JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY;

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS,

AND A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia),

MICROSCOPY, &c.

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FOR THE YEAR

1895.

LONDON:
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20 HANOVER SQUARE, W.;
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THE

Royal Microscopical Society.

(Established in 1839. Incorporated by Royal Charter in 1866.)

The Society was established for the promotion of Microscopical and Biological Science by the communication, discussion and publication of observations and discoveries relating to (1) improvements in the construction and mode of application of the Microscope, or (2) Biological or other subjects of Microscopical Research.

It consists of Ordinary, Honorary, and Ex-officio Fellows of either sex.

Ordinary Fellows are elected on a Certificate of Recommendation, signed by three Ordinary Fellows, setting forth the names, residence, and description of the Candidate, of whom the first proposer must have personal knowledge. The Certificate is read at two General Meetings, and the Candidate balloted for at the second Meeting.

The Admission Fee is 2*l.* 2*s.*, and the Annual Subscription 2*l.* 2*s.*, payable on election, and subsequently in advance on 1st January annually, but future payments may be compounded for at any time for 31*l.* 10*s.* Fellows elected at a meeting subsequent to that in February are only called upon for a proportionate part of the first year's subscription. The annual Subscription of Fellows permanently residing abroad is 1*l.* 11*s.* 6*d.*, or a reduction of one-fourth.

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The Council, in whom the management of the property and affairs of the Society is vested, is elected annually, and is composed of the President, four Vice-Presidents, Treasurer, two Secretaries, and twelve other Ordinary Fellows.

The Meetings are held on the third Wednesday in each month, from October to June, at 20 Hanover Square, W. (commencing at 8 P.M.). Visitors are admitted by the introduction of Fellows.

In most Sessions there is a Conversazione devoted to the exhibition of Instruments, Apparatus, and Objects of novelty or interest relating to the Microscope or the subjects of Microscopical Research.

The Journal, containing the Transactions and Proceedings of the Society, and a Summary of Current Researches relating to Zoology and Botany (principally Invertebrata and Cryptogamia), Microscopy, &c., is published bi-monthly, and is forwarded post-free to all Ordinary and Ex-officio Fellows residing in countries within the Postal Union.

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JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

FEBRUARY 1895.

TRANSACTIONS OF THE SOCIETY.

I.—*The President's Address: The History of the Royal Microscopical Society.*

By A. D. Michael, F.L.S., &c.

(*Read* 16*th January*, 1895.)

A presidential address is usually a review of something. This Society has now existed for over half a century; I think, therefore, it is a time when we can afford to devote part of a single evening to a subject which, although not strictly to be called scientific, may probably interest you; namely a review of the history of the Society itself.

If any one of you will leave this West-end abode of science, and crossing the business parts of the City will make his way eastward as far as Tower Hill, and leaving Tower Hill at Sparrow Corner will pass along Royal Mint Street, he will find himself in Cable Street, St. George's in the East. I cannot promise that he will be struck either by the quietness or the cleanliness of the locality; the shadow of the neighbouring docks is on it, and its principal features seem to be rag and bottle shops, marine store dealers, and street stalls; but if he turn to the right down Shorter Street he will suddenly emerge in a much quieter spot; in front of him will be what has once been a considerable space of green, but is now chiefly occupied by St. Paul's church for seamen. The "Infant Nursery" belonging to that excellent institution will be exactly facing him, but the foundation stone of that building was not laid until 1872, so at the time I am going to speak of the Green still existed; and although a church stood upon it it was the Danish church, in which was a royal closet specially reserved for the King of Denmark when visiting this country, opening by two sash windows, one looking on to the pulpit and the other over the congregation. Beyond the fine old trees which surrounded the church was a somewhat famous spring well. The place, I fear, will not now impress our traveller as having either a scientific or a fashionable aspect, but if he passes the Catholic

Seamen's Club and observes the houses surrounding the enclosure he will notice that many of them are old, and have been good substantial brick houses, pleasant enough to live in; and that some bear considerable remains of artistic ornament. Following round the enclosure he will pass Messrs. Geo. Wybrow's pickle manufactory, and between that and Messrs. Greenfield, Harvey & Co's. brewery, he will find a house which certainly looks as if it had stood there for considerably more than half a century; at the present moment its bell-handles are broken relics, and the ridge-tiles of its roof look as if they would be better for a little repair; but this house is No. 50 Wellclose Square, and there, in the year 1839, lived Edwin J. Quekett, F.L.S., and in its drawing-room, on the 3rd September of that year, seventeen gentlemen assembled "to take into consideration the propriety of forming a society for the promotion of microscopical investigation, and for the introduction and improvement of the Microscope as a scientific instrument." Probably few of my hearers have ever heard of Edwin Quekett, he has been so entirely overshadowed by the fame of his younger brother John; but Edwin Quekett was a man of considerable scientific reputation, and had he lived longer he would probably have increased it. Born at Langport, in Somerset, in September 1808, he commenced his studies for the medical profession at University College when he was just twenty; there he gained one gold medal in anatomy and physiology, another in practical anatomy, and a silver medal in chemistry, besides a certificate of honour in every class he attended. He practised his profession at Wellclose Square, but he was chiefly known as lecturer on botany at the London Hospital medical school. He contributed numerous scientific papers to the various Societies and journals of his time, including six important papers to our own Transactions. He died at his house in Wellclose Square on the 20th June, 1847, under the age of thirty-nine.

Seventeen men did not meet at Edwin Quekett's house on that 3rd September, 1839, by pure accident; coming events had thrown their shadows before; nor was Edwin Quekett the only man of science, or the only one of our original members who lived in Wellclose Square. At No. 57 lived the Rev. William Quekett, who was the original of Charles Dickens' sketch in the second volume of 'Household Words,' entitled, "What a London curate can do if he tries." At No. 46 lived Charles Foulger; at No. 45 lived Edward Newman, the well-known entomologist and for so many years editor of the 'Zoologist,' whose connection with microscopy included not only his original membership of this Society, but also his famous diatribe upon the ignorance of microscopists apropos of some one having mistaken the curious eggs of the Stone-Mite for a new fungus, and called it *Craterium pyriforme;* and last, but by no means least, at No. 7 lived Nathaniel Bagshaw Ward, the botanist and inventor of the Wardian case. He was born in 1791, at Plaistow, in Essex, where his father practised as a medical man; the son was brought up to the same profession and practised it at Wellclose Square, where he made his discovery of the glazed cases for the transmission and growth of plants, which were the means of introducing the tea-plant into Assam, the cinchonas into India, and which are used to this day whenever it is desired to import new plants into this or other countries—not to speak of their having rendered life somewhat more pleasurable to thousands of dwellers in cities who have a taste for ferns and mosses. Ward erected a large Wardian case on his staircase at Wellclose Square, and a Tintern Abbey window was modelled for it by Edwin Quekett. When he left the square and went to live at Clapham Rise, Ward took this window away with him, and it stands to this day where Ward put it, namely in the rockery round the water-lily pond at what is now No. 303 Clapham Road, where lives our respected Past President, Dr. Braithwaite, and it may not be unknown to you that Mrs. Braithwaite was once Miss Ward.

Ward was one of the most active founders of this Society; he was its first Treasurer and occupied that position for twenty-three years; he retired in 1862, and died on the 4th June, 1868, at the age of seventy-seven. Ward and Dr. Bowerbank practically kept open house to microscopists and other men of science, and a number of microscopists, whom Bowerbank called his "Band of Brothers," used to meet frequently at these two houses. It was after one of these gatherings, assembled to greet Ehrenberg, that Bowerbank is said to have exclaimed to the Rev. J. B. Reade, "God bless the Microscope, let us have a Society." The matter was broached at the next meeting in Ward's drawing-room, and it was in consequence of what took place there that those seventeen gentlemen came to Edwin Quekett's house on that September evening some five and fifty years ago.

The time was propitious, ideas of the improvement of the Microscope and microscopical science had been in the air for some little time, and the Society was becoming a want. In January 1830, Mr. Lister had published his epoch-making paper "On the Improvement of Achromatic Compound Microscopes," announcing the discovery of two aplanatic foci in a double achromatic object-glass, upon which, together with the practical directions of the author, Messrs. Powell, Ross, and Smith (names not unknown to us to day) worked so successfully. In 1832, Mr. J. T. Cooper's suggestion of using Canada balsam for mounting objects had been put in practice by Mr. Bond, and a first notice of it had appeared in print in 1835, in a book by Mr. Pritchard entitled 'A list of Two Thousand Microscopic Objects'; and in 1837 Andrew Ross had suggested the correction-collar.

Among the seventeen assembled at Edwin Quekett's house we find, in addition to that gentleman himself and Ward, the names of Mr. Bowerbank (not Dr. then), Dr. Farre, George Jackson, and the Rev. J. B. Reade, all of whom became Presidents of the Society, and also Lister himself, George and Conrad Loddiges the nurserymen, and

Cornelius Varley. Joseph Jackson Lister, F.R.S., was born in London on the 11th January, 1786; his parents were members of the Society of Friends, to which he also belonged throughout his life; at the age of fourteen he left school to assist his father in the wine-trade. His tastes were shown early, for as a little child he found out that if he looked at distant objects through air-bubbles in the window-pane the vision of his eye (then myopic) was improved—a subject which he subsequently worked out; it was not, however, until 1824, when he was thirty-eight years of age, that he turned his attention to object-glasses. The history of his optical researches in this and other subjects, culminating in the great paper of 1830, which will be found in our Transactions for 1870, p. 134, is from the pen of his still more famous son. It has been said of Lister, by one well fitted to judge, that "he was the pillar and source of all the Microscopy of the age." He died at Upton House, Essex, in October 1869, at the age of eighty-four. The Loddiges were a great deal more than ordinary nurserymen; George was one of the most liberal patrons and most skilful users of early achromatic objectives; he was his own architect for his great palm-house at Hackney, which was built by his own workmen. In his publication 'The Botanical Cabinet,' eight hundred and eighty-nine of the figures were drawn by himself; his collection of casts of antique gems was about two thousand, principally taken by himself; and his collection of humming-birds, on which he intended to publish a book, was at the time unrivalled.

Cornelius Varley will also be a name well known to you; he was a very active early member of this Society, and his communications, illustrated by rough but effective drawings, will be found frequently in our Transactions.

It will be remembered that the seventeen had met "to consider the propriety of forming a Society for the promotion of microscopical investigation, and for the introduction and improvement of the Microscope as a scientific instrument." The result was a resolution that such a Society should be formed, and that a Provisional Committee (Bowerbank, Lister, G. Loddiges, E. Quekett, Reade, Solly, and Ward) be appointed to carry this resolution into effect.

This Committee held meetings, drew up a set of rules, adopted the name of "The Microscopical Society of London," which was devised by Bowerbank and Reade, and arranged to hold a public meeting at the rooms of the Horticultural Society, which were then at No. 21 Regent Street, on the 20th of December, 1839. At this meeting Prof. Owen took the chair, and was elected President; Ward, Treasurer; and Dr. Arthur Farre Secretary. Forty-five gentlemen inscribed their names in a book as original members, and it was resolved that all who joined before the 29th of January, 1840, were to be considered original members.

No more fitting first President than Prof. Owen could possibly have been found, his is a name of world-wide reputation; but at the time of his death, which occurred since I have occupied this chair, so many able memoirs of him appeared in print, and so full a biography has just been published, that I hardly think it would be desirable for me to enter here upon any lengthy summary of his history or achievements; but I may remind you that when he became our President he was not the venerable and striking figure which we used to see near the Sheen Gate of Richmond Park, and which made so deep an impression on all present when he received the first Linnean gold medal. Born at Lancaster in July 1804, he matriculated at Edinburgh in 1824, and in 1825, when he was just twenty-one, he paid that visit to Paris which enabled him to make Cuvier's acquaintance, and probably greatly influenced his future life. He became one of Abernethy's dissectors at St. Bartholomew's Hospital, and it was upon Abernethy's suggestion that Owen was first employed in 1828 to catalogue the Hunterian collection at the College of Surgeons, with which institution he was connected until 1855. When he took the chair at our first public meeting Richard Owen was a man of thirty-five, in the full tide of work and vigour; he was already a Fellow of the Royal Society, Lecturer on Comparative Anatomy at St. Bartholomew's, and Hunterian Professor at the Royal College of Surgeons; he had just completed his catalogue of the physiological specimens in the Hunterian collection, in five quarto volumes, and was commencing his great work on the study of teeth, but the larger number of the three hundred and sixty papers which he contributed to the Transactions of various learned Societies, and which will be found duly enumerated in the Royal Society's catalogue, and at the end of vol. ii. of Owen's biography, were yet to come. He remained our President for two years, was a regular attendant in the chair, and took a deep interest in the welfare of the Society.

On the 29th of January, 1840, Owen was in the chair at the council meeting when Bowerbank reported that, in addition to the forty-five members who had joined at the first meeting, sixty-five more had joined the Society; he also reported that the Society had made its first purchase; it is rather amusing to find that this was a diamond and cutting-board, to cut glass slips for the use of the members, the Provisional Committee having fixed on the sizes of 3 in. by 1 in. and 3 in. by $1\frac{1}{2}$ in. as those to be adopted.

At this moment Schleiden was commenting upon the paucity of British microscopical research, and attributing it to the want of efficient instruments, not knowing that an Association was then forming which was to raise British Microscopes to probably the first position in the world.

On the 29th of February, 1840, it was decided to accept the offer of the Horticultural Society to allow the Microscopical Society to hold its evening meetings at their rooms, 21 Regent Street, for a payment of 20*l.* a year.

It would seem that thus early in the Society's career a question arose which has troubled many others, for we find a resolution of the 18th of March, 1840, "That it did not appear desirable at present to act upon the rule relating to the holding of soirées at which ladies should be admitted."

On the 27th of January, 1841, Mr. Daniel Cooper submitted a prospectus of a proposed Microscopical Journal, and asked permission to publish abstracts of the papers read at the meetings of the Society, offering to make the journal serviceable to the views of the Society; this request was granted, and thus the Transactions of the Society first appeared in print, and thus commenced the connection of the Society with Cooper's, afterwards Cooper and Busk's, 'Microscopic Journal,' published by one who has done good service to English science, and whose face is still sometimes seen with pleasure at the Linnean Club, viz. the veteran John Van Voorst.

On the 15th of February, 1841, the Society held its first annual meeting, and it was then reported that it had one hundred and seventy-seven members; it is a curious evidence of the change of times to find that fifty of these resided in the City of London. The recognition of the scientific importance of the Society is shown by the fact that twenty-two of the members were Fellows of the Royal Society, and its wide range of interest by the fact that the list included such widely different names as Richard Beck, Thos. Bell, Professor of Zoology at King's College, John Birkett, of Guy's, George Busk, Sir James Clarke, John Edward Gray, Keeper of the Zoological Department of the British Museum, Chas. Hullah, the musician, John Kippist, the librarian of the Linnean, Dr. Lindley, the Marquis of Northampton, then President of the Royal Society, Andrew Ross, Dr. Sharpey, John Tomes (not Sir John then, and miscalled Thomas in the lists of members), Van Voorst, and Erasmus Wilson. In spite of all this the new-comer was perhaps not universally received with special cordiality, for we find Owen in his first address combating the idea that the Microoscpical Society would deprive the older Societies of biological papers.

On the 17th of February, 1841, the propriety of appointing a librarian and curator was discussed, and it was suggested that John Quekett might accept it as an honorary office. On the 17th of March the first number of the 'Microscopic Journal' was presented by the editor; on the 23rd of June Dr. Farre resigned the secretaryship, and John Quekett was appointed to that office, which he held for nineteen years. It is odd that these are the first mentions of John Quekett in connection with this Society, he is not among the original seventeen, and yet he must have been residing in the house at the time, and as he is marked as an original member he must have joined the Society before the 29th of January, 1840. This is, I think, the appropriate place to say a few words about him, for although he was eventually elected president, yet it was a mere compliment at a time when his health would not allow him to perform the duties of the office. It was as secretary that he laboured so earnestly to promote the welfare of this Society, and it was during his secretaryship that he contributed the twenty-one papers, including some of his most important, which adorn our Transactions.

Probably no sounder or more earnest student of nature ever lived than John Thomas Quekett, who was born on the 11th of August, 1815; he was the youngest son of the head-master of the Langport Grammar School; his earliest tastes were for entomology, and accompanied by his brothers Edwin the botanist and Edward the ornithologist, and by his sister, who in later years drew so many of his diagrams, he used to wander about the Langport woods in search of those treasures with which the young people filled their father's house. So early did he turn his attention to the Microscope, that at the age of sixteen he delivered a course of lectures at Langport on microscopical science, illustrated by diagrams and by a Microscope manufactured by himself out of a roasting-jack, a parasol, and a piece of brass which he bought at a marine-store dealer's and hammered out. He was described as "strangely sedate, careless of his appearance, heedless of conventionalities, and unattracted by the ordinary amusements of children." Being intended for medicine he was sent to London, apprenticed to his brother Edwin, and entered at the London Hospital; he became a M.R.C.S. in 1840, and in the same year competed for and obtained the studentship in human and comparative anatomy, then recently established. When the studentship expired in 1843 he became Assistant Conservator of the Hunterian Museum at the College of Surgeons; in 1844 he was appointed by the Council "to deliver annually a course of demonstrations with a view to the exhibition and connected description of the collection, and the explanation of the method and resources of microscopical study." On the retirement of Owen in 1856 Quekett was appointed his successor and also Professor of Histology; these offices he held up to his death. He was elected a F.R.S. in 1860, shortly before his death; he made over sixteen thousand preparations for the histological collection of the College of Surgeons, which he practically created. In 1848 he published his celebrated 'Practical Treatise on the Use of the Microscope,' a German translation of which was published in 1850; his other important works are too numerous for me to mention here; yet he died at the early age of forty-six, at Pangbourne, on the 20th of August, 1861, and for some time previously had been in very bad health; and few men spent so much of their time in helping others.

It had been anticipated that probably the construction of the Microscope would be the first subject which would attract attention, but this turned out not to be so; such was the activity of biologists that, although the number of papers presented to the older Societies was not diminished, yet those that flowed in to the new Society from men of first-class standing were at first almost wholly biological; the equally, or perhaps even more, important optical and mechanical papers came more slowly and later.

In this year (1841) we first find the name of Michael Faraday among our Members, and in September and October of this year it was determined that the Society should publish its Transactions in royal octavo, as it does to-day; this arrangement lasted for ten years. Those who will look at Leonard's illustrations to Quekett's papers on the intimate structure of bone, on the capillaries in the gills of fishes, and on the vascularity of the capsule of the crystalline lens in Reptilia, or at George Busk's illustrations to his papers on *Notamia bursaria* and *Anguinaria spatulata*, or Warren de la Rue's to his paper on the markings on the scales of *Amathusia Horsfieldii*, may not improbably think that the advance in illustration up to this time is more conspicuous in quantity than in quality; but this I fear is the same with almost all English scientific drawings; those of forty or fifty years ago compare not unfavourably with those which are now appearing.

On the 15th February, 1842, Owen retired, and Dr. John Lindley was elected President; he was the son of a nurseryman, and was born at Catton, near Norwich, on the 5th February, 1799, and educated at the Grammar School of Norwich; which he left at the age of sixteen, and was then employed for three or four years in his father's nursery. His father failing in business, Lindley was thrown on his own resources. He proceeded to London in 1819, and obtained from Sir Joseph Banks the position of his assistant librarian. At this early age he began the long series of works with which his name is identified by the publication of a translation of Richard's 'Analyse du Fruit,' made at one sitting, which, however, lasted two days and three nights.

In 1822 Lindley became Garden-Assistant-Secretary to the Horticultural Society, and in 1826 he became sole Assistant Secretary. He was elected a F.R.S. in 1828; became in 1829 Professor of Botany in University College, which appointment he held for upwards of thirty years. His 'Synopsis of the British Flora,' published in 1829, was followed by an 'Introduction to the Natural System of Botany' in 1830, which ultimately took the form of 'The Vegetable Kingdom,' probably the best known of his works. In 1831 he produced, with the aid of Mr. Hutton, the well-known 'Fossil Flora of Great Britain,' and he published numerous other general works and papers. In 1857 the Royal Medal of the Royal Society was awarded him. He was a juror of the Great Exhibition of 1851, and undertook the Colonial Department of that of 1862; but the strain was too much, and he never recovered it. He died on November 1st, 1865.

During Lindley's presidency we find a committee, consisting of Owen, Quekett, and Rymer Jones, appointed to investigate the structure of shell; we also find for the first time the name of Edward Forbes, who soon became a member of the Council and a contributor to the Transactions; and then was held the Society's first *soirée*, where twenty-one Microscopes were exhibited, which was then thought a great thing.

On the 15th of February, 1844, Lindley retired, and Thomas Bell was elected his successor; he was born at Poole in Dorsetshire on 11th October, 1792. His father was a surgeon, and he was educated as a surgeon-dentist. In 1815 he commenced lecturing at Guy's Hospital on the anatomy and diseases of teeth; he was appointed dental surgeon, and also lectured on comparative anatomy at the same hospital; and in 1836 he was appointed Professor of Zoology at King's College. He was President of the Linnean Society from 1853 to 1861. In 1828 he became a F.R.S., and was one of the Secretaries of the Royal Society from 1848 to 1853. Bell's treatise on the anatomy, physiology, and diseases of the teeth appeared first; his monograph of the Testudinata in the years 1836–42, his well-known works on British Quadrupeds and Reptiles in 1837 and 1839. He was joint editor with Forbes of Burmeister's Trilobites for the Ray Society, and joint author with Owen of the fossil Reptilia of the London Clay for the Palæontographical Society, which also published his 'Fossil Malacostracous Crustacea'; his 'British Stalk-eyed Crustacea' appeared in 1853. He described the Reptilia of the 'Beagle' for the Government, and also the collections formed by the 'Assistance' during the search for Sir John Franklin. In 1866 he retired from his profession, and purchased The Waters, Selborne, from the grand-nieces of Gilbert White. The rest of his life was devoted to editing the 1877 edition of White's 'Selborne.' Bell died on the 13th March, 1880, at the age of eighty-eight.

We find Bell in his annual addresses impressing two things upon his hearers; firstly, the extreme importance of using the Microscope more in pathology; secondly, the great desirability of cheap Microscopes—a favourite subject with the Society and its successive Presidents, who worked earnestly at it for over a long period with great ultimate success; although possibly some people might be inclined to think that Microscopes were cheap enough already, for Ehrenberg, who was the first Honorary Fellow of this Society, tells us that the instrument which he carried half over the world, and with which he made most of his wonderful discoveries, was purchased in the streets of Berlin for thirty shillings.

On the 11th February, 1846, Bell retired, and Dr. James Scott Bowerbank was elected in his place.

It has been said of Bowerbank that in science he was an amateur very near to the border of the professional; he was one of the founders not only of the Microscopical Society, but also of the London Clay Club, which gave birth to the Palæontographical Society, of which he was first Secretary and then President, and also of the Zoological Society. He was elected a F.R.S. in 1842, contributed many valuable papers to our Transactions and to those of the Royal, Linnean, Zoological, and Geological Societies; but he is probably best known by his great work on the British Spongiadæ published by the Ray Society. Bowerbank was born in Sun Street, Bishopsgate, in July 1797, and succeeded to his father's distillery there, in which he was an active partner until 1847. He lectured publicly upon botany and upon human anatomy. Bowerbank's weekly receptions of microscopists and men of science have been before referred to; he continued them at his new house at No. 3, Highbury Grove, after he had left Islington (where he lived when the Microscopical Society was founded). No man ever was more anxious to communicate his knowledge and exhibit his scientific treasures to those who had tastes similar to his own; but he was not equally desirous of acting as showman to those who did not take an intelligent interest in them. I have been told, from what should be a trustworthy source, that Bowerbank kept a small collection of showy and striking slides in a special box which he called his "goodness gracious box," and that if any one whose tastes he did not know wanted to see through his Microscopes, he would show them some slide having plenty of information in it: if the visitor asked some intelligent question about structure the host was delighted to go on showing and explaining; but if the first remarks were unappreciative Bowerbank would hand him over to some one else to exhibit "the beautiful things in that box." Bowerbank has passed away from us, but the two classes into which he divided slide-seeing humanity still exist, the lovers of structure and the lovers of the "goodness gracious box" are with us to-day; personally I do not see why the latter should not get all the pleasure they can from the face of Nature. When Carpenter wrote somewhat contemptuously of "mere beauty," he, to my mind, as much missed one of the most charming aspects of Nature, as did a certain well-known artist, who when I was about to explain to him the structure of the object he was looking at, said, "I do not want to know how it is made, I am satisfied with the beautiful exterior. If I see a beautiful scene at a theatre, I do not want to go on the stage and examine all the cardboard and gold-leaf that it is composed of." It seems to me that he who can admire both the structure and the beauty to the eye is the truest student of Nature and derives most pleasure from the study.

If any jealousy of the new Society ever existed it must have died out before 1848, for in that year we find the Linnean Society inviting the Microscopical to join them in their annual dinner.

In this year George Busk became President; he was an original member and a frequent contributor to the Journal. He was born in 1807, and was the second son of Robert Busk of St. Petersburg. He became a M.R.C.S. in 1830, and was appointed surgeon to the seamen's hospital ship 'Dreadnought'; in 1856 he resigned this appointment to devote himself to scientific work. He became President of the Royal College of Surgeons in 1871. Besides papers contributed to various scientific Societies and journals, he wrote the descriptive catalogue of the Marine Polyzoa in the collection of the British Museum; the article Polyzoa in the English Cyclopædia, which contained the first satisfactory attempt at a classification of the group; and the 'Monograph of the Fossil Polyzoa of the Crag' for the Palæontographical Society; and he translated Steenstrup's 'Alternation of Generations' for the Ray Society. In 1864, he and Dr. Falconer went to Gibraltar to investigate the ancient cave-fauna there; and finally he examined and described the Polyzoa collected during the voyages of the 'Rattlesnake' and the 'Challenger.'

It was during Busk's presidency in 1848 that we find in our Transactions a paper by Mr. Warrington, "On a new method for the mounting of organic substances as permanent objects for microscopic investigation." The medium recommended is "the liquid known under the name of glycerine;" and just at the end of his presidency that we find there Gosse's well-known paper "On the architectural instincts of *Melicerta ringens*."

Dr. Arthur Farre, F.R.S., who became President in 1850, was an original Fellow and first Secretary of the Society. He contributed several papers to our Transactions, but his fame was rather medical than microscopical. He was the fifth son of Dr. John Richard Farre, and was born in 1811 in Charterhouse Square, and educated at Charterhouse. He was Abernethy's prosector, lecturer on comparative anatomy at St. Bartholomew's in succession to Owen, and Robert Ferguson's successor in the chair of obstetric medecine at King's College. It was during his presidency that we find the first paper in our Transactions by Mr. Wenham, whose long series of inventions and improvements in the Microscope and its apparatus, which will be chiefly found in the pages of our Journals, have been of such material benefit to almost all workers with our favourite instrument. This list of inventions is far too long for me to attempt to refer to them to-night, but I may remind you that what is now known as the Wenham prism for binocular Microscopes is figured in our Transactions for 1861. During this presidency we also find the first paper by Mr. Sorby, who subsequently became your President, and by Prof. Huxley, who became a member of the council in 1857.

In 1852 George Jackson, well known to microscopists by the Jackson-Lister form of Microscope, became President, but as the time at my disposal to-night will not allow me to speak of all the eminent men who have occupied the presidential chair subsequent to this time, I propose to add a few notes respecting such of them as have passed away from us, in the form of an appendix, if you think it worth printing this address.

Shortly after Mr. Jackson's election an offer was received from Dr. Lankester and George Busk that they would start and edit a journal, to be called the 'Quarterly Journal of Microscopical Science,' in which they would publish the Society's Transactions, and supply copies for the members, if the Society would contribute a certain sum towards the expenses; this offer was accepted, and the arrangement continued down to the end of 1868, and although the growth of both the Journal and the Society produced financial difficulties, which finally forced a severance of the connection, yet the journal exists to-day in the enlarged form in which it is so ably conducted by Dr. Lankester's son. The new journal did not improve the Society's finances, and consequently it was rather with dismay that the Council, about this time, received a notice from the Horticultural Society that they must raise their rent; the Society consequently removed to the rooms of the Chemical Society at 5 Cavendish Square; but these rooms were found so inconvenient that after a year the Microscopical moved back to the Horticultural Society's rooms, where they remained until the end of 1856, when the Horticultural Society sold its house in Regent Street. Then commenced the connection of the Microscopical Society with King's College, which lasted until when, King's College not being able to afford them accommodation any longer, the Society removed to its present rooms in Hanover Square.

At this time (1853) we find the first contribution to our Transactions by Wheatstone, which I may stop to notice, for probably there never existed a mind more teeming with scientific constructive invention than that of the inventor of the electric telegraph.

It may be thought that eminent scientific men are not invariably the best men of business when we find that up to 26th October, 1853, no minute book of the meetings of the Society had been kept; at that date one was started, and an endeavour was made to write it up for the back period, which was only partly successful, for we find in it an entry, "The minutes of meetings between 17th January, 1844, and 26th October, 1853, are lost."

Dr. Carpenter succeeded Jackson as President. His is, of course, a leading name in microscopy, but his work continued up to such a late period, and he and it are so well remembered by almost all of you, that it would be idle for me to speak of it at any great length to-night. George Shadbolt was the next, and I believe that he is still one of our members. It was during his presidency that the Council proposed and successfully carried out the idea of having the screw known as the "Society's screw" for the attachment of objectives, so that they might be interchangeable between Microscopes, which has been so great a boon to all English microscopists. It is perhaps to be regretted that the Society's later efforts to make other pieces of apparatus interchangeable did not meet with equal success. About the same time Maltwood read his paper, "On a new form of Object-finder," which has been of considerable service, even if somewhat superseded now.

In 1858, when Dr. Lankester became President and Jabez Hogg was first elected on the Council, the Society possessed a library of sixty-eight works; somewhat a contrast to its present condition. It was towards the end of this presidency that there appeared in our Transactions the first of that long and admirable series of papers on the Diatomaceæ, by Dr. Robert Greville of Edinburgh, which do so much credit to the author and to our Transactions. He was a man of many activities, and I can well remember him in his latter years, polished and courtly in manner, a leader in Edinburgh society, and in the charitable and religious societies of that city he was enabled to obtain material for his search after diatoms from the missionaries in most wild parts of the world. He wrote on ferns in conjunction with Hooker, and on sea-weeds alone; he was a good and eager entomologist in almost all orders, an excellent landscape painter in oils, and probably the beauty of his scientific illustrations has not ever been exceeded. Lastly, he was a remarkable pedestrian, and on one occasion walked 300 miles in a week.

In February 1860, John Quekett's failing health compelled him to resign the secretaryship, and G. E. Blenkins, who remained a member of the Society until his death a few months ago, and M. J. Legg were appointed joint secretaries. Quekett was elected President without his knowledge, a letter from him asking to be excused on account of his health having arrived too late. But his election was a mere compliment; he was too ill to occupy the chair, and he never did so. At his request he was not re-elected, but during his year the number of members of the Society for the first time exceeded 300.

Quekett died in August 1861, and there was a sale of his scientific effects, amongst which was a large and interesting Microscope by the celebrated Benjamin Martin, supposed to be of the date of 1770, and to have been made for George III., which is described in a paper by Williams in our Transactions in 1862. The Secretary of the Society was authorized to bid for this instrument up to 21*l.*, and the Library Committee to buy books at the same sale to the extent of 20*l.*, but it was thought that the Society could not afford this expenditure, and it was resolved to raise it by a private subscription, which should be extended so as to raise a fund, the interest of which should be devoted to providing a medal, to be called the "Quekett Medal," and given from time to time to those members of the Society who had best promoted microscopical science; afterwards it was decided not to confine it to members. The fund was raised, and in 1863 a committee was appointed to consider what steps should be taken with regard to striking the medal, and it was decided that the medal should be annual. In January 1864, Dr. Carpenter suggested that the medal should be given for the best cheap Microscope. Finally, advertisements were issued inviting competition in four classes of cheap Microscopes, the lowest to be a simple Microscope, and the lowest compound three guineas and the highest ten guineas. None of the three principal makers competed, and nothing sent in for the simple class was considered worthy of the medal. Eighteen instruments were sent in in the other classes to the rooms of the Astronomical Society, where the judging took place; those of Mr. Wheeler were found so superior to all others that all three medals were awarded to him. They were, however, so far superior that the Council called Mr. Wheeler's attention to the fact that the conditions were that equally good instruments should be supplied to the public at the prices named; thereupon Mr. Wheeler refused to accept medals in any but the lowest class, whereupon the Council revoked the entire award, and the three silver medals which had been struck remain in the Society's cabinet to this day.

Nothing more was done in the matter until 1874, when a committee was formed to consider "what use could be made of the Quekett medal," and they decided to institute an annual Quekett Lecture, for which the medal should be given; bronze medals were struck, and Sir John Lubbock was invited to deliver the first lecture. He did so, and the highly interesting lecture, which we most of us remember, will be found in our Transactions for April 1877. Difficulties arose in attempting to continue these lectures, and they were allowed to lapse, so that the only Quekett medal ever issued was that presented to Sir John Lubbock. In 1879 it was decided to expend part of the fund in the purchase of books, and to invest the balance, and apply the interest from time to time in the same manner.

It was not until 1865 that the question of obtaining a Royal Charter of Incorporation for the Society arose, and in 1866 Her Majesty was graciously pleased to grant the existing Charter and to consent to the word "Royal" being added to the name of the Society; the Prince of Wales became Patron and the Society assumed its present form.

In 1867 Blenkins resigned the secretaryship, and Jabez Hogg was appointed in his place, who retained the office until 1873, when he was succeeded by our friend Prof. Charles Stewart.

At the end of 1868 the connection with the 'Quarterly Journal of Microscopical Science' ceased, and a new journal called the 'Monthly Microscopical Journal' was started, edited by Dr. Henry Lawson, and published by Messrs. Hardwick and Bogue; this continued until 1878 when, the number of Fellows having risen to over four hundred and fifty, the Society reverted to its original plan of publishing its own Transactions; and the new Journal was started, which was soon edited by Mr. Frank Crisp, in whose hands it became so great a credit both to the Society and the editor, and a publication of such great utility to microscopists and biologists generally.

We have now arrived at modern times which we almost all of us remember well, and at what is practically the present position of the Society, therefore I do not propose to carry this history any further; but I will consider for a moment the question, "Has the Society fulfilled the purpose for which it was originated? namely the promotion of microscopical investigation and the introduction and improvement of the Microscope?" I think we may answer confidently and emphatically

Yes! It is not merely the instances of important inventions and improvements, such as those before referred to, and such as Mr. Stephenson's suggestion of homogeneous-immersion lenses which Prof. Abbe worked out, and the same gentleman's binocular Microscope, so admirable for dissecting purposes, &c., all of which have been the direct outcrop of the Society, but it is in an even greater degree the hundreds of small improvements which have been gradually brought out under its influence, and have formed a constant progress towards the present excellence of the instrument; and most of all it is the steady encouragement which the Society has been able to afford over half a century to improvements in the instrument and to its intelligent use, an influence which has spread all over the civilized world and has resulted in hundreds of other Societies and institutions with more or less similar objects springing up in this and foreign countries, that have formed the real value of this institution. During its more than fifty years of existence, the Microscope has grown from the comparatively rarely used and imperfect possession of a few men of science and the amusement of a few children to be the highly finished and most important companion of almost all investigators of nature; sold in thousands, and employed alike by the physician, the anatomist, the general biologist, the botanist, the mineralogist, and even the physicist, and extending its range into commerce and agriculture. There is at the present time hardly a biological or medical Society in the world which does not derive a large part of the discoveries laid before it from investigations made by the aid of the Microscope, and I believe that this Society and its influence have been most important factors in this great progress. There is also plenty of admirable biological work to be found in the Transactions both by the eminent men before referred to and by Allman, Caruthers, Dallinger, Drysdale, Rupert Jones, Klein, Ray Lankester, Murie, and others.

Finally, I will say a word as to the future: an idea is, I think, prevalent in some quarters that the Microscope is now perfect and that consequently the chief *raison d'être* of this Society is over. I am not by any means one of those who take this view; we may not for the moment see how further improvements are to be made, but people rarely do until they are made. There is a tendency in the human mind when a considerable progress has been made either in invention or investigation to say, "Now we have got to the end of it, there is not any more to come"; but this seldom turns out to be correct; it has been said about the Microscope over and over again as each step was made. I will only quote one instance: there were few of our early microscopists who knew more about the Microscope or contributed more to its improvement than Dr. Goring; in his exordium to the first edition of his 'Microscopic Illustrations,' published in 1829, the learned doctor says, "Microscopes are now placed completely on a level with telescopes and like them must remain stationary in their construction." In January 1830, Lister published his era-making paper on improvements in the Microscope before referred to.

APPENDIX.

Notices of such of the Presidents since 1852 *as are now deceased.*

George Jackson, M.R.C.S.

President 1852–3.

George Jackson was an original Fellow of the Society, and a member of its first Council, and he was elected as its seventh President in 1852.

He was born in 1792, and was the eldest son of a farmer at Higher Yellington, in South Devon. He was educated at the Ashburton Grammar School, and, being destined for the medical profession, was articled to Mr. Gervis, a surgeon at Ashburton; he, however, graduated in London.

Jackson was a born mechanician. His first effort was the manufacture of an efficient mouse-trap, his grandmother having rashly offered him a guinea if he would do so, she believing it to be impossible. He was an excellent manipulator with the table blowpipe, and supplied himself and friends with thermometers, hydrometers, and barometers. He also constructed a transit instrument. In 1826 he was rewarded by the Society of Arts for an instantaneous light-apparatus, being a modification of the hydrogen and spongy platinum lamp.

He was an early lover of the Microscope, and many years before the existence of the Microscopical Society constructed an efficient instrument for using the doublet lenses introduced by Dr. Wollaston; later he produced a large-sized instrument equal to the best Microscopes of that period. He was an adept with the turning-lathe and planing-machine. These instruments he had constructed on his own plans, much of them by his own hands. He also constructed an elegant little ruling-machine for the division of micrometers; a subject with which his name is intimately connected. About the same time he made a very serviceable cutting-machine for producing thin sections of wood, &c.

In conjunction with Drs. Carpenter and Lankester and John T. Quekett he was appointed by the Council of the Society of Arts to award their premium for the best and cheapest Microscope. In 1857 he exhibited and described a new form of travelling Microscope. He was the inventor of what is known as the Jackson limb for the Microscope, which is still largely used.

When the collodion process came into vogue Mr. Jackson turned his attention to photography, and constructed a camera for himself. The Society's museum still contains photomicrographs of some sixteen of its members, taken by him. Mr. Jackson died in December 1860.

Edwin Lankester, M.D., LL.D., F.R.S.

President 1858–9.

Edwin Lankester, whose genial manners made him generally popular, was born on April 23rd, 1814, at Melton, in Suffolk, and was educated at Woodbridge, where he was articled to Samuel Gissing, surgeon. He entered the medical profession. He became Lecturer on Materia Medica and Botany to the School of Medicine adjoining St. George's Hospital in 1843. He was Secretary of the Ray Society for many years, and in 1845 was elected F.R.S. In 1850 he was appointed Professor of Natural History in New College, London; in 1851 he received the degree of LL.D. from Amherst, U.S.A. In 1853 he became Lecturer on Anatomy and Physiology at the Grosvenor Place School of Medicine; in 1858, Superintendent of the Food Collection at the South Kensington Museum; in 1862, Examiner in Botany to the Science and Art Department at South Kensington. He was elected Coroner for Central Middlesex in 1862.

Besides contributing to the publications of the learned Societies and to scientific periodicals, Dr. Lankester wrote the 'Natural History of Plants yielding Food' and 'Memorials of John Ray,' published in 1845. He edited the 'Correspondence of John Ray' in 1846; published a translation of Schleiden's 'Principles of Scientific Botany' in 1849; he translated Küchenmeister's 'Animal Parasites' in 1859. In 1858 he published a popular work entitled 'Half-hours with the Microscope.' In 1855 he edited Macgillivray's 'Natural History of Dee Side and Braemar.' In conjunction first with the late Dr. G. Busk, and afterwards with his son, Prof. E. Ray Lankester, he edited the 'Quarterly Journal of Microscopical Science' from 1853 to 1871.

He died on Friday, October 30th, 1874, at Margate, and was buried in the churchyard of Hampstead Cemetery.

Robert James Farrants, F.R.C.S.

President 1861–2.

Beyond the fact that Mr. Farrants was a F.R.C.S. in practice in the north-east of London, little appears to have been known about him. He died at the age of sixty, some time in 1870. His name is best known to microscopists in connection with Farrants' mixture, which mounting medium may still be usefully employed for many objects.

Charles Brooke, M.A., F.R.S.

President 1863–4, 1873–4.

Charles Brooke, who joined the Society in 1851, and was elected as the thirteenth President, was born on the 30th June, 1804. He was the son of the well-known mineralogist, Mr. H. G. Brooke. His early education was carried on at Chiswick; after this he studied at Rugby; proceeding from thence to Cambridge, where he took honours as a wrangler. During the intervals of his University training he was a student at the Windmill Street School of Medicine. He completed his professional training at St. Bartholomew's Hospital. He lectured for one or two sessions on surgery at Dermott's School, and afterwards held positions on the surgical staff of the Metropolitan Free and Westminster Hospitals. At the latter institution he continued to lecture till a short time before his death. In 1884 the Royal College of Surgeons conferred an Honorary Fellowship on him; in 1847 he was elected Fellow of the Royal Society. He was President of the Meteorological Society; he also served on the management of the Royal Institution, and was connected with the management of many scientific, philanthropic, and religious institutes.

He was much esteemed as a surgeon; and was the inventor, forty years ago, of the "bead suture," which at that time was an advance in the scientific treatment of deep wounds. He invented those self-recording instruments which have been adopted at the Observatories of Greenwich, Paris, and other meteorological stations. They consisted of barometers, thermometers, psychrometers, and magnetometers which registered their variations by means of photography. His method obtained the premium offered by the Government for such apparatus, as well as a council medal from the jurors of the Great Exhibition of 1851. Mr. Brooke was the inventor of the double nose-piece for the Microscope.

He contributed many papers on physical and electrical matters to the 'Philosophical Magazine,' 'Philosophical Transactions,' 'Proceedings of the Royal Society,' and to the Reports of the British Association, &c.

Mr. Brooke edited, and in fact re-wrote Dr. Golding Bird's 'Elements of Natural Philosophy' (the fourth edition).

Mr. Brooke died at Weymouth on the 17th May, 1879.

Rev. Joseph Bancroft Reade, M.A., F.R.S.

President 1869–70.

Mr. Reade was one of the original Fellows of the Society, and was elected the fifteenth President. He was born on 5th April, 1801, at Leeds in Yorkshire. He received his early education at the Leeds Grammar School, and subsequently matriculated at Trinity College, Cambridge; he obtained a scholarship at Caius College. He entered the ministry, and at the time of his death (on 12th December, 1870) he held the Rectory of Bishopsbourne, near Canterbury. He was elected a Fellow of the Royal Society in 1838. In 1837, whilst making photographic experiments with the solar Microscope, he discovered a mode of separating the rays of heat from those of light, so as to enable pictures to be taken with cemented achromatic objectives, and it was at this time that he made the first microphotographs. He also discovered the value of gallic acid as a sensitizer, and hyposulphite of soda as a fixer. At the Exhibition of 1851 he exhibited an astronomical eye-piece, of his own invention, called a solid eye-piece, which was thought very highly of. About 1861 he invented the hemispherical condenser for the Microscope. He subsequently improved this by adding two lenses to the hemisphere. In 1869 he invented the illuminating prism which now goes by his name. Besides contributing to our own Journal he also published many papers on botanical, chemical, and astronomical subjects in the Reports of the British Association, 'Proceedings of the Royal Society,' 'Philosophical Magazine,' and other scientific publications.

William Kitchen Parker, F.R.S.

President 1871–2.

W. K. Parker was the sixteenth President of the Society. One of our ablest biologists is reported to have said, "Tap Parker, and osteology will flow out for a fortnight." Certainly no more accomplished comparative osteologist, or one who had the subject more thoroughly at his fingers' ends, ever lived. He was born at his father's farm at Dogsthorpe, near Peterborough, on June 23rd, 1823. Village schooling at Dogsthorpe and three-quarters of a year at Peterborough Grammar School prepared him for an apprenticeship, at 15 years of age, to Mr. Woodroffe, a chemist at Stamford. While there he usually rose several hours before his morning's work began, and scoured the neighbourhood for botanical specimens; thus, in two summers, he formed a collection of 500 species. He had already been attracted to anatomy, and without any instruction whatever, he made skeletons of many animals. Three years afterwards he was apprenticed to Mr. Costal, a medical practitioner at Market Overton. In December 1844 he entered Charing Cross Hospital as a medical student. He subsequently became prosector at Dr Todd's lectures at King's College. He qualified in 1849, and commenced practice at Tachbrook Street, Pimlico.

He was elected a Fellow of the Royal Society in 1865, and in the following year he received the Royal Medal for his researches in the developmental osteology, or embryonal morphology, of Vertebrates. In 1874 he was appointed one of the Hunterian Professors of Comparative Anatomy. In 1885 he received the Bayly Medal from the Royal College of Physicians. As a draughtsman, Prof. Parker particularly excelled, and the value of his memoirs was greatly enhanced by the excellence of the plates. In 1862 the Ray Society published the 'Introduction to the Study of the Foraminifera,' which he wrote in conjunction with Dr. Carpenter and Prof. Jones; and in 1868 the same Society published his monograph 'On the structure and development of the shoulder-girdle and sternum in Vertebrata.' In 1875 he, together with the late Mr. G. T. Bettany, brought out a work on 'The Morphology of the Skull.' He, in conjunction with Prof. A. Newton, wrote the article "Birds" in the 'Encyclopædia Britannica,' ninth edition, 1875. In 1885 he published the Hunterian lectures which he gave in 1884 under the title of 'On Mammalian Descent.' In vol. i. (1884) of the 'Zoology of the 'Challenger' he wrote the section on the Development of the Green Turtle. In the Proceedings and Transactions of the Royal, Linnean, and Zoological Societies, as well as in the 'Annals and Mag.,' the 'Zoologist,' and other scientific periodicals, will be found many monographs and papers by him on the morphology, chiefly cranial, of Vertebrates. He died suddenly on 3rd July, 1890.

Peter Martin Duncan, M.B., (Lond.), F.R.S.

President 1881–2–3.

Prof. Duncan was the twentieth President; he was born at Twickenham in 1824 and educated at the Grammar School there, and afterwards at a school in Switzerland. In 1842 he entered the Medical Department of King's College. He practised his profession of medicine at Rochester, Colchester, and Blackheath, but his taste for original research induced him to abandon the medical profession. In 1870 he was appointed Professor of Geology at King's College, which appointment he held till his death. He was one of the secretaries of the Geological Society from 1864 to 1870, and became its President in 1876. In 1866 he was elected a Fellow of the Royal Society, and served on its Council from 1876 to 1878. He was also President of the Geological Section of the British Association in 1879.

Prof. Duncan's favourite science was Palæontology, especially the Corals and Echinoderms. The Palæontographical Society published his 'Monograph of the British Fossil Corals' during 1866–72. In 1879 his memoir on the Syringosphæridæ ('Scientific Results of the second Yarkand Mission') was published. Many papers by him will be found in the publications of the Royal, Geological, and Linnean Societies, and also in the scientific periodicals. In conjunction with Dr. J. W. Griffith he edited the third edition of the 'Micrographic Dictionary.' In conjunction with Mr. Sladen he wrote the monographs on the Tertiary Echinoidea of India, in the 'Palæontologia Indica.' He also wrote 'A Monograph of the Fossil Corals and Alcyonaria of Sind,' published in 1880. He died on the 28th May, 1891.

II.—*A New Erecting Camera Lucida.*

By Edward M. Nelson, F.R.M.S.

(*Read* 21*st November*, 1894.)

Some few years ago we had an eruption of cameras, when every conceivable kind of prism was cut and tried, it would therefore under these circumstances seem impossible to bring forward any new form. If, however, we bear in mind that nearly all new ideas and inventions are complex, and subsequent improvements simplifications; and if we glance back at the multitude of complicated prisms which have long since passed away, we may find ample room for simplification.

Probably the most persistent of all forms of cameras ever designed is that known as Beale's neutral tint. It is acknowledged on all hands to be a defective form, but solely on account of its simplicity it is still largely used. There is only one defect in Beale's camera, but that is a serious one: the microscopic image as received at the eyepiece is inverted and transposed; now Beale's camera corrects the inversion, while it leaves the transposition untouched, therefore all objects drawn with this camera are unlike the originals. A drawing made with this camera will only be similar to the original when it is drawn on tracing paper and viewed from the wrong side.

This point is so important, and I fear so imperfectly understood by microscopists as a body, that a very simple example may be pardoned. Place the letter F on the stage in the position as here printed: when examined by the Microscope it will appear thus Ⅎ. Now in order to view this letter as the original all that we have to do is to turn this paper round. But this object as drawn by a Beale's camera will appear ꟻ, and, turn the paper which way you will, it can never become like the original; it will only become so when it is viewed as a transparency from the other side of the paper.

For micrometry and brass and glass work, this transposition is not of much moment, but in biological work it is of the utmost importance that things should be depicted as they really are. Thus there are some insects which have the right leg longer than the left; in drawing these therefore it would be making a serious error to reverse the order.

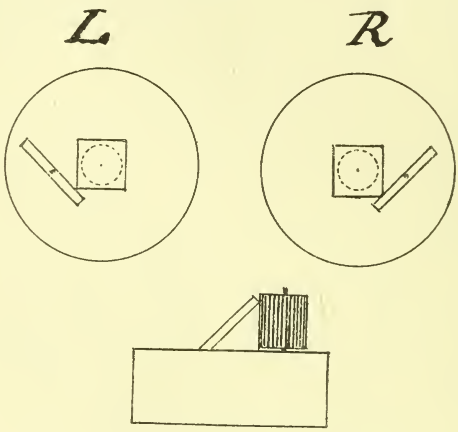
The difficulty with regard to the erection of the image has in the main been overcome by reflecting the image of the paper and pencil down the tube of the Microscope. The drawing thus made will of course be inverted and transposed, but by turning the picture round we at once have a correct representation of the object itself.

The instrument for this purpose which in recent years has come into considerable notoriety is that known as Abbe's camera lucida.

The idea is not a new one, for it was suggested for micrometric purposes by Mr. G. Burch.* Without discussing the respective capabilities of that and the one now before you, I think you will admit that the new one is the simpler and less cumbersome of the two.

My new camera merely consists of a small piece of common looking-glass, such as is used for the plane mirror of a Microscope, fixed at an angle of 45° to an eye-piece cap. This, when the Microscope is placed in a horizontal position, reflects the rays horizontally and at right angles to the optic axis; these rays then fall on a piece of neutral tint placed at an angle of 45° to these rays, so as to reflect them upwards to the eye.

Fig. 1.



The mirror corrects the transposition, and the neutral tint the inversion; an erect image is therefore seen on the table. In other words, the image is precisely the same as the object on the stage of the Microscope. (But any one who possesses a right-angled prism and places it anywhere between the objective and the eye-piece—maintaining, of course, a horizontal position for the reflected ray—can use any ordinary Beale camera on the eye-piece.)

The neutral tint is mounted on a pivot, so that it may be turned round through a right angle; this is to adapt the instrument for use with either the right or left eye. Of course it would be simpler and cheaper to make it immovable, adapting it for the eye which the observer is in the habit of using.

By this device the simplicity of the Beale's neutral tint is maintained, while the serious disadvantage spoken of above is removed.

The rules for working this instrument are precisely the same as those for Beale's neutral tint. The old caution, however, may as well

* Journ. Quek. Micr. Club, v. (1878) p. 47.

be repeated, viz. that when with a critical image the light becomes too strong it should be modified by glass screens placed at the back of the substage condenser, and not, as is too often the case, by racking the condenser out of focus, which would instantly put an end to the criticalness of the image.

As the inversion and transposition of Microscope images, either when projected or photographed, or seen through various cameras, is not quite so simple as it appears, and as in works on the Microscope and on photomicrography the subject is conspicuous from its absence, I have drawn up the following table which will, I trust, place the phenomena in the clearest possible light:—

		3. Image projected on screen or on sensitive plate. ꟻ	4. Image seen through ground glass. F
1. Object on stage. F	2. Image seen through eye-piece. Ⅎ	5. Image seen through Wollaston's camera. Ⅎ	6. Image seen through Beale's neutral tint or Soemmering's mirror. ꟻ
		7. Image projected on table by 45° mirror or right-angled prism (C. W. Cooke, 1865). F	8. Image seen through Nelson's camera. ㄒ

No. 2. This is the image that is traced when cameras, which project the image of the paper and pencil down the tube of the Microscope, are used. No. 1 can be reproduced by inverting the drawing.

No. 3 is important, because it shows that when a projection Microscope is employed, though the image is erect, it is still transposed. Further, when a negative is printed by contact, or copied by projection in a camera, provided that the film faces the lens, the print will be the same as the original. (Note, in an ordinary landscape camera, although the case is different, the image on the sensitive plate being inverted and not transposed, thus ᖵ, yet when printed either by contact or by projection, so long as the film faces the lens, the image will be similar to No. 1.)

No. 5. By inverting the drawing the original is represented.

No. 6. The original is not reproduced whichever way the paper is turned. In order to obtain an exact copy of the original it is necessary to draw the object on tracing paper and view it from the wrong side.

No. 7. This case is not so clear; the mirror erects the inverted image No. 2, but its transposition is due to the fact of its not being viewed as a transparency.

Addendum (*read 19th Dec.* 1894).

The discussion on my paper opened out some interesting points with regard to drawing with the Microscope and the distortion of the image. It was suggested that a direct drawing made by placing ruled squares on the diaphragm of the eye-piece, and using paper ruled in squares, was more accurate than one made by a camera lucida, for this reason, that unless all points of the paper were at an equal distance from the camera lucida the magnification would not be uniform throughout the image. In other words, that unless a camera lucida drawing is made in a hollow spherical shell, whose radius is equal to that of the distance of the paper from the camera lucida, distortion will be present.

This is quite true, but is the direct method any better? for it was pointed out many years ago by Coddington, that owing to the "over refraction of the oblique pencils" a real image had barrel distortion, fig. 2, and a virtual pincushion distortion, fig. 3. The real image formed by the objective has therefore barrel distortion, fig. 2, which is made rectilinear by the virtual or pincushion distortion of the eye-piece. If therefore we place ruled squares on the diaphragm of the eye-piece they will suffer pincushion distortion by reason of the virtual image formed by the eye-lens. Hence if we place ruled squares on the stage of the Microscope, and view their image through a properly constructed Microscope, we ought to obtain a perfectly rectilinear image, because the barrel distortion will have been compensated by the pincushion distortion of the eye-piece. But if we make a drawing of this rectilinear figure by means of the pincushion distorted squares at the diaphragm of the eye-piece, the drawing so made will obviously be barrel distorted. Suppose we place an objective on the nose-piece, which will magnify the squares on the stage so that they appear the same size as those at the diaphragm of the eye-piece, they will coincide with one another in the centre of the field, but at the margin, where the pincushion distortion more largely exists, the lines of the

Fig. 2.

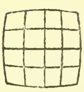
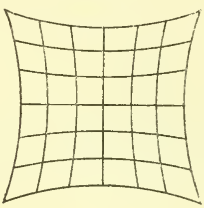


Fig. 3.



squares in the grating at the diaphragm will diverge from those in the image formed by the objective, and if a corresponding drawing be made on rectilinearly ruled paper a barrel distorted image must necessarily be produced.

It is only when there is a pincushion distorted image in the Microscope that the method of drawing on rectilinearly ruled paper by comparison with ruled squares at the diaphragm of the eye-piece yields a true picture.

Note.—Figs. 2 and 3 are not diagrammatic, but are drawn to scale, and if they are reproduced precisely the same size as the drawing they will represent the amount of distortion produced by a plano-convex lens of $2\frac{3}{4}$ in. focus, such as the plano-convex field lens of Powell's 2 in. Huyghenian eye-piece. If that, or a similar lens, be held about 17 in. from the eye and 6 in. from the pincushion figure, the convex side of the lens facing the figure, an inverted, real, but rectilinear image will be seen ; this proves that the lens has produced a corresponding amount of barrel distortion. Whereas, if the small barrel figure be brought $1\frac{1}{2}$ in. from the lens, the eye being kept at the same distance as before, and the convex side of the lens still facing the figure, a virtual, erect, and rectilinear image will be seen, which shows that the lens has given pincushion distortion to an equal extent. The images will appear about the same size, the real being a diminished, and the virtual a magnified image.

III.—*A Portable Microscope by J. Zentmayer of Philadelphia.*

By Edward M. Nelson, F.R.M.S.

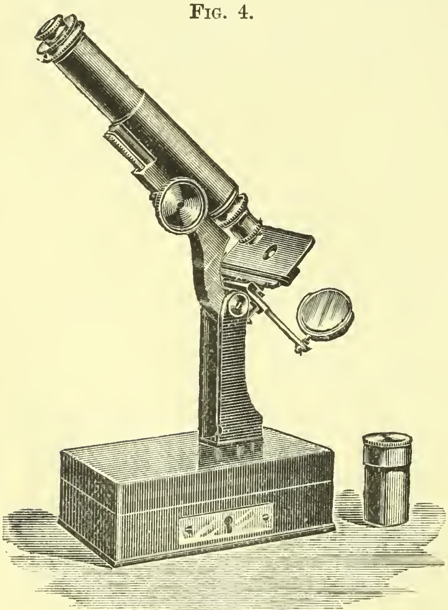
(*Read* 21*st November*, 1894.)

This instrument, while probably the smallest portable Microscope in existence, is nevertheless a thoroughly useful one for real practical work. It is not, therefore, what so many of these pocket Microscopes actually are, a toy. The box in which it is packed is unusually small, measuring $4\frac{5}{8} \times 3\frac{1}{8} \times 1\frac{5}{8}$ in.

A glance at fig. 4 will show that a very early feature is retained by making the box the stand (J. Marshall's Microscope was mounted in this manner, 1704).

This Microscope has a firm and well-made coarse-adjustment. The stage, $2\frac{5}{8} \times 1\frac{3}{8}$ in., is plain, having a wheel of diaphragms let into its thickness; it now has a sliding bar, but originally it was fitted with spring clips, of the Powell type, fixed below the stage. One word about this sliding bar before passing on. Mr. Rousselet, the owner of the instrument, with his usual ingenuity, has fitted whalebone instead of steel springs below the lugs of the sliding bar. This is quite a novel feature in microscopical construction, and a smoother sliding bar I have never used. This is a point Microscope makers might adopt with advantage; a steel spring always works stiffly on a brass plate; if the spring is made of metal it ought to be brass also, but whalebone is better.

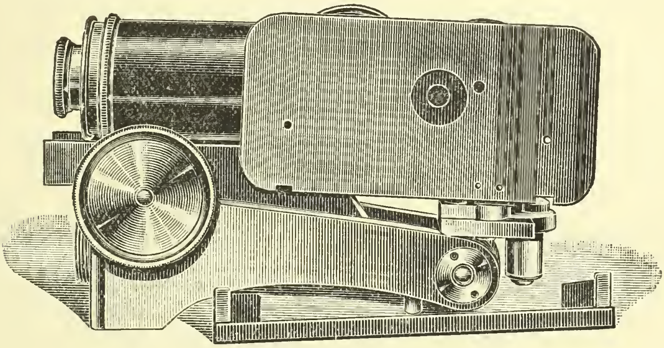
Fig. 4.



The body, which is $2\frac{3}{4}$ in. long, is tapped with the Society's screw, it has a draw-tube, which permits of a total extension of $5\frac{1}{4}$ in.; it has one Huyghenian eye-piece, and by drawing this out another inch of tube-length can be obtained. The illuminating apparatus consists only of a concave mirror. The manner in which the stage is mounted is peculiar: it, in common with those of most portable Microscopes, revolves on a pivot, but in this one the pivot is not in a line with the axis, but is a little towards the right-hand side of the stage; and curiously the hole in the stage is not in its centre, but is displaced 1/8 in. nearer to the right-hand side. When the stage is rotated into position it is held there by a spring notch.

To pack up the instrument the legs are bent back against the limb; the stage, being released from the spring notch, is turned through 3/4 of a whole revolution, until it lies along the body as in fig. 5. The mirror, by means of its cranked arm, is turned against the other side of the body; the sliding arm however packs separately in the lid of the box.

Fig. 5.



There is a new feature about the box, it has a stout brass plate attached to the bottom to impart steadiness. The weight of the box is 13 oz., and that of the Microscope with an objective is 17 oz. My Jubilee Microscope,* with objective and substage condenser, weighs 14 oz., and its stand 2 lb.; its foot might screw into the lid of its box, and thus the stand might be dispensed with. The Zentmayer has the more rigid limb and legs, while mine has the more rigid stage. The size of the Zentmayer when closed, and without its box, is $4\frac{1}{4} \times 2\frac{1}{2} \times 1\frac{3}{8}$ in., while that of the Jubilee is $4\frac{5}{8} \times 3 \times 2$ in.; its body, which is 4 in. long, is separate. The distance of the optic axis from the limb in the Jubilee is $1\frac{3}{16}$ in. as against 3/4 in the Zentmayer. This is a defect in the Zentmayer, for when the sliding bar is on the stage nothing can be seen on a 3×1 slip higher than 1/8 in. from the centre. If an object were higher than this the slide would have to be reversed. This might not make much difference beyond a slight inconvenience with mounted objects, but it would be very inconvenient whilst following living objects. If the sliding bar were replaced by the original spring clips, a little more but still an insufficient amount of play would be given to the slide.

* See this Journal, 1887, p. 1013, figs. 238, 239.

To sum up the advantages and disadvantages of both models. The advantages in the Zentmayer form seem to me to be rigidity of limb and legs, and the body taking the Society's thread; while that of the Jubilee is the firmness and size of the stage, and the possession of a substage condenser. The disadvantages of the Zentmeyer are the insufficient distance between the optic axis and limb, and the want of a substage condenser; while those of the Jubilee are the weakness of the bar, the separation of the body in packing, and its not having the Society's screw.

In this summary I do not wish to make any invidious comparisons between Zentmayer's and my own model, but merely to point out their respective advantages and defects, so that any future designer of a portable Microscope may avoid the errors of both designs.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.

*Including Original Communications from Fellows and Others.**

ZOOLOGY.

VERTEBRATA:—Embryology, Histology, and General.

a. Embryology.†

Inadequacy of Cellular Theory of Development.‡—Mr. A. Sedgwick returns to the attack on the cellular theory which he made, in guarded terms, ten years ago. Notwithstanding changes of opinion among some biologists, Mr. Sedgwick finds that the theory still blinds men's eyes to the most patent facts, and still obstructs the way of real progress in the knowledge of structure. One difficulty is that there is a want of precision about the cell-phantom which he desires to lay.

To illustrate his meaning, Mr. Sedgwick first discusses the so-called mesenchyme tissue of Elasmobranch embryos; this is said to consist of branched cells lying between the ectoderm and endoderm, but, as a matter of fact, there are no such separate cells, but in their place a reticulum of a pale non-staining substance, which holds nuclei at its nodes. Another erroneous view is that this tissue is not continuous with the ectoderm or endoderm, whereas the fact is that the primary layers are simply parts of this reticulum, in which the meshes are closer and the nuclei more numerous and arranged in layers. These facts can be easily seen, and they would, Mr. Sedgwick thinks, have been recognized long ago had it not been for the dominating influence of the cellular theory of development. Turning next to the origin of nerve-trunks and the fate of the neural crest, the nerves, he says, are developments of the

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, &c., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development and Reproduction, and allied subjects.

‡ Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 87–101.

reticulum, being, as it were, a gathering up of its strands; or, to put it in another way, nerves are a special development of the reticulum along certain lines. These special developments are generally marked by an increase in the number of nuclei, such increase being particularly great in the neighbourhood of the ganglion. The development of nerves is not an outgrowth of cell-processes from certain central cells, but is a differentiation of a substance which was already in position; this differentiation seems to take place from the medullary walls outwards to the periphery, both in the anterior and the posterior roots, and to precede, or to proceed *pari passu* with, the development of other tissue. The nerve-crest, then, is a centre for the growth of nuclei; there are many other such centres, as the walls of the cœlom, the caudal swellings, and, in the Amniota, the primitive streak. All these centres of growth are in so-called epithelial tissues, of which, indeed, at one stage many embryos are entirely composed.

Mr. Sedgwick adduces evidence to show that nervous, muscular, connective, and vascular tissues are all developed in continuity, and proceeds to discuss some details of the development of the cranial nerves of Elasmobranchs, into which our space will not allow us to follow him. We must be content to report that the embryonic medullary wall is connected with the reticulum by pale fibres similar to those which compose the reticulum, and the nerve-roots, both anterior, posterior, and cranial, are special enlargements of such connecting strands. "They are formed at a time when no structures which could be called cells by any but a fanatical devotee of the cellular theory are present."

This essay will probably give rise to a lively discussion.

Experimental Embryology.*—Dr. R. Zoja has experimented with ova of *Clytia flavidula*, *Laodice cruciata*, *Mitrocoma Annæ*, *Liriope mucronata*, *Geryonia proboscidalis*, and other Medusæ, isolating blastomeres by operation. He finds that a fraction as small as 1/16 will follow a development like that of the entire ovum and will produce an entire organism. The limit observed by Driesch and Wilson in Echinoid and Amphioxus ova was one-quarter. There is nothing about the development of the Medusoid blastomeres to suggest indirect regenerative processes, each segment developes like the whole ovum. The facts point to the conclusion that the early cleavages are quantitative.

Human Embryology.†—Dr. W. O. Manton has published a syllabus of lectures on Human Embryology, as an introduction to the study of Obstetrics and Gynæcology. The work is certainly not adapted for the general student; the "numerous outline drawings" have a very sketchy appearance, and are not well executed.

Development of Primordial Cranium in Man.‡—Herr M. Jacoby comes to the following general conclusions:—First, as to the method of development, it is inaccurate to adopt Kölliker's generalization according to which the cranium ceases at an early stage to differentiate, and only grows. Although it is indeed a continuous mass without separate cartilages, there are distinct parts and histological hints of progressive dif-

* Anat. Anzeig., v. (1894) pp. 195–8.
† Philadelphia and London, 8vo, 1894, vi. and 125 pp., 69 figs.
‡ Arch. f. Mikr. Anat., xliv. (1894) pp. 61–86 (1 pl.).

ferentiation. Secondly, as to the relation between the human primordial cranium and that of other Mammals, Jacoby thinks there is exaggeration in the common statement that the development of the primordial cranium gradually decreases throughout the series, and is at its minimum in man. He directs attention especially to the marked development of the "parietal plates" which in his specimen were strongly developed laterally and were also closed dorsally. Thirdly, as to the stapes, the author is very cautious, but believes in its relation to Reichert's cartilage. He also notes that he found only a very narrow perichondrial layer between the distal ends of Meckel's cartilages.

Vitelline Body of Balbiani.*—Herr H. Mertens has studied this much-discussed body in the ova of young mammals and birds, e. g. cat, rat, chick, pigeon. He finds that the term has been applied to two quite different elements. First, there is the attractive sphere, a rounded granular mass near the germinal vesicle, increasing in size as the ovum becomes more mature. Secondly, there are elements of nuclear origin found within the vitelline mass and consisting of chromatin granules of variable size. These are expelled from the germinal vesicle when it is young and active, and break up finally into vitelline granulations.

Oogenesis in the Rabbit and the Medullary Strands of the Ovary in Fox and Man.†—Dr. A. Bühler observes that a germinal epithelial cell in the rabbit divides by indirect cell-division into two cells, of which the one next the stroma becomes an ovum. This is enveloped by cells of the epithelium, and by the forward growth of the epithelium becomes ensheathed by the stroma. But when stroma and epithelium have not time to surround the ovum before new ova are produced, balls of ova and immigrant epithelial cells are formed; at a later stage the epithelial cells are arranged around the ova, and the follicle rudiments so arising are received within the stroma. In man, similar facts were observed, excepting the mitoses in the germinal epithelium.

In fox and man the Wolffian duct persists, for the most part obliterated, as a "fundamental strand" (*Grundstrang*) in the hilus ovarii. The medullary strands of the ovary are products of the epithelium of the same duct, which come into the closest relation with the growing follicles; the tubules of the epoophoron have a similar origin.

Anterior Extremity of Notochord in higher Vertebrates.‡—M. G. Saint-Remy finds that in Birds and Mammals the notochord ends primitively at the point of insertion of the pharyngeal membrane. It is only secondarily, and in consequence of the growth of epithelium, that it is displaced, and comes into relation with other points. The author refuses, therefore, to regard Seessel's pouch as the end of the undeveloped notochord, and thinks rather, with Selenka, that the pouch has no morphological significance, and is only a groove formed mechanically by the cephalic flexure.

Origin of Sympathetic System.§—Dr. G. Mazzarelli has investigated embryos of *Pristiurus*, *Torpedo*, *Rana*, *Tropidonotus*, *Zamenis*, and

* Arch. Biol., xiii. (1893, published July 1894) pp. 389–422 (1 pl.).
† Zeitschr. f. wiss. Zool., lviii. (1894) pp. 314–39 (2 pls.).
‡ Comptes Rendus, cxix. (1894) pp. 567–9.
§ Atti R. Accad. Lincei (Rend.), ccxci. (1894) pp. 269–73 (1 fig.).

Passer in regard to the origin of the sympathetic nervous system. He has no doubt that the sympathetic ganglia arise from the spinal ganglia and therefore from the ectoderm. A proliferation in a ventral direction from the ganglionic rudiment gives rise to elements which gradually accumulate dorsally, and approach the walls of the aorta and cardinal veins. They are at first scattered in the mesenchyme, but come to form a cord in which the spinal ganglia arise dorsally and the sympathetic ventrally.

Bulbus Cordis in Birds and Mammals.*—Dr. A. Langer finds that in Birds the division in the bulbus proper is effected by the fusion of longitudinal pads, which correspond to the bulbus-pads in Reptiles. At the origin of the bulbus, however, the division is effected by a fusion of two pads which probably correspond to the ostium-pads of Reptiles. The valves, as in Reptiles, take their origin wholly from the bulbus-pads. In the Mammalian embryo the two ostium-pads, and the first and third bulbus-pads have fused into two longitudinal pads. For details, however, which are difficult to state without the accompanying figures, the original paper must be consulted.

Development of Wing of Sterna Wilsoni.†—Mr. V. L. Leighton finds that, in Wilson's Tern, there are at least seven elements in the carpus, and four distinct metacarpals. The evidence is in favour of the persistent digits of the bird's wing being II., III., and IV., and not I., II., and III.

Notes on Development of Amphibia.‡—Dr. H. H. Field finds that the archinephric capsule of Amphibians is a product of the protovertebra; an analogous organ is, in all probability, present in *Acipenser sturio* and in *Petromyzon*. It is not, however, an independent organ, but represents the last remains of a protovertebral process, the ventrally growing edge of which gives rise to muscles. The ventral musculature arises, along the whole length of the body, from this part of the protovertebra. The elements which are destined for the musculature of the extremities are at a very early stage likewise given off from the ventral part of the protovertebral process.

The connective tissue elements of the limbs arise from a thickening of the lateral somatopleure which combines with the elements derived from the protovertebra to form an apparently homogeneous "Anlage." In *Amblystoma* a very small number (about three) of the protovertebræ take part in forming the "Anlage" of the anterior extremity. The presence of a serially homologous somatopleuric thickening between the two pairs of limbs may be taken as an indication of the previous existence of a continuous fold.

Origin of Bones of Teleosteans.§—Mr. R. G. Harrison doubts the correctness of Dr. H. Klaatsch's conclusion that the scleroblastic cells of Vertebrates are derived exclusively from the ectoderm. He brings forward evidence to show that the apparent disappearance of the membrane bones at certain points, and the incrowding of ectodermal cells into the

* Morph. Jahrb., xxii. (1894) pp. 99–112 (11 figs.).
† Tufts College Studies, No. 3 (1894) pp. 63–76 (1 pl. and 7 figs.).
‡ Anat. Anzeig., ix. (1894) pp. 713–23 (5 figs.).
§ Op. cit., x. (1894) pp. 138–43 (3 figs.).

underlying tissue are merely due to the obliquity of the plane of section, and the consequent overlapping of the two layers; the splitting off of the lower layer of the ectoderm appears to be due to resistance offered to the section-knife; no actual inwandering of this layer into the mesenchyme can be observed.

Fins of Fishes.*—Prof. C. Gegenbaur maintains that there is fundamental uniformity in the fin-skeleton of Selachii, Crossopterygii, and Dipnoi. The type is a stem with biserial radials—an archipterygium. Whether the stem is much jointed or but little is immaterial; even in the young *Ceratodus* it is not jointed (Semon); between recent Selachii with few joints and Xenacanthinæ with many there are all possible stages; similarly the biserial radials are plain enough in the old Xenacanthinæ. In Selachii the distal modification of the hind-fin as a "mixipterygium" is associated with a loss of median radials; the loss of the mixipterygium in Teleosteans, &c., is associated with great reduction of the hind-fin. Gegenbaur gives this comparative table as to fore-fin:—

Crossopterygii.			Dipnoi.			Selachii.	
Fin-stem			Stem long, much-jointed, basal joint specially differentiated.			Radials only biserial terminally.	
long	short radials		Radials			Stem	
	probably uniform	heterogeneous	biserial	uniserial	absent	much jointed	with few joints; lateral radials reach shoulder girdle
Phanero-pleurini Holoptychius	Cœlacanthini	Polypterini	Ceratodus	Protopterus	Lepidosiren	Xenacanthinæ	Recent Selachii

But it is perhaps more appropriate to notice that Gegenbaur adheres to his original theory in regard to the origin of paired fins. As is well known, he finds the material for fins in the branchial arches. He seeks to show why there is no longer any ontogenetic evidence of this, and maintains that an ætiological explanation which finds the cause of an origin in the final function is just "die alte Teleologie." He derives the skeleton of a fin from a branchial arch and its musculature from a portion of the associated myomere which, with new attachments, acquired a new function.

Development of Olfactory Organ of Torpedo.†—Mr. John F. Holm describes as the first stage an ectodermal thickening a little to the side of the neuropore; it is connected with the brain at one spot through rows of cells. Secondly, the organ begins to involute and increases in thickness, while the brain has now retracted. Connecting nerve-cells between the brain and the olfactory organ represent the beginning of the olfactory nerve or ganglion. It seems probable that "during the process of separation of the brain from the organ some of the connecting cells elongate, send out fibres, and thus form a beginning of an olfactory nerve or ganglion, so that a kind of connection always exists from the very first." Thirdly, the organ forms a pit or sack and the olfactory bulb is differentiated, giving off numerous nerve-fibres.

* Morph. Jahrb., xxii. (1894) pp. 119–60 (5 figs.).
† Anat. Anzeig., x. (1894) pp. 201–7 (6 figs.).

Pronephros of Lepidosteus.*—Dr. J. Beard finds in unhatched or newly hatched embryos of *Lepidosteus osseus* that the pronephros presents on each side three outer and three inner ciliated funnels. The three outer open into the general body-cavity, the three inner into a capsule, which represents a shut-off portion of the body-cavity. Into the capsule there projects from the under side of the aorta a long folded glomerulus, made up of small and large lappets. At a later stage the number of outer and inner funnels becomes reduced to two on each side; and it should also be noted that to begin with there are suggestions of five or six. The author discusses the resemblances between *Amia*, *Lepidosteus*, and *Acipenser* as regards the pronephros; *Lepidosteus* is less reduced as to its funnels, and therefore, in this respect, more primitive than *Amia*, but whether the pronephros of *Acipenser* is really the most primitive of the three, as Jungersen would have it, can hardly as yet be decided.

Metamorphosis of the Attraction-sphere in Spermatogonia of Salamander.†—Dr. F. Meves describes in great detail how the attraction-sphere in the spermatogonia of *Salamandra maculosa* breaks up at the end of summer into a mass of granules, out of which it is reconstituted in spring. He distinguishes a medullary and cortical zone in the sphere, and describes its normal state as well as that of the nucleus and the cell-substance. The change is first seen in the form of the sphere, which becomes irregular with small tubercles. Then it breaks up into a number of separate bodies, roundish, oval, concavo-convex, or otherwise in form. These separate in the cell-substance and break up into smaller portions. They come to surround the nucleus, and cease to be homogeneous, becoming granular. Meanwhile the nucleus also changes, becoming cleft and "polymorphic," and the cytoplasm becomes looser in structure. Reverse processes occur in spring. In a number of testes fixed in spring, Herr Meves was able to detect an elimination of nuclear and even nucleolar substance.

The author thinks that the metamorphosis of the sphere chiefly affects the cortical zone, and that the medullary zone possibly remains intact. But the intricate process remains enigmatical. The elimination of nuclear material is possibly comparable to a "réduction karyogamique."

β. Histology.

The Central Corpuscles.‡—We should have given an earlier notice of Prof. M. Heidenhain's great paper on central corpuscles and their relations to nucleus and cytoplasm, but the magnitude of the task has delayed us. The cells investigated were lymphocytes and the giant cells of the medulla of bones, for it appeared safer to make an exhaustive study of these two types, than to attempt more diffuse investigation.

The first chapter deals with the microcentrum. The resting cell has at least two centrosomata, though by over-differentiation of the

* Anat. Anzeig., x. (1894) pp. 198–201.

† Arch. f. Mikr. Anat., xliv. (1894) pp. 119-84 (5 pls.). [This journal now changes its title to 'Archiv für Mikroskopische Anatomie und Entwicklungsgeschichte.']

‡ Arch. f. Mikr. Anat., xliii. (1894) pp. 423–758 (7 pls.).

cell it may be that only one is visible. But there is often a third little body—an accessory corpuscle—or there may be two. These, with the centrosomes, are imbedded in an achromatin substance in the centre of the astrosphere. This structure, which binds the centrosomes in organic unity ("a primary centrodesmosis") is the *microcentrum.* The author gives statistical tables showing the size-relations and numerical relations of the parts of the microcentrum in 1000 lymphocytes; thus 74·6 per cent. have centrosomes of unequal size, 19·1 have equal centrosomes, and in 6·3 there are three corpuscles without an accessory corpuscle distinguishable as such, for its presence is not constant. The substance included in the primary centrodesmosis is the material from which the central spindle is formed by assimilation, growth, and differentiation; it is the rudiment of the central spindle in the resting cell, and the accessory corpuscles are minute extra centrosomes. During rest, one or two centrosomes may be formed anew, by a process comparable to budding. The microcentrum is an organ which pursues its course of development to a certain degree independently of mitosis.

The second chapter discusses the position of the microcentrum and the polymorphism of the nucleus. The polymorphism only occurs when the volume of cytoplasm is relatively little when compared with the volume of the nucleus. A large proportion of the cellular threads (the fila of the mitome) are centered as radii around the astrosphere; they are the organic radii of the cell; the microcentrum is their point of insertion. All the radii are supposed to have the same number of microsomata, and it is supposed that under equal strain they are of equal length. What Heidenhain seeks to show is that the relative positions of microcentrum, nucleus, and masses of plasma, as well as the polymorphism of the nucleus, are interpretable in terms of varying tension in the mitome.

The third chapter criticizes Flemming's attempt to deduce a "polarity" of the cell from the presence of two centrosomes. Heidenhain finds that Flemming's so-called cell-axis—drawn through the two centrosomes—is quite inconstant, and he dismisses this conception of polarity.

The fourth chapter discusses the final movements of mitosis (telophases, telokinesis). They also are interpreted in terms of the tensions of the mitome threads. The fifth chapter deals with the structure of the nucleus. The framework consists of a fundamental substance (linin) with spherules (microsomes) of the size of centrosomes imbedded in it. The author distinguishes oxychromatin (or lanthanin) with a special affinity for acid anilin stains (rubin S) from basichromatin with a special affinity for basic anilin stains (Biondi's methyl-green). All nuclei show this double reaction, but the two substances occur in intimate juxtaposition; oxychromatin is probably nuclein poor in phosphorus, while base chromatin is rich in phosphorus; the diverse affinities of the microsomes probably vary in an unknown way according to the metabolism of the nucleus and cell.

Herr Heidenhain then passes to the megacaryocytes, the giant-cells of the medulla. The sixth chapter describes their form and nuclei. The concentric layering of the cytoplasm is very characteristic, and is the subject of the seventh chapter; there are three layers in the ectoplasm, and three orders of limiting membrane; even the endoplasm shows a hint of two zones. As to the centrosomes (chap. 8.), they vary in number up to 135! there is a constant central group and there are several smaller groups. The ninth chapter is full of details as to the fine structure of the protoplasm in giant cells; then follow chapters on the development of the cells—their early stages, their mitoses, their direct division, and on their degeneration—which shows (*a*) forms described by Arnold, with chromatolytic nuclei, (*b*) forms without protoplasm, (*c*) complete disruption of nuclei.

The thirteenth chapter, which begins the theoretical portion, discusses the general conception of a centrosome. Central corpuscles are sharply defined solid granules of very small size, specifically stainable by iron-hæmatoxylin. They have the power of assimilating, of growing, and of multiplying by budding. They show a marked tendency to form groups, and the members of a group are united by a substance formed during multiplication. Singly or as a group they unite the origins of the threads of a centered system.

The next chapter is devoted to a general discussion of the astrosphere. This is a topographical conception. The astrosphere or attractive sphere is no definite organ; it owes its origin to the fact that the inner ends of the threads of a centered system are secondarily defined off from the rest of the cell by the appearance of a granular zone.

As to the archoplasm (chap. 14), it is no substance of specific quality, as Boveri maintains, but a part of the cyto-mitome. The alleged ubiquity of centrosomes is the subject of the next chapter. This was a bold prophecy on the part of van Beneden and Boveri, but it seems justifiable. The centrosome appears to be constant in all cells which are still able to divide. But the author is careful to notice that there is apparently a formation of centrosomata *de novo* in many cells, and that the centrosome is apparently absent from cells of the adult body which are incapable of division (ganglion-cells). The sixteenth chapter is concerned with showing that there is a specific substance in the centrosomes which does not occur in other parts of the cell. As to the physiological rôle of the centrosome (chap. 17), whether it be the central insertion-point of a system of contractile fibrils, or whether it is a dynamic centre controlling its surroundings, Heidenhain is cautious, but the former is the alternative which he supports.

The origin of the centrosome (chap. 18) is then discussed. It is a question of topography mainly, for there is no essential difference between nuclear and cytoplasmic substance. The author's view is that the macronucleus of Infusoria represents the nucleus of Metazoa, that the chromatin substance of the micronucleus has disappeared from the cells of Metazoa, that the achromatin substance surrounding the centrosome in the microcentrum of lymphocytes corresponds to the achromatin substance of the micronucleus of Infusoria, both giving origin to spindles; the macronucleus has come to be represented by the part transporting the chromosomes; the centrosomes are polar differentiations of the micronuclear spindle. Finally (chaps. 19 and 20) the author discusses the various hypotheses of cell-polarity (Flemming's, Rabl's, van Beneden's), but we refrain from following him. While we have stated his chief conclusions, it is self-evident that we have been forced to leave untouched much that is important in this monumental memoir.

Cell-Studies.*—Dr. F. Reinke refers first to Kromayer's conclusion that the chromatophores in the epidermis of mammals, e. g. man, are not cells, but fibrils of epithelial cells, modified into pigment, and that one cannot tell where the fibres of one cell end and those of another begin. Reinke cut sections of skin hardened in alcohol, stained them for several days in concentrated alcoholic solution of safranin half diluted with water, washed them, left them 1-3 hours in potassium iodide, and differentiated them with picric acid in absolute alcohol. So prepared the sections show the body of the cell, the fibrils traversing it, and the intercellular bridges, with nodes on the middle of them. The limits of the cells are quite distinct. Perhaps the nodes represent multiple cell-plates.

Reinke then describes the system of radiating threads in leucocytes, the formation of collagen and elastic fibres and granular substance in fixed connective-tissue cells; he discovers small bodies, like the trophoblasts of plants, which appear to form the organic substrata of the pigment-granules in animals.

Like Heidenhain, he finds a complex structure in the "nuclear sap" (parachromatin of Pfitzner, paralinin of Schwartz). Using the lysol method and others, he comes to the conclusion that the linin is the nuclear plasma, and that it becomes web-like or foam-like, owing to the presence of granules imbedded in it. These granules are partly of chromatin, partly of another substance which has remarkable properties and to which he gives the name œdematin. Of this substance he has much to say, and he shows that a series of nuclei may be differentiated in relation to the state of the œdematin present and the manner in which the lysol acts.

Nature of the Central Spindle.†—Dr. L. Drüner regards the central spindle as a supporting framework which not only fixes the poles against one another, but by its growth determines their distance, altering in form according to the strain on the fibres at different moments.

Variations in Mitosis.‡—Herr V. Herla has studied the variations in the mitosis of *Ascaris megalocephala*. In the *univalens* variety he noted prophases with *two* chromosomes in each pronucleus, prophases with a longitudinal division of the chromosome within the pronucleus, metakinesis and dyaster also with traces of the precocious longitudinal division of the chromosome, metakinesis and dyaster, with the two halves progressing at unequal rates towards the poles, reconstruction associated with a secondary division, peculiar bilobed nuclei, ova with three chromosomes, ova with six chromosomes and abnormal polar bodies, and so on through a long list.

In an ovum with three chromosomes the development remains normal. An ovum of the *bivalens* variety may be fertilized by a spermatozoon of *univalens* variety, and develope. To say the least, one must be careful not to exaggerate the exactness with which the chromatin elements represent the hereditary material.

The doubling of the chromosomes is regarded as a manifestation of

* Arch. f. Mikr. Anat., xliii. (1894) pp. 377–422 (3 pls., 1 fig.).
† Jenaische Zeitschr. f. Naturwiss., xxviii. (1894) pp. 469–74.
‡ Arch. Biol., xiii. (1893, published July 1894) pp. 423–520 (5 pls.).

their proper activity, but in their movement to the poles they are passive, and move only in virtue of the contractility of the achromatin.

The central corpuscle and the attractive sphere are morphologically quite distinct, with different staining reactions. Between the two halves of the equatorial plate Herla discovers a new element, the equatorial "lentille." Everything points to the conclusion that the phenomena of karyokinesis are dominated by the attractive spheres.

These are some of the conclusions which Herla has reached in the course of his studies. The chief importance of his paper is probably in the first part—his contribution to cellular variation and pathology.

Giant-Cells of the Medulla of Bones.*—Prof. M. Heidenhain describes the mononuclear "megacaryocytes" from the osseous medulla of the rabbit. The enormous nucleus is a perforate hollow sphere, with irregular external lobes. Its framework consists of a ground-substance of linin, with chromatophilous microsomata imbedded in it. In the ectoplasm three concentric zones are distinguishable, and the endoplasm may also exhibit differentiated layers. Numerous central corpuscles occur in groups; in one case 135 were counted. Heidenhain discusses the minute structure of the plasma, and interprets the zones of the ectoplasm as an arrangement which allows the rapid production of a cell-membrane. Probably the only function of the megacaryocytes is to take up albuminoid material, act upon it in some specific way, and return it again to the blood-plasm.

Morphology and Distribution of Wandering Cells of Mammalia.†—Dr. A. A. Kanthack and Mr. W. B. Hardy point out that the recognition of the fact that the fine granule of the common blood-corpuscle of Mammalia is oxyphile (or stains with acid dyes) enables us to improve on Ehrlich's classification of the specific granules of wandering cells, and to arrange them in two main groups:—

I. Oxyphile granules { (a) Coarse (Eosinophile of most writers).
(b) Fine.

II. Basophile granules { (a) Coarse (Ehrlich's γ granulation).
(b) Fine „ δ „

Similarly, the wandering cells of Mammals fall into three groups:—

I. Oxyphile cells { (a) Coarsely granular.
(b) Finely „

II. Basophile cells { (a) Coarsely granular.
(b) Finely „

III. Non-granular or hyaline cells.

To these may be added:—

IV. Immature cells or Lymphocytes.

These different cells are described in detail, and the following table gives the facts of structure and distribution of the cells composing the sporadic mesoblast of the higher Mammalia:—

* SB. Phys. Med. Ges. Würzburg, 1894, pp. 18–32.
† Journ. of Physiol., xvii. (1894) pp. 82–119.

Division I.	I. Oxyphile.	II. Basophile.	III. Hyaline.
Hæmal cells; characterized by being relatively small cells with fine specific granules.	Nucleus branched; specific granules small, with relatively feeble oxyphile reaction.	Nucleus lobed; specific granules very small.	Nucleus round; no specific granules.
Division II. Cells of cœlomic and interstitial spaces, characterized by large size of cells and granules.	Nucleus crescentic; specific granules large, with intense oxyphile reaction.	Nucleus round; granules very large.	Nucleus round; no specific granules.

From these differences it will not be difficult to see that there are two kinds of leucocytosis, in which the cells are, respectively, mainly of the cœlomic or of the hæmal type. In all the cases investigated by the authors the first cells to accumulate at a leucocytic focus were oxyphile cells; of these the coarsely granular accumulate more quickly than the finely granular forms. When a conflict with bacilli is watched in hanging drops of blister fluid the coarsely granular oxyphile cells are seen to attack the bacilli, and to suffer thereby a diminution of granulation. The attack is rapid, and is quickly followed by phagocytosis; this latter commences at a much earlier period than is generally supposed, and is at its maximum in about 25 minutes after the introduction of the bacilli; it is always carried out by the hyaline cells.

The authors find the main interest of the facts they have discovered in the marked difference between the activities of the coarsely granular oxyphile cell and the hyaline cell, and they are inclined to regard these cells as morphological units as distinct as are the striped and unstriped cells of muscular tissue.

Beading of Nerve-Fibres.*—Mr. E. J. Allen calls attention to the varicose or beaded appearance so often presented by nerve-fibres in preparations made by the methylen-blue method, or by the method of Golgi, and to the swellings which occur on the finer nerve-endings. He concludes that both phenomena are due to a simple physical cause—the difference of surface tension between two fluids. He points out that a fluid cylinder surrounded by some other fluid of different surface tension is in a condition of unstable equilibrium, and tends to break up into spherical drops. He has been able to produce almost similar appearances by putting a drop of a thick syrup of gum and sugar in the centre of a glass slide, which has been covered with a layer of paraffin oil. If fine threads are drawn from the syrup across the oiled surface of the glass, with a rough needle, these threads will, on examination under the Microscope, be seen to be beaded, and generally take on all the various forms assumed by nerve-fibres.

* Quart. Journ. Micr. Sci., xxxvi. (1894) pp. 492–8 (5 figs.).

Terminology of Nerve-Cell.* — Dr. Fish proposes a consistent nomenclature; he would call the whole cell with its appendages neurocyte; the axis-cylinder prolongation, neurote; the other processes, dendrites; and the neuroglia cell, spongiocyte.

γ. General.

Physiological Research.†—Prof. Max Verworn appears to look to the Microscope to relieve the physiologist from the *impasse* in which his science has been landed. He thinks the time has come to turn more attention to the cell, and the first and easiest thing to do is to make simple microscopic observations of vital processes; under the Microscope we can conduct vivisectional operations on unicellular organisms with greater methodical precision than with higher animals. And, lastly, microchemical methods should be developed.

Origin of Markings in Grass Snake.‡—Herr J. Zenneck finds an upper lateral row, a middle lateral row, and a lower lateral row of spots in *Tropidonotus natrix*, as Eimer did in *Lacerta muralis;* the median band of the lizard is awanting. The rows of black spots in the older forms correspond exactly in position and extent to red longitudinal lines in the young embryos. These red lines correspond to blood channels. Thus one of them corresponds to the line of facial, jugular, and epigastric veins. To state it generally, the longitudinal rows on which the black pigment accumulates in spots in the rete Malpighii are lines along which these run beneath the skin, and various longitudinal vessels which at regular intervals are in communication with deeper vessels. The pigment follows the course of the vessels, either carried by wandering connective-tissue cells, or else gradually arising along definite lines from within outwards.

Light-Sense in Blind Animals.§—Dr. W. A. Nagel finds that the whole surface of *Amphioxus* is acutely photoskioptic, i. e. responsive to sudden illumination. Removal of its anterior end makes no difference. The animal is but slightly skioptic, i. e. responsive to sudden shading.

The tube-inhabiting worm *Spirographis Spallanzanii* is sensitive even to a slight shadow; *Ciona intestinalis* closes and retracts its openings on sudden illumination; *Cereanthus membranaceus* (as Bronn states) contracts on sudden illumination; neither of the last two animals are skioptic; in *Adamsia* and *Anemonia* neither the skioptic nor photoptic reaction was demonstrable.

The skin of *Helix pomatia* or of *H. hortensis* is acutely skioptic; the dark *H. arbustorum* reacts less markedly, the nocturnal snails very slightly. The skioptic function is independent of the eyes, which are truly iconoptic. In *Unio pictorum* there is a rapid retraction of mantle-lips and closure of the shell on sudden shading or illumination.

Faunal Regions of Australia.‖—Mr. C. Hedley finds in Australia indications of three divisions of life. The earliest he calls the Autochthonian, and suggests that it arrived from the Austro-Malayan islands in

* Journ. Comp. Neurol., iv. (1894); see Amer. Natural., xxviii. (1894) p. 1041.
† Monist, April 1894; see Nature, li. (1894) pp. 58–60.
‡ Zeitschr. f. wiss. Zool., lviii. (1894) pp. 364–93 (1 pl.).
§ Biol. Centralbl., xiv. (1894) pp. 810–3.
‖ Ann. and Mag. Nat. Hist., xiv. (1894) pp. 390–2.

or before the Cretaceous era, and it spread over the whole continent. The next, the Euronotian, probably reached Tasmania from South America not later than the Miocene, and it probably drove out, particularly on the east coast, many of the original inhabitants. Thirdly, a contingent of Papuan forms seized on the Queensland coast late in the Tertiary, and largely exterminated their predecessors.

INVERTEBRATA.

Lymphatic Glands of Invertebrates.*—M. A. Kowalevsky has published a preliminary notice of his experimental studies on these glands. He has made a considerable step by the introduction of bacteriological methods in order to demonstrate the phagocyte organs of Invertebrates. His first experiments were made on *Pleurobranchus aurantiacus*, into the body-cavity or under the subcutaneous tissue of which he introduced anthrax Bacilli, or *B. tuberculosis avium.* An hour after the injection the cells of the spleen of this Mollusc were more or less filled with the introduced Bacilli; the animal did not appear to suffer at all, but a piece of spleen, taken four days after the injection, was cultivated in bouillon, and the injection of part of the cultivation killed a rabbit. Cultures made eight days after the injection gave rise to no colonies on gelatin or in bouillon, whence we may suppose that the Bacteria were killed.

These experiments were repeated with *Philine*, *Doris*, and various species of *Eolis*; in these last the Bacteria were absorbed by cells of the character of connective tissue arranged symmetrically on either side of the foot.

While in Gastropods and Lamellibranchs solid substances injected into any part of the body are carried to the spleen or to the phagocyte cells which are scattered in the connective tissues, such injecta into Cephalopods remain at the spot where they are introduced. The phenomena exhibited by Cephalopods are detailed at some length, and evidence is brought forward to show that there is a kind of phagocyte gland in the gills themselves.

Helix pomatia will support the introduction of large quantities of Bacteria without any inconvenience, and they become collected in the most delicate parts of the wall of the lung, which are essentially phagocytic in function.

A number of experiments have been made on Crustacea, but the results are as yet incomplete, but true glandular cells have been recognized; the branchial glands of Decapods have been correctly described by Cuénot as phagocytes.

In studying Arachnids Scorpions were first used; the Bacteria were found to be absorbed by the spleen and the phagocytes of the fat-body. *Epeira diadema* and *Lycosa Latreillei* were found to die within two days of the introduction of anthrax Bacilli. *Scolopendra morsitans* was almost exclusively studied as a representative of Myriopods; *Bacillus subtilis*, *prodigiosus*, and *anthracis* were all found to be fatal in from two to five days; the function of the spleen appears to be played by groups of cells disposed symmetrically in the body, surrounded by adipose tissue. Of

* Bull Acad. Imp. St. Petersb., xxxvi. (1894) pp. 273–95.

Insects only a few Orthoptera have as yet been studied, and specially successful observations were made with *Gryllus domesticus;* the spleen appears to be composed of four plates arranged cross-wise on either side of the heart, and it is quite clear that here the organ is perfectly definite and circumscribed; the plates are true diverticula of the heart, but the walls have no muscular fibres, while their cavities are often found to be filled with a compact mass of cells. Further details, with illustrations, are promised.

Cryptozoic Fauna of New Zealand.*—Prof. Dendy explains that by this term he means the curious assemblage of animals found beneath logs and stones, and in similar situations. He gives a list of 16 Land Planarians, of which 13 are due to Prof. Dendy and his friends; the ubiquitous *Bipalium Kewense* is one of them, but it has almost certainly been introduced. Most of the species of Land Planarians seem to be very closely related to Australian forms, as they present only slight differences in colour or pattern. The most interesting addition is a Land-Nemertine, the sixth now known, and distinguished as *Geonemertes novæ-zealandiæ.* A variety of the usual 15-legged *Peripatus* of New Zealand is described as having 16 pairs of legs.

Fauna of Lakes of the Jura.†—M. F. Zschokke has an interesting article on the animal life of these lakes; there appears to be a considerable amount of variety in different lakes, and the amount of plankton present seems to depend on the strength of streams running through the lakes.

North American Mesozoic Invertebrata.‡—Mr. C. B. Breckinridge has published a catalogue and bibliography of these forms which appears to be very well arranged. Works of this kind are of the greatest assistance to students.

Microscopic Contents of Bargate Beds.§—Mr. F. Chapman describes the Ostracoda and Foraminifera found in this lower Greensand deposit in Surrey; as the beds are intermediate between the Folkestone and Hythe series, the memoir should attract those who have been interested by Mr. Chapman's papers in our own 'Transactions' during the last few years.

Tunicata.

Evolution of Sexual Elements in Compound Ascidians.‖—M. A. Pizon finds in the Didemnidæ and Diplosomidæ the same continuity between the sexual cord of the parent and that of the bud as has been observed in other Ascidians. The genital organs of the young are not absolutely new and independent formations. The fact may be generalized for all compound Tunicates, and throws an unexpected light on the evolution of these remarkable organisms.

Cleavage of Ascidian Ova.¶—Dr. P. Samassa has shown by an investigation of *Ciona intestinalis* and *Clavellina lepadiformis* that the

* Ann. and Mag. Nat. Hist., xiv. (1894) pp. 393–401.
† Rev. Suisse Zool., ii. (1894) pp. 349–76 (1 pl.).
‡ Bull. U.S. Geol. Survey, No. 102 (1893) [received Nov. 1894] 315 pp.
§ Quart. Journ. Geol. Soc., l. (1894) pp. 677–729 (2 pls.).
‖ Comptes Rendus, cxix. (1894) pp. 569–72.
¶ Arch. f. Mikr. Anat., xliv. (1894) pp. 1–15 (2 pls.).

third cleavage establishes the separation of the two primary layers, for the four dorsal blastomeres form endoderm and the four ventral ectoderm.

Julinia.*—Under this name Mr. W. T. Calman describes a new genus of Compound Ascidians from the Antarctic Ocean, attention to which was attracted by the large size and remarkable appearance of its single representative, which is called *J. australis.* The colony is irregularly cylindrical, 78·5 cm. long and from 1·5 to 2·5 cm. in diameter. A detailed description is given of its anatomy, and, taking the present definition of families, it is judged to have its nearest affinities to *Distaplia.* A systematic definition of the genus is given.

Mollusca.

Shells from the Great Lagoon, Watling Island, Bahamas.†—Mr. W. H. Dall finds that the Molluscs from this island belong to two categories, those which live in the lagoon, and those which live on its shores. The marine forms which live in the waters of the lagoon are all more or less peculiar, and seem to indicate by their characters that they have been derived by a more or less direct modification from recent species living normally in the sea about the island. The number of species is small, but all are marked by tenuity of shell, diminutive size, and, when coloured, by a relatively brilliant colour.

The terrestrial species are certainly less influenced by the special condition of the lagoon than those which live in its water, but they are not without their peculiarities. Most are very local; the presence of a *Planorbis*, the only representative of a freshwater fauna, is very interesting.

Hermaphroditism in Mollusca.‡ — Dr. P. Pelseneer discusses the question of hermaphroditism in the Mollusca, where it occurs in every class except the Cephalopoda and Scaphopoda. It is remarkable that there is very great diversity in the structure of the hermaphrodite gland of these classes, and four chief types can be distinguished.

(1) The undifferentiated gonad, i. e. with acini completely hermaphrodite, is seen in *Valvata*, a great number of Tectibranchs, almost all Pulmonata, and two species of *Ostrea.* There are some indications of specialisation in the Neomeniidæ, where each gonad generally gives rise to male products towards its lateral face, and to ova towards its axial face.

(2) Gonad with separate male and female acini, but not separate male and female regions; this is seen in various Tectibranchs, Nudibranchs, and others. In various Nudibranchs the female acini are the most superficial.

(3) Gonad with separate male and female regions, and a common duct; this is seen in *Pecten*, where the male and female regions are contiguous, and in the Cycladidæ, where the two regions are fairly separated.

(4) Male and female portions in the same individual entirely distinct from one another, and with special ducts. The vas deferens and oviduct may open into a common orifice, as in the Poromyidæ, or there may be

* Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 1–17 (3 pls.).
† Bull. Mus. Comp. Zool., xxv. (1894) pp. 113–24 (1 pl.).
‡ Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 19–46 (3 pls.).

no common orifice, as in the Anatinacea among Lamellibranchs, and in *Entoconcha* among Gastropods. These last exhibit the highest specialization of the hermaphrodite state. Whatever, however, be the extent of the hermaphroditism of a Mollusc, the eggs of one individual have to be fertilized by the spermatozoa of another; as in the hermaphrodites of other groups, protandry is general.

The author proceeds to show that hermaphroditism is not a primitive arrangement in the Molluscan phylum, and that it has been derived from the unisexual stage; and further, that it has become superimposed upon the female condition. Fixation, parasitism, and fluviatile or terrestrial habitats appear to be specializations accompanied by hermaphroditism; of them the Oyster, *Entoconcha*, the Pulmonate Molluscs, and the Oligochæte Annulata are, respectively, examples.

What is true as to the appearance of hermaphroditism after the separation of the sexes in Mollusca is true also of Myzostomidæ, Crustacea, and Fishes, as well as of plants; and in Crustacea and Fishes, at least, hermaphroditism is grafted on the female sex.

γ. Gastropoda.

Pedal Gland of Pulmonata.*—M. E. André has examined this gland in a number of forms, and applies the terms "superior masses" to the glandular masses which are found in its supero-anterior part. The floor of the excurrent canal is ciliated, and has intercellular passages. In addition to the just-mentioned masses the glandular part contains ordinary and vacuolated glandular cells. The first, which are formed from connective-cells, form in their interior secretory products which they expel into the intercellular passages, and thence into the canal. After excretion the cell is for a period in repose, again elaborates secretory products, and eliminates as before. After repeating this several times the cell dies and is expelled.

The gland is not a sensory organ, but has to secrete a lubricating mucus on the path taken by its possessor; this mucus is driven out by the cilia, by *vis a tergo*, by compression of the gland by muscular bundles, by the undulatory movements of the foot during progression, and by the movements of the whole body. Blood cannot pass out by the gland, but a fluid from the exterior may traverse the intercellular passages.

Anatomy of Trophon.†—Dr. L. Plate has a note on the enteric canal and kidney of what is probably *Trophon geversianus*. The pharynx is small, and the radular papilla is a long thin filament, 8 mm. wide. The kidney corresponds in position and structure with the description given by Remy Perrier in his work on the Muricidæ, but Dr. Plate cannot accept his explanation of the nature of the high fold found in it.

Origin of Mesoderm in Paludina.‡—Dr. R. v. Erlanger has revised his account of the origin of the mesoderm in *Paludina vivipara*, on which Korschelt has cast doubt. He corroborates himself:—*Paludina* is certainly enterocœlic, but besides a cœlom sac there are primitive mesoblasts (*Urmesodermzellen*). These are the forerunners of those

* Rev. Suisse Zool., ii. (1894) pp. 291–348 (2 pls.).
† SB. Ak. Wiss. Berlin, 1894, pp. 224 and 5.
‡ Morphol. Jahrb., xxii. (1894) pp. 113–8 (1 pl.).

which form the cœlom sac. Perhaps it is the sparsity of yolk which has made *Paludina* more primitive than the other Gastropods which show primitive mesoblasts at an early stage, even before gastrulation.

Musculature of Chiton.*—Miss L. V. Sampson first describes the muscles of the shell:—(1) A median dorsal muscle; (2) a pair of oblique dorsal muscles; (3) a series of longitudinal lateral muscles from the dorsal surface of the apophyses to the ventral surface of the next piece in front. The muscles of the foot—latero-pedal, medio-pedal, postero-oblique, &c. are then described, as are, finally, those of the mantle.

Solenogastres.†—Herr J. Thiele gives an account of some of the Solenogastres of Naples,—*Neomenia grandis* sp. n., *Proneomenia (Amphimenia) neapolitana* Thiele, *Proneomenia vagans* Kow. u. Mar., *Rhopalomenia aglaopheniæ* Kow. u. Mar., *Rh. Eisigi* sp. n., *Myzomenia banyulensis* Pruvot. He suggests the advisability of placing those genera which have a slightly developed cuticular layer in a special family (Myzomeniidæ) between Neomeniidæ s. str. and the Chætodermatidæ. He gives a useful general account of the comparative anatomy of the Solenogastres. The generalized type of nervous system consists of a supra-œsophageal ganglion, the centre for the oral cirri; two lateral longitudinal stems united posteriorly above the rectum; two ventral stems, united to one another and to the laterals by numerous connectives, and also connected with the supra-œsophageal ganglion; an œsophageal ring with which are associated two small buccal ganglia, the centre for the anterior part of the gut. Pharynx, œsophagus, radula and glands form the true stomodæum, lined by epithelium without cilia. The radula is frequently without a basal membrane, which is remarkable. Only the cloaca is truly proctodæum, the rectum is endodermic.

Arthropoda.

Insect Fauna of Rhode Island Coalfield.‡—Mr. S. H. Scudder describes *Anthracomartus*, the first Arachnid discovered in the Carboniferous deposits of the Eastern United States, a new genus of Neuropteroidea and one of Protophasmida, allied to certain French forms, and presenting new features of alliance between the Carboniferous faunæ of Europe and America. A number of cockroaches, represented by wings alone, show considerable variety of form.

α. Insecta.

Sub-intestinal Nervous System of Insects.§—M. A. Binet has succeeded, by a special method of double staining, in following the course of the nerve-fibres of the cylinder-axis, into the protoplasm; here he finds that the fibres do not enter into relation with the muscles, but that in certain cells they remain united into a bundle, and describe a spiral turn around the nucleus before separating; in other nerve-cells the fibrils separate regularly from one another as soon as they have penetrated into the cell, and describe spiral lines in the more superficial layers of the protoplasm.

* Jenaische Zeitschr. f. Naturwiss., xxviii. (1894) pp. 459–68 (4 figs.).
† Zeitschr. f. wiss. Zool., lviii. (1894) pp. 222–302 (3 figs.).
‡ Bull. U.S. Geol. Survey, No. 101 (1893) 21 pp. (2 pls.).
§ Journ. Anat. et Physiol., xxx. (1894) pp. 449–580 (4 pls.).

The majority of the nerve-cells of Insects are pyriform, unipolar, and send out a prolongation of regular calibre, whence there are given off laterally fine branches which ramify. The primitive prolongation of large cells, which may be followed in a certain number of cases, is converted into the peripheral nerves or the connectives.

An abdominal Insect-ganglion consists of two ventral columns and a ventral lobule, formed of a very dense and a very fine fibrillar substance, and a dorsal lobule formed of a fibrillar coarser substance, which is traversed by three groups of dorsal connectives. The abdominal nerve has three roots, one of which is dorsal. A thoracic ganglion differs only in the addition laterally of two crural lobes. The crural nerve is composed of two kinds of fibres—some very fine, which blacken with osmic acid, and thicker fibres which stain with borax-carmine; the former pass into the ventral part of the ganglion, and the latter into the dorsal. Details are given as to various nerves, and to the special parts of particular Insects.

Physiological experiments confirm the anatomical demonstration, and show that the ventral lobe of the ganglion is sensitive, and the dorsal motor.

The movements of Insects are due to an unequal stimulation of the legs of the two sides of the body, and this awakens by fundamental association the motor mechanism.

Early Stages in Spermatogenesis of Insects.*—Prof. N. Cholodkovsky urges that there can be no doubt that the presence of one or more large spermatogonia is a very common phenomenon in the spermatogenesis of Insects. As he has always been able to see nuclear-division figures in these large cells he cannot accept the view of Nogakushi that they are merely supporting cells, analogous to the rachis of Nematodes. He would rather compare them to the contents of the terminal chamber of the ovarial tube, especially as Nogakushi has himself shown that the large cell is found not only in the testicle, but also in the ovary of the caterpillar.

Antennary Organ of Insects.†—Mr. C. M. Child describes "Johnston's organ," a sensory organ lying in the second antennary joint of many insects. It consists essentially of ganglion-cells which are continued into long rod-like processes, or are connected with "rods" by means of fibres. The rods end in pores in the membrane between the second and third joint or on chitinous processes of the margin. In the males of Culicidæ and Chironomidæ the organ is very large. It arises in the larvæ of these orders as an annular fold near the base of the invaginate hypodermic antennary saccule. The rods usually arise from the coalescence of cells. The function of the organ seems to be primarily tactile, secondarily to respond to vibrations, and in the above-mentioned males to hear the sound which the females make.

Classification of Lepidoptera.‡—Mr. G. F. Hampson calls attention to recent contributions to the classification of the Lepidoptera by

* Zool. Anzeig., xvii. (1894) pp. 302–4.
† Zeitschr. f. wiss. Zool., lviii. (1894) pp. 475–528 (2 pls.).
‡ Ann. and Mag. Nat. Hist., xiv. (1894) pp. 254–61.

Prof. J. H. Comstock * and Dr. T. A. Chapman.† The former has discovered that the fore and hind wings of the Hepialidæ and the Micropterygidæ are united by a membranous lobe which he calls the "jugum"; this jugum is found also in the Trichoptera. As it has long been recognized that these two families of Lepidoptera are widely separated from all the others, and that, further, they have very different mouth-organs the one from the other, this discovery of a specialized common structure is of great importance. The possession of a jugum by the Trichoptera is a strong argument in favour of the derivation of the Lepidoptera from that group, and against the theory of a Hymenopterous ancestor. Dr. Chapman's discovery of the larva of *Eriocephala*—the lower of the two Micropterygid genera—tends to complete our knowledge of the group.

Suggestions are made as to a revised arrangement of the families of Lepidoptera.

Classification of Lepidopterous Larvæ.‡—Mr. H. G. Dyar finds that a classification based on the structure and arrangement of the setiferous tubercles corroborates in a general way Comstock's classification based on the methods of union between fore and hind wings and on the modifications of the wing veins. That there should not be perfect agreement is natural when we remember that larvæ living an exposed life show many particular specializations. There are two great types of arrangement. The first or more generalized shows, in the abdominal segments, five tubercles above the spiracle on each side, three in a transverse row about the middle of the segment, and two behind, and two oblique rows below the spiracle with two and four tubercles respectively. The second type shows on each side above the spiracle three tubercles; below, or behind the spiracle and above the base of the leg, three more; on the base of the leg three (or four) on the outside and one on the inside near the mid-ventral line. Mr. Dyar's classification of larvæ is based on the modifications in these fundamental arrangements and in the tubercles themselves.

Spermatogenesis of Silk Moth.§—Prof. E. Verson returns to his investigation of the spermatogenesis of *Bombyx mori*, as his previous work (1889) has been partly overlooked, partly misunderstood. The kidney-shaped testis consists of four chambers, the narrowed ends of which open into a common vas deferens. In each chamber, near the outer margin of the testis, there is a giant cell whose margin is notched and fringed, with small roundish nucleated elements between the radiating strands. There is no evidence of an epithelium covering each chamber nor of division into special follicles, as is alleged in other Lepidoptera. Each capsule consists of connective tissue, and tracheæ extend freely into its cavity. The spermatogonia of v. La Valette correspond to the nuclei around the margin of the giant cell, but what Verson insists upon is that the giant cell embraces and nourishes all the specific elements of a chamber, and connects the spermatogonia and their products the spermatocysts. The nucleus of the giant cell divides; nuclei have been seen in transit outwards to the radiate periphery;

* Wilder Quarter Century Book (1893) pp. 37–113.
† Trans. Ent. Soc., 1893, p. 97, and 1894, p. 335.
‡ Ann. N.Y. Acad., viii. (1894) pp. 194–232 (6 figs.).
§ Zeitschr. f wiss. Zool., lviii. (1894) pp. 303–13 (1 pl.).

there can be no doubt that these secondary nuclei are derived from the nucleus of the giant cell.

Polymorphism and Ergatomorphism.*—Prof. A. Forel gives an account of the seven different forms which occur among Formicidæ:—(1) winged female; (2) winged males; (3) wingless workers—large and small; (4) soldiers; (5) ergatomorphic females; (6) transitional forms between (1) and (3); and (7) ergatomorphic males. Ergatomorphism is a secondary phylogenetic tendency to produce wingless sexual forms of the worker type. It may lead to perpetual inbreeding, as in *Anergates*. In *Tomognathus* there seems to be only one form (monomorphism)—an apterous parthenogenetic female. As many as five out of the seven types may be illustrated by one species. Forel regards the polymorphism as expressing phylogenetic germinal variations fixed by natural selection; nutrition and other such influences may act as stimuli, not as efficient causes. In short, he agrees entirely with Weismann.

Formation of New Termite Colonies.†—M. J. Pérez finds that a couple of winged termites (*Termes lucifugus*) are, in proper conditions, able to form a new colony without the aid of workers. His experiments show this to be the case, and contradict Fritz Müller's remark that a winged pair left to themselves had no more chance of founding a new colony than a couple of new-born children left on a desert island. The fact is that they may remain for at least five or six months immature, incapable of pairing, but that they survive and finally become functional king and queen.

Poison-Apparatus of Ichneumonidæ.‡—M. L. Bordas has discovered a poison-apparatus in various species of *Ichneumon;* they are provided with three kinds of glands, two of which correspond to the acid and alkaline glands of the Apidæ, Vespidæ, and others. The multifid gland is formed of a bundle of long, cylindrical tubes, which are often branched at their ends; they open into a common reservoir, which gives off the excretory canal. The tubular gland (or alkaline gland of Aculeata) may be as much as 1 cm. long and 4 cm. wide; its anterior portion alone seems to be glandular, the rest serving as a reservoir. The accessory gland is small in size, triangular in form, and provided with a filiform excretory duct.

The author states, in conclusion, that he has met with well-developed poison-glands in about forty species of the sub-order Terebrantia; in some of them the accessory gland is wanting.

Phosphorescence of Chironomidæ.§—Herr P. Schmidt gives reasons for thinking that the luminosity of these Insects is due to the presence of Bacteria, just as in the case of *Talitrus* described by Giard. Unlike that author, however, he has not yet been able to detect the microbes.

He bases his conclusions on the facts that there are no specially luminous species, but that the commonest and widely spread forms give off light, that the light is not localized, is independent of the will of the

* Arch. Phys. Nat., xxxii. (1894) pp. 373–80.
† Comptes Rendus, cxix. (1894) pp. 804–6.
‡ Zool. Anzeig., xvii. (1894) pp. 385–7 (1 fig.).
§ Zool. JB. (Abth. f. System., &c.), pp. 58–66.

animal, and remains for some time after immersion of the specimen in spirit. No structures which look like luminous organs have been detected in any sections. The light is to be seen in both sexes, and is, therefore, not a sexual character, and as the Chironomidæ are not predatory it cannot be for attracting prey.

Morphology of Gryllotalpinæ.*—MM. H. de Saussure and L. Zehntner find that these Orthoptera form a chain connected at one end to the Gryllidæ by *Gryllotalpa*, and by the other to the Acrididæ, and specially to the Tetticidæ by *Rhipipteryx;* the intermediate form is *Tridactylus*. Definitions of the tribe and of its sub-tribes are given.

Defence against Parasites.†—M. L. Cuénot finds in the cœlom of *Gryllus domesticus* L. an extraordinary abundance of a Gregarine, like *Diplocystis Schneideri*. There was not the least trace of phagocytosis around the oviform or conjugate stages, but the cysts were covered with a mantle of phagocytes. The same thick mantle was observed around a Nematode in the cœlom of the same insect, but a dipterous larva in *Forficula auricularia* L. showed no hint of phagocytosis. In fact, phagocytosis seems to play an unimportant defensive rôle in insects; the elements of the blood remain indifferent to the introduction of the most fatal organisms.

δ. Arachnida.

Morphology of the Pedipalpi.‡—Mr. M. Laurie commences his memoir with some notes on the anatomy of *Thelyphonus*, as the internal anatomy of the Pedipalpi has never been described in any great detail. The greater part of the cavity of the abdomen is occupied by the enormous digestive gland, which forms a solid mass concealing, at first sight, everything except the heart and a few muscles. The stercoral pocket is described as part of the mesenteron. The nervous system is said to be almost entirely concentrated in the thorax. Details are given as to the stink-gland, coxal gland, and other organs.

There is an account of some observations on imperfectly preserved embryos of *Phrynus*, but there is only enough to lead to the belief that the proper working out of the embryology of the group will almost certainly give important results, and throw much light on the morphology of the Arachnida.

The author thinks it useless to attempt to construct a phylogenetic tree till more is known of the structure and development of the Lipoctena.

Development of Macrobiotus.§—Dr. R. von Erlanger gives a preliminary account of the development of *Macrobiotus macronyx*, and it may be noted that the only other account (Kauffman's) is now more than forty years old. The segmentation is total and approximately equal; a long oval blastula is formed; by invagination of the vegetative pole a gastrula arises; the blastopore, which soon closes, occupies the position of the anus; there is a very short hind-gut, and the archenteron divides into an anterior portion (afterwards pharynx, suctorial region, and gullet)

* Rev. Suisse Zool., ii. (1894) pp. 403–30 (2 pls.).
† Comptes Rendus, cxix. (1894) pp. 806–8.
‡ Journ. Linn. Soc. Lond., xxv. (1894) pp. 20–48 (3 pls.).
§ Biol. Centralbl., xiv. (1894) pp. 582–5.

and a stomach. The embryo becomes segmented into a head and four thoracic segments; on each side four cœlom pockets arise from the gut; the head-cœlom is divided ventrally into paired sacs—the rudiments of the first pair of appendages; the cœlom pouches of the second and fourth thoracic segments give rise to appendages, while from the cœlom pouches of the third thoracic segments there also arise gonads and a pair of mid-gut glands of doubtful nature. The oral papilla arises somewhat late from a proliferation of ectoderm, from which the teeth are also formed; the salivary glands arise as ectodermic invaginations; the muscles arise from the cœlom pouches, and so do the glandular cells of the appendages. The four pairs of ganglia in the ventral chain and the paired sub-œsophageal ganglion are late in being separated from the ectoderm. Dorsally a paired ectodermic proliferation appears, which soon divides into three portions on each side; the most ventral forms the brain, the median the optic ganglion, the most dorsal the eye. The eye is somewhat complex; each visual cell is surrounded by several pigment cells; there is a single lens. Erlanger supposes that the head and the first two thoracic segments represent a cephalothorax; that the third and fourth segments form an abdomen, behind which is a rudimentary post-abdomen or tail which degenerates.

ε. Crustacea.

Development of Crustacea.*—Prof. L. Roule has made a study of the development of *Porcellio scaber.* He finds that the fertilized egg diminishes in volume as it becomes converted into an embryo; as a space becomes developed between the embryo and the egg-membrane it becomes filled with a liquid which plays the part of a protective cushion. The egg contains a large quantity of deutolecithin and several superficial islets of blastolecithin; these two substances differ only in the presence or absence of vitelline granules, but the latter only gives rise to the cells of the embryo, while the former serves for food, being absorbed by phagocytosis.

Segmentation is partial. As the blastoderm increases in extent, it divides into an outer epithelial layer, and an internal mass of cells scattered in the deutolecithin; the former is the protectoderm, the latter the protendoderm; the latter, again, undergoes division into a mesenchymatous part which is the mesoderm, and an epithelial endoderm. The author points out that, from their origin and nature, the layers of Arthropods are not the homologues of the corresponding parts in other Cœlomata.

The so-called dorsal organ is really only a temporary dorsal swelling formed by deutolecithin which is not yet absorbed. The foundations of the nervous centres are simple, continuous, and unpaired. After absorption of the deutolecithin most of the elements of the mesoderm are converted into connective cells, or by the formation of a sheath of sarcoplasm into muscular fibres.

"The irrigating apparatus" is organized into a "polycœlom," which is likewise developed from the mesoderm; its cavities correspond to more or less regular spaces hollowed out in the connective and muscular

* Ann. Sci. Nat., xviii. (1894) pp. 1–156 (10 pls.).

framework; its corpuscles are derived from such of the mesodermic elements as are not used to make the framework. The development of *Porcellio* must be looked upon as condensed.

Freshwater Crustacea of Indian Archipelago.*—Prof. M. Weber finds that Entomostraca are incomparably less numerous in Indian than in European waters; in discussing the cause of this, he suggests the division of the freshwater fauna into—

1. Universal freshwater animals.
2. Regional „ „
    - *a.* Local genuine freshwater animals, which form an already ancient stock.
    - *b.* Marine forms.
        - *α.* Relics.
        - *β.* Immigrants.
            - β_1. Active immigrants.
            - β_2. Passive „

A list of the species collected by Prof. Weber shows not only the relative paucity of Entomostraca, but the fact that all the Isopods observed are either exclusively stationary, or permanent parasites, and belong either to marine species, genera, or, at least, marine families. The Amphipod fauna of Indian fresh waters is totally different from that of Europe. While Gammaridæ are entirely absent, Orchestiidæ are only rarely met with, and such as were, were undoubtedly originally immigrants from the sea.

The list of Decapoda proves clearly the immigration of members of this group into the Indian rivers; some, indeed, have as yet only reached brackish water; what is true then of the Isopod and Amphipod freshwater fauna is true also of the Decapod.

The Crustacean fauna of the fresh water in the Indian Archipelago is composed of (1) forms of universal occurrence, and of (2) regional or local animals destitute of the aids to dissemination afforded by smallness of body and special gill-arrangements; they are derived directly or indirectly from the sea, and even now fresh elements are continually being added to the freshwater fauna, which is of a character quite different from that of Europe.

Stomatogastric System of Astacus and Homarus.†—Mr. E. J. Allen gives a detailed account of this part of the nervous system, and looking at it as a whole, finds it probable that there are three main centres from which motor fibres start and in which sensory fibres end—the two commissural ganglia and the gastric ganglion. The two former communicate with the central nervous system by means of fibres which enter it from the commissures, while they have a special direct communication with the brain by fibres which pass through the anterior median nerve, and bifurcate in the œsophageal ganglion. The gastric ganglion is placed in common communication with both commissural ganglia by means of elements originating in cells in the œsophageal ganglion, the processes of which divide into three main branches. It is

* Zoolog. Ergebnisse, ii. 2, pp. 528–43; translated in Ann. and Mag. Nat. Hist., xiv. (1894) pp. 237–53.

† Quart. Journ. Micr. Sci., xxxvi. (1894) pp. 483–92 (2 pls.).

also placed in independent communication with each commissural ganglion by elements which originate in cells of the latter, and run through the œsophageal ganglion.

Homarine Origin of Brachyura.*—M. E. L. Bouvier is satisfied that Crabs are directly derived from the Homaridæ, and probably from those of the Jurassic epoch. The most primitive abyssal Dromiid which he has studied is *Homolodromia paradoxa;* it has a resemblance to the Macrura and the Anomura in its elongated carapace, its widely open orbits, and its rostrum independent of the epistome. In a number of other characters it differs from the Galatheidæ and Axiidæ, and has a closer resemblance to the Homaridæ. The mass of common characters is, indeed, so large that it seems to him impossible to doubt that the Homolodromiæ are derived frem the Homaridæ, though from Homaridæ more primitive than any now existing; from forms, that is, that had preserved all the anterior arthrobranchs found in their ancestors, the Penæidæ.

Sound produced by Ocypoda ceratophthalma.†—Dr. A. R. Anderson describes the means by which this Crab produces a loud croaking noise, closely resembling that of frogs; the burrows formed by the animals are, further, so constructed as to act as excellent resonators.

Entomostraca and the Surface-Film of Water.‡—Mr. D. J. Scourfield remarks that, although it has long been recognized that the curious physical properties possessed by the surface-film of water render it of considerable importance to many of the smaller aquatic animals, the question of specific relation has been somewhat neglected by naturalists.

The author is led by his observations to conclude that to large numbers of Cladocera and Ostracoda this surface-film is a very dangerous element in their environment; to others, on the other hand, it affords peculiar advantages; this is the case with a few specially modified Cladocera and Ostracoda, and some Copepoda, which do not present any apparent structural modifications. In nearly all cases the relation to the surface-film, whether beneficial or not, depends on the same physical principles—the upward pull of the surface-film when forming a capillary depression, and the possession by the animals of water-repellent shells, ridges, scales, or setæ, capable of penetrating the surface-film, and producing capillary depressions.

Freshwater Copepoda.§—Dr. A. Mrázek calls attention to the variability of the characters generally used to establish species of freshwater Copepods, and next proceeds to discuss the Copepod-fauna of Bohemia; no less than 47 species of Copepods are enumerated, eight of which are new. The abnormal characters of some examples are described and discussed.

Annulata.

Abnormal Annelids.‖—Mr. E. A. Andrews records several cases of doubling of the posterior end of *Allolobophora fœtida* and *Podarke obscura.*

* Comptes Rendus, cxix. (1894) pp. 656–8.
† Journ. Asiat. Soc. Bengal, lxiii. (1894) pp. 138 and 9.
‡ Journ. Linn. Soc. Lond., xxv. (1894) pp. 1–19 (2 pls.).
§ Věstnik Spol nauk v Prage, 1893, 74 pp. 3 pls.; see Zool. Centralbl., i. (1894) pp. 593 and 4.
‖ Quart. Journ. Micr. Sci., xxxvi. (1894) pp. 435–60 (3 pls.).

As in previously described cases there was a complete duplication of part of the body, with the sole exception of one earthworm in which the endodermal part was absent. The author suggests that the absence of the endodermal core leads us to doubt whether the ultimate explanation of metamerism is to be found in the idea that "gut-pouches" are the first steps. It is not yet determined whether the monstrous growth occurs in the adult or the embryo, but the balance of evidence is in favour of the bifurcation being produced in the adult. Experiments, however, made with the object of producing duplication, were all failures.

Mr. Andrews thinks that there is no need to invoke the activity of any unusual amount or character of idioplasm; no special manipulation of "supplementary determinants" seems necessary if we apply the facts worked out for the cleaving ovum by Driesch and Wilson.

Larval Stages of Chætopterus.*—Prof. E. Béraneck gives an account of his observations on a larval Annelid, which appears to belong to this genus, found at Villefranche-sur-mer. He finds that from an early stage the metamerism of the parapodial region is marked by the appearance of parapodia, and this region is maintained without much modification to the adult state. The parapodial buds are well marked, and have numerous projecting setæ, so that they afford evidence that the ancestors of these Annelids were errant forms. The anterior and ciliated regions acquire their definite external form much sooner than the post-ciliary region. The larvæ of the Chætopteridæ have an independent existence for a comparatively long time, and have locomotor organs in the shape of ciliary crowns and parapodia. The region of the latter extends, in the young, over about half the body, but in the adult it occupies only one-sixth.

A comparison of the European with the American *Chætopterus* shows that the hinder of the two mesotrochal circlets, which are found in Chætopterids during almost all their embryonic metamorphoses, appears latest. These larvæ pass through a stage in which, like *Telepsavus*, they have only one circlet of cilia. The second circlet is doubtless a secondary acquisition, due probably to a more precocious segmentation of the hinder region of the larva. The ciliary circlets characteristic of larval Polychætes have no absolute value from the phylogenetic point of view, and are not always comparable with one another. One and the same species may, in different stages, be successively mesotrochal, atrochal, and telotrochal, and the author urges that the mesotrochal condition of a larval *Chætopterus* of some age has not the same morphological significance as the similar condition in a quite young larva.

Prof. Béraneck thinks that the Chætopteridæ form a distinct group, and represent a special phylum of the class of Annelids. Their ancestors were probably free, and, in becoming adapted to a sedentary mode of life, the hinder part of their body has been especially modified; so great indeed is the change that the homology of the posterior and anterior segments is very difficult to see in the adult, though obvious enough in the young.

Nephridial Duct of Owenia.†—Prof. G. Gilson finds a pair, sometimes two pairs, of very small nephridial funnels, lying in the posterior

* Rev. Suisse Zool., ii. (1894) pp. 377–402 (1 pl.).
† Anat. Anzeig., x. (1894) pp. 191–4 (5 figs.).

part of the sixth segment, against the muscular layer, in a dorsal position. Each funnel has a thin tube which passes through the muscular coat, but instead of opening directly and freely on the epidermic surface, it opens into a longitudinal duct. This duct may remain at certain places an epithelial groove, or it may be a complete tube. As *Owenia* is somewhat tight within its tube, the duct serves for the escape of the ova. It is of interest to compare it with the longitudinal duct of *Lanice conchilega*, described by Cunningham and E. Meyer, which, like that of *Polymnia*, *Polygordius*, and others has been compared with the segmental duct.

Filiform Glands of Owenia fusiformis.*—Prof. G. Gilson takes the filiform glands of this tubicolous Polychæte as the text for the second of his researches on secreting cells. Their structure, general and minute, is described in detail, and it is urged that the substance which fills the glandular tubes is got rid of by the epithelial cells in the same way as the silk or sericigenous substance is got rid of in Lepidoptera and Trichoptera; that is by a process of regular oozing through the cellular membrane.

Comparative Anatomy of Oligochæta.†—Dr. R. Hesse begins with a description of the musculature. In *Chætogaster*, *Nais*, *Tubifex*, *Lumbriculus*, &c., the longitudinal muscle-cells are of a nematoid type, U-shaped, with a contractile sheath surrounding the unmodified plasma, except at the narrow end turned towards the middle of the body. In the annular muscles, as seen in horizontal longitudinal section, the same nematoid type occurs, but the plasma is prolonged far beyond the contractile sheath. These prolongations bear the nuclei and are all disposed in two lateral lines. The same nematoid type occurs in all Lumbricidæ, though there are often modifications; thus in the majority of the cells which form the longitudinal bundles there is no unmodified plasma between the limbs of the U, but only at the open end. The unmodified plasmic portion bearing the nucleus represents in position the embryonic cell; physiologically it is probably the part which transmits the nervous stimulus to the contractile substance. Herr Hesse goes on to show in regard to the disposition of the longitudinal muscles in Lumbricidæ, that these forms pass through stages which are fixed states in the Limicolæ and Polychæta.

His second chapter is concerned with the integumentary sense-organs of Lumbricidæ. The most important result is that there is a regular arrangement of sensory organs—groups of sensory and supporting cells—occurring on three zones around each segment, in relation to the three pairs of annular nerves which arise from the nerve-cord in each segment. They are extraordinarily abundant on the upper lip, which is an important tactile organ. Physiologically, as they seem to respond to diverse stimuli, they may be regarded as *Uebergangssinnesorgane* (Ranke) or *Wechselsinnesorgane* (Nagel).

The third chapter deals with the gonads of *Lumbricus*, &c. Here there is much that is interesting. Thus the ovaries show three zones—(*a*) germinal cells, (*b*) a zone of multiplication, (*c*) ova. The ova show

* La Cellule, x. (1894) pp. 299-331 (1 pl.).

† Zeitschr. f. wiss. Zool., lviii. (1894) pp. 394-439 (2 pls., 3 figs.).

spots of yolk. The cementing and other glands which form an interestingly diverse series are described. But as most of this chapter is simply corroboratory, we shall only further note that Hesse believes that the spermatogonia pass into the seminal vesicles by amœboid movement.

Gonads of Lumbriculus variegatus Grube.*—Dr. R. Hesse describes the gonads of this Oligochæte when sexually mature, a state in which the animal is rarely found. There is one pair of testes in the eighth segment. In the same segment lie the seminal funnels with which the vasa deferentia are connected; the latter open into a pair of capacious atria, also in the eighth segment. The septum between the eighth and ninth segment is dilated into paired seminal vesicles which extend far back. There are two pairs of ovaries, lying in segments 9 and 10; the small oviducts open in the intersegmental grooves between 9 and 10, 10 and 11. There are four pairs of receptacula seminis in segments 10–13. No clitellum was to be seen. In the possession of a large atrium at the end of the vas deferens, in the minuteness and position of the oviducts, and in the number of the parts, this genus stands apart from other Lumbriculidæ.

Benhamia cæcifera.†—Dr. W. B. Benham gives a description of this new earthworm from Axim, West Africa. It owes its specific name to the presence of a number of peculiar finger-shaped cæca arising from the intestine, and is marked by the presence of peculiar copulatory pits on the ventral field, and some other characters. In point of size (510 mm. long) it resembles some other species of the genus from the same area.

Development of Hirudinea.‡—Herr O. Bürger lays emphasis on the essential agreement of *Nephelis*, *Hirudo*, and *Aulostomum*, as regards the development of cœlom, blood-vessels, botryoidal tissue, nephridia, and gonads. The present paper is concerned with *Hirudo medicinalis* and *Aulostomum gulo*.

The rudiment of the blood-vascular system is quite distinct from that of the cœlom. The latter arises in a manner similar to what is observed in the mesoderm bands of Annelids. Though the botryoidal vessels become very closely connected with cœlom and blood-vessels, they are originally quite distinct. The nephridial funnels of *Nephelis* correspond to the testicular lobes of the nephridia in *Hirudo* and *Aulostomum*, and probably to the funnels of Chætopods; in all cases the structures arise from a single large cell occupying a similar position in the different forms. The same is true of the looped portion and the efferent duct. The ovaries arise as thickenings of the splanchnic layer of the lateral cavities, the ducts are invaginations. The testes and the vasa deferentia connecting them arise from the peritoneal epithelium, from the somatic layer of the lateral cavities; but the anterior portions of the vasa deferentia, the copulatory apparatus and genital aperture arise as invaginations of the body epithelium. In this also there is agreement with Annelids in general.

* Zeitschr. f. wiss. Zool., lviii. (1894) pp. 355–63 (1 pl.).
† Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 103–12 (1 pl.).
‡ Zeitschr. f. wiss. Zool., lviii. (1894) pp. 440–59 (3 pls.).

Sphincter of Nephridia of Gnathobdellidæ.*—Prof. H. Bolsius has determined the existence of a nephridial vesicle with an excretory duct in nine species of Leeches; the duct, which is generally of some length, always has near its point of union with the vesicle a sphincter-muscle; the cells of this sphincter are smaller in diameter than the ordinary muscular cells of the body. The terminal portion of the excretory duct has no proper musculature.

Structure of Clepsine.†—Mr. Asajiro Oka has studied the structure of various species of *Clepsine*, of which he found seven around Leipzig. He begins his description with the rings and segments, in regard to which there is much variety of interpretation, but what follows is more important.

The *body-cavity* consists mainly of five longitudinal lacunæ—a median lacuna, which divides into dorsal and ventral lacunæ in the region where the gut is pouched, two lateral or marginal lacunæ, and a pair of intermediate lacunæ, simple or divided, between the median and the laterals. These are all connected by segmental transverse lacunæ. There are also superficial hypodermic lacunæ. The lacunæ contain (*a*) free-swimming cells like those in the blood, and (*b*) larger cells (peculiar to *Clepsine ?*), which are at first fixed to the walls, but subsequently become free and divide. Oka calls the lacunæ cœlomic because they are quite distinct from the vascular system, because the nephridia open into them, because the gut, female gonads, &c. really lie in the lacunæ, and for other reasons.

The *vascular system.* While corroborating much, Oka notes that the dorsal vessel is saccular, and surrounds the gut, that a pair of vessels perforate the œsophageal ganglion, and that the blood-fluid is different in colour from the lacunar fluid, which makes the assumption of communication between the two systems improbable.

The *nephridia.* That part of the nephridium which lies between the capsule and the skin-invagination consists of a simple row of cells perforated by a canal. Proximally this is branched; its lumen increases towards the external aperture. As long as the canal is branched, the cells are glandular; thereafter, they are merely tubes. The limits between adjacent cells mostly disappear, and the row is so coiled that the walls of adjacent portions fuse. The glandular and the distal terminal parts remain distinct.

As regards segmentation, body-cavity, vascular system, nephridia, &c., *Clepsine* is finally compared with other Annelids, and the author concludes that it is among Hirudinea the type nearest the Oligochæta.

Nemathelminthes.

Strongylus filaria R.‡—Herr O. Augstein furnishes a careful description of this common parasite of sheep, which does not seem to have been hitherto investigated in any detail. The worm occurs in the lungs, bronchial tubes, and trachea, and is of much practical importance. Of

* La Cellule, x. (1894) pp. 335–45 (1 pl.).
† Zeitschr. f. wiss. Zool., lviii. (1894) pp. 77–151 (3 pls.).
‡ Arch. f. Naturges., lx. (1894) pp. 255–304 (2 pls.).

its intermediate host nothing is definitely known. Its anatomy is here sufficiently discussed, but it is not in any remarkable way divergent.

The Tubular Organ of Oncholaimus.*—Dr. O. Zur Strassen discusses the peculiar organ discovered by De Man in the females of *Oncholaimus*.

In *O. fuscus* De Man described the tubular organ as a closed tube lying in the body-cavity, extending for about two-thirds of the animal's length, communicating with the exterior by two short chitinous tubes, which open on each side, just in front of the anus. Moreover, there are two delicate connecting tubules from two papillæ on the enigmatical organ to the two branches of the uterus. In *O. albidus* it is much the same, but there is only one papilla.

Zur Strassen finds in *O. pristiurus* sp. n. and in *O. de Mani* that the tubular organ is in open communication with the gut. The inner end has Rhizopod-like cells; with the stem of the tube a rosette-shaped gland is associated. The function, probably associated with reproduction, remains quite obscure, and the difficulty is increased by the divergence between the species.

Notes on some known and unknown Entozoa.† — Herr A. Mueller describes (1) *Filaria gastrophila* sp. n. from the stomach of the domestic cat, a parasite interesting not only because it was hitherto unknown, but also because the parasites are located in great numbers at the lower end of the œsophagus and the cardiac end of stomach. The bodies project into the stomach and block up the œsophageal aperture so that the animal dies of hunger. (2) *Strongyluris brevicaudata* sp. n. from the intestine of *Agama colonum*, a species of West African lizard. (3) *Trachocephalus affinis* Rud. from *Cervus capreolus.* (4) *Trichocephalus unguiculatus* Rud. from *Lepus timidus.* (5) *Liorhyncus vulpis* Duj. from the lungs of *Canis vulpes.* (6) *Echinorhynchus pristis* Rud. from the intestine of *Exocœtus evolans* and *exsiliens.* (7) *Echinorhynchus annulatus* Rud. from the same source. (8) *Monostoma filum* Duj. from the intestine of the first-mentioned fishes. (9) *Monostoma filicolle* Rud. from the fins of *Exocœtus.* (10) *Distoma militare* Rud. from the gut of *Rallus aquaticus*, and *Distoma segmentatum* sp. n. from the gut of an African bird, *Vidua paradisea.*

Platyhelminthes.

Stilet of Hoplonemertines.‡—Mr. T. H. Montgomery confirms the statement of v. Kennel that the primary stilet of these worms has not the same structure as the secondary, but is always simpler; he finds that it is quite impossible for the latter to replace the former. The primary stilet lies in an evagination of the wall of the anterior part of the proboscis; the wall of the former is made up of an epithelium, basal membrane, single layer of outer circular muscular fibres, and a membrane of connective tissue. The anterior part of the evagination forms a circular fold round the base of the stilet itself and is lined by a

* Zeitschr. f. wiss. Zool., lviii. (1894) pp. 460–74 (1 pl.).

† Arch. f. Naturg., lx. (1894) pp. 112–28 (1 pl.). See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 930.

‡ Zool. Anzeig., xvii. (1894) pp. 298–300 (3 figs.); 301 and 2.

cubical epithelium; the fold the author calls the pouch of the primary stilet.

The hinder fold of the evagination has no lumen, but its cylindrical, non-glandular cells are closely pressed against the support of the stilet. The reserve stilets found in some Nemertines are formed in the pouch of the primary one, and are of the same size as it. The glands connected with the support of the stilet form that organ.

The author thinks that the present condition was, phylogenetically, preceded by one in which the proboscis contained several pouches which formed stilets, and were of the same structure throughout. At a later stage one pouch became differentiated from the rest by forming in the hinder part of its glandular wall a firm secretion; this secreted mass, or support of the stilet, took on an oval form. Later on, the stilets were only formed in the anterior part of the pouch. In the primitive Hoplonemertine the epithelium of the proboscis did not consist of glandular, but of supporting cells, and a remnant of that condition is to be seen in the pouch of the support of the stilet.

Mr. Montgomery has not been able to see how the secondary stilets function in the living animal, but it is probable that they are weapons of less importance than the primary stilet. Further details are promised.

Development of Tænia anatina.*—Herr J. E. Schmidt has been able to follow the life-history of this tapeworm by infecting *Cypris ovata* Jur. with the eggs. The cysticercoids are also known to occur in *Cypris compressa* and *C. incongruens*. Two great periods in the development may be distinguished—that of all-round growth and that of growth in length. In the first period there are three stages, that of the still moving embryo, the solid germinal sphere, and the hollow sphere. In the second period, Schmidt distinguishes (1) the stage in which the rudiments of the most important "vegetative and animal" organs are established (excretory system, annular muscles, spindle-cells); (2) the stage during which the anterior region and attaching structures are differentiated; (3) the third stage of maturation, when the cysticercoid takes its final form and becomes encapsuled. Two processes of folding must be distinguished, (*a*) the infolding of the anterior end to form the head, and (*b*) the purely protective infolding of the anterior region within the posterior, two processes which are quite distinct, though they occur together. Herr Schmidt describes the mature cysticercoid and the structure of the Tænia.

Echinoderma.

Holothurians from the Eastern Pacific.†—Prof. H. Ludwig has published in detail, and with great wealth of fine illustrations, his report on the Holothurians collected by the 'Albatross' in 1891, under the charge of Prof. Agassiz. As we analysed the preliminary notice at the time of its appearance ‡ at some length, it is not now necessary to go into details. The genus called *Mesites* in the preliminary report is now called *Mesothuria*, as *Mesites* is already in use for a Cystid.

* Arch. f. Naturges., lx. (1894) pp. 65–112 (1 pl.).
† Mem. Mus. Comp. Zool., xvii. No. 3 (1894) 183 pp. and 19 pls. with descriptions.
‡ This Journal, 1893, p. 484.

Variations in Larva of Asterina gibbosa.*—Mr. E. W. MacBride describes certain variations which seem to prove that the sac which he has called the right hydrocœle is a structure of the same nature as the left. As the larva in its early stage is quite bilaterally symmetrical, it may be assumed that the free-swimming pelagic ancestor of the Echinoderms had two equally developed hydrocœles; the variations described may, for the most part, be put under the head of atavism.

Cœlentera.

Indian Actiniaria.†—Dr. A. Alcock reports from the Indian Seas five species of Zoanthidæ and a new variety of *Sphenopus arenaceus*. The only Cerianthid found is *Cerianthus andamanensis*, which appears to be very close to *C. americanus*.

Spongodes.‡—Herr O. Holm makes a contribution to our knowledge of this genus of Alcyonids. After a general historical review, he divides it into four subgenera thus—

I. Polyps not united in distinct bundles.
  a. Branches lobed.
    α. Spicules of the tentacles arranged in two regular longitudinal rows . . . . 1. *Nephthya*
    β. Spicules of tentacles scattered irregularly 2. *Panopes n.*
  b. Branched elongated, cylindrical. . . . 3. *Spongodia*
II. Polyps united in distinct bundles . . . . 4. *Spongodes*

A considerable number of new species are described.

Flabellum anthophyllum.§—Prof. H. de Lacaze-Duthiers has published a full report of his observations on this Coral, the preliminary notice of which we have already ‖ noted. The history and structure of *Flabellum* are now detailed, with references to figures of great interest.

Stinging Organs of Hydroids.¶—Herr L. Murbach distinguishes in the stinging-cell, (1) a structure which facilitates the action of the poisonous secretion; (2) a muscle which sets the weapon in action; (3) a sensory hair associated with the muscle, and perhaps also with nerve-elements more deeply situated.

The capsule consists of a very delicate vesicle surrounded by a firm outer wall. The vesicle owes its origin to the nucleus; the outer wall is formed from the material secreted around the vesicle during its formation. The tubular thread is formed, as a continuation of the vesicle, from the protoplasm surrounding the nucleus, and its mode of origin explains its spiral coiling. By the removal of water from the mass surrounding the vesicle an osmotic pressure is exerted on the vesicle, and this is the cause of the extrusion of the thread. Vesicle and thread are, beyond doubt, intracellular products.

* Proc. Camb. Phil. Soc.. viii. (1894) pp. 214–7.
† Journ. Asiat. Soc. Bengal, lxii. (1893) pp. 151–3.
‡ Zool. JB. (Abth. f. System., &c.), viii. (1894) pp. 8–57 (2 pls.).
§ Arch. Zool. Expér., ii. (1894) pp. 445–84 (1 pl.).
‖ See this Journal, 1894, p. 457.
¶ Arch. f. Naturges., lx. (1894) pp. 217–54 (1 pl.).

Budding in Cœlentera.*—Herr O. Seeliger has studied the formation of a hydranth on the main stem, and of a blastostyl on the secondary hydranth, of *Eudendrium racemosum*, and the budding of a medusoid on the blastostyl of the gonangium in *Obelia gelatinosa*. In every case both ectoderm and endoderm share in the formation of the bud. Thus he very thoroughly dissents from the conclusion of Albert Lang, that the bud of Hydroids (*Hydra* in particular) is wholly ectodermic. Braem, working at Hydra and hydroids, has also controverted Lang. In the general part of his paper, Seeliger runs a tilt against the conception of a special *Knospungs-Keimplasma*, which appears to him gratuitous.

It should be noted, however, that Lang † has answered Braem's criticism of his work, and adheres to his conclusion that the hydroid bud is ectodermic.

Porifera.

Metamorphosis of Freshwater Sponge.‡—Dr. B. Nöldeke does not come to quite the same conclusions as his predecessors, Goette, Maas, or Delage. He finds that the larva of the freshwater Sponge consists of a flagellate ectoderm and an endoderm; the attachment of the larva is dependent on the differentiation of the peripheral endodermal layer, but is independent of the further differentiation of the endoderm. After the attachment of the larva the ectoderm wanders into the internal mass, where its cells are eaten and digested by definite endoderm cells. The epidermis of *Spongilla* is of endodermal origin, but is formed out of the epidermal layer. The whole Sponge is to be credited to the larval endoderm. The flagellate chambers have no connection with the larval endodermal cavity or the ectoderm; they are independent structures which may arise in the free larva.

Dealing with the subject from the theoretical point of view, the author concludes that Sponges have a typical Gastrula with ecto- and endo-derm, which have the typical topographical relations to one another. The conversion of the germinal layers of the Sponges does not correspond to that which is known as the typical mode. The ectoderm, after the attachment of the larva, undergoes a process of degeneration, in consequence of which it takes no part in forming the adult animal. After the Gastrula-stage is passed Sponges have no further genetic relations with any other of the Metazoa.

In a postscript the author points out that Maas' recent researches on the embryonic development and metamorphosis of the Cornacuspongiæ confirm the accuracy of his observations, but he refuses to accept Dr. Maas' deductions.

Protozoa.

Infusorian living on Comatulid.§—M. L. Cuénot recognizes in the Urceolariid *Hemispeiropsis Comatulæ* of König the Infusorian which he described more than three years ago as *Trichodina antedonis*. He now,

* Zeitschr. f. wiss. Zool., lviii. (1894) pp. 152–88 (3 pls.).
† Biol. Centralbl., xiv. (1894) pp. 682–7.
‡ Zool. JB. (Abth. f. Anat.), viii. (1894) pp. 153–89 (2 pls.).
§ Zool. Anzeig., xvii. (1894) p. 316.

however, agrees with the Austrian author in the propriety of establishing for it a new genus.

Coccoliths.*—Mr. E. H. L. Schwarz comes to the conclusion that the discolith represents the adult stage of the coccolith, and is a separate organic individual, consisting of a phosphatic disc, which appears to be surrounded with protoplasm. He is inclined to think they should be removed from the Animal Kingdom, and put provisionally near *Glœocapsa* and *Chroococcus*, to which they are allied by their mode of reproduction.

Encystation of Actinosphærium.†—Dr. A. Brauer describes the process of encystation in *Actinosphærium Eichhorni.* The animal draws in its pseudopodia and excretes a gelatinous envelope; the vacuolar structure becomes less distinct; yolk-like granules appear in the medullary layer; flinty skeletal pieces are excreted all through and gradually displaced towards the periphery; a large number of nuclei fuse together. Then the animal falls into as many portions—cysts of the first order—as there are nuclei. Each cyst excretes a gelatinous envelope. Then by division of cell and nuclei, cysts of the second order are formed, which, after division has ceased and the flinty envelopes are fully formed, become resting cysts. Each resting cyst has one large central nucleus, around this a zone of granules, then a cortical layer without granules, then the siliceous envelope. A gelatinous envelope surrounds two or four cysts, and a second gelatinous envelope surrounds all. Dr. Brauer does not think that the fusion of nuclei has anything to do with "fertilization"; the breaking up into fragments may be associated with the large size of this Protozoon, for it is too large to encyst *in toto*; multiplication is wholly due to division of the cysts of the second order.

Division of Amœba.‡—Dr. F. Schaudinn has observed the amitosis of *Amœba crystalligera* Gruber, thus confirming Prof. F. E. Schulze's observation of *A. polypodia* M. Schultze. The resting nucleus has a round or oval central body (or nucleolus), which stains slightly, but has an alveolar structure like that of the outer nucleus. This central body appears to play an important part in the direct division. The nucleus elongates, becomes slightly constricted, then dumbbell-shaped, and divides. As the daughter nuclei pass back into the resting stage the cell-substance divides. On a living animal the nuclear division occupied scarcely a minute; the division of the cell followed in two minutes or not for hours.

Movements of Gregarines.§—Dr. W. Schewiakoff has studied *Clepsidrina munieri* and other species of this genus, and finds that the movement is caused by the excretion of gelatinous threads, which emerge by fine longitudinal clefts in the cuticle from a layer between the cuticle and the ectoplasm. Why the excretion should form threads he has not discovered. When the substance of the gelatinous layer is exhausted, the Gregarine must rest until a new supply accumulates.

* Ann. and Mag. Nat. Hist., xiv. (1894) pp. 341–6 (27 figs.).
† Zeitschr. f. wiss. Zool., lviii. (1894) pp. 189–221 (2 pls.).
‡ SB. Ak. Preuss., 1894, pp. 1029–36 (5 figs.).
§ Zeitschr. f. wiss. Zool., lviii. (1894) pp. 340–54 (2 pls.).

Sporozoa of Sarcoma.*—Mr. J. J. Clarke describes certain bodies which he finds are constanly present in sarcoma. From their general appearance and from their resemblance to the psorosperms of the ureter and to the cell-inclusions of carcinoma the author believes them to be Sporozoa. They are present in all varieties of sarcoma, and their intracellular free and sporing forms are easily recognizable. The number of the bodies present is proportionate to the rapidity of growth of the neoplasm.

Sarcoma and Sporozoa.†—Dr. Wedeler describes a case of round-celled sarcoma in which Sporozoa were present. The pieces were fixed in 5 per cent. sublimate hardened in alcohol and the sections stained with hæmatoxylin and eosin. The nuclei of the tissue cells are stained blue, while the parasite is yellowish. As a rule the parasite is circular, of variable size, and nearly always a nucleus is present. Most examples are intracellular, but some lie free between the cells. The numbers present vary inversely as size, thus when there is only one body in the cell it is large and well formed, when numerous they are small. Though the predominating shape is circular, many of the parasites are oval, and this shape may be due to endogenous fission.

Crescentic and Flagellated Bodies in Malarial Blood.‡—After describing the appearances most common in malarial blood, Dr. P. Manson discusses the nature of the crescentiform and flagellated bodies and their significance. The flagellated body, which is a constant feature of and always present in cases of malaria, is evolved either from the crescentiform body or from certain large pigmented intracorpuscular forms. The flagellated form is, however, never found immediately after the withdrawal of the blood, but requires some minutes (usually not less than fifteen) for its development.

The appearance of the flagella is preceded by changes in the corpuscles and movements of the pigment-granules, after which flagella in variable numbers are extruded. The flagella, after exhibiting characteristic vibratile undulating motions, break away from the central body and swim about free in the plasma.

Though the crescentiform body is not always found in malarial blood, it possesses important special characteristics. It may persist in the blood for days or weeks after the other intracorpuscular forms have disappeared. It is never attacked by phagocytes. It does not undergo development within the body, but has been observed to do so after removal. From this it is inferred that the crescentiform body is intended to carry on the life of the species outside the body, the flagellated organism being the first, and the free flagella the second stage of development. Hence an extraneous agent to assist the malaria parasite to escape from the human body becomes probable. That agent, as in the case of *Filaria sanguinis nocturna*, may be a suctorial insect.

Plasmodia in Bilious Typhoid.§—In a small epidemic of bilious fever occurring at Alexandria Drs. Schiess and Bitter found in all their

* Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) 809–12 (12 figs.).
† Tom. cit., pp. 849–53 (1 pl.).
‡ Brit. Med. Journ., Dec. 8, 1894, pp. 1306–8 (16 figs.).
§ Deutsche Med. Wochenschr., 1894, p. 682. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 705.

five cases plasmodia in the blood of the patients while alive. The plasmodia, which exhibited lively amœboid movements, were from 1–2 μ in diameter, and were observed both in the red corpuscles and free in the plasma. All phases such as are present in malaria were seen. Amœboid forms of all sizes up to completely filling the red corpuscles and the sporulation stage were alike present. The oval bodies of the sporulation stage exhibited lively movements and penetrated directly into the red corpuscles. The authors are inclined to the view that bilious typhoid must be considered a form of malaria.

Chromatophilous Bodies in Cancer-cells.*—Sig. Morpurgo has not unfrequently met with certain chromatophilous bodies in cancer-cells. These bodies are very small, and are found in connection with the karyokinetic changes of the nucleus; they probably consist of free chromatophilous substances.

* Mittheil. aus d. XI. Internat. Med. Kongr. in Rom. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 695.

BOTANY.

A. GENERAL, including the Anatomy and Physiology of the Phanerogamia.

α. Anatomy.

(1) Cell-structure and Protoplasm.

Reduction of the number of Chromosomes in Plants.*—Prof. E. Strasburger gives a detailed review of recent observations on the periodic reduction of the number of the chromosomes in the life-history of living organisms. He considers the fact as established that the number of chromosomes characteristic of the generative nuclei of Angiosperms is determined, in the one case, in the mother-cells of the pollen-grains, in the other case, in the mother-cells of the embryo-sacs, corresponding to a similar phenomenon in the animal kingdom. The physiological utility of this reduction is evidently that it prevents the number of chromosomes in the nuclei of each generation becoming twice as great in the preceding generation. Morphologically it indicates a return to the original generation from which, after it had attained sexual differentiation, offspring was developed having a double number of chromosomes. The reduction by one-half in the number of chromosomes takes place, in the Muscineæ, Pteridophyta, and Phanerogamia, in the spore-mother-cells, i. e. at the close of the generation developed from the fertilized ovum; but in the lower Cryptogams, where the cell produced by the sexual act does not give rise to a definite organism representing the non-sexual generation, the reduction probably takes place on the germination of this cell.

Seeing that it is in the mother-cells of the spores that the reduction takes place in the higher plants, it is these which must be regarded as the first term of the new generation; their true significance in this respect being indicated by the fact that they usually isolate themselves from cohesion with other cells. This greatly reduces the significance of the archespore or mass of cells which gives rise to the sporogenous tissue, and which still belongs to the sexually developed non-sexual generation. It is simply the merismatic tissue from which the spore-mother-cells are derived.

Centrospheres in Fungi.†—Mr. H. Wager describes certain peculiar bodies accompanying the process of nuclear division in the basids of *Agaricus reticulatus*, which appear to indicate the presence of centrospheres or kinetic centres in the vegetative cells of Fungi. They are apparently of archoplasmic nature, and are found singly or in pairs just outside the nucleus, and generally in close contact with it before division has commenced. They appear to consist of a homogeneous mass of substance, spherical in outline. There is no indication in them of any medullary corpuscle or centrosome; but they present a strong resemblance to the archoplasmic bodies described by various writers in

* Ann. Bot., viii. (1894) pp. 281–316. Cf. this Journal, 1894, p. 583.
† Tom. cit., pp. 321–34 (1 pl.). Cf. this Journal, 1894, p. 380.

animal cells.* The two bodies gradually approach one another at the apex of the nucleus, and fuse together into a single large body, which is at first in close contact with the nucleus, but subsequently makes its way to the top of the basid, followed by the nucleus, which then begins to divide. While the chromatic elements are being developed, the centrosphere undergoes a change. It is at first in close contact with the nuclear threads as a homogeneous mass more or less spherical in outline, which gradually becomes more irregular, and finally disappears. Shortly after this the spindle-figure appears, with the two centrosomes, one at each end; the spindle being probably formed out of the substance of the archoplasmic body as it becomes invisible. The archoplasmic bodies are first seen in the basid at the stage when it contains two large nuclei formed by the fusion of four pre-existing nuclei.

Karyokinesis.—Herr W. Belajeff † finds the pollen-mother-cells of *Larix*, especially of *L. davurica*, a very favourable object for following out the various stages of the division of the nucleus, for which they are in a condition during the period of winter repose. The preparations were fixed by Flemming's solution, and stained first with saffranin and then with gentian-violet or orange G.

When cell-division commences, the first change which takes place is the formation round the nucleus of a dense felted layer composed of meshes parallel to the wall of the nucleus. In the meantime the chromatin-granules contained in the nucleus coalesce into homogeneous irregular chromatin-bodies, usually X-shaped, or angular with four projections. The outer felted layer and the inner mass of threads form together a central body sharply differentiated from the surrounding protoplasm, within which lie the chromatin segments. After the absorption of the wall of the nucleus, the nucleole gradually disappears. The threads of the protoplasm form at this time irregular knots, but gradually unite into groups. The further changes in these filaments are followed in detail. During these processes the chromatin segments are gradually constituting themselves into the equatorial group. Every new segment of the nucleus originating in each polar half has the form of a bow which is fixed at its middle to the filament-bundle, the free ends facing the equatorial plane of the spindle.

The division of the pollen-mother-cells of *Lilium* and *Fritillaria* proceeds in a course which, in its main features, is identical with that of *Larix*.

Herr R. Franzé ‡ describes the karyokinetic processes which take place in the division of the nucleus after the conjugation of swarmspores in Algæ.

Origin of the Directing Spheres.§—M. L. Guignard contests the view of Karsten ‖ that the centrosomes have their origin in the nucleoles; he re-affirms his previous statement that these bodies are always

* Cf. this Journal, 1894, p. 666.

† Flora, lxxix. (1894) Ergänzungsbd., pp. 430–42 (2 pls.).

‡ SB. K. Ungar. Naturw. Gesell. Buda-Pest, March 14, 1894. See Bot. Centralbl., lix. (1894) p. 267.

§ Journ. de Bot. (Morot), viii. (1894) pp. 241–9, 257–64 (1 pl.); Comptes Rendus, cxix. (1894) pp. 300–2. Cf. this Journal, 1891, p. 614.

‖ Cf. this Journal, 1894, p. 360.

found in the cytoplasm, where they can be observed during the condition of rest of the cell. The nucleoles are, as a rule, resorbed during the early stages of division of the nucleus, although in *Psilotum* they sometimes persist till a later period, and were then mistaken by Karsten for nucleoles. The true centrosomes may be distinguished from nucleoles by several characters—by their size, which varies only within narrow limits, by the presence of a central corpuscle which stains more strongly than the surrounding zone, and by their constant position at the two poles of the nuclear spindle. Their average diameter is from 2 to 3 μ, while that of the nucleoles varies between 2 and 5 μ. The process of nuclear division in the formation of the mother-cells of the spores of *Psilotum* are described in detail. The presence of nucleoles in the cytoplasm after the nucleus has lost its membrane and entered into the dividing stage, is not very uncommon. Herr Karsten confirms altogether the observations of Humphrey on this subject, and is unable to substantiate those of Farmer.*

(2) Other Cell-contents (including Secretions).

Starch-grains.†—Dr. A. Zimmermann gives a *resumé* of recent literature on starch-grains. The newest observations are referred to on their mode of growth, their finer structure, and the mode in which they are absorbed. In connection with true starch, the literature is also referred to of the following allied substances:—Florideæ-starch (Rosanoff), Fucosan or Phæophyceæ-starch (Schmitz), Fungus-starch, cellulin-grains (Pringsheim), fibrosin-bodies (Zopf), cellulose-grains (Weber van Bosse).

Aleurone-grains.‡—Dr. A. Zimmermann reviews recent researches on aleurone- or protein-grains, with especial reference to the following points:—their demonstration and permanent preservation; their mode of formation and their connection with the vacuoles; and the substances contained within them. The allied substances are also referred to known as myrosin (Cruciferæ and *Tropæolum*) and emulsin (Amygdaleæ).

Protein-crystalloids.§—We have from Dr. A. Zimmermann an account of what has been recently written on protein-crystalloids, with reference to their occurrence in Fungi, Algæ, Pteridophytes, Gymnosperms, Monocotyledons, and Dicotyledons. Their special reactions are then described, as are the researches on the question whether they are formed in the cytoplasm or the cell-sap. Reference is also made to the rhabdoids or plastoids observed by Gardiner in *Dionæa*, and to the spiny bodies (*Stachelkugeln*) of the Characeæ.

Existence in Plants of principles which are readily doubled, with production of carbon dioxide.‖—By a series of experiments (chiefly on leaves of the ivy and on the sugar-cane) MM. Berthelot and G. André have demonstrated the existence in vegetable tissues of substances which set free carbon dioxide by a process of doubling going on within the tissues, without oxidation by the carbon dioxide of the air.

* Cf. this Journal, 1894, pp. 581, 583.
† Bot. Centralbl., 1894, Beih., pp. 329–35. ‡ Tom. cit., pp. 321–4.
§ Tom. cit., pp. 324–9. ‖ Comptes Rendus, cxix. (1894) pp. 711–4.

(3) Structure of Tissues.

Anatomy of the Casuarineæ.*—Mr. L. A. Boodle and Mr. W. C. Worsdell have studied the structure of the tissues of the Casuarineæ, with especial reference to their relations with the Gnetaceæ and with the Cupuliferæ.

The chief peculiarities of the structure of the stem were found to be the great development of xylem-parenchyme in the form of concentric bands, and the very broad medullary rays, sometimes occupying one-third of the circumference of the stem. The tracheal part of the xylem, consisting both of vessels with numerous and with single perforations, together with fibrous tracheids, resembles that of the Cupuliferæ and other low forms of Dicotyledons. The vessels of the primary and early secondary wood are different from those in the later-formed wood, and show characters of a preceding type [*sic*] of structure. The phloem is dicotyledonous in structure. Transfusion-elements occur in the ridges of the young stem and in the leaves; but they have evidently a different origin from the transfusion-tissue in the leaves of Gymnosperms. In the young stem an external endoderm was found extending round the outer limit of the cortical bundles and dipping beneath the furrows. The structure of the seedling agrees with that of other dicotyledonous plants.

In the structure of its phloem, *Casuarina* shows no important deviation from the dicotyledonous type; and in its xylem-elements it agrees pretty well with the Cupuliferæ and other Dicotyledons. It is in the disposition of the xylem-parenchyme, &c., that it shows the greatest peculiarity.

Several new points in the structure of *Gnetum* are also described, viz. the presence in the wood of two kinds of vessel, with different modes of perforation, and the great difference between the structure of the node and that of the internode.

Secondary Xylem of the Proteaceæ.†—M. C. Houlbert proposes a classification of the genera of Proteaceæ according to the histology of the secondary xylem, which he represents as also largely in accordance with their natural affinities. This structure shows a degree of simplicity which is probably an indication of an archaic origin. The three groups are as follows:—(1) Group of *Banksia;* vessels in concentric zones, forming complete vascular arcs; (2) Group of *Orites;* vessels in concentric zones forming incomplete vascular arcs, terminated by parenchymatous wings; (3) Group of *Protea;* vessels in concentric zones in the initial layers of the spring wood, irregularly scattered in the autumn wood. In each group the special characters are given of the various genera.

Secondary Tissues of Arborescent Monocotyledons.‡—According to M. H. J. de Cordemoy, while in some arborescent Monocotyledons (*Dracæna, Cordyline, Lomatophyllum*) the secondary formations become lignified and perform a supporting function, in others they play a very

* Ann. Bot., viii. (1894) pp. 231–64 (2 pls.). Cf. this Journal, 1894, p. 220.

† C.R. Ass. Franç. pour l'Avancement des Sci., 1894, pp. 544–57. See Bot. Centralbl., lx. (1894) p. 208.

‡ Comptes Rendus, cxvii. (1893) pp. 132–4. Cf. this Journal, 1893, p. 652.

different part, the cells remaining thin-walled and becoming filled with reserve-substances. These substances may be sugars (*Yucca*), starch (*Dioscorea*, *Tamus*), or fatty oils (*Cohnia*).

Anatomy of the Wood of Albizzia.*—Herr A. Burgerstein describes the histological structure of the remarkably soft and light wood of *Albizzia moluccana* (Mimoseæ) from Java. The xylem has a very simple structure, and consists of five elements, viz.:—very thin-walled xylem-cells; large pitted vessels; wood-parenchyme; medullary-ray-cells; and septated crystal-fibres. The vessels are so large as to be visible to the naked eye. In the crystal-fibres each cell contains a single large crystal of calcium oxalate.

Sieve-tubes of Calycanthus.†—According to Mr. J. L. Williams, in young stems of *Calycanthus occidentalis*, the greater part of the phloem in the cortical bundle consists of sieve-tubes, these elements being far more numerous in the cortical bundles than in the bundle-ring.

Structure of the Terebinthaceæ.‡—M. F. Jadin has studied the anatomical structure of the stem of the Terebinthaceæ, in the case of 207 species belonging to 67 out of the 71 genera. The order is divided into the two tribes, Bursereæ and Anacardieæ. The most constant character is the occurrence of secreting canals in the liber, protected by pericyclic fibres. Less constant as generic characters are those drawn from the anatomy of the stem, and from the presence or absence of medullary canals.

(4) Structure of Organs.

Doubling and Reduction in Flowers. — Dr. L. J. Celakovsky § regards the doubling of leaves (including petals and stamens) as always the result of an actual increase in the number of parts.

To this Prof. K. Goebel replies ‖ that this is certainly not the case in the branched stamens of the Hypericaceæ and Loasaceæ, where these structures are not of foliar origin, but result from the projection of divided portions of the receptacle. Such flowers are in fact derived, by reduction, from other polyandrous forms.

Integument of the Seed of Polygalaceæ.¶—According to M. A. Rodrigue, the testa of the ripe seed is, in this order, derived from the inner integument only of the ovule, the outer integument having entirely disappeared. The parenchyme of the testa and of the aril, the raphe, and the pseudo-raphe have been formed at the expense of the innermost layer of the inner integument. When the seed contains endosperm the cells of the nucellus have been entirely resorbed. During germination the differentiation of the tissues of the embryo commences with the formation of the tracheal elements; then follows the development of the conducting elements of the phloem; next the palisade-parenchyme and the chloroplasts of the leaf; and finally the stomates. Three types

* Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 170–2, 267–8.
† Ann. Bot., viii. (1894) pp. 367–70 (1 fig.).
‡ Ann. Sci. Nat. (Bot.), xix. (1894) pp. 1–51 (20 figs.).
§ SB. K. Böhm. Gesell. Wiss., 1894 (5 pls.).
‖ Flora, lxxix. (1894) Ergänzungsbd., p. 443.
¶ Bull. Herb. Boissier, i. (1893) pp. 450–63, 514–41, 571–83 (3 pls.). See Bot. Centralbl., 1894, Beih., p. 349.

are distinguished in the structure of the mature testa in the various genera, viz. (1) there are true palisade cells; (2) these are replaced by isodiametrical cuticularized cells containing crystals; (3) there are no corresponding cells. This last occurs especially in those fruits which do not dehisce. The various sections of the genus *Polygala* are characterized by special peculiarities in the structure of the testa. When the fruit is indehiscent, the mechanical elements are strongly developed in the pericarp, while the testa is rudimentary or disappears entirely; when the fruit is dehiscent and still contains mechanical elements, the testa is but feebly developed.

Leaves of Alpine Plants.*—From an examination of the flora of the alpine portion of Sweden, Dr. J. R. Jungner classifies the leaves, with regard to their form and structure, under the following heads:—Transpiration leaves, covered with a dense felt of hairs, or otherwise protected against excessive transpiration (*Salix lanata*, *Gnaphalium norvegicum*); Frigor-leaves, small, crowded, with recurved margins (*Empetrum nigrum*, *Azalea procumbens*); Circumpolar light-leaves, found in the highest latitudes, erect, very narrow, and commonly cylindrical, protected against the protracted insolation (*Juncus trifidus*, *Aira alpina*); Snow-leaves, growing flat on the snow or on wet ground, generally circular or kidney-shaped (*Salix herbacea*, *Viola biflora*, *Betula nana*); Wind-leaves, lobed or incised, protected against violent winds (*Geranium sylvaticum*, *Ranunculus glacialis*). Any of these types may be occasionally found remote from the conditions in which they originated.

Spiral Phyllotaxis.†—In an examination of the phyllotaxis in spiral lines which occurs in many genera of Monocotyledons, especially in *Pandanus* and *Cyperus*, Herr S. Schwendener finds a constant occurrence of larger or smaller divergences in the angle, which can only result from a continuous torsion of the apex of the shoot.

Tubers of Tacca and Tamus.‡—M. C. Quèva attributes the formation of a tuber to the partial or entire suppression of the growing point of the stem, one or two tubers then being formed at the expense of axillary buds; these produce leaves, and finally a flowering stem. The tuber of *Tamus communis* (as also those of *Dioscorea sinuata* and *altissima*) is the result of a secondary hypertrophy, which is limited to the dorsal region of the hypocotyl, extending only to the first two internodes of the primary stem.

Root-swellings of Ailanthus.§—Herr E. Andreæ describes the swellings which often appear on the roots of *Ailanthus glandulosa*. They are of a vegetative, not a parasitic character; though fungi occur in them, these take no part in the formation or development of the swellings.

Morphology and Biology of the Cactaceæ.‖—From a study of the structure of the organs of a number of different genera of Cactaceæ,

* Flora, lxxix. (1894) Ergänzungsbd., pp. 219–85 (3 pls.).
† SB. K. Preuss. Akad. Wiss. Berlin, 1894, pp. 963–80 (1 pl.).
‡ C.R. Ass. Franç. pour l'Avancement d. Sci., 1894, pp. 519–27, 551–9 (8 figs.). See Bot. Centralbl., lx. (1894) pp. 234, 235. Cf. this Journal, 1894, p. 83.
§ 'Ueb. abnorme Wurzelschwellungen b. *Ailanthus glandulosa*,' Erlangen, 1894, 34 pp. and 3 pls. See Bot. Centralbl., lx. (1894) p. 187.
‖ Flora, lxxix. (1894) Ergänzungsbd., pp. 49–86 (17 figs.).

Mr. W. F. Ganong finds that the various modifications in the external conformation may be referred back to a few, or even to a single fundamental form. Transitional forms between leaves and spines occur in *Opuntia* and *Echinopsis*, showing that the latter are modified leaves. Each leaf has a single axillary bud; but in some genera the growing point is elongated and bifurcates; this is not the result of branching, but of the formation of a permanent tissue between two divisions of the growing points. The sheath of the spines in *Opuntia* is formed of viscid hairs. Some species of *Cereus*, *Opuntia*, *Rhipsalis*, and *Mamillaria* possess honey-secreting structures, which are always metamorphosed spines. A scheme is appended of the relationship of the various genera of the order.

Morphology of Cabombeæ and Nymphæaceæ.—M. M. Raciborski * adds some further details to his account of the structure of these natural orders. The cells of the rhizome of *Brasenia* contain a crystalline substance (brasenin) which is organic, and appears to belong to the series of oils. The tannin which abounds in these plants is apparently an excretory product, and has very little, if any, function in the way of protection. The mucus which clothes the intercellular spaces displays none of the reactions of protoplasm.

Herr K. Schumann † differs in some points from Raciborski's morphological interpretations, and lays much more stress on the effect of contact in producing certain morphological peculiarities.

β. Physiology.

(1) Reproduction and Embryology.

Cross- and Self-Pollination.—According to Dr. P. Knuth ‡ the flowers of *Lonicera Periclymenum* are strongly proterandrous, and are not self-pollinated. They owe their pollination to night-flying moths, especially Sphingidæ, which visit them abundantly.

In *Lonicera japonica*, according to Mr. T. Meehan,§ the flowers are self-pollinated, but usually infertile. Bees obtain much more honey from the fallen withered than from the living flowers.

Mr. P. H. Mell ‖ records the results of a series of observations on the intercrossing of different varieties of the cotton-plant, which he finds distinctly advantageous in increasing the strength of the fibre. The cotton-plant is pollinated by the agency of the wind and of insects. It is remarkable for the rapid growth of the pollen-tube.

Mr. A. G. Hamilton ¶ describes the arrangements for effecting cross-pollination in *Clerodendron tomentosum* and *Candollea serrulata*. The former is proterandrous, and is pollinated by a night-flying moth *Deilephila celerio*. The latter is also strongly proterandrous, and is not self-fertile. The pollination is effected by bees, through the agency of the strongly irritable column.

* Flora, lxxix. (1894) Ergänzungsbd., pp. 92–108 (1 fig.). Cf. this Journal, 1894, p. 588.

† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 173–8.

‡ Bot. Centralbl., xl. (1894) pp. 41–4 (3 figs.).

§ Trans. Acad. Nat. Sci. Philadelphia, 1894, pp. 169–71.

‖ Agricultural Exper.-Stat., Auburn, Ala., Bull. No. 56, 1894, 47 pp., 4 pls. and 5 figs.

¶ Proc. Linn. Soc. N.S. Wales, ix. (1894) pp. 15–24 (1 pl.).

Cleistogamy in the Solanaceæ.*—Prof. E. Hackel records the occurrence of cleistogamous flowers in *Salpiglossis variabilis*, the first time it has been observed in the Solanaceæ. It appears to be the result of unfavourable nutritive conditions of the soil.

(2) Nutrition and Growth (including Germination, and Movements of Fluids).

Activity of Assimilation in Leaves.†—Herr R. Meissner has established the fact that when dorsiventral leaves are inverted, the activity of assimilation is reduced. This is due to the closing of the stomates under the influence of direct sunlight, and to the chlorophyll-grains of the palisade-parenchyme being unable to perform their function. In isolateral leaves, on the other hand, no change is produced by inversion. The removal of the epiderm of the lower surface increases the intensity of assimilation.

Correlation in the Growth of Roots and Shoots.‡—Herr L. Kny has experimented on the effect produced by the destruction of the root on the growth of the stem, and the reverse, in certain seedlings and cuttings. In seedlings—*Zea Mays*, *Vicia Faba*—the general result was that the growth of the roots and that of the shoots proceed with a high degree of independence, the complete destruction of the one having no very marked effect on the growth of the other. In cuttings—*Salix acuminata*, *S. purpurea*—the results were different; the removal of the shoot arresting the development of the roots; and, to a less degree, the removal of the roots arresting the development of the shoot.

Penetration of Roots into Living Tissues.§—From experiments made chiefly on the penetration of the roots of the pea and other plants into potato-tubers, Mr. G. J. Peirce concludes that the process differs in some respects from that in true parasites. In the latter case, the root of the parasite exudes a starch-corroding ferment, which is not the case with the former. While haustoria absorb from the hosts both organic and inorganic nutrient substances, true roots take up only water and substances dissolved in the water. The power of penetration into living tissues is, however, not a special property of the roots of parasites.

Insectivorous habit of Drosophyllum.‖—Drs. A. Meyer and A. Dewèvre have investigated the structure of the leaves of *Drosophyllum lusitanicum*, and the mode in which they capture insects. Three collateral vascular bundles run through the leaf from the base to the apex. These are connected with one another by smaller bundles, and from them all there branch off tracheal bundles which end beneath the cells of both the sessile and the stalked glands; the sieve-tube bundles do not reach as far as the glands. The stalked glands are completely covered by a strong cuticle, through which the secretion oozes. The secretion is strongly acid, but contains neither formic nor oxalic acid,

* SB. Versamml. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 258.

† Beitr. z. Kenntn. d. Assimilationsthätigkeit d. Blätter, Bonn, 1894, 48 pp. See Bot. Centralbl., lx. (1894) p. 206.

‡ Ann. Bot., viii. (1894) pp. 265–80.

§ Bot. Ztg., lii. (1894) 2te Abtheil., pp. 169–76 (1 fig.).

‖ Bot. Centralbl., xl. (1894) pp. 32–41 (1 fig.).

nor a reducing sugar. No bacteria could be detected in it. Under ordinary circumstances the sessile glands do not secrete any digesting fluid. The secretion attracts great quantities of insects, the bodies of which are digested and absorbed; and the same is the case with flesh and fibrin, and especially with boiled white of egg. Although the sessile glands do not themselves secrete a digesting fluid, they assist this process in the stalked glands by carrying off the products of digestion. No diastatic ferment is present in the secretion.

Symbiosis as the result of Grafting.*—Prof. H. Vöchting has succeded in obtaining a number of successful plants, resulting from the grafting of *Helianthus tuberosus* on *H. annuus*. In opposition to the statement of previous observers, he found no "graft-hybridization" to take place; each species preserved fully its own characters. There was no tendency to the formation of tubers by *H. annuus*, nor did this species produce inulin. Corresponding results were obtained by grafting *H. annuus* on *H. tuberosus*. Each species fulfils its part in the life of the symbiont, but no transference of properties takes place from one to the other.

Grafting of Herbaceous Plants.†—As the result of a number of experiments, chiefly on Cruciferæ and Leguminosæ, M. L. Daniel states that graft-hybrids may be produced in herbaceous plants, and that these can be endowed with new alimentary powers by grafting them on plants which excel them in this respect, and sowing the seeds produced on the graft. Plants differ greatly in their power of acquiring new characters. It appears to be especially strongly marked in the Cruciferæ. With etiolated herbaceous plants all attempts at grafting were unsuccessful.

Vitality and Germination of Seeds.‡—From experiments made on the germination of a number of seeds, Mr. A. J. Ewart concludes that the power possessed by certain seeds of resisting the action of absolute alcohol is due to the relative impermeability of the seed-coat, and to the inherent vitality of the protoplasm of the seed, and more especially of the embryo. The protoplasm of seeds presents a marked difference from that of ordinary protoplasm. It is more stable, of a less complex nature, and contains a smaller proportion of water. The latent period of germination of seeds, i. e. the period before the evolution of carbon dioxide commences, varies with the species. The radicle exhibits a distinct oxytropic irritability.

Influence of the different Rays of Light on Assimilation and Transpiration.§—From a series of experiments carried on on a variety of different plants, Herr E. Wollny finds that yellow light has the greatest power of producing organic substances; next the red; while blue light has a remarkably prejudicial effect on the development of the reproductive organs. It is, therefore, the most refrangible (chemical) rays which take the least part in metabolism, the assimilation of carbon being carried on mainly by the less refrangible (illuminating) rays. The

* SB. K. Preuss. Akad. Wiss. Berlin, 1894, pp. 705-21 (1 pl.).

† Comptes Rendus, cxviii. (1894) pp. 992-5; Rev. Gén. de Bot. (Bonnier) vi. (1894) pp. 356-69 (2 pls.). Cf. this Journal, 1894, p. 476.

‡ Trans. Liverpool Biol. Soc., viii. (1894) pp. 207-47.

§ Wollny's Forsch. a. d. Geb. d. Agriculturphysik, xvii. (1894) pp. 317-32. See Bot. Centralbl., lx. (1894) p. 216.

influence of the different rays of light on transpiration was less easily determined. The absolute amount of transpiration was greatest in yellow light, least in the blue; but this seems to be due to the necessary connection between the intensity of transpiration and the development of the transpiring organ. The results were obtained by growing the plants behind glasses of different colours.

From a series of experiments made on the growth of various plants behind glasses of different colours, M. A. M. Villon * states that the vine produces a greater weight of grapes, which also contain a larger quantity of alcohol and of acid, when grown behind glass coloured red-violet by manganese, which absorbs the yellow and brown rays. Flowers are also favourably influenced by the same colour, which is, moreover, advantageous to the growth of yeast, bacteria, and silkworms.

Influence of Light on the Structure of the leafy Cactaceæ.†—Prof. H. Vöchting has carried out a series of observations on the leaf-producing Cactaceæ (chiefly *Phyllocactus* and *Lepismium*), from which he draws the conclusion that the phyllotaxis is largely dependent on light. By alterations in the intensity and direction of the light he was able to produce changes in the arrangement of the leaves, and even in the structure of the stem. The "wings" of *Phyllocactus* appear to be induced by the direct action of the light on them, and not indirectly by its action on the growing point. In *Rhipsalis paradoxa*, on the other hand, the angles of the stem are developed even in the dark. The conclusions of the author differ from those of Schumann,‡ who refers the arrangement of the foliar organs on the stem to the space available for their formation in the growing point.

Influence of Light on the Buds of the Copper-beech.§—From a series of observations made on the copper-beech, Herr L. Jost finds that in this tree, contrary to what takes place in other cases, the putting out of the bud is dependent upon light.

Influence of Light on Diastase.‖—According to Prof. J. R. Green, light, whether solar or electric, exercises a destructive influence on diastase. This influence is, however, confined to the violet end of the spectrum, the remaining rays being slightly favourable rather than destructive. In the grain of barley the colouring matter of the husk acts as a screen to protect the diastase from the destructive effect of light.

(3) Irritability.

Heliotropism.¶—Dr. W. Rothert records the results of a large number of observations on the heliotropic curvatures of seedlings, of which the following are the more important.

If a portion of an organ is illuminated on one side only, the heliotropic irritation may be transmitted to other portions of the organ which are either illuminated on both sides or on neither. This transmission

* Rev. Scient., i. (1894) pp. 460–3. See Bot. Centralbl., lx. (1894) p. 144.
† Jahrb. f. wiss. Bot. (Pringsheim), xxvi. (1894) pp. 438–94 (5 pls.).
‡ Cf. this Journal, 1891, p. 366.
§ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 188–97.
‖ Ann. Bot., viii. (1894) pp. 370–3.
¶ Beitr. z. Biol. d. Pflanzen (Cohn), vii. (1894) pp. 1-212 (60 figs.). Cf. this Journal, 1893, p. 70.

was observed in all the organs examined, and even, in the case of seedlings of Paniceæ, from the cotyledon to the hypocotyl. It takes place invariably in the basipetal direction, and usually but slowly. The irritation is transmitted through the fundamental parenchyme, the vascular bundles taking no essential part in it. As a rule (in opposition to Darwin's view), the entire region over which the curvature extends is heliotropic, but in the seedlings of certain Paniceæ the cotyledon only is sensitive, the hypocotyl curving only under the influence of an irritation conveyed to it from the cotyledon. The degree of sensitiveness, however, varies greatly in different parts of the organ. In all the cases hitherto accurately investigated, it is only a very short apical region in which heliotropic sensiveness is very strongly marked; in the whole of the rest it is usually very much weaker.

The author distinguishes between heliotropic sensitiveness (*Empfindlichkeit*) and irritability (*Reizbarkeit*), which are dependent on two different properties of the protoplasm. Irritation (*Reizung*) may be direct or indirect, i. e. may be the result of a local sensitiveness, or can be transmitted. The power of heliotropic curvature is dependent on four factors,—the anatomical structure, the thickness, the intensity of growth, and the heliotropic irritability of the organ or of the portion of an organ. It is not necessarily dependent on the sensitiveness of the part; the curvature may be the result of an irritation transmitted from another part. For the same reason the maximum power of curvature does not necessarily coincide with the maximum intensity of growth.

So far as curvature is the result of growth, the power of heliotropic curvature ceases with the cessation of growth. Heliotropic sensitiveness and irritability are, on the other hand, entirely independent of growth, and continue after the power of growth and of curvature have completely ceased. There is no such thing as the "traction-growth" of Wiesner.

The decapitation of the seedling of grasses has two results; a greater or less diminution of the intensity of growth, and an entire destruction of its heliotropic and geotropic sensitiveness; but both effects are only temporary. They are not the result of the removal of the apex, but of the cut, which causes the transmission of an irritation in the basipetal direction.

Movements of Zygomorphic Flowers.* — From observations of zygomorphic flowers, chiefly of *Aconitum* and *Delphinium*, in nature, and also from experiments with the clinostat, Dr. R. Meissner supports the theory of Noll, rather than that of Schwendener and Krabbe, with regard to the causes of their characteristic movements of position (*Orientirungsbewegungen*). He finds no evidence of the action of the force called by the latter writers geotortism. The lateral movements of the flower-stalk are, on the other hand, the result of the action of gravitation.

Geotropic Sensitiveness of the Root-tip.†—Prof. W. Pfeffer describes a series of experiments by which he proves that in uninjured roots it is the tip only that is geotropically sensitive. Roots (*Faba, Lupinus*, &c.) were made to grow into short tubes of thin glass bent at a right angle. By this means a short terminal portion 1·5–2 mm. long was forced to grow at right angles to the rest of the root. To prevent

* Bot. Centralbl., lx. (1894) pp. 1–15 (8 figs.). Cf. this Journal, 1893, p. 354.
† Ann. Bot., viii. (1894) pp. 317–20.

geotropic stimulus, the roots were made to revolve slowly round their own axis in a klinostat. It was found that if a root is so placed that the terminal part points vertically downwards while the rest is horizontal, no geotropic curvature takes place; but that such curvature is exhibited when the terminal portion is directed horizontally or at an acute angle with the normal position.

Function of the Apex of the Root.*—Dr. W. Rothert gives a detailed *resumé* of the literature of the phenomena of sensitiveness connected with the root—geotropism, heliotropism, aerotropism, hydrotropism, galvanotropism—and the effect on these phenomena of the decapitation of the apex. Thermotropism appears to belong to the whole growing region of the root; but, with regard to the other properties, it cannot yet be determined whether they are confined to the apical region, or whether they belong to this region chiefly, and in a less degree to the rest of the growing portion, or are uniformly distributed over the whole of the growing portion. There is no evidence in support of Darwin's hypothesis of a "brain function" of the apex of the root.

(4) Chemical Changes (including Respiration and Fermentation).

Germination of Oleaginous Seeds.†—M. Leclerc du Sablon states that in the germination of oleaginous seeds—hemp, flax, colza, poppy, *Arachis*, *Ricinus*—a chemical change takes place similar to that in amylaceous seeds, viz. a transformation of the oil into a saccharose with but little or no reducing power, and finally into glucose.

Metastasis and Respiration of Germinating Potatoes.‡—After experiments with germinating potatoes, seedlings of *Lupinus luteus*, and other plants, Herr E. Ziegenbein asserts that the decomposition of albuminoids in the growing plant is independent of the action of the free oxygen of the air, and also of the action of light, although light appears to produce conditions which favour the subsequent production of carbon dioxide. Various results are also given respecting the influence of different temperatures on metastasis and respiration.

Respiration of Leaves.§—M. L. Maquenne finds that the amount of carbon dioxide evolved by leaves in the process of respiration is greatly reduced by placing them in a vacuum; from which he draws the conclusion that the evolution of carbon dioxide in this process is not merely the doubling of an already oxidized substance, as in fermentation, but is a true oxidation.

B. CRYPTOGAMIA.

Cryptogamia Vascularia.

trobilus in Archegoniatæ.‖—Prof. F. O. Bower proposes a theory of the origin of the strobilus in a simple form like that of *Equisetum*, and its gradual development in the higher divisions of Vascular Cryptogams

* Flora, lxxix. (1894) Ergänzungsbd., pp. 179–218.
† Comptes Rendus, cxix. (1894) pp. 610–2. Cf. this Journal, 1894, p. 230.
‡ 'Unters. üb. d. Stoffwechsel u. d. Athmung keimender Kartoffel-Knollen, u.s.w.,' Berlin, 1893, 48 pp. and 1 pl. See Bot. Centralbl., lx. (1894) p. 145.
§ Comptes Rendus, cxix. (1894) pp. 100–2.
‖ Ann. Bot., viii. (1894) pp. 343–65.

and in Phanerogamia. He regards sterilization of potential sporogenous tissue as a common phenomenon, recurring frequently throughout the Archegoniatæ (Bryophyta and Pteridophyta) and Phanerogamia. In the further development of the strobilus this is succeeded by the formation of septa, the relegation of the spore-producing cells to a superficial position, and the eruption of outgrowths (sporangiophores) on which the sporanges are supported. It is probable that the Filices, with their large leaves and numerous sporanges, originated from some smaller-leaved strobiloid ancestry; and it is possible that the same theory is also applicable to the flower of Phanerogamia. Foliage-leaves have, in certain cases, been produced by sterilization of sporophylls.

Muscineæ.

Hennedia, a new Genus of Musci.*—Under the name *Hennedia* Mr. R. Brown describes a new genus of moss from New Zealand, with the following characters:—Annual or perennial plants; capsule erect or inclined, ovate or ovate-oblong, symmetrical, narrowed towards the mouth; opercule short, stout, conical, straight; calypter mitriform, large, covering the whole capsule, confluent at the base, commonly ruptured at the middle by the lateral growth of the capsule; when maturing, very persistent; peristome 0. Three species are described of the genus, which is nearly allied to *Encalypta;* also twenty-one species of *Andreæa* from New Zealand, of which sixteen are new.

Evolution of the Hepaticæ.†—Prof. L. M. Underwood proposes a fresh classification of the Hepaticæ, more in accordance with their probable genetic affinities than that at present in vogue. From the original thallose form with its simple sporogone, they appear to have developed in three different lines of specialization, viz. the development of the thallus as such; the transformation of the thallus into a leafy axis, combined with the modification from creeping to ascending or erect habit; and the specialization of the sporogone at the expense of the thallus. The Hepaticæ may be conveniently divided into three primary groups, the Marchantiales, Jungermanniales, and Anthocerotales. In the first the vegetative structure is always thalloid, but varies in all degrees of development, from the simplest form in *Riccia* to the most highly specialized in *Marchantia.* The reproductive organs become much more highly differentiated in the higher forms. In the Jungermanniales the protonemal development is usually slight, but that of the foliar structure remarkably varied. The author proposes to separate those genera in which the archegone terminates the growth of the shoot as a separate family of Jungermanniales, with the name Metzgeriaceæ. In the Anthocerotales the differentiation is manifested in the development of the sporogone, which has become a permanent fleshy structure, and leads up to the line of development of the leptosporangiate ferns.

Vegetative Propagation of Hepaticæ.‡—Herr W. Schostakowitsch has investigated the mode of nonsexual multiplication of the Hepaticæ, either by adventitious shoots or by gemmæ, in a large number of genera

* Trans. N. Zealand Inst., 1892 (13 pls.). See Grevillea, xxii. (1894) p. 113.
† Bot. Gazette, xix. (1894) pp. 347–62.
‡ Flora, lxxix. (1894) Ergänzungsbd., pp. 350–84 (39 figs.). Cf. this Journal, 1894, p. 375.

of Hepaticæ, both thallose and foliose. The following are the more general conclusions at which he has arrived. Many species produce gemmæ or gemmules, which, in their mode of propagation, are analogous to spores. Light has a marked influence on the development of the plant from the gemma. Almost every cell of the Hepaticæ possesses, under ordinary conditions, the faculty of producing again an entire plant, although this faculty comes into play only under certain external influences. This property is possessed in different degrees by the different tissues. The most necessary condition for the process of vegetative propagation is the presence of a certain quantity of plastic formative materials.

Characeæ.

Antherozoids of Characeæ.*—After a *resumê* of what is at present known respecting the origin and the structure of the antherozoids in the various classes of Cryptogams, Herr W. Belajeff describes further researches of his own in relation to those of the Characeæ, and gives the following as the more important results.

The antherozoid of the Characeæ consists of a spiral body and two cilia which are attached at some distance from its anterior end. The body may be divided into an anterior end, a central portion, and a posterior end. The anterior end constitutes about one-half of a coil of the spiral, and is formed from the cytoplasm of the mother-cell. The central portion forms, in the mature antherozoids of *Chara*, about two-and-a-half, in those of *Nitella* about one-and-a-half coils of the spiral. It is formed from the nucleus, and possesses all its characteristic chemical properties. On its ventral side it has a border of granular protoplasm, which gradually decreases in breadth as the antherozoid matures. The posterior end forms about half a coil, and owes its origin to the cytoplasm; when mature it often has a honeycomb structure. The cilia are formed out of the cytoplasm of the mother-cell. It follows that the cytoplasm plays an important part in the formation of the antherozoids; the nucleus does not appear to participate in the process until the anterior and posterior portions of the antherozoid are already developed.

In conclusion the author replies to the observations of Guignard, Schottländer,† Strasburger, and others, which are not altogether in harmony with his own.

Rabenhorst's Cryptogamic Flora of Germany (Characeæ).—The ninth part of this work by Dr. W. Migula is entirely occupied by species of *Chara*, viz. *C. baltica*, *Kokeilii*, *gymnophila*, and *fœtida*, with their varieties, of which a large number are described under the first and last. The illustrations are numerous and excellent.

Algæ.

Cell-contents of Marine Algæ.‡—An examination of a number of brown sea-weeds—Phæophyceæ (including Dictyotaceæ) and Fucaceæ—leads Herr E. Bruns to the conclusion that starch is never found in

* Flora, lxxix. (1894) Ergänzungsbd., pp. 1–48 (1 pl.). Cf. this Journal, 1889, p. 785.
† Cf. this Journal, 1893, p. 203.
‡ Flora, lxxix. (1894) Ergänzungsb., pp. 159–78 (1 pl.)

them, and that oil is not nearly so universally present as has been stated by Hansen. Phloroglucin is generally present, usually accompanied by oil; but the latter was not found in *Fucus*, and only doubtfully in *Hydroclathrus*. The author does not agree with Crato, that the drops or vesicles which he terms physodes * are endowed with an independent power of motion. They are invariably enclosed in a layer of protoplasm, to which their motility must be ascribed. Whether these vesicles are small vacuoles or actual products of assimilation, the author was unable to determine.

All the Florideæ examined contained bodies closely resembling starch-grains in their appearance and their properties. This substance is not an excretory product, but is used up by the plant in the formation of other nearly related bodies.

Antherids of Florideæ.†—Mr. T. H. Buffham continues his description of the reproductive organs, especially the antherids, in a large number of Florideæ in which they have not hitherto been accurately described. The antherids of *Choreocolax Polysiphoniæ* are described for the first time; also the male plant of *Harveyella mirabilis*. In addition, descriptions are also given of the nematheces of *Ahnfeldtia plicata*, and of the cystocarps of *Plumaria elegans;* the so-called naked favellæ in this sea-weed are, in reality, non-sexual polysporanges.

Myriophylla, a new Genus of Florideæ.‡—Among a number of new species of sea-weeds from Natal, Mr. E. M. Holmes describes a new genus *Myriophylla*, with the following diagnosis:—Frons gelatinoso-carnosa, cylindraceo-compressa, stratis duobus contexta, interiore cellulis magnis oblongis pluriseriatis, cellulis minoribus interstitiis replentibus, superficiem versus cellulis gradatim minoribus strato corticali tenui, cellulis minutis constituente; sphærosporæ in phyllis minutis lanceolatis obtusis totam frondem super basim dense distiche obtegentibus, cruciatim divisæ, in strato corticali immersæ. It probably belongs to the Rhodymeniaceæ.

Choreocolax albus sp. n.§—Dr. P. Kuckuck finds on *Rhodomela subfusa*, on the shores of Heligoland, a parasitic alga belonging to the Florideæ, which he regards as a new species of *Choreocolax*. It differs from all other known species of Florideæ in the entire absence of chromatophores and leucoplasts, and is therefore a true parasite, a character which it shares only with *Harveyella mirabilis;* all the other so-called parasitic algæ being, according to the author, merely endophytes, capable of self-assimilation. The protoplasm is also destitute of vacuoles. Like other true parasites, it is confined to the cell-walls of the host, pressing the cells aside without entering them. In its structure it resembles the Squamariaceæ, but the only reproductive organs at present detected are tetraspores; and, until the cystocarps have been found, the systematic position of *Choreocolax* cannot be definitely determined.

* Cf. this Journal, 1893, p. 58.

† Journ. Quekett Micr. Club, v. (1893) pp. 291-305 (2 pls.). See Grevillea, xxii. (1894) p. 119. Cf. this Journal, 1891, p. 777.

‡ Ann. Bot., viii. (1894) pp. 335-42 (1 pl.).

§ SB. K. Preuss. Akad. Wiss. Berlin, 1894, pp. 983-7 (1 pl.). Cf. this Journal, 1891, p. 778.

Myelophycus, a new Genus of Phæosporeæ.*—For a sea-weed from Japan Herr F. R. Kjellman establishes the new genus *Myelophycus* belonging to the family Encœliaceæ. The fronds have the habit of *Scytosiphon*, but the internal structure of *Chordaria*.

Fungi.

Cirrhoid Filaments in a Fungus.†—M. E. Boudier records the observation of remarkable prehensile filaments in *Sepultaria Sunneriana*. These have nothing to do with the ascogone in the Sphæriaceæ or the spiral branches connected with the perithece in *Eurotium*, or those which accompany the oogone in *Achlya*, but are analogous in function to tendrils in the higher plants. They are found on ordinary filaments beneath the surface of the soil, especially when the fungus grows in a gravelly soil, appearing first as protuberances, which then elongate into branches, and these finally coil, and embrace, in the manner of a tendril, any other filament with which they come into contact. These cirrhoid filaments are usually simple and septated, but sometimes branch.

Action of Mould-Fungi on Albumen.‡—M. E. Marchal has tested the changes produced in a 10 per cent. solution of white of egg, by the growth of different kinds of mould-fungus. A number of species belonging to the genera *Penicillium*, *Mucor*, *Botrytis*, *Acrostalagmus*, *Aspergillus*, *Cephalothecium*, *Circinella*, *Fusoma*, *Isaria*, possess the power of decomposing albumen, appropriating the carbon and nitrogen; while other species of the same genera displayed this property but feebly, and others produced only yeast-forms. In all cases where decomposition takes place, even when only yeast-forms are produced, the albumen is transformed into ammonia. In no case could a production of nitric acid be detected. The species which produced the most rapid decomposition were *Aspergillus terricola* and *Cephalothecium roseum*.

Culture of Saprolegniaceæ.§—Herr A. Maurizio describes the mode of cultivating various Saprolegniaceæ, and discusses the bearings of the result on the distinctness of the species. Two new species are described, *Saprolegnia rhætica*, intermediate between *S. monilifera* and *hypogyna*, and *Achlya aplanes*, intermediate between *A. oblongata* and *prolifera*. The five forms of *Saprolegnia* characterized by hypogynous antherids, and included by Pringsheim under *S. ferax* var. *prolifera*, are made into a single distinct species, and the hypogynous position of the antherid is explained as a result of the prolification which is so common in the genus. The conids of *S. rhætica* may, under certain circumstances, be transformed into sporanges. In *A. aplanes* the spores frequently germinate within the sporange; no zoospores were observed. The generic distinction between *Achlya* and *Aplanes* can hardly be maintained.

* Bih. K. Svensk. Vetensk.-Akad. Handl., xviii. (1893) 12 pp. and 1 pl. See Grevillea, xxii. (1894) p. 117.

† Bull. Soc. Bot. France, xli. (1894) pp. 371–5 (1 fig.).

‡ Bull. Soc. Belge Micr., 1893. See Bull. Soc. Bot. France, xli. (1894) Rev. Bibl., p. 403.

§ Flora, lxxix. (1894) Ergänzungsbd., pp. 109–58 (3 pls.).

Zoospores of Pythium and Ceratiomyxa.*—In reference to the fact that the zoospores of some species of Pythiaceæ are described as uniciliate, those of others as biciliate, Prof. G. F. Atkinson states that in *Pythium de Baryanum* the biciliate zoospores swarm for a time with amœboid movements, and then divide into two zoospores, each with a single cilium. A new species of *Ceratiomyxa* is described, with a remarkable mode of germination of the zoospores. Through a small perforation in the wall of the spore the protoplasm escapes slowly as a vermiform body with tortuous motion, which shortly becomes amœbiform and developes short pseudopodes. This then divides into an 8-lobed body, with a single long cilium on each lobe, accompanied by a continual development of pseudopodes; it finally breaks up into uniciliate zoospores. The species is named *Ceratiomyxa plumosa* sp. n.

New Genera of Fungi.—A new genus of Sphæropsideæ is thus described by Herr C. A. J. A. Oudemans: †—*Cytodiplospora* g. n.:—Stromata erumpentia, verruciformia, peridermatis laciniis circumvallata, intus loculis difformibus distincte circinatibus fœta; sporulæ copiosissimæ, basidiis suffultæ, hyalinæ, fusiformes, medio septatæ (itaque biloculares). *C. Castaneæ* was found on the Spanish chestnut in Holland.

Under the name *Sachsia albicans* g. et sp. n., Mr. C. Bay ‡ describes a fungus found in tubercular sputum, which possesses a true mycele of the nature of that of *Mucor* or *Penicillium*, and also developes yeast-like cells resembling those of *Mycoderma*. It was cultivated on various media; the resting condition does not differ from the growing state. It does not cause fermentation.

Prof. G. F. Atkinson § finds on rotten capsules of the cotton-plant a saprophytic fungus, *Olpitrichum carpophilum* g. et sp. n., which he makes the type of a new genus belonging to the Mucedini, allied to *Rhinotrichum*, but differing in its inflated basids, which are constricted at the point of union with the hypha.

M. L. Géneau de Lamarlière ‖ establishes a new genus of Sphæriaceæ, *Massarinula*, from *M. quercina* found on dead branches of the oak. It is distinguished from the most nearly allied genera by the two-celled sporids being invested with mucus.

A new genus of Polyporeæ, *Laccocephalum* McAlp., is described by Mr. J. G. O. Tepper ¶ from Victoria. It comes near to *Boletus*, but is distinguished by the tubes of the hymenophore not being separable from the sporophore. The sporophore is pileate, with a central stipe; the tubes of the hymenophore are parallel and closely packed, their mouth roundish or oval, their inner part covered by the hymenium; the spores are large, spherical, and coloured.

M. N. Patouillard ** establishes a new genus of Hydnaceæ, *Asterodon*, from *Hydnum ferrugineum*, with the following characters:—Resupinatum, effusum, membranaceo-floccosum, aridum, cystidiis stellatis brunneis

* Bot. Gazette, xix. (1894) pp. 375–8. † Hedwigia, xxxiii. (1894) pp. 17–21.
‡ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 90–3 (1 fig.).
§ Bot. Gazette, xix. (1894) pp. 244–5 (1 pl.).
‖ Rev. Gén. de Bot. (Bonnier), vi. (1894) pp. 321–3 (3 figs.).
¶ Bot. Centralbl., lx. (1894) pp. 193–5.
** Bull. Soc. Mycol. France, 1894, p. 129 (1 pl.). See Hedwigia, xxxiii. (1894) Rep., p. 129.

farctum; hymenio infero, aculeato, aculeis subulatis; sporis oblongis, subhyalinis.

Heterœcious Ascomycete.—Herr S. Nawaschin * records the fact that *Sclerotinia Ledi*, parasitic on *Ledum palustre*, is constantly destitute of conids.

Herr M. Woronin † finds, on *Vaccinium uliginosum*, a parasite with the conids of *Sclerotinia Ledi*, and quite distinct from *S. megalospora* which produces the sclerote-disease of *Vaccinium*. He establishes from this a case of heterœcism in the Ascomycetes, a phenomenon not hitherto observed, and proposes for the parasite the name *Sclerotinia heteroica*.

Poisonous Property of Penicillium glaucum.‡—Herr Zippel obtained negative results from feeding animals (dog, rabbit, goat, horse) with fodder infected with large quantities of pure cultivations of *Penicillium glaucum*. But by feeding rabbits on mouldy and decomposing bran, the animals died on the third or fourth day with symptoms of palsy. The post-mortem examinations were negative.

Aspergillous Pseudo-Tuberculosis.§—Several observers have recorded cases of pseudo-tuberculosis produced by *Aspergillus fumigatus*; the naked-eye appearances, especially in animals, having a great resemblance to true tuberculosis. Apropos of this subject, Dr. E. Koltjar has made a special study of this fungus for the purpose of determining whether it can form toxines; and by toxines the author means exclusively extra-cellular toxines, i.e. the excreta of microbes in the media, whether natural or artificial. Neither in Rawlin's fluid nor in bouillon does it form toxines. It was, however, found that in pseudo-tuberculosis not only spores, but a luxuriant mycele was formed; and as these require oxygen for their proper development, the author infers that the lethal action of the parasite is due to its using up the oxygen required by the host.

Botrytis tenella parasitic on the Cockchafer Grub.‖—The experiments of Herr Schaffer, who has infected larvæ of *Melolontha hippocastani* with spores of *Botrytis tenella*, led to very unequal results. Of nine healthy cockchafer grubs kept in a glass box, eight died within nine days after exposure to the spores of a larva affected with the fungus. The ninth larva, as well as three other grubs similarly exposed, remained healthy.

When artificially infected the larvæ died in from five to ten days. In one to two days they were quite mummified, hard, and red. In four to five days more the mycele appeared outside, and in twenty-eight to forty-five days after infection conids were formed.

Dry and Wet Rot of Tobacco.¶—According to Herr J. Behrens, two *Sclerotiniæ*, *S. Libertiana* Fuckel and *S. Fuckeliana* de Bary (*Botrytis cinerea* Pers.), are the cause of much disease of the tobacco plant. The

* Ber Deutsch. Bot. Gesell., xii. (1894) pp. 117–9.
† Tom. cit., pp. 187–8.
‡ Zeitschr. f. Veterinärkunde, 1894, p. 57. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 751. § Ann. Inst. Pasteur, viii. (1894) pp. 479–89.
‖ Zeitschr. f. Forst. u. Jagdwesen, xxv. pp. 85–90. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 662.
¶ Zeitschr. f. Pflanzenkrank., iii. (1893) pp. 82–90. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 315–6.

former is the more common (the latter being less frequent), and is identical with the *Botrytis* appearing on onions and vines. Both first appear on the veins, afterwards penetrating into the mesophyll. *S. Libertiana* forms a fine white coating, while the other is distinguished by its abundant conidiophores; the endophytic mycele is intercellular. The sclerotes of the first are free, easily detached, and may attain a diameter of 1 cm., while those of the latter are partially buried in the tissue of the leaf. Both fungi cause very similar changes, which may be effected by a poisonous ferment excreted by the hyphæ, or by the copious production of oxalic acid. Both fungi grow well on artificial media. Both the *Sclerotiniæ* require to be invigorated by saprophytic nutriment ere they are fitted for a parasitic existence on living leaves. *S. Libertiana* infects by its ascospores, *S. Fuckeliana* by means of conids, and both extend from leaf to leaf by vegetative growth.

Species of Botrytis.*—Herr C. Wehmer finds a species of *Botrytis* very destructive to plants of *Cyclamen* and of *Primula sinensis* grown in the house. He is disposed to identify with *B. cinerea* a large number of forms which have been described as distinct species (of *Botrytis*, *Sclerotinia*, or *Peziza*) attacking the turnip, carrot, hemp, clover, onion, rape, dahlia, balsam, hyacinth, and even the sclerote-diseases of *Vaccinium*, the *botrytis*-disease of the douglas-pine, and the *Edelfäule* of the grape.

Aureobasidium Vitis.—MM. E. Prillieux and G. Delacroix† describe the pathological effects of the fungus, which they identify as the cause of the burning (*brûlure*) of vine-leaves, *Aureobasidium Vitis*; they regard it as belonging to the genus *Exobasidium*.

MM. P. Viala and G. Boyer, ‡ on the other hand, assert that the *brûlure* is due to *Botrytis cinerea*, while under the term *rougeot* are included several diseases having different causes, parasitic and physiological. They prefer maintaining *Aureobasidium* as a distinct genus of Hypochnaceæ.

M. P. Eloste § attributes to the attacks of the same fungus the disease of the vine known in the south of France as *maladie rouge*.

Systematic Position of Lichens.||—Prof. J. Reinke gives a historical account of Schwendener's theory of the dual composition of lichens, which he accepts in its main features, but contends that it does not justify the abolition of lichens as a distinct section of Cryptogams, and the regarding them simply as a family of fungi. All the lichens have, he believes, a course of development of their own; in the form and structure of their vegetative organs they agree more with those classes of plants that contain green assimilating organs than with fungi. Although lichens may have had several lines of descent, Reinke denies that it is in accordance with facts to deduce any genus or species of lichen directly from a genus or species of fungus. The gonids and hyphæ are each structures which have become lichen-organs; but it is not correct to say that the hyphæ alone determine the form of the thallus. Other

* Zeitschr. f. Pflanzenkrank., iv. (1894) pp. 204–10. See Bot. Centralbl., lx. (1894) p. 122. † Comptes Rendus, cxix. (1894) pp. 106–8.
‡ Tom. cit., pp. 248–9. § Tom. cit., pp. 317–8.
|| Jahrb. f. wiss. Bot. (Pringsheim), xxvi. (1894) pp. 524–42.

arguments in favour of the independent position of lichens are that they have produced a new form of fructification of their own, the sorede; and that they develope special pigments and other chemical substances.

"Reticulate Structure" of Ramalina reticulata.*—Herr K. G. Lutz agrees with Cramer in identifying Agardh's genus of Algæ *Chlorodictyon* with the lichen *Ramalina reticulata*. He disputes the inference of Agardh that the remarkable reticulate appearance of this organism is the result of the breaking-up of a single cell, or that it is derived from any peculiarity in the mode of growth characteristic of the species. The formation of the so-called "meshes" is, on the contrary, due to mechanical causes. The cortical hyphæ in which the gonids are imbedded are enclosed in a mucilage which absorbs water strongly; and it is the degree in which these hyphæ are separated from one another in consequence of the swelling caused by the absorption of water, that produces the reticulate appearance.

Parasitic Fungi.†—Herr C. R. Heck gives a detailed account of the cancer of the silver fir, *Abies pectinata*, which attacks also *A. Pichta*, *balsamea*, *Nordmanniana*, *cephalonica*, and *Pinsapo*. The development of the mycele of *Æcidium* (*Peridermium*) *elatinum* takes place very slowly, and only with the assistance of living cambium cells.

Herr F. Nobbe ‡ describes the ravages inflicted on pine-forests by the "leaf-red" (*Fichtennadelröthe*) caused by the attacks of *Hypoderma macrosporum*.

Alopecurus pratensis (*Wiesenfuchsschwanz*) is, according to Herr P. Sorauer,§ greatly injured by the attacks of an undescribed fungus, *Pestalozzia Soraueriana* Sacc., which finds its home chiefly in the flowering-stalks of the grass.

Herr E. Rostrup ‖ describes the mode in which *Phoma sanguinolenta* attacks the carrot, destroying its power of forming seed.

Herr P. Magnus ¶ calls attention to the pathological phenomena produced in the wallflower by the attacks of *Peronospora parasitica*.

M. L. Mangin ** describes the ravages effected in nurseries of trees (lime, almond, *Ailanthus*, maple, mountain ash, &c.) in France by the attacks of *Nectria cinnabarina*.

Mr. E. F. Smith †† traces a very destructive disease of water-melons in Georgia to a new species of *Fusarium*, *F. niveum*.

Prof. R. D. Halsted ‡‡ ascribes a destructive root-rot of beet to an undescribed species of *Phyllosticta*, in which the pycnids are of non-sexual origin.

* Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 207–14 (3 figs.). Cf. this Journal, 1891, p. 505.

† 'Der Weisstannenkrebs,' Berlin, 1894, 163 pp., 19 pls. and 10 figs. See Bot. Centralbl., 1894, Beih., p. 374.

‡ Tharand. forstl. Jahrb., xliii. (1893) pp. 39–55. See Bot. Centralbl., lx. (1894) p. 26.

§ Zeitschr. f. Pflanzenkrankheiten, iv. (1894) pp. 213–5. See Bot. Centralbl., lx. (1894) p. 82.

‖ Tom. cit., pp. 195–6 (1 pl.). See Bot. Centralbl., lx. (1894) p. 143.

¶ SB. Vers. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 197.

** Comptes Rendus, cxix. (1894) pp. 753–6.

†† Bot. Gazette, xxix. (1894) pp. 373–4.

‡‡ Tom. cit., p. 379.

Culture of Uredineæ.*—From the cultivation of Uredineæ, Herr H. Klebahn has established the following points:—*Coleosporium Sonchi* belongs to *Peridermium Fischeri* sp. n.; *C. Euphrasiæ* must be divided into two species, belonging to *Peridermium Stahlii* parasitic on *Alectorolophus*, and to *P. Soraueri* sp. n. on *Melampyrum*; the æcidia on *Convallaria majalis*, *Polygonatum multiflorum*, and *Maianthemum bifolium* are identical; the uredoform on *Phalaris* and *Holcus mollis* infects only *Rhamnus Frangula*, that on *H. lanatus* only *R. catharticus*.

Rusts of Grain.†—Prof. J. Eriksson and Dr. E. Henning state that *Puccinia graminis* does not hibernate in Sweden in its uredo-stage. *P. Phlei-pratensis* sp. n., on the other hand, parasitic on that grass, possesses a hibernating mycele, and has no genetic connection with *Æcidium Berberidis*. The authors discard altogether the name *P. rubigo-vera*, breaking up this parasite into three species, of which *P.* (*Uredo*) *glumarum* is by far the most destructive to corn-crops. The other two species formed out of *P. rubigo-vera* are *P. dispersa* sp. n. and *P. anomala* (*rubigo* var. *simplex*). They agree with Klebahn in dividing *P. coronata* into two species, *coronata* and *coronifera*, the former of which has its æcidioform on *Rhamnus Frangula*, the latter on *R. catharticus*.

Mycorhiza of the Fir.‡—Herr B. Frank concludes, from experiments on growing the spruce fir in sterilized and unsterilized soil, that the mycorhiza is of service to the young plant in enabling it to make use of the nitrogen compounds present in the humus. Parasitic fungi, like *Agaricus melleus*, do not form a mycorhiza.

Organisms of the Mucus-flux of Trees.§—In the "mucus-flux" or "sap-flux" of a lime and of an elm respectively, Dr. W. Krüger finds two organisms, which he makes types of a new genus of fungi, *Prototheca*, the one found in the elm being named *P. Zopfii*, that in the lime *P moriformis*. *Prototheca* is characterized by the entire absence of a mycele. In the usually round, oval, or ellipsoidal sporange a number of spores are produced by successive divisions, and are freed by the bursting of the sporange or the absorption of its wall. These spores again directly form sporanges. In the author's view this genus forms a new type of fungi, bearing a similar relation to the Protococcaceæ that the Schizomycetes bear to the Cyanophyceæ, the Saprolegniaceæ to the Siphoneæ, and the Ascomycetes to the Florideæ.

In the same situations were found also two new green algæ. The first of these occurs in the flux of poplars and elms, and was named *Chlorella protothecoides*. In its physiological relationships it agrees almost entirely with *Prototheca Zopfii*. The other has been found at present only in the flux of the poplar (*Populus alba*), and has been made by the author the type of a new genus of algæ, under the name *Chlorothecium saccharophilum*. *Chlorothecium* consists of ellipsoidal,

* Zeitsch. f. Pflanzenkrankheiten, iv. (1894) p. 194. See Hedwigia, xxxiii. (1894) Rep., p. 128.

† Tom. cit. See Bot. Ztg., lii. (1894) 2te Abtheil., p. 310. Cf. this Journal, 1894, p. 722.

‡ Forstwissensch. Centralbl., 1894, 5 pp. and 1 pl.. See Bot. Centralbl., lix. (1894) p. 145.

§ Beitr. z. Phys. u. Morph. niederer Organismen (Zopf), 4tes Heft, 1894, pp. 69–116 (2 pls.); Hedwigia, xxxiii. (1894) pp. 241–60. Cf. this Journal, 1894, p. 604.

ovoid, or globular sporanges, and differs from *Chlorella* in having a flatter chlorophore.

All these four organisms were grown independently in nutrient solutions, and a large number of observations are recorded on their vital conditions and physiological properties.

Oidium lactis.*—MM. M. Lang and E. de Freudenreich have watched the development of *Oidium lactis* on all kinds of media and under various conditions of environment, without observing anything particularly new in its morphological and cultural characters.

Their fermentation experiments, however, led to different results from Brefeld's, and they found that in grape-sugar solutions 0·55 vol. per cent. of alcohol could be detected in 10 days, and in 5 weeks 1 vol. per cent. Similar but less marked results were obtained from lactose, sucrose, and maltose.

During the fermentation of the last three sugars which were in solution with pepton bouillon, the smell of Limburger cheese was perceptible. This indicated proteid decomposition, and special observations were then made with sterile milk. Analysis of the milk after 3, 6, and 23 weeks showed that there had been continual diminution of the casein and increase of peptonoid substances and decomposition products. The authors therefore conclude that, besides possessing a fermenting power, it can also decompose albuminous substances.

Fossil Fungi.†—Herr J. Felix proposes the following new genera of fossil fungi, the characters of which are in most cases derived from spores only:—*Chætosphærites*, *Trichosporites*, *Haplographites*, *Cladosporites*, *Dictyosporites*, *Spegazzinites*.

Protophyta.

α. Schizophyceæ.

Development of Rivularieæ.‡—Herr S. Schwendener has investigated the mode of growth of the Rivularieæ, especially *Glœotrichia Pisum*, and some species of *Calothrix* and *Rivularia*. After the manubrium has hibernated, it germinates by the formation of a moniliform germ-filament. A very slight apical growth takes place in a single division of the apical cell; the cell-divisions take place principally in the upper half of the filament, although great elongation and a constriction of the filament occur in its lower portion; there is certainly a fresh formation of cell-wall from the protoplasm. The terminal hair is then formed from the apical cell. After its formation, cell-division advances gradually in a basipetal direction, all the cells taking part in it except the basal one, which forms the heterocyst. Owing to the course of cell-division here described, the lower portion of the filament is often much finer than the upper meristematic portion. A "gliding growth" certainly takes place in the cell-walls. Above the manubria are stopper-like filaments (*Propfföden*) which ultimately become detached.

* Ann. de Micrographie, vi. (1894), and Landwirthsch. Jahrb., vii. (1893) pp. 229–37.

† Zeitschr. Deutsch. Geol. Gesell., xlvi. (1894) p. 269 (1 pl.). See Hedwigia, xxxiii. (1894), Rep., p. 122.

‡ SB. K. Akad. Wiss. Berlin, 1894, pp. 951–61 (1 pl.).

Nucleus of Diatoms.*—Dr. P. Miquel asserts that, notwithstanding the siliceous envelope by which most diatoms are protected, they are peculiarly liable to destruction by Infusoria and by unfavourable vital conditions. It is only their extraordinary numbers, and the rapidity with which they multiply, that preserves them from extermination. The Infusoria may even carry on a parasitic existence within the cell. The diatom-cell consists of four parts; the external gelatinous layer or coleoderm, often erroneously called the thallus, the siliceous coat, the protoplasm, containing phæoleucites, oil-drops, and other substances, and the nucleus. As a rule, the protoplasm completely fills up the space within the valves; this is especially well seen when the microfrustules are transforming themselves into auxospores or megafrustules.

The nucleus of diatoms is often exceedingly difficult to distinguish, in consequence of its being masked by the phæoleucites, or because its index of refraction differs only very slightly from that of the surrounding protoplasm. A favourable species is *Coscinodiscus concinnus*. By the use of suitable reagents,† the author was able to demonstrate the existence of a nucleus in a large number of species of diatom, even in some very minute ones, and he asserts that cell-division is always preceded by division of the nucleus; the protoplasm then divides into two nearly equal parts, each carrying with it one half of the bands of endochrome; there is no sudden formation of a siliceous septum.

Spores of Diatoms.‡—Replying to the arguments of Dr. Miquel, l'Abbé Comte F. Castracane adduces further evidence in favour of his view that the most common mode of propagation of diatoms is by means of endogenous spores.

Schmidt's Atlas der Diatomaceen-kunde. — The latest part published of this magnificent work is a double one, Hefte 48, 49, pls. 189–96. It is entirely occupied by recent and fossil forms of the genus *Cocconeis*, including a few that have been referred to *Raphoneis.*

β. Schizomycetes.

Present Condition of the Immunity Question.§—In a review of the present condition of the question of immunity, M. E. Metschnikoff remarks that the humoralists have shifted their ground. Thus Buchner now attributes the bactericidal power to leucocytic products, and R. Pfeiffer assumes that immunity is due to liquids secreted by endothelial cells, while Behring supposes that, besides passive immunity due to the body-juices, there is an active immunity due to cell-function. In passive immunity, set up by serum vaccine or other preventive substances, the author only sees an increase in cell reaction; while even the antitoxic action of humours is also to be ascribed to cell defence, and not to destruction of the toxines.

Facts are quoted to show that the view that bacteria are destroyed by secretions from eosinophilous leucocytes is untenable, while the theory of phagocytosis has constantly received support ever since it was promul-

* Le Diatomiste, ii. (1894) pp. 105–118 (1 pl.). † Cf. *infra*, p. 127.
‡ Atti Accad. Pontif. Nuovi Lincei, xlvii. (1894) pp. 48–52; Le Diatomiste, ii. (1894) pp. 118–22. Cf. this Journal, 1894, p. 239.
§ Ann. Inst. Pasteur, viii. (1894) pp. 706–21.

gated. Thus the examples which have been quoted as exceptions to phagocytosis (mouse septicæmia, diphtheria, anthrax in Crustacea and Mollusca) are found on close examination to support the author's theory. Moreover, the cholera peritonitis of guinea-pigs, in which degenerated vibrios are found in the peritoneal fluid of hypervaccinated animals, phenomena described by R. Pfeiffer, is explained away as being due to leucocytic products modified by the hypervaccination. The author agrees with A. Kossel about the bactericidal action of nucleic acid, which is only exerted in acid media; but he points out that intracellular destruction of microbes also takes place in alkaline media. Phagocytes not only react against microbic invasion, but against intoxications from various poisons, e. g. diphtherin, tetanin, ricin, abrin, venin.

Immunity, therefore, is the result of cell activity, and the most important agents in this respect are phagocytes.

Immunification of Guinea-pigs to Hog-Cholera.* — Mr. E. A. de Schweinitz immunified guinea-pigs to hog-cholera in the following way:—Six fresh guinea-pigs were subcutaneously injected with 3 ccm. of blood-serum of guinea-pigs which had been immunified by means of albumoses obtained from hog-cholera cultures, and then inoculated with virulent cultures. In 10 days' time these and also six control animals were alike subcutaneously injected with 0·1 ccm. of a 24 hours' old culture of hog-cholera. All the control animals perished with characteristic lesions of hog-cholera, numerous bacilli being found in liver and spleen. Of the animals experimented on, four remained quite well, while the other two died a long time (5 weeks and 3 months) after the inoculation, no micro-organisms being found in the viscera, and no specific pathological changes.

While 10–15 ccm. of a sterilized culture, or a similar quantity of albumose, were required to produce immunity, 3 ccm. of blood-serum sufficed to produce the same effect.

In the experiments where guinea-pigs were inoculated with 0·1 ccm. of virulent hog-cholera cultures, and then treated with serum of immunified guinea-pigs (0·5 ccm. two days after infection), the animals survived the controls for 7–10 days, one indeed recovering permanently.

The quantity of leucocytes in the blood rose alike in the control animals, those treated after infection, and those that received an immunizing injection, sinking to the normal number if the animal were to remain healthy, or diminishing till death.

Bacillar Diseases of the Vine. — Sigg. G. Del Guercio and S. Baroni † attribute the disease which attacks choice kinds of vine in Italy, and which is known as *gommosi bacillare*, to the presence of a bacteriform Schizomycete.

M. L. Mangin ‡ finds, in vines attacked by this disease, a peculiar structure which he describes as "gummy thyllæ." They are thyllæ in which the membrane, instead of forming hernioid projections into adjacent cells, becomes disorganized into a gummy exudation. He considers, therefore, the existence of a true "bacillar gummosis" to be doubtful.

* Philadelphia Med. News, 1892, pp. 346–7. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 763. † Nuov. Giorn. Bot. Ital., i. (1894) pp. 221 5
‡ Comptes Rendus, cxix. (1894) pp. 514–6.

Dr. P. Baccarini * attributes the *mal nero* of the vine to the attacks of a pathogenous Schizomycete which he finds universally in the disorganized tissues of the part affected. It consists of short rods 1–1·5 μ long and 1 μ broad, rounded at the ends; the author proposes the name *Bacillus vitivorus* sp. n.

MM. E. Prillieux and G. Delacroix † find the vines in certain districts of France subject to a disease shown by gummy degeneration of the tissues. It is apparently caused by two microbes of a bacillar form, which are found in large quantities in the diseased tissues. One of these consists of septated filaments, which may assume the length of a *Leptothrix*; the other is apparently identical with that which causes *mal nero* in Italy.

Anaerobiosis and Suppuration.‡—Herr W. Lubinski has examined the effect of anaerobic cultivation on some of the ordinary pyogenic microbes by the method previously described.§ Among the more important results it is stated that *Bacillus pyocyaneus*, which is an essential aerobe, will retain its vitality, in the absence of oxygen. for a period as long as seven months. *Streptococcus pyogenes* (*vel erysipelo-pyogenes*) grows well without oxygen, and no difference can be detected between aerobic and anaerobic cultures. *Staphylococcus pyogenes aureus* thrives just as well without as with oxygen, but the anaerobic cultivations are devoid of pigment, and are also distinguishable by differences of growth. The formation of pigment gradually returns when air is restored. The gaseous atmosphere appears to have a certain influence on the intensity of pigment formation; for H-cultures are permanently weakened, while in CO_2-cultures the pigment may be increased after the air has been restored. The virulence of this microbe is increased by anaerobic cultivation. The chromogenic function was found to be lost after ten consecutive generations, and then the organism had all the characters of *S. pyogenes albus*. By cultivating *Staph. pyogenes albus* in pure oxygen it was found to lose its virulence and liquefying property, but did not acquire any chromogenic power. It thus became indistinguishable from *Staph. cereus albus*. These facts lead to the suspicion that the foregoing Staphylococci (and perhaps also *Staph. cereus flavus*) are not independent species, but are merely physiological varieties of one and the same organism.

Disease of Wood Pigeons.‖—M. E. Leclainche describes a disease peculiar to wood pigeons, belonging to the group of hæmorrhagic septicæmias, which occurred at Saint-Jean-de-Luz during October and November 1893, the most prominent symptoms being diarrhœa and general enfeeblement, and the principal anatomical appearances being hæmorrhagic enteritis and enlargement of the spleen.

From the tissues was isolated an ovoid bacterium of the same shape as, but of larger size, than that of fowl-cholera. It was best stained with alkaline methylen-blue, and was found very abundantly in the spleen, liver, and kidneys. Cultivations were easily made on peptonized

* Bull. Soc. Bot. Ital., 1894, pp. 228–37. Cf. this Journal, 1893, p. 82.
† Bull. Soc. Bot. France, xli. (1894) pp. 384–5. Cf. this Journal, 1894, p. 492.
‡ Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 769–75.
§ Cf. this Journal, 1894, p. 628. ‖ Ann. Inst. Pasteur, viii. (1894) pp. 490–4.

media and on potato. Gelatin was not liquefied. Inoculation experiments (intravenous and feeding) gave positive results with wood pigeons, rabbits, and guinea-pigs, while fowls, cats, and dogs were refractory. Cultivations kept in closed tubes, protected from the influence of light preserved their virulence for months, but when heated to 60° for only five minutes the microbes perished.

Acute Infectious Disease of young Pheasants.*—Dr. E. Klein describes an acute infectious disease belonging to the group of infective septicæmias, which attacks young pheasants. Drowsiness and its intensification are the most prominent symptoms, though in some cases diarrhœa is also present.

Cultivations from the blood and viscera showed a bacillus having much resemblance to *B. coli communis*, but differing from this latter in possessing greater motility, in being smaller, and in not possessing the power of coagulating milk. Inoculation experiments proved that this organism was lethal to pheasants, but not to other animals (chickens, rabbits, pigeons, guinea-pigs).

Chromogenic Bacteria from the Mouth.†—Dr. M. Freund describes four new chromogenic bacteria from the mouth. *Micrococcus latericeus* developes at blood heat on agar as flesh-coloured colonies, which become darker with age. The cells are, on the average, 1 μ thick, and easily stainable. Gelatin is not liquefied. On potato the growth is but slight and confined to the track, and is of a waxy yellow hue. Both pigments are soluble in water, but not in ether or alcohol. Light and temperature have no influence on their formation; they are both destroyed by nitric acid, and restored again by caustic potash.

M. citreus granulatus developes both at room and blood heat, forming a slimy chrome-yellow looking film, mostly confined to the inoculation track. The cells are 0·7–1 μ in diameter, and stainable, except by Gram's method. The gelatin is liquefied, but not till the cultures are some weeks old. The growth along the track in thrust cultures is defective, though pretty free on the surface. On potato there is a moist-looking overlay somewhat darker in colour than that on agar, and by 8 weeks the whole surface is overgrown by a granular film. The pigment is soluble in water, but not in alcohol or ether; light and heat have no influence on its formation. It is at once decolorized by nitric acid, and strong alkali restores it.

Bacillus griseoflavus is 1–1·5 μ long and about 0·7 μ broad; the ends are rounded. It forms filaments, is without motion, and stains well. On gelatin yellow colonies develope in 2 or 3 days, attaining a diameter of 1·5–2 mm. Gelatin is softened, and assumes a kind of violet reflex. On agar, temperature does not affect the growth, but the pigment is only formed at low temperatures, and not at incubation heat. On potato a yellowish deposit is produced. The pigment is soluble in water and not in ether or alcohol. Nitric acid destroys it; caustic potash imparts to the bleached pigment a red-brown hue. The formation of pigment is greatly inhibited by light and heat.

* Journ. of Pathol. and Bacteriol., ii. (1893) pp. 214–6.

† Inaug.-Diss., Erlangen, 1893 (2 pls.). See Centralbl. f. Bakteriol. u. Parasitenk. xvi. (1894) pp. 640–2.

B. viscosus odoraceus is 1·25–6 μ long and 0·7 broad; it often forms filaments, especially at temperatures over 26°. It is easily stainable, but not by Gram. On gelatin, which is liquefied, chrome yellow colonies are formed. Along the track in thrust cultures the growth, which is colourless, resembles a series of closely packed granules, imparting a very characteristic appearance. On agar, at ordinary temperature, the surface film is of a chrome-yellow colour. On potato there forms a granular coherent mass of a yellow hue, but having a dash of green in it. At incubation temperature there is no pigment formed. Both pigments are soluble in water, but not in ether or alcohol. They are decolorized by nitric acid, and restored by alkalies.

Acetifying Bacteria.*—The recent investigations of M. E. C. Hansen on acetifying bacteria were made with *Bact. aceti*, *Bact. pasteurianum*, and *Bact. Kützingianum.* Though several kinds of nutritive media were used, the most favourable was found to be double beer, a high fermentation product relatively rich in extractives and poor in alcohol. Acetifying bacteria are classified by the author as follows:—A. Species forming easily separable membranes, in which the gelatinous formation can only be observed by means of special preparation. (1) The jelly is not coloured by iodine solution nor by iodopotassic iodide. *B. aceti* (*Ulvina aceti*, *Mycoderma aceti*), when cultivated in double beer, forms at 34° a smooth glairy membrane; the cells are, for the most part, hour-glass-shaped rodlets, in chains. Sometimes there are swollen forms and filaments; on other media there is less tendency to form chains. (2) The jelly is coloured blue by solution of iodine and by iodopotassic iodide. *Bact. pasteurianum* (*Mycoderma pasteurianum*) forms at 34° in double beer a dry membrane, which soon gets wrinkled and puckered. The cells are longer and thicker than those of *B. aceti;* long chains are formed. *Bact. Kützingianum* forms in double beer at 34°, a membrane much resembling that of *B. pasteurianum*, but rises more above the level of the fluid, and crawls up the side of the cultivation vessel. The rodlets are small, usually single or in pairs, rarely forming chains. B. Species forming a membrane, in which the jelly becomes cartilaginous or coriaceous. *Bact. xylinum.*

Several illustrations are given to show certain morphological changes which occur to *B. aceti* and *B. pasteurianum.* These are the filamentous and swollen forms; and with regard to the latter the author finds that these apparently abnormal forms are regularly produced, and actually indicate that energetic increase is taking place. The morphological and physiological remarks are preceded by a historical introduction.

Bacterium radicicola.†—From an examination of the nodules on the rootlets of lupins Dr. E. Klein finds that two distinct species of Bacteria are present in these "tubercles." One is a liquefying bacillus which imparts to gelatin and agar a greenish fluorescent appearance; while the second species, which is a small oval motionless bacillus, forms only small punctiform colonies and only softens the medium after 12–14 days. The former bacterium tends to spread over the medium like *Proteus*

* Ann. de Micrographie, vi. (1894) pp. 385–95, 441–70 (14 figs.). Cf. this Journal, 1894, p. 384.

† Journ. of Pathol. and Bacteriol., ii. (1893), pp. 205–13 (8 figs.).

vulgaris and, as the illustrations show, forms large, circular, well-defined colonies. In shape, motility, and liquefying properties it resembles *B. fluorescens liquescens*, but is distinguished therefrom by its slower growth and other characters.

Vibrio terrigenus.*—Dr. Günther isolated from mould a vibrio which in hanging drops and in stained preparations is indistinguishable from the cholera vibrio. *V. terrigenus* is mobile and possesses flagella at both ends. It does not liquefy 10 per cent. gelatin. On gelatin the colonies are at first small, round, and homogeneous; in the second 24 hours they look like fat drops, and in 8 days are about 1 cm. in diameter. In old plates the colonies are brownish and exhale a faintly ammoniacal aromatic odour. On agar *V. terrigenus* grows better at 27°–28° than at 37°, forming a thin greyish-white overlay which is indistinguishable from cultures of other colonies. Bouillon suits it well, but not alkaline pepton solutions. Its cultures do not give the nitroso-indol reaction. It grows well on potato, especially at 28°, forming a yellowish to brownish overlay. It is strongly aerobic. It does not ferment sugar nor coagulate milk. It is easily stained, but not by Gram's method. It is not pathogenic to guinea-pigs, rabbits, mice, or pigeons.

Intestinal Bacilli of the Horse and other Domesticated Animals.†—Mr. H. G. Dyar and Mr. S. C. Keith examined the excrement of horses, dogs, goats, rabbits, cats, pigs, and cows, and found that *Bacterium coli commune* exists in the majority of the domestic animals. In the goat and rabbit the presence of *B. coli com.* is exceptional and scanty, in the cat, cow, dog and pig frequent, and often as a pure cultivation. From cultivations of these *coli* organisms on agar, gelatin, bouillon, glycerin-agar, nitrate solution, milk, Wurtz's agar, potato, &c., they were found to be in perfect agreement with the behaviour of the *B. coli com.* of man.

In horse-dung the authors found a hitherto undescribed microbe *Bacillus equi intestinalis*, remarkable for its variable shape. On agar it is from 1–2 μ long and 1 μ broad. On oblique agar at 37°·5 it grows as thin transparent round spots which usually remain isolated and never run all over the agar surface. On Wurtz's agar the medium is stained red, milk is coagulated in two days, but no gas is developed.

New Bacillus of Malignant Œdema.‡—Prof. F. G. Novy describes a microbe which he names *Bacillus œdematis maligni* ii. The rods are quite straight, 3·5–4·3 μ long and 0·8–0·9 μ thick. The flagella, which may be extremely long, are easily stained, and can be seen in unstained preparations. The bacillus is an essential anaerobe; it grows well in alkaline bouillon, gelatin, or agar with 2 per cent. pepton and 2 per cent. grape-sugar at 35°–38° C., and is pathogenic to animals.

In mixed cultures with *B. acidi lactici*, *M. prodigiosus*, and *Proteus vulgaris*, the new microbe will grow in the presence of air and retain its virulence. Much smaller quantities of the mixed cultures than of the pure culture of *B. maligni œdem.* ii. are required for infecting animals.

* Hyg. Rundschau, 1894, p. 721. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 746–7.

† Technol. Quarterly, vi. No. 3. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 838.

‡ Zeitschr. f. Hygiene u. Infektions., xvii. (1894) pp. 209–32 (2 pls.).

From the bacillus of malignant œdema it is distinguished by being longer and thicker. Its movements are less lively, and it does not form spores. Very long (giant) flagella are more frequent. In bouillon cultures it often forms commas, and also short twisted filaments consisting of two or three cells, while the rodlets of bacillus of malignant œdema are usually straight and single, short filaments being exceptional.

The microbe was isolated from guinea-pigs which had been injected with milk nuclein. The milk nuclein was prepared by Hammarsten's method from fresh casein, by digesting it at 37° with pepsin and HCl, and then, after filtering and washing, dissolving it in 0·25 per cent. sodium carbonate. The solution thus obtained was injected.

Loeffler's Mouse-Typhoid Bacillus.*—Herr S. S. Mereshkowsky has recently made some independent observations on the bacillus of mouse-typhoid; and while he agrees with Loeffler in the main, differs from the latter on some not unimportant points. He finds that the disease is often much more protracted than was originally stated, lasting not 8–14 days, but even as long as 56–63 days. Agar cultures, when required for practical purposes, are very difficult to manipulate, and the author now never uses them or even gelatin cultures for sending away to agriculturists, but meat-pepton-bouillon cultivations. The fluid medium does away with any danger of damaging the culture from overheating. The meat-pepton-bouillon cultures are placed in glass-stoppered bottles holding 290–300 ccm. Each bottle contains 250 ccm. of the culture. Glass-stoppered bottles are not absolutely necessary, and ordinary bottles or flasks may be used if the cotton-wool plug be pushed in and the top of the neck filled up with some cementing fluid such as sealing-wax, paraffin, or Mendelejeff's cement.

After a period of 7 months, agar cultures become not only harmless to mice, but seem to confer a sort of immunity on them; and there are well-marked differences in the results of infection by young and old cultures. With young cultures it is found post mortem that there is considerable enlargement of the liver and spleen; the intestinal contents are pink or even black and fluid. Bacilli are in crowds in the blood, intestinal contents, and in the viscera. With the old agar cultures the animals do not die of the disease; they must be killed. Post mortem examination however shows that they are suffering from a chronic form of infection, which seemed to make the animals more lively and better nourished. The liver and spleen were enlarged. The intestinal canal was healthy. There were bacilli in the viscera, but none in the blood. There was a large deposit of subcutaneous adipose tissue. The intestinal contents were full of bacilli.

Deviation from the Type of Cholera Vibrios and Difficulty of Diagnosis.†—Drs. Bordoni-Uffreduzzi and Abba record a case of cholera in which the isolated organism presented certain differences from the typical vibrio. The gelatin was liquefied a little more quickly. The appearance of pure colonies was not exactly the same. The bacilli were

* Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 612–24.

† Hyg. Rundschau, 1894, p. 481. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 201–2.

thicker, shorter, and some were coccoid. In liquid media there were no spirilla forms. They grew well in bouillon and in pepton salt solution, forming a scum on the surface. In calves' serum they grew up in 4 days at 37°. Injected into the peritoneal sac of guinea-pigs, they caused death in 24–28 hours from peritonitis, the bacilli being found both in the exudation and in the blood. After having been cultivated for 9 months the organism reverted, in its morphological, cultural, and pathogenic characters, to the typical cholera vibrio. The authors infer that the bacteriological diagnosis of cholera may occasionally present difficulties on account of morphological and biological deviations of the bacteria from the recognized type.

Action of Toxin of Staphylococcus pyogenes aureus on the Rabbit.* —MM. Mosny and Marcano find that a 10 ccm. intravenous injection of the filtrate of culture of *Staphylococcus pyogenes aureus* will kill rabbits in a few seconds. They can withstand an injection of 1–2 ccm., though this has no vaccinating influence; for the animals, after emaciating for some weeks, die of an attack of diarrhœa. Post mortem examination shows usually peritonitis, suppuration of the lumbar lymphatic glands, and invariably miliary abscesses on the intestinal walls, chiefly of the large intestine. Cultivations and stained preparations showed that these abscesses invariably contained microbes from the intestine. Now these microbes, taken either directly from the intestine or from abscesses in the intestinal wall, have no effect when inoculated on the peritoneum, while an intravenous injection of them kills within 24 hours, the rabbit dying of septicæmia.

These results are taken to show that if a toxin be circulating in the system, microbes, otherwise inoffensive, may emigrate from the intestine and excite fatal suppuration. Human pathology is full of examples of disease due to the influence of apparently saprophytic microbes acting on an organism weakened by some antecedent infection.

M. Verneuil suggests the adoption of the term *Staphylococcosis* for disease due to the action of *Staphylococci*.

Placental Tuberculosis.†—Dr. Lehman has seen typical tuberculosis in the placenta of a patient suffering from chronic pulmonary and laryngeal phthisis. The tuberculous foci lay in the chorionic tufts, and therefore in the fœtal part of the afterbirth. The child died 10 days after birth, and no tubercular lesions were found on post mortem examination. Sections of the placenta 0·5 cm. apart showed that the tubercular foci were either round grey bodies, and sharply delimited, like tubercles in other organs, or were yellow and caseous. Small numbers of tubercle bacilli were found in all the tuberculous foci. The preparations confirmed the author's hypothesis that tubercles first form in the decidua, and are enabled by mere contiguity to pass to the placenta.

Erysipelas Serum and Tuberculosis.‡—Dr. R. Emmerich, after noticing that cases of disease, both malignant and inflammatory, have

* Comptes Rendus, cxix. (1894) pp. 962–3.

† Berlin Klin. Wochenschr., 1894, p. 601. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 647.

‡ Münchener Med. Wochenschr., 1894, p. 549. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 669–70.

got well owing to chance infection with erysipelas, records some experiments on the effect produced on tuberculosis of rabbits by artificial infection of erysipelas. The rabbits were inoculated in the anterior chamber of the eye with tuberculosis, and on the same day received an intravenous injection of 2 ccm. of a bouillon culture of erysipelas cocci. In one case the disease was arrested; in others its progress was impeded. In consequence of this modified success, the author expresses the hope of being able to successfully treat tuberculosis with erysipelas serum free of cocci, and already the new serum is obtainable for the treatment not only of tuberculosis but of other diseases.

Vitality of Cholera Vibrios on Food-stuffs.*—Herr Pachomoff finds, from experiments on fruit and vegetables infected with cholera vibrios, that these organisms live longer on boiled than on raw vegetables, &c., and thus arrives at almost the same result as Friedrich.

Bacterial Pigment as a Specific Diagnostic Criterion.†—Herr P. Schneider has endeavoured to ascertain how far the chemical reactions of the pigments produced by different species of bacteria might be used for discriminating between them, and he found that (1) Bacterial pigments may to some extent be distinguished by their behaviour to solvents; (2) Under similar conditions the same organism produces the same pigment; (3) Two species of bacteria, morphologically and culturally unlike, may produce the same pigment; (4) Most species which apparently produce the same pigment, and indeed are otherwise very similar, may be easily differentiated by the reactions of their pigments.

Antitoxic Serum.‡—Since Behring's discovery, says M. E. Roux, it has been established that the serum of animals immunified to various contagious maladies is preventive and therapeutic of these diseases, yet, though the neutralizing property is well marked in diphtheria and tetanus, it appears to be absent from the blood of animals vaccinated against other diseases such as hog-cholera, pneumonia, cholera, typhoid. The animals are protected against the microbe, but not against its toxin, and the reason of this is that the serums act as stimulants to phagocytic cells. And since a preventive serum acts as a cell-stimulant, it is conceivable that the serum of an animal vaccinated against one disease may be efficacious against another; hence this preventive power need not always be specific.

But protection against a living microbe is not the same thing as protection against its toxin. With regard to the formation of antitoxins, the first notion was that they were derived from the toxin by a transformation within the body; but this idea is negatived by the fact that antitoxin (e. g. tetanus) is reproduced as fast as it is withdrawn, and the quantity of antitoxin in the blood is not so much proportional to the quantity of toxin introduced as to the manner of its introduction.

It would seem that antitoxin is a cell-product; yet, though the antitoxic property is easily demonstrable by mixing the toxin and antitoxin

* Protokoll. d. Kaukasischen Gesellsch., 1893–4, No. 9. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 199.

† Inaug.-Diss., Basel, 1894, 44 pp. and 2 pls. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 633.

‡ Ann. Inst. Pasteur, viii. (1894) pp. 722–7.

of tetanus together, it is not altogether as simple as a chemical reaction; the one is not chemically, so to speak, neutralized by the other, for experiments show that the two coexist side by side. Thus, if guinea-pigs be previously vaccinated against cholera or diphtheria and subsequently injected with the mixture of toxin and serum, they take tetanus and diphtheria. Hence the serum acts rather on the cells than on the toxin, and this view is further supported by the fact that if a mixture of venin and antivenin serum, which in certain proportions is harmless, be heated to 70°, the antitoxin is rendered inert, the toxin remaining unaffected.

Another interesting point with regard to these antitoxins is that they are not always specific for the one disease, but can act against others; thus the serum of a horse immunified against tetanus renders venin inert, though the converse does not hold good. The serum of rabbits vaccinated against hydrophobia is highly antivenomous.

Fossil Schizomycete.*—MM. B. Renault and C. E. Bertrand record the finding, on coprolites belonging to an ichthyophagous reptile of the Permian period, of a Schizomycete which assumes all intermediate forms between that of a straight rod 14–16 μ long and 2·5 to 3 μ broad, occurring singly or in pairs, and that of a coiled streptobacillus. They propose for it the name *Bacillus permiensis* sp. n.

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New York Med. Journ., 1894, p. 265.

JACZEWSKI, A. DE—**Note sur quelques espèces critiques de pyrénomycètes suisses.** (Note on some Critical Species of Swiss Pyrenomycetes.)
Bull. de l'Herbier Boissier, 1894, pp. 417–24.

JOBERT—**Recherches pour servir à l'histoire du parasitisme.** (Researches on Parasitism.) *Compt. Rend. Soc. Biol.*, 1894, p. 519.

LECLAINCHE, L.—**La virulence des viandes tuberculeuses.** (The Virulence of Tubercular Meat.) *Rev. de la Tuberculose*, 1894, pp. 135–53.

LINDER, P.—**Saccharomyces farinosus und S. Bailii, zwei neue Hefenarten aus Danziger Jopenbier.** (*S. farinosus* and *S. Bailii*, two new Yeast-species from Danzig Beer.) *Wochenschr. f. Brauerei*, 1894, No. 6.

PROSKAUER, B., & M. BECK—**Beiträge zur Ernahrungsphysiologie des Tuberkelbacillus.** (Contributions to the Physiology of the Nutrition of the Tubercle-bacillus.) *Zeitschr. f. Hygiene*, XVIII. (1894) pp. 128–52.

WALSH—**Does Baking sterilize a Loaf?**
Brit. Med. Journ., 1894, No. 1775, pp. 355–6.

WERNICKE, E.—**Beitrag zur Kenntnis der im Flusswasser vorkommenden Vibrionenarten.** (Contribution to the Knowledge of the Species of *Vibrio* found in running water.) *Arch. f. Hygiene*, XXI. (1894) pp. 166–97.

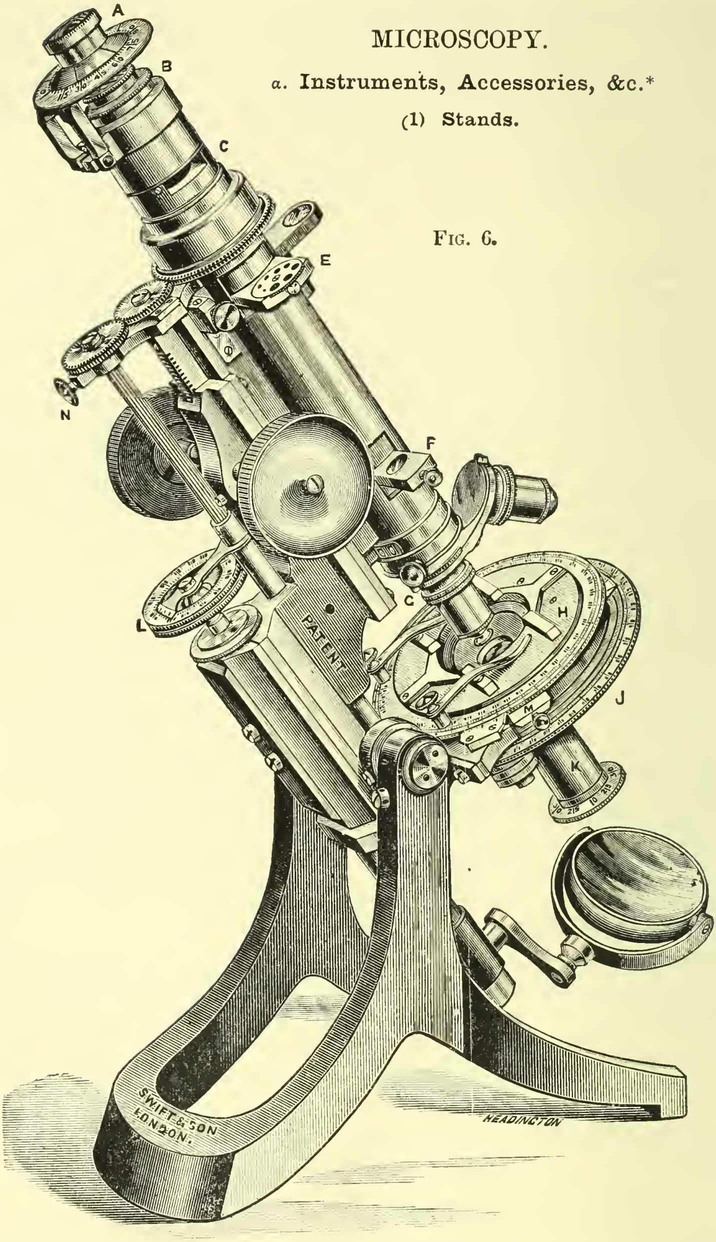
* Comptes Rendus, cxix. (1894) p. 377–9.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Fig. 6.



* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

Messrs. Swift and Son's Improved Dick Petrological Microscope.—The original form of this stand was described by Mr. Allan B. Dick in this Journal in 1889, pp. 432–6, fig. 57. The present instrument (fig. 6) differs from the ordinary Dick model in having an independent revolving stage, which allows the object to be revolved in the field of the cross-wired eye-pieces; whereas in the first stand the object remained stationary, and the eye-piece revolved instead.

In the present stand an achromatic convergent system is provided, the upper lens of which slides in and out of the centre of the stage for use with high and low powers; being flush with the surface of the stage, it is always in contact with the object, and when an immersion fluid is used it gives an angle of 1·05. The lower lenses of the system are moved up or down by a revolving collar. The convergent system can easily be adapted as a spot-lens for any objective from 2 in. to 1/8 in.

Immediately below the system, and above the polarizer, is a small iris diaphragm. The polarizer is made to swing out of the axis of the Microscope to allow the achromatic condenser to be brought into use. The nose-piece is a self-centering one. The upper horizontal slide E has a revolving diaphragm of apertures for viewing rings and brushes in minute crystals.

Messrs. W. Watson and Son's "Grand Model" Van Heurck Microscope.—This instrument (fig. 7) is constructed on similar lines to Messrs. Watson's "B" Van Heurck Microscope figured in this Journal (1893, p. 92), but possesses the following special features:—The stage has rectangular mechanical movements, controlled by two stationary milled heads, working on one centre; 1 in. of motion is afforded to the stage plates in either direction. The whole stage can also be completely rotated in any position. The base-plate carrying the stage is continued in one casting round the sides of the limb and fixed by screws, instead of being screwed to the front of the limb as in the ordinary way, and the bolt on which the instrument is inclined goes through the whole—limb and stage supports—thus imparting unusual firmness. In order to incorporate these alterations an increase of size of the Microscope has been necessary, and all the parts are more massive than in the original stand. The tripod foot is cork-shod, and has a spread of over 10 in. in each direction.

Zeiss new Mechanical Stage for Stand Ia.—For this stand Messrs. Carl Zeiss have recently constructed a mechanical stage which differs from that formerly supplied by them. The object in designing this new type of stage was to obtain, without diminishing its size and the exactness of its movements, an instrument of such solidity as to admit of its being permanently left on the Microscope and thus rendering the use of a separate stage superfluous.

The object-slide is placed in the usual manner with its shorter edge against the left stop A (fig. 8) and the left end of the lower long edge is pressed against the frame ledge R. The other stop B, which slides in a slot, is then placed against the other edge of the slide so as to hold it firmly. Stop A may by means of a screw *h* and a set pin be fixed at different points of the frame, there being a series of holes provided

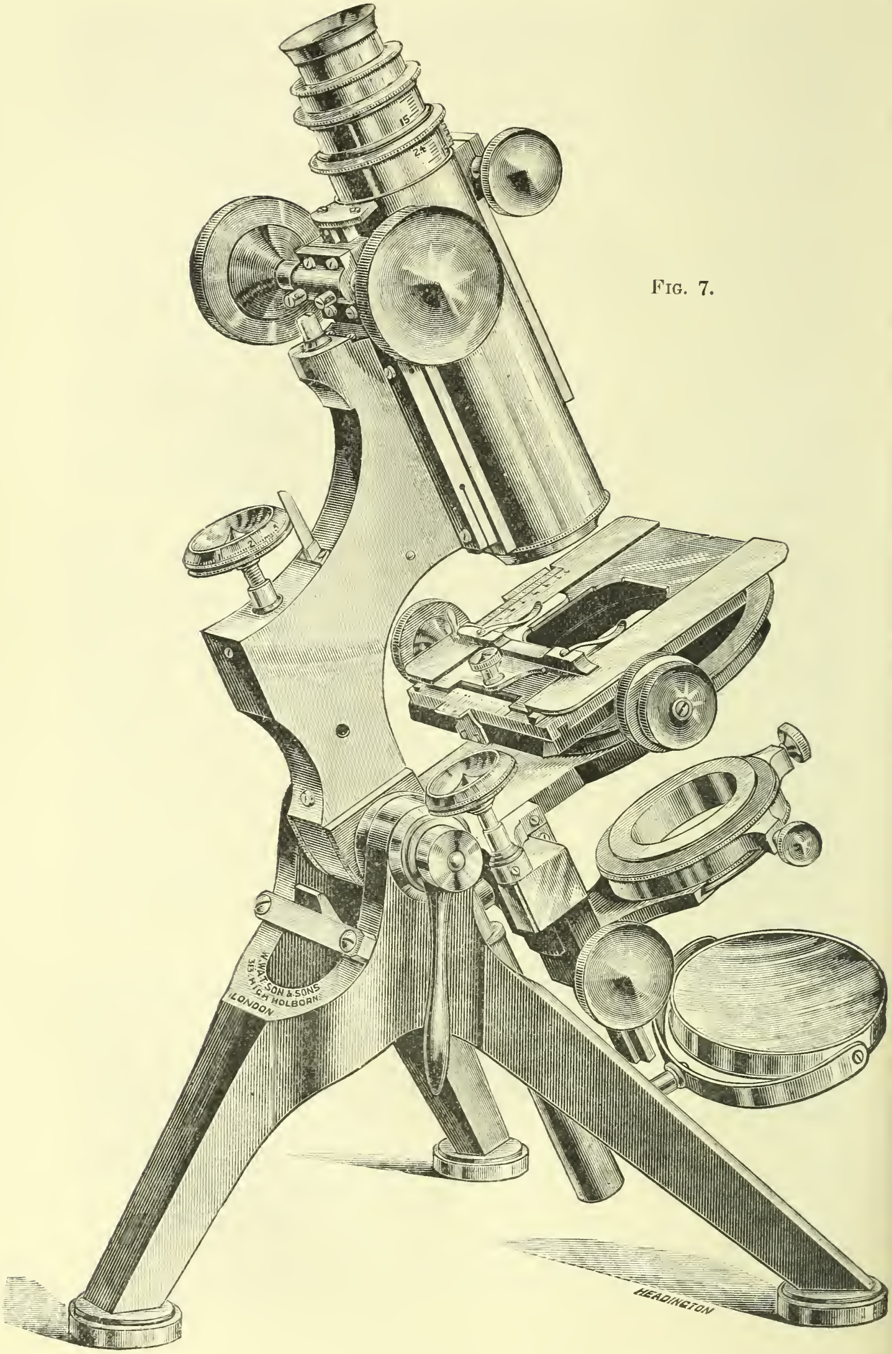


Fig. 7.

for the purpose, so as to adapt the object-holder to slides of various sizes.*

This frame together with the stops and object-slide is moved laterally by means of the milled head K, fixed in a slanting position towards the

Fig. 8.

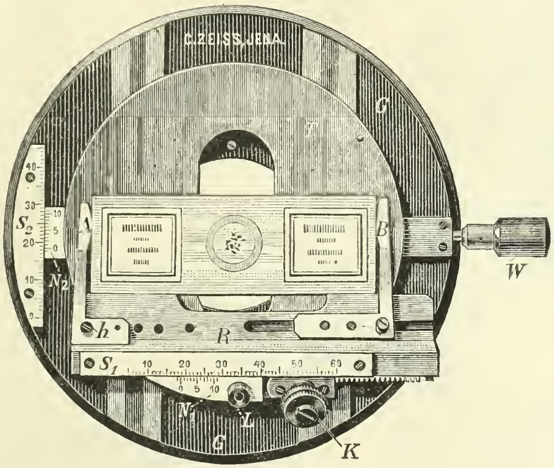
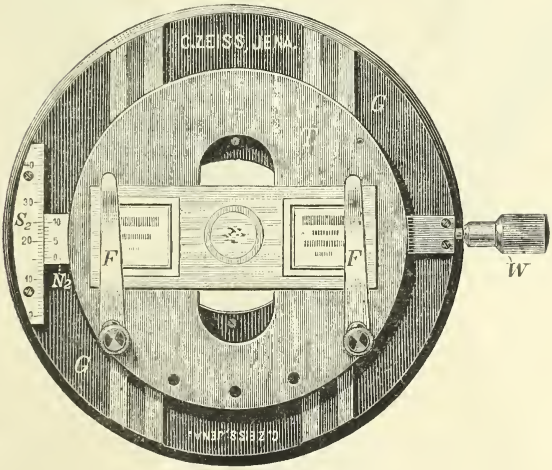


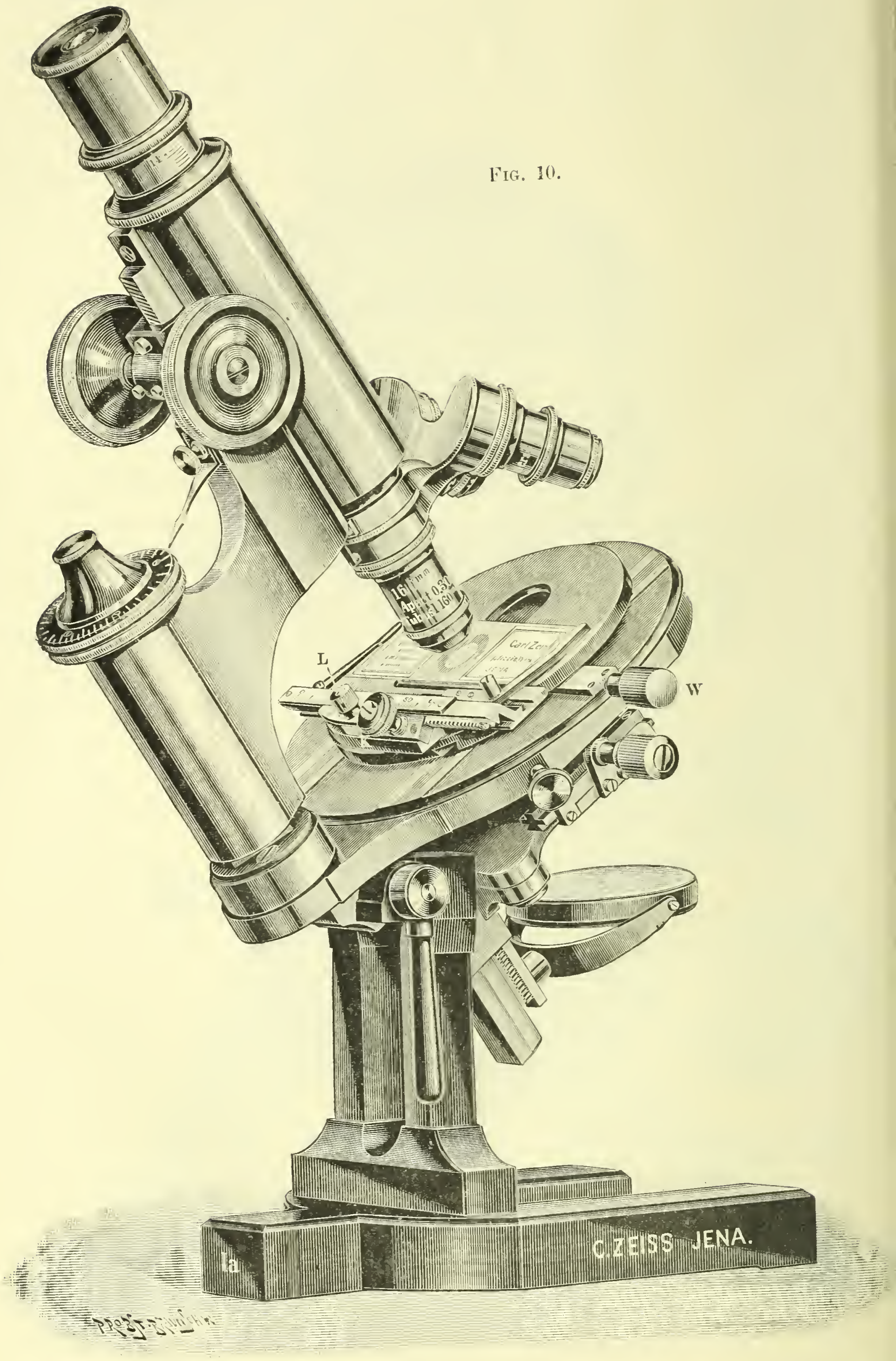
Fig. 9.



back and controlling a rack slantingly fixed to a lower side of the frame. The available lateral movement measures 50 mm. The guiding

* Screw *h* is to be loosened by means of a screwdriver. Messrs. Zeiss have intentionally used an ordinary slit-head screw, since as a rule the position of the stop is adjusted once for all, and changes in the position of the stop would preclude the use of the scale as a finder.

Fig. 10.



of the movement is effected by a dove-tail bar attached to a lower portion of the frame and is completely covered. The amount of the movement of the lateral position of the frame can be read by scale S_1 and vernier N_1.

The milled head W projecting from the side of the stage is connected with a pinion, working a rack attached to the under side of the stage T on the right, and effects the forward and backward movement of the stage. The stage is made to move accurately and smoothly by means of two guide strips (not visible in the illustration). The four strips rising from the base shown in the figure are ground perfectly plane and smooth and serve as sliding surfaces for the guides. The magnitude of the movement is read off scale S_2 by means of vernier N_2. The range of the movement in this direction is 35 mm. The milled head W also serves as a handle for rotating the entire stage.

The movable stage disc T is provided with an oval slot running in the direction of the movement. This slot is conically expanded downwards, and the base-plate G, which remains in a fixed position on the Microscope, has a circular opening in the centre. The arrangement admits of contact being established between the object-slide and the front surface of the condenser at any position of the stage. The makers state that all sensitive parts are well protected from dust and other influences. To set free the entire surface of the Microscope stage, unscrew the small vertical head L, and the whole frame R, which is fixed in position by two set-pins and held down by this screw, may be lifted off, and the stage then presents the appearance shown in fig. 9.

The stage is sufficiently large to take a culture plate or dish, or an object-slide of any desired form may be fixed by means of the spring-clips FF.

The stage is attached to the stand (fig. 10) and detached from it in precisely the same manner as in the case of the older stage.

(3) Illuminating and other Apparatus.

Differential Object-carrier.*—Dr. H. E. Hildebrand has devised a new form of object-carrier for use in morphological work, where moving living objects are being studied. It allows, without changing the position of the guiding hand, both of constant tracks being kept, as in the ordinary mechanical stage, and also of any movements required by the object being given. This is effected by a difference in the friction between the surfaces for the back and front movement and those for the side to side movement. This difference in the friction can be ignored by the guiding hand in the production of any desired movement, but is allowed to control the motion when constant tracks are to be described.

The object-carrier consists essentially of a plate with central aperture lying across the Microscope-stage, which is provided with a pressure spring, and by means of a grooved head can be rotated about a stationary vertical rod and also displaced laterally.

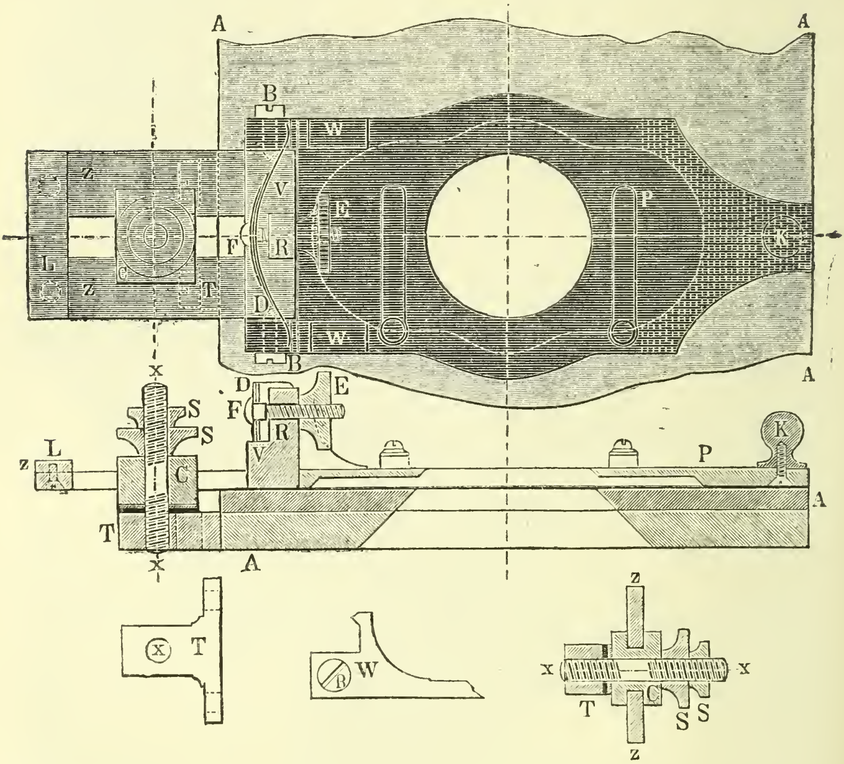
The steel rod x (Fig. 11), as the axis of all movements, is firmly fixed in its base-plate, the T-piece T, which is of such a length that

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 304–12.

the pillar x stands in the middle of the slit of the plate Z, when the whole instrument lies upon the Microscope-stage in such a way that the apertures of the stage and the plate P are concentric.

The grooved head C is a rectangular block with a central smooth bore of such a size that it fits tightly on the rod x. Two of its opposite sides are provided with grooves in which the arms of the plate Z slide. The part of the rod x which projects above the head C, possesses a screw-thread for two screws S S, the upper for clamping the lower. These serve for the exact adjustment in height of the whole instrument above the Microscope-stage.

Fig. 11.



The two-armed plate Z, which forms a long rectangle, consists of a single piece. On the length of its arms depends the extent of the lateral displacement of the object, which should amount to at least 3/4 in. After the introduction of the head C, the arms at the further side are closed by the cross-piece L which limits the displacement in this direction, while at the opposite side the plate is closed and is there also strengthened by a prismatic piece V, on which is a block R for the pressure spring D. The four-sided prism V fits between two projecting pieces of the plate P, and is connected with the plate P by the screws BB.

On the spring D depends the proper functioning of the instrument. It is a steel spring in the shape of an arc, and is provided in the centre with a screw-bolt F which fits in a boring of the block R. The tension of the spring is regulated by the screw E. The pressure of the spring is transmitted to the plate P by means of the two angle-pieces WW, so that the plate is pressed down upon the Microscope-stage AA.

The plate P with all its accessories is cast in one piece, and has a large aperture for the complete use of the Abbe condenser. The dotted line in P marks the outline of the aperture on the under side of the plate. The whole plate should be made of aluminium to diminish the weight, so that a slight spring pressure would suffice in order to prevent a sliding of the carrier in an inclined position of the stand.

To prevent scraping in the sliding motion, about a third (the dotted part in the figure) of the under side of the plate P is covered with a thin woollen material. As regards the method of using the instrument, it is clear that the vertical rod x with the grooved head C always keeps the plate Z horizontal. It is otherwise with the plate P which is inclined by the pressure of the spring against the stage AA of the Microscope. This pressure, however, induces a pressure of the arms of the plate Z in the grooves of the head C, since here a variation from the horizontal plane is impossible. Since, further, the force of the spring acts on levers of unequal length—from the hinge BB to the rod x on the one side, and from the same hinge up to the place where the plate P comes in contact with the stage AA on the other—therefore the friction on the stage must be correspondingly smaller than that in the grooves of the head C.

In the practical use of the instrument, first the plate P is set parallel to the stage A of the stand by means of the two screws SS. The necessary tension is then given to the spring, which will vary according to the inclination of the Microscope.

By loosely holding the knob K between the thumb and first finger, the preparation on the carrier may be made to describe the same curve backwards and forwards. In this case the guiding hand makes no attempt to overcome the greater friction in the grooves, while the slight friction on the Microscope stage A is scarcely felt. A firmer pressure on the knob K is required to make the carrier move to and fro in the grooves C. By these two movements the whole preparation can be systematically examined. But if it is desired to follow the outline of an object or the course of a curve in a drawing, in this case, the hand holding the knob K must take no account of the resistance offered by the friction in the grooves C, but must follow the curves and outline of the object as they present themselves.

The figure represents the instrument in two-thirds of its natural size.

A new Drawing Apparatus.* — Dr. S. Czapski states that the following conditions should be satisfied by a good drawing apparatus :—

(1) The light from the image must not to any great extent be weakened by the apparatus.

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 289–98.

(2) The image of the drawing board must reach the eye with the least possible loss of intensity and coaxial with the microscopic image.

(3) There must be an arrangement by which the relation of the intensities of these two images can be changed within sufficiently wide limits; and this arrangement, as in Bernhard's apparatus,* must allow of a change not only of the apparent brightness of the plane of the drawing but also of the intensity of the microscopic image.

(4) The apparatus must be adjustable in height and capable of being centered in its horizontal plane.

(5) It must be possible to easily separate the apparatus from the eye-piece and replace it again in its original position at will.

(6) The image of the plane of the drawing and the image of the microscopic object projected on it must be seen with the apparatus without any distortion.

The author describes the latest drawing apparatus offered by the firm of Zeiss, and shows to what extent it fulfils the above conditions.

As regards conditions 1 and 2, the author comes to the conclusion, as the result of numerous experiments which he has made, that the well-known method of Schröder, Govi, and others, which consists in the use of a glass plate with a thin metallic deposit on its surface, does not sufficiently correspond to the requirements, since the light passing through the metallic layer is too much weakened. He accordingly adopts instead of this essentially the arrangement of the original Abbe camera, viz. two rectangular prisms with the hypothenuses cemented together, of which one is silvered with a small portion of the deposit in the centre scratched away, and with these a second mirror A (fig. 12) for transmitting the image of the plane of the drawing to this prism. But since one and the same prism, with a determined opening in its silver deposit, cannot suffice for all purposes and changes of magnification, an arrangement is added by which the prism P (fig. 13), with its fastening, can be easily taken out of the apparatus and replaced by another with an opening of different size.

With respect to condition 3, the author has sought to render the methods adopted by Abbe and Bernhard † less cumbrous by substituting for the discs, with their series of smoked glasses, an arrangement of two smoked glass wedges, after the principle of Babinet's quartz-wedge compensator, one wedge being made to move over the other, so as to form a plate of continuously varying thickness. By such an arrangement the problem in question meets with its complete solution, but for the apparatus in question the method was abandoned, since it raised the price of the instrument too considerably. Instead, a modified form of the Bernhard and Winkel arrangement was adopted. The smoked glass plates were set in the cylindrical wall of a small cap R (see figs. 12 and 13), which was simply placed over the prism. Each smoked glass can be in turn interposed in the path of the rays by turning the cap on its upper edge until a small pin engages in a corresponding small hole on the lower edge of the cylinder. In the cap are five smoked glasses of different strengths, while the sixth hole is left empty.

For diminishing the brightness of the image a disc B, as in Bernhard's apparatus, with four smoked glasses and a vacant space, is interposed between the prism and the eye-piece.

* See this Journal, 1892, p. 263. † Loc. cit.

The requirement of convenient adjustability in height is satisfied by the apparatus being attached to the body-tube by means of a clamping ring, while the adjustment from side to side is effected by the prism,

Fig. 12.

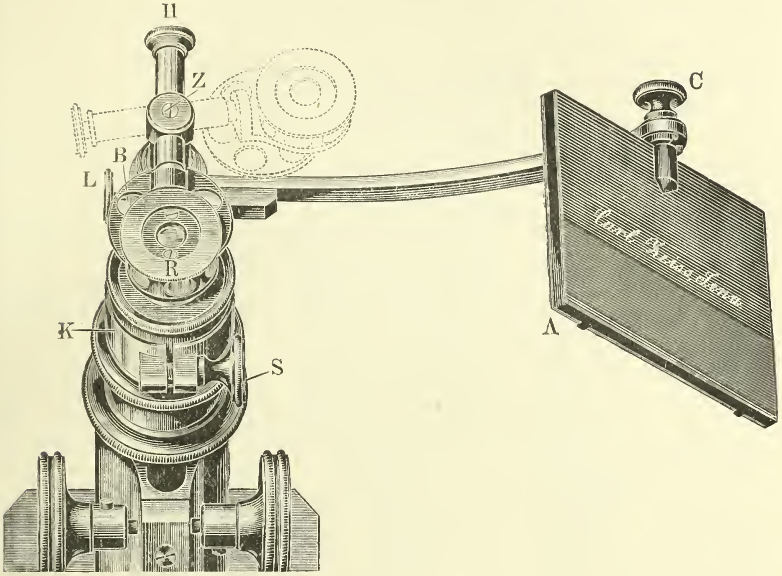
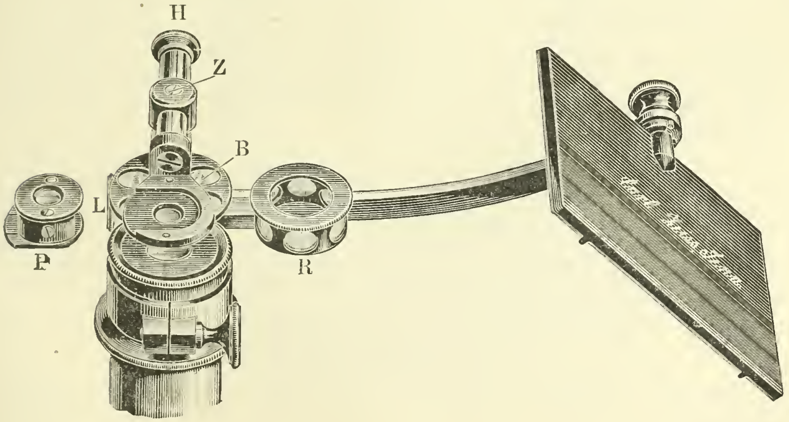


Fig. 13.



together with the cap and smoked glass disc, being centered from front to back by means of a screw H working through a spring socket, and from right to left by means of a second screw L, against which works a counter-spring not seen in the figure.

In order to pass conveniently from observation through the apparatus to observation through the free eye-piece, the prism, with its diaphragm arrangement, can be rotated to one side about a vertical pin Z. The return of the prism to the central position is marked by a spring-catch.

To obtain on the table an image of moderate size quite free from distortion, such an extent, and thereby weight, would have to be given to the side arm carrying the mirror, and to the mirror itself, as would be quite incompatible with the proper working of the apparatus. A moderate length, therefore, of 10·5 cm. was given to this arm, which was made of aluminium, while the size of the mirror was 7 to 8 cm. long and not much more than 5 cm. broad. To obtain drawings free from distortion, in combination with this apparatus a drawing table, similar to that described by Bernhard,* must be used.

Improved Form of Bernhard's Drawing Desk.†—Dr. W. Bernhard has introduced the following changes in his desk for microscopical drawing which was described in this Journal for 1893, pp. 782–3.

(1) The drawing plate has, instead of the earlier swallow-tail groove, a very exactly worked brass groove on the upper plate, so that any shifting of the plate is prevented.

(2) The arrangements for determining the necessary height and inclination of the drawing board have been modified. The guiding arc on the left frame has now a division in 5°, while the edge of the right frame is provided with a centimetre scale, on which a pointer attached to the movable slide of the frame is adjusted.

(3) An adjustable rest for the drawing arm has been added to the instrument. This rest is connected with the drawing plate by a hinge, and is supported by a hinged piece, which is capable of extension, and has its lower end resting against the base-plate of the apparatus. By this arrangement the rest can be used in any position of the table, and can be folded down upon the drawing plate when the apparatus is not in use.

(4) For convenience in drawing an arrangement has been added by which the Microscope and drawing plate can be inclined towards the drawer. For this purpose the apparatus is connected by two hinges in front with a solid base-plate, so that the whole drawing table, with the Microscope, can be inclined towards the observer, and fixed at any inclination by a clamping screw.

A Silver on Glass Camera Lucida.‡—Mr. W. Forgan gives a description of the various drawing apparatus which have been devised for the Microscope, and speaks of the difficulties experienced by many in their use. The method which he proposes is to place a small silver on glass mirror, such as is used as a *flat* in the Newtonian telescope, on the eye-piece of the horizontal Microscope, and so project the image down on the paper lying on the table.

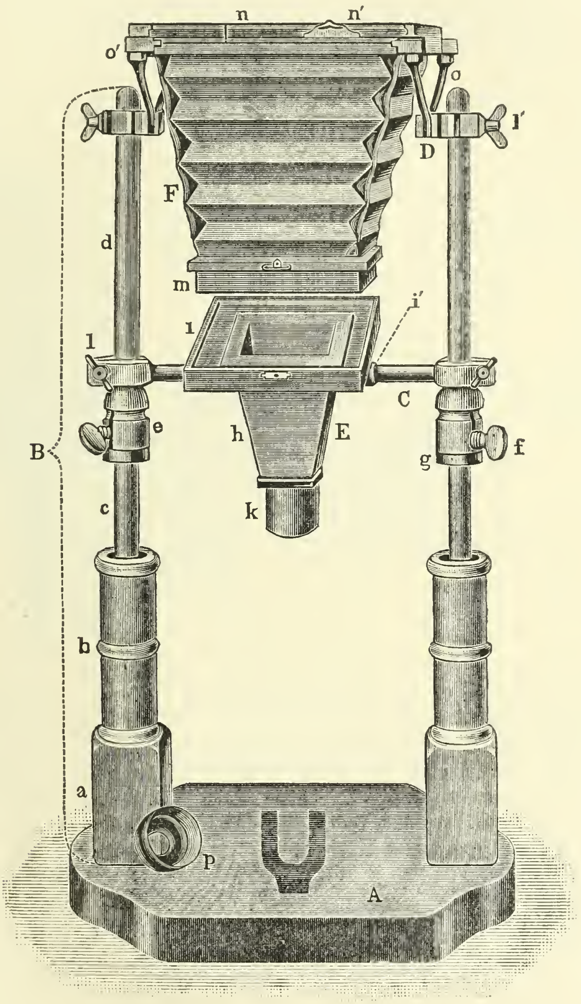
(4) Photomicrography.

Photomicrographic Apparatus.§—Prof. M. Lavdowsky's apparatus reminds one of that of Reichert, but differs from it in many respects,

* See this Journal, 1893, p. 782.
† Zeitschr. f. wiss. Mikr., xi. (1894) pp. 289–301.
‡ Proc. Scottish Micr. Soc., 1893–4, pp. 122–9.
§ Zeitschr. f. wiss. Mikr., xi. (1894) pp. 313–20.

being much lighter and more portable. The total weight, inclusive of a large shutter, only amounts to 16 lb. On a moderately thick base-plate A (fig. 14) rise two wooden pillars B, which, by means of the two holders C and D, carry the two photographic cameras, the lower small

FIG. 14.



one E for small plates 8 × 8, and the upper one F, which fits into the lower, for larger plates, 16 × 18.

This division of the camera into two parts is very useful in working with petroleum light.

The base-plate A is 45 cm. long, 40 cm. broad, and 5 cm. deep, so that its dimensions are sufficient to adjust conveniently the Microscope, the petroleum lamp with the lens, and, if necessary, also the light-filter. The base-plate rests on a heavy round oak table, in which is a drawer for slides, &c. The under surface of the base-plate is thickly coated with felt.

The wooden pillars B consist of the following four parts: the base *a*, the movable intermediate piece *b*, and the two rods *c* and *d*, of which the first is screwed into the base *a*, while the second *d* is set on the upper end of the first.

The four-sided bases, which are 14 to 16 cm. high and 6 cm. broad and deep, are imbedded in the base-plate, and fixed by screws from underneath. Each has a screw-matrix of 3 cm. diameter, in which the rod *c* is screwed. The rotating intermediate piece *b* has the same matrix, and serves to fix the rod *c*. The rods are 2 cm. thick; the total length of the lower one is 38 cm., that of the upper 31 cm. The upper rods *d* are without screw-threads; they have at their lower ends the

FIG. 15.

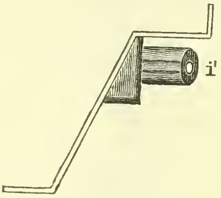
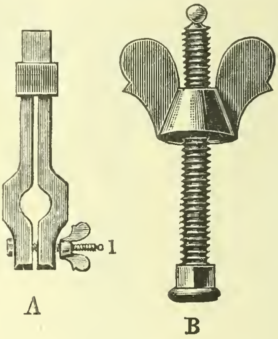


FIG. 16.



blocks *e*, by means of which they fit over the lower rods; the rods are clamped together by the wooden screw *f*, which works through a slit made in the block. A metal ring *g* serves to strengthen the block.

The camera E consists of the following four parts:—the box E, 12 cm. high, lined with black cloth; the plate frame *i* of 16 cm. side-length and 10 cm. opening for light; the wide camera tube *k*, and the fork C which supports the camera.

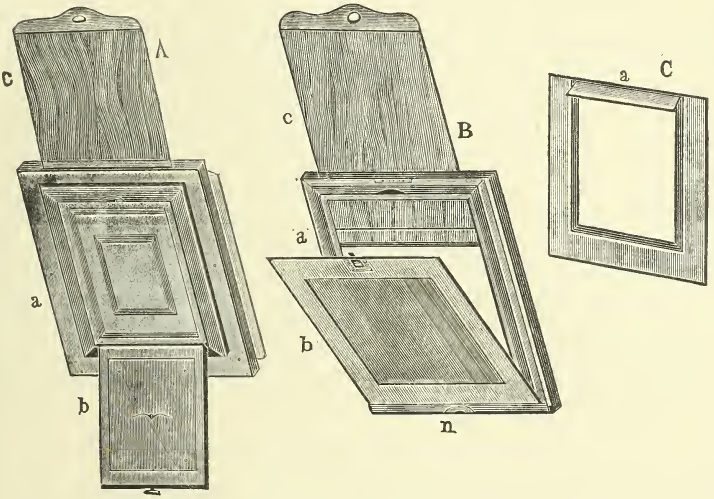
The connection between the upper and lower camera is made by a metal catch. The lower camera is attached to the stand in a peculiar way (fig. 14, I′, and fig. 15). Beneath the frame on the side of the camera is a triangular piece of wood on which a projecting cylindrical socket, 3 cm. long, is screwed. In this socket fits a fork C, seen in fig. 16 A, which consists of a metal bar split down the greater part of its length, and having at one end a hole and a pressure screw (fig. 16 B) for fixing it on the rod.

When the lower camera is used alone, it is fastened by the screw *l* on the rod *c*, and the rod *d* is removed. The camera can be easily turned about the fork C, so as to be inclined in any position.

The upper camera F consists of two wooden frames *m* and *n*, with a bellows between which can be drawn out to 20 cm. The upper frame is solid and is provided with two grooves and a catch *n′*, which closes automatically after the slide has been introduced, and can be easily opened by pressure of the finger when the slide is to be taken out.

The upper part of the camera and its connection with the uprights is more complicated. By this connection the camera stands vertical, is movable on the rod *d*, and can be fixed in any position by the screw *l′*. The blocks D which fit over the uprights carry forks *o*, *o′*, which support the corners of the frame.

Fig. 17.



Of the slides shown in fig. 17, A is for the lower camera, B for the upper.

The small slide consists of the frame *a*, with the cover *b*, and the slider *c*. The larger slide B is similar. Its size is 16 × 18 cm., but it can be used for plates 8 × 8, 8 × 10, &c., by inserting frames like that shown in C.

The First Photomicrogram in Natural Colours.*—Dr. R. Neuhauss has made experiments in photography in natural colours by the methods of Valenta † and met with considerable success in the reproduction of mixed colours. An experiment was made in taking in natural colours a photomicrogram of a preparation of *Distomum lanceolatum* coloured bright red, with the internal organs black, yellowish brown, and dark red. The picture was taken with a linear magnification of 9 times, and with the use of the Auer incandescent light and Hartnack projection system on a bromsilver plate prepared by the method of Valenta. The plate was about ten thousand times less sensitive than those generally used for

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 329–31.
† Valenta, E., 'Die Photographie in natürlichen Farben,' Halle a. S., 1894.

photomicrographic work, so that an exposure of three hours had to be given.

When developed the plate showed a very satisfactory reproduction of the colours of the original.

Simple Method of taking Photomicrographs of Opaque Objects.* —Drs. E. W. Carlier and G. Mann have sought to obtain photomicrographs of the surface instead of sections of various animal and vegetable tissues.

The authors give a detailed description of the apparatus and process which they employed.

A horizontal camera made by Mr. Forgan, of Edinburgh, fitted to a large Zeiss Microscope, was used. The preparation was illuminated with a beam of light concentrated by a bull's-eye condenser. The light of an argand burner was found to be sufficient in most cases for focusing on the ground-glass screen. Magnesium ribbon fed through a piece of brass tubing was used for taking the photograph.

Ilford ordinary medium isochromatic plates were used. For timing the exposure an ordinary metronome set to half seconds was found to be very convenient.

As developer the old Ilford hydrokinone formula was used. After developing, the plates were immersed in an acetic acid bath, as by this process the negatives were rendered much clearer.

The best results were obtained with most objects when the incident light formed with the plane of the stage an angle of about 40°. Only low-power lenses such as No. 1 and 3 of Leitz were used.

Gelatino-chloride papers of the kind termed "Solie" (Eastman) were used for printing, and Eastman's combination toning and fixing bath for toning.

(5) Microscopical Optics and Manipulation.

On the Passage of Light through a System of Spherical Lenses.† —Mr. C. V. L. Charlier considers that the theory of the spherical aberration of light, although of the utmost importance in the construction of optical instruments, has not by any means been sufficiently developed to answer the requirements of practical optics. As contributions to the subject, the author intends to publish investigations:—

(1) On the image of a point by the passage of light through any number of centric lenses.

(2) On the choice of the radii of curvature, refractive indices, thickness and distances apart of the lenses, in order to obtain the best possible images.

(3) On the photographic images of stars.

As a preliminary to these investigations, in the present paper he gives the mathematical determination of the equation for the *aberration curve* as defined below.

A system of lenses is considered with refracting surfaces spherical, and with centres on one straight line, the axis of the system. Through the centre of curvature of the first of these surfaces a plane, called the

* Proc. Scottish Micr. Soc, 1893–4, pp. 115–21.
† Nova Acta Sci. Upsala, xvi. (1893) viii.

fundamental plane, is drawn at right angles to the axis. In this plane a circle of any given radius κ and with its centre on the axis is drawn.

If rays from a given point be considered before refraction as passing through this circle, after refraction they will form on any plane at right angles to the axis a curve. This curve the author calls the *aberration curve* for the radius κ.

With respect to this curve the author has demonstrated the following properties :—

It is an algebraic curve of the fourth degree. The coordinates can be represented by trigonometrical functions thus:

$$y = (\mu_0 + \mu_1 \sin \phi) \cos \phi$$
$$z = \lambda_0 + \lambda_1 \cos \phi + \lambda_2 \cos^2 \phi$$

where ϕ is an angle in the fundamental plane between the y axis and the radius vector to the incident ray; and the five magnitudes λ and μ depend on the constants of the system of lenses and on the position of the plane of the image.

The Secret of the Brownian Movement.*—Mr. R. Meade Bache gives an account of the experiments which he has made in order to determine the cause of the Brownian movements. Robert Brown found as the result of a series of experiments which he made on finely crushed glass, various minerals, and many organic substances, that extremely minute particles of solid matter, whether organic or inorganic, when suspended in water, exhibit motions resembling in their irregularity the less rapid motions of some of the simplest animalcules of infusions, and states his belief that the motions "neither arose from currents in the fluid containing them, nor depended on the intestine motion which may be supposed to accompany its evaporation." More recently Herren Wiener, Exner, and Schultze have investigated these movements. Wiener concluded from his experiments that they have for their basis the movements which, by virtue of their molecular constitution, belong to fluids. Exner considered that the liveliness of the movement was heightened by light and heat.

The author, in his experiments, made use of finely divided carmine suspended in water. He found that no effect was produced upon the movement by the passage of a galvanic current through the liquid, by placing the liquid in the lines of force of a permanent magnet, nor by the application of heat and cold. Herr Wiener had been inclined to attribute the movement to the action of the red wave of light, but the author could detect no alteration in the movements when either a violet or a red glass was interposed between the source of light and the particles.

By observation for weeks, both with water-immersion lenses and also with a 1/15 dry lens, of liquid enclosed in a hermetically sealed cell the author could find no alteration in the movement, and concludes that evaporation has nothing to do with it. As the result of all his experiments the author therefore concludes "that it is not the particles which are moved by their own energy, or moved by any energy directly imparted to them from outside sources, but that it is the fluid that moves them."

* Proc. Amer. Phil. Soc., xxxiii. (1894) pp. 163–77.

According to the author, in alcohol and in fixed and volatile oils the Brownian movement is not observable; it is a property of water and of water alone, and is caused by the mutual repulsion of the molecules of this liquid.

Mechanics and Optics at the World's Fair at Chicago, 1893.*— Herr B. Pensky and Prof. A. Westphal give an account of the various exhibits connected with Mechanics and Optics at the Chicago Exhibition of 1893. In these departments the German firms were well to the fore. Polished plates of the various kinds of optical glass manufactured at the Jena glass-works were exhibited by the firm of Schott and Genossen. These included crown glasses, heavy and very heavy baryte-crown with high refraction, crown glass with low colour dispersion, phosphate and borate glass free from silica, ordinary flint glasses, Jena normal glass for thermometers, combustion tubing, &c. The firm of Carl Zeiss was well represented by a collection of their apparatus arranged in three divisions. The first division contained microscopical apparatus, viz. apochromatic and achromatic objectives, compensation eye-pieces, apparatus for examining objectives, projection apparatus, photomicrographic apparatus, Microscopes of all kinds for biological, crystallographic, petrographical, purposes. In the second division were the photographic lenses, including the well-known Zeiss Anastigmatics. The third division showed the productions of the firm in optical apparatus intended for physical and technical purposes, and included refractometers, contact-micrometers, spherometers, focometers, &c., made after the designs of Prof. Abbe. In the department of photographic objectives the firms of Steinheil, Voigtländer, and Schulze and Bartels had extensive exhibits; the first-named firm showed their well-known antiplanatics and their new apparatus for telephotography; the firm of Voigtländer exhibited a number of euryscopics and anastigmatics; while Schulze and Bartels were represented by the teleobjective of Dr. Miette and by a collection of telescopes and optical glasses of all kinds.

In the department of microscopy the firm of Voigt and Hochgesang was prominent with Klein's Microscope for mineralogical and petrographical purposes, and with Lehmann's crystallization Microscope and its accessories. The old Berlin firm of Schieck exhibited Microscopes for investigations on trichinosis, for entomological and other purposes.

Important exhibits of spectral, polarization, and photometric apparatus were made by the firms of Krüss, and Schmidt and Haensch. The first of these firms is responsible for the introduction of the Hefner lamp, and the latter for that of the Lummer-Brodhun apparatus in photometry. In the mineralogical division of the University Exhibition in the German section were exhibited petrographical Microscopes by Fuess and by Voigt and Hochgesang, Klein's Microscope for more exact mineralogical-petrographical investigations, Klein's heating-Microscope, Nörremberg's polarization-instrument, a collection of Fuess's mineralogical instruments, the crystal refractometer of Abbe, the total-reflectometer of Kohlrausch, and many other apparatus.

England was very poorly represented at the Exhibition. Ross and Co. exhibited Microscopes and a number of photographic objectives in

* Zeitschr. f. Instrumentenk, xiv. (1894) pp. 133–6, 176–80, 210–14, 252–5, 327–31, 366–9.

which the Jena glasses were extensively used; the newest of these was the "Concentric" objective for landscape and architectural photography, consisting of two symmetrical double-lenses. Watson and Son, besides astronomical and measuring instruments, exhibited photographic and projection apparatus and Microscopes. Amongst the latter was shown the Van Heurck Microscope for work with high magnification, one of the peculiarities of which is the special draw-tube which allows of the use of the German as well as the English tube-length, according as the objective to be used is corrected for one or the other. The firm of Beck also exhibited a collection of Microscopes.

Other European nations were well represented in the department of Microscopy by the firms of Nachet, Reichert, and Koristka.

Amongst American exhibits the Gundlach Optical Co. showed their photographic objectives and Microscopes; and the Bausch and Lomb Optical Co. a large collection of their Microscopes, microtomes, and photomicrographic apparatus. A peculiarity in the Microscopes of the latter firm was a hemispherical diaphragm intended to replace the Zeiss iris-diaphragm.

β. Technique.*

Practical Methods in Microscopy.†—This is an elementary manual of microscopical manipulation intended to guide such as have little or no previous acquaintance with the instrument, or the methods of examination and preparation of objects. It deals firstly very briefly, but perhaps sufficiently for an absolute beginner, with the phenomena of refraction, the formation of optical images, aberration, and so forth, followed by a description of the compound Microscope and its chief accessories, drawing instruments, microtomes, &c., polarized light having a short chapter to itself. Manipulation and the examination, preparation and mounting of specimens necessarily take up the major part of the work, and the pages devoted to making sections of vegetable and animal tissues, rock sections without a lapidary's wheel, and the cultivation and staining of bacteria, are up to date and quite as full and exact as is required by the class of student for whom the book was specially written. No mention, however, is made of the freezing process, which is rather an oversight considering the great convenience of such instruments as the Cathcart, and particularly Jung's automatic ether microtome, to those who do not devote themselves almost entirely tc section-cutting, as, after all, the complicated celloidin and paraffin processes are only requisite for serial sections, or where the material necessitates continual internal and external support during the whole time it is under treatment. It is perhaps superfluous to state that the now indispensable chapter on photomicrography is not forgotten. The work is illustrated with the usual figures, and also by a series of process plates from photographs done with a low power. It is well printed, and commendably free from errors, typographical or otherwise, but in the examination of human blood (p. 79) the white corpuscles are

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† By Chas. H. Clarke, A.M., Boston, U.S., and London, 1894, 211 pp.

stated to be smaller than the red, and plate IX., given as human liver, represents indifferently the cortical portion of the kidney.

ABEL, R.—**Taschenbuch für den bakteriologischen Praktikanten, enthaltend die wichtigsten technischen Detailvorschriften zur bakteriologischen Laboratoriums-arbeit.** (Handbook for Bacteriologists, containing the most important technical details for the work of the Bacteriological Laboratory.) 3rd edition of Bernheim's Taschenbuch. Würzburg, 1894, large 16mo, vii. and 56 pp.

(1) Collecting Objects, including Culture Processes.

Cultivation of Rhizobes.*—Mr. A. Schneider cultivated rhizobes in the following way:—Instead of ordinary pepton gelatin he used a cultivation medium of agar made up with a watery extract of *Melilotus alba.* To the extract pepton, pancreatin, and NaCl were added in different quantities. The reaction of the medium was acid. The bacteroids of *M. alba* were artificially cultivated by incising a root-tubercle and then inoculating the medium from the wound. After 4–5 days white colonies of *Rhizobium Frankii* var. *majus* were formed. Most of them were mobile, and they multiplied both by spores and fission. The mobility was greatest in fluid media, and the character of the movements rendered the presence of cilia probable. By staining with Hoffmann's violet a cilium at both ends was demonstrated (sometimes two). Spores just developing had 3–4 cilia.

FIG. 18.

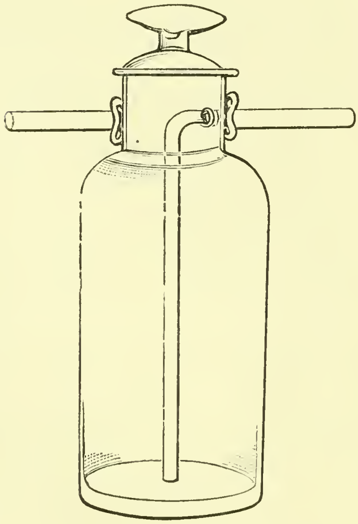
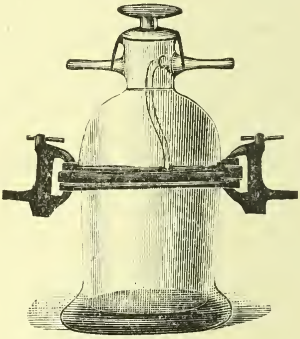


FIG. 19.



Apparatus for Cultivating Anaerobes.†—Prof. F. G. Novy describes a bottle for cultivating anaerobes which will hold four or more Petri's

* Bull. Univ. Illinois, 1893, pp. 301–19, 3 pls. See Centralbl. f. Bakt. u. Parasitenk., xvi. (1894) pp. 631–5.
† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 566–71.

capsules at the same time, and which can be used for working with hydrogen, carbonic acid or coal gas, or with pyrogallic acid. In shape it is somewhat like an exsiccator, and its neck and stopper are shown in fig. 19. The body of the bottle is in two moieties, which are fitted together very accurately, and joined by carefully ground flanges. The diameter of the body of the bottle (fig. 18) is 12 cm. and its depth is 12 cm. The stopper has a diameter of 2–3 cm., and by giving it a quarter turn, or 90°, the apparatus is closed. After putting in the material the two parts, the edges of which have been previously smeared with a mixture of bees-wax and olive oil, are fitted together, and the chink covered with a broad rubber band. This is securely held by an iron clamp, tightened up by means of screws. The stopper must be prevented from jumping out by securing it to the neck with a rubber band.

Apparatus for Collecting Samples of Water.*—Dr. C. Gonçalves has devised a very simple and inexpensive apparatus for collecting samples of water from any depth for bacteriological examination. The apparatus consists of a glass bottle supported on a metal plate weighing 2 kilos, and kept in position by a ring round the neck, and joined to two iron rods rising vertically from the iron plate by means of screws. Above the bottle the iron rods are joined by a cross piece placed at such a distance above the stopper that the latter can only be just raised, and not completely removed. From the stopper runs a wire, passing through a hole in the cross piece to the surface. Another wire, connected with another terminal cross-piece, supports the apparatus. A sample is obtained by just letting down the apparatus to the required depth, and then pulling the wire connected with the stopper, which returns to its place when the wire is released merely by its own weight.

Examining Water containing the Bacillus of Typhoid Fever.†—M. Grimbert made experiments for the purpose of ascertaining if it were possible to isolate the bacillus of typhoid fever from water also containing *B. coli commune*. For this purpose flasks containing sterilized water were inoculated with 1 ccm. of a typhoid culture and also with 1 ccm. of a coli culture. Neither in the flasks to which carbolic acid had been added nor in those without this addition could living typhoid germs be found after 48 hours. When the author inoculated 1 litre of sterile water with 1 ccm. of a typhoid culture, and with only 2 drops of a coli culture, and made gelatin plates after 3 days, only colonies of *B. coli com.* grew up. As the typhoid bacilli, when alone in the water, were still alive after the same period, it seems to follow that their disappearance was due to the influence of *B. coli commune*.

Cow's Milk and Cholera.‡—According to Dr. W. Hesse fresh cow's milk, so far from being a cultivation medium for cholera bacilli, actually kills these germs. The destructive process begins directly the bacilli are placed in the milk, and it is over in 12 hours at a temperature of 15°–20°, or in 6–8 hours at incubation temperature. This destruction is independent of the acids in the milk or of the germs and their metabolic

* Rio de Janeiro (Leuzinger et Filhos), 1893. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 257.

† La Semaine Méd., 1894, p. 230. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 586.

‡ Zeitschr. f. Hygiene u. Infektionskr., 1894, p. 238. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 202–4.

products, but is an expression of the vitality of the living milk, and is instantly extinguished when milk is heated to 100° C. Exposure to the action of steam for 3 hours or more does not affect the germicidal power of milk, and this is to be ascribed to the increased acidity resulting from the action of steam. But an exposure to steam for less than 1½ hours renders milk a good cultivation medium. In a few days' time a reversal ensues, and this is probably the result of the growth of the bacilli, the formation of acid, and the coagulation of the casein. Yet even in acid and clotted milk viable cholera bacilli will be found at the expiration of a week. The practical outcome of these observations is that raw cow's milk is less suspicious than boiled as regards cholera bacilli.

Effect of Bile, Urea, and Borax on Cholera Bacilli.*—Herren H. Leo and R. Sondermann have studied the effect of bile, urea, and borax on the growth of cholera bacilli. Fresh ox-gall was discontinuously sterilized by heating it for several days to 60° C. The urea and borax were dissolved in water and then steam sterilized. When the medium (gelatin) contained 50 per cent. of bile, its influence was favourable to the growth of the comma bacilli; if considerably more it became unfavourable but never fatal. This promotion of growth was probably due to the increased alkalinity imparted to the medium through the bile, though increased fluidity probably had some influence, as experiments made by adding water showed. These two factors, increased alkalinity and fluidity, overcame the inhibitory effect of the bile acids. Hence in the organism the bile can have no inhibitory effect, as the intestine rarely contains 50 per cent. The addition of 1·45 per cent. of urea had an evidently restraining effect, and this increased with increase of the amount of urea, though more than 4·5 per cent. could not be added without affecting the solidification of the gelatin. A 10 per cent. solution of urea was found to kill cholera bacilli in 20 hours.

With regard to borax it was found that 1 : 1000 exerted an inhibitory action, but none was observable when the proportions were 1 : 5000. A half per cent. borax solution possessed bactericidal powers, while a 5 per cent. solution killed cholera bacilli in 17 hours.

New Diagnostic Criterion of the Bacillus of Typhoid Fever.†—Though *Bacillus typhosus* and *Bacterium coli commune* may usually be distinguished by their behaviour in sterile milk, in saccharated media, and in pepton water, a further criterion is sometimes desirable. This, says Sig. C. Gorini, may be found by adding 2 per cent. of urea to a gelatin cultivation of typhoid. On the first two days the organism grows in the usual way, but on the third or fourth the gelatin, which was rendered cloudy by the urea, clears up, and fine white granules, apparently crystals of carbonate of ammonium, which are disseminated throughout very regularly, appear in the medium. *Bacterium coli* also forms crystals, but these only accumulate in little heaps along the inoculation track. Besides this numerous gas-bubbles can be seen, and these are apparently due to the splitting up of the urea into carbonic acid and ammonia.

* Zeitschr. f. Hygiene, xvi. p. 505. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 198–9.

† Giornale d. Reale Soc. Ital. d' Igiene, 1894, No. 7. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 713.

Examining purulent Exudations for Bacteria.*—Dr. Heim adopts the following procedure for examining exudations, e. g. of the pleural sac, and especially for streptococci. Before proceeding to puncture, the contents of two glycerin-agar tubes are poured into the capsules and allowed to set. The exudation having been removed with proper precautions, some 1/2 ccm. is injected into the peritoneal sac of a mouse, and 1–2 ccm. into that of another. Stroke cultivations are next made on the agar plates, and these are incubated with the lid downwards. The rest of the exudation serves to make microscopical preparations. Should there be a suspicion of tuberculosis, 1 ccm. should be injected into the peritoneal sac of a guinea-pig, and this should always be done if the exudation be of a serous character. If capsule cocci be present the mice will die within 24 hours, and then microscopical preparations are easily made. The colonies of capsule cocci on agar plates are closer and less diffused than those of streptococci. The microscopical preparations in these cases show the lancet-shaped diplococci or chains of cocci. White mice are the animals most sensitive to streptococci, and when injected subcutaneously at the root of the tail die in from 2–7 days, and the cocci are demonstrable in almost every part and organ.

Sterilizable Injection Syringe.†—Prof. F. Loeffler recommends for experimental injections a syringe which can be sterilized by steam or alcohol-ether and which works satisfactorily. The piston-rod and its plunger are made of metal. The latter is a disc of thin metal with a sharp edge, and its diameter is such that the piston can be moved up and down without touching the inside of the syringe. Over the disc is stretched a thin rubber cap, which is fastened behind by silk thread or fine iron wire. When thus fitted and lubricated with vaseline or even water it glides up and down the canula quite easily if the proper thickness of rubber have been chosen. There is no escape of fluid behind the plunger. Syringes of this construction may be made to hold 1–50 ccm. of fluid. In order to ensure that the syringe works perfectly it is necessary that the internal diameter of the canula should be quite regular throughout, and that the plunger should not be too thick.

Filtration of Agar-agar.‡—The ordinary methods of filtering taking too much time, Dr. W. St. C. Symmers employs the method used at the Pasteur Institute. The important requisite in this method is the filter-paper known as the "papier chardin," made by Cogit et Cie. The agar-agar is heated in an autoclave to 120° C., and poured at once on to the filter-paper in a cold funnel. It filters as rapidly as nutrient gelatin does in the ordinary method, and a litre may be obtained in half an hour.

Hüppe, F., & A. Fajans—**Ueber Kulturen im Hühnerei und über Anaërobiose der Cholerabakterien.** (On Cultures in Fowls' Eggs, and on the Anaerobiosis of Cholera-bacteria.) *Arch. f. Hygiene*, XX. (1894) pp. 372–83.

Kleiber, A.—**Qualitative und quantitative bakteriologische Untersuchungen des Zürichseewassers.** (Qualitative and Quantitative Investigations on the Bacteriology of the Water of the Lake of Zurich.) Zurich-Oberstrass, 1894, large 8vo, 57 pp., 1 fig., 1 pl.

* Münchener Med. Wochenschr., 1894, No. 22. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 799–801.

† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 729–31.

‡ Brit. Med. Journ., No. 1765 (1894) p. 951.

LEMIÈRE, G.—**Un appareil simplifié pour la numération des bactéries.** (A simplified Apparatus for Counting Bacteria.) *Journ. Sci. Méd. Lille*, 1894, pp. 169-75.

UNNA, P. G.—**Natürliche Reinkulturen der Oberhautpilze.** (Natural Pure Cultures of Epidermal Fungi.) *Mtsh. f. Prakt. Dermatol.*, 1894, pp. 257-67.

(2) Preparing Objects.

Centrosomata.*—Dr. M. Heidenhain observed the following technique in his researches on centrosomata. For preserving he used especially sublimate and Flemming's acid mixture; for staining, Bordeaux R, Biondi's solution, iron-hæmatoxylin, triacid-solutions of Ehrlich. The best nuclear staining he has yet seen was got with thionin (Ehrlich-Hoyer). For differential staining he used, in the first place, Bordeaux R, anilin-blue, or methyl-eosin; but chiefly the first, then the iron-hæmatoxylin. The chapter on methods is well worth the attention of histologists.

Hardening of Chick's Egg in toto.†—As it is almost impossible to take out the contents of a fresh egg entire after the first week of incubation, Mr. S. Hirota recommends that the egg should be patiently tapped until the greater part of the shell is broken into small pieces; these should then be separately removed, and the underlying shell-membranes left intact.

If the egg has been in incubation less than two weeks, care should be taken not to injure the large blood-vessels of the allantois; if they are injured, the blood should be coagulated by blowing at the point. At this stage, as the contents are still soft, a large piece of shell should be left to support the envelopes in their relative positions till they have become hardened in Kleinenberg's fluid. Next day the fluid should be pipetted off and carefully replaced by alcohol.

When the egg has been in incubation for more than two weeks there is no danger of injuring the blood-vessels, even the inner shell-membrane can be removed without fear of bleeding if the whole be put in Kleinenberg's fluid for half an hour or even less. When the contents are entirely cleared from the non-cellular envelopes the specimen is put in the same fluid for half a day; the fluid, when it has done its work, can easily be replaced by alcohol.

In both cases yolk, albumen, and amniotic fluid should be removed, as these substances coagulate in alcohol, and cannot then be removed.

Examination of Pedal Gland of Pulmonates.‡—M. E. André used the methods of teasing when fresh, and teasing after maceration in various reagents as well as that of sections. As a macerating reagent he found 1 per cent. osmic acid and 1 per cent. bichromate of potash to be good, if used alternately for from two to seven days, when studying the glandular cells; for the epithelial cells of the excretory canal saturated solutions of boric and salicylic acids kept at a temperature of from 25° to 30° for two or three hours, and a 3 per cent. solution of chloral hydrate were found to be good, especially if a suitable nuclear stain was added.

* Arch. f. Mikr. Anat., xliii. (1894) pp. 423-758 (7 pls.).
† Journ. Coll. Sci. Imp. Univ. Japan, vi. (1894) pp. 367-9.
‡ Rev. Suisse Zool., ii. (1894) pp. 293-5.

Examination of Hirudo medicinalis.*—Dr. J. M. Croockewit killed his leeches with 96 per cent. alcohol, and put them into alcohol, to which was added picric acid to dissolve the carbonate of lime in the teeth, for a day; the best staining results were got with Böhmer's hæmatoxylin.

Mitosis in Ova of Ascaris.†—Herr V. Herla found the best fixative to be a mixture of 1 part of glacial acetic acid with 5 parts of absolute alcohol. His stain was a mixture of the following (parts by weight):—Vesuvin ·25, malachite-green ·25, distilled water 100, glycerin 10.

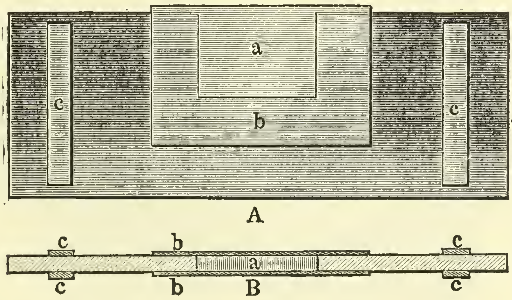
Division of Amœba.‡—Dr. F. Schaudinn fixed *Amœbæ* with hot concentrated sublimate, or in platinum chloride-osmo-acetic acid (Herrmann), or in Kleinenberg's picro-sulphuric acid. He washed them in the first instance with 63 per cent. iodine-alcohol, in the second with water, in the third with 63 per cent. alcohol. Those fixed with sublimate were best stained with iron-alum and hæmatoxylin (Benda-Heidenhain), but Ehrlich's hæmatoxylin, &c. yield good results.

(3) Cutting, including Imbedding and Microtomes.

Micro-Aquarium which can also be used for Paraffin Imbedding.§—Dr. F. Schaudinn has devised a small cover-glass aquarium to replace the Cori stage-aquarium when small organisms not visible with the unaided eye are to be examined.

In an ordinary slide is cut a rectangular opening *a* which reaches about up to the middle of the slide. On each side of this, cover-glasses

FIG. 20.



b are cemented by Canada balsam, as seen in the figure (fig. 20). On both sides of the cover-glasses small strips of glass *c* are cemented. In this way a small aquarium is obtained into which water and creatures can be introduced by means of a pipette. The slide can be used in the horizontal position, since owing to capillarity no water can flow out.

For keeping the water fresh, green algæ can be used or fresh water can be introduced by means of a woollen thread.

For the observation of living organisms the aquarium offers the advantage that even with high magnification the whole space can be easily examined.

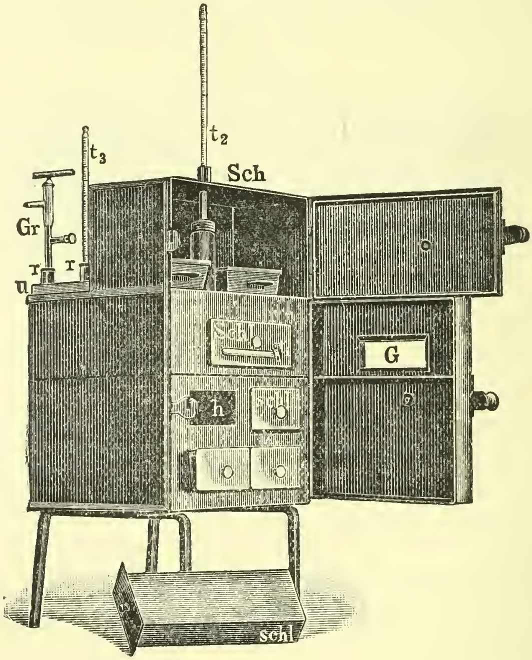
Organisms which have fastened themselves on the walls of the cover-

* Tijdschr. Nederl. Dierk. Vereen, iv. (1894) pp. 297 and 8.
† Arch. Biol., xiii. (1893, published 1894) pp. 423–50 (5 pls.).
‡ SB. K. Preuss. Akad., 1894, pp. 1029–36 (5 figs.).
§ Zeitschr. f. wiss. Mikr., xi. (1894) pp. 326–9.

glass can be killed in this state, and after removal of the water preserving liquid can be introduced. The colouring and hardening of creatures so fixed is very convenient. The author has also used the aquarium for the imbedding of small objects in paraffin. For *Amœbæ* and similar organisms, for example, a triangular piece is cut out of the slide, and the cover-glasses are cemented on with isinglass. The creatures introduced sink to the bottom into the point of the triangle. The xylol in which they were preserved is removed and replaced by paraffin. The slide is then placed in cold water, when the paraffin solidifies and separates from the walls of the aquarium. The isinglass at the same time dissolves in the water, and the paraffin-block thus set free is ready for cutting.

The aquarium can also be used for orienting small objects for cutting. For this purpose some of the very finely fibrous material sold under the name of Penghawar-Djambie is introduced with the xylol into the aquarium. A small round hole is made in this with a rounded wooden rod, and the object to be oriented is placed in it. The object is held in any desired position by means of the fine fibres and can be readily adjusted under the Microscope. The xylol can then be replaced by paraffin, or the orientation can be originally made in paraffin on the hot stage.

Fig. 21.

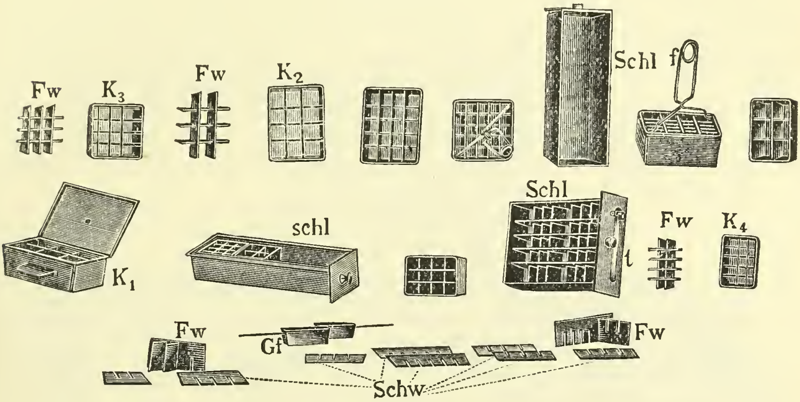


Apparatus for Paraffin Imbedding.*—Dr. A. Kolossow describes an apparatus for imbedding objects in paraffin, which though much

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 154–61 (5 figs.).

dearer than the Naples water-bath, is more suitable for paraffin imbedding. The apparatus consists of a quadrangular box of copper (fig. 21), tinned on its inner surface. It is about 24 cm. broad and 26 cm. high, and it is divided by a horizontal partition into two compartments, the upper being 10 cm., the lower 16 cm. high. In the upper one and in the lower are four spaces for the reception of drawers made of nickeled copper. The drawer-cases are supported by upright pieces. On the top of the front of the box is a cupboard, behind which is a free space of 10 cm. To the bottom of the cupboard and to the top of the box a sort of damper, in which is a double row of holes 15 cm. in diameter, is fitted.

FIG. 22.



At the top left corner are two openings, both of which communicate with the lower department, and through which it can be filled with water. In one is fixed a thermometer t_3 and in the other a gas-regulator. The level of the water is marked by a tube. At the bottom of the box is a tap for letting off the water. The thermometer t_2, the end of which dips into a glass vessel filled with water, indicates the temperature of the cupboard, and that of the top drawer is given by t_1. Three temperatures, with differences of about 8° C., are obtained by this apparatus, and this is a desideratum in paraffin imbedding.

Fig. 22 shows the subsidiary parts of the apparatus, and these are intended for the drawers and for the cupboard; their use is too obvious to require description. One point in connection with the shape of the drawers, &c. may be alluded to and that is the sloping back and sides of the trays and drawers. This has some practical value, for when the paraffin has set it allows the whole lot of blocks to be taken out with ease.

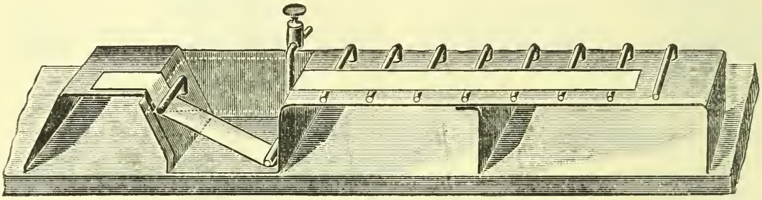
Cutting and After-treatment of Paraffin Ribbon Sections.*—Dr. G. C. van Walsem advocates the use of hard paraffin to which about 5 per cent. of cera flava has been added for cutting sections with the Minot-Zimmermann microtome. To this instrument, which is preferred

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 207–36 (4 figs.).

to the Degroot or Reinhold-Giltay microtomes, the author has adapted some subsidiary apparatus for facilitating the cutting of ribbon sections. The first of these is an arrangement for warming the knife. This consists of a kettle, heated by a spirit-lamp, which is placed on the right-hand side of the microtome. To the spout is connected a long rubber tube, passing along close to the back of the knife, its other end dropping into a vessel on the left of the microtome. The steam passing through the tube is found to impart sufficient warmth to the knife to prevent the sections curling, and also to render cutting more easy. The knife is placed at such an angle that the sections do not touch the blade, but are passed on to the ribbon frame. By a simple device the microtome is worked with a treadle, thus leaving both hands free for manipulation.

The sections, which have been received on long strips of thin parchment paper, are then immersed in 70 per cent. spirit, preparatory to being stretched. During this process the sections not unfrequently get lifted by the development of air-bubbles underneath, and to get rid of these the author uses a special apparatus (fig. 23). As will be seen it is a pan having a plate on either side, that on the right 36 cm. long, being divided up by wire partitions 0·5 cm. thick and 4 cm.

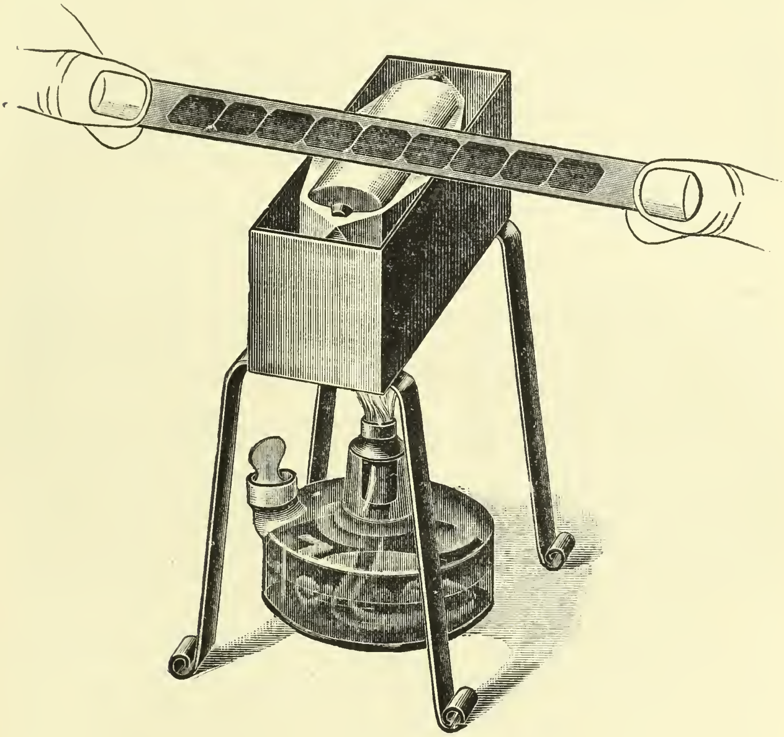
Fig. 23.



apart. The pan, filled with 70 per cent. spirit, is 6 cm. high and its bottom 10 cm. × 10 cm. The right side is vertical, the left slopes. The plate on the left has a leg inside the trough parallel to the oblique side, and can therefore be moved to and fro. To this leg is soldered a wire at such a distance that it is about 0·5 cm. below the level of the fluid (see fig. 23). On the right side is another wire parallel to and 0·5 cm. above the bottom of the trough. This is also movable to and fro by means of a screw. By passing the strips of paper, which have been placed on the long plate, underneath the two wires and through the fluid, a perfectly smooth surface is obtained. If necessary they can, when they are lying flat on the left plate, be cut up into strips. The strips are then passed rapidly over a roller placed in a vessel filled with water heated to 60°–70° C. (fig. 24). The apparatus is merely a copper tank in which a glass or porcelain roller is placed. The measurements of the tank are 12 × 5 × 5 cm., and the roller projects 0·5 cm. above the top. By passing the bands to and fro as indicated in the illustration, the sections are damp-stretched.

As a solvent to the paraffin the author expresses his preference for benzin, and then goes on to consider how the section should be stuck. Two great divisions are made: (1) where the sections are to be examined unstained or where the object has been stained *in toto*. (2) Where the sections are to be stained. Under (1) an adhesive of the following composition is given: turpentine oil 1, 20 per cent. aqueous solution of gelatin 2. This makes an emulsion which may be spread on with the fingers. When the sections are placed on this layer they are to be pressed down with filter-paper and then allowed to dry in the air. This procedure is only intended for sections which are not large or of such a nature that they do not crumple, &c. when treated with the paraffin solvent. In such case the section-strips must undergo a previous treatment, and this at the stage when they are removed from the ribbon frame just after

FIG. 24.



cutting. The one surface must then be covered with a layer of 20 per cent. gelatin solution. When dry the strips are placed in 50 per cent. spirit and then damp-stretched. By this they are made to adhere to the strips, after which, having been dried in air, they are placed in benzin. When the sections are to be stained the adhesive recommended is turpentine oil 1, 2 per cent. aqueous solution of bichromate of potassium 1, 20 per cent. aqueous solution of gelatin 3. This emulsion must always be freshly prepared. When a soft and flexible underlay is requisite, then the slides must be coated with a 10 per cent. solution of gutta-percha in carbon disulphide, and when the disulphide has volatilized a coating of Ol. Ricini 3 vols., absolute alcohol 2 vols., is laid on. In this way very large sections can be laid on evenly after smoothing them down by pressing on several folds of filter-paper. If now placed in absolute alcohol the strips come away, leaving the sections adhering.

Many more details are given by the author as to the treatment of paraffin sections, but we have only space to indicate the more salient features of his procedure.

(4) Staining and Injecting.

Staining Nervous System of Insects.*—M. A. Binet has obtained his best results by using sublimate and osmic acid as fixing agents; certain parts of the dotted substance take on a deep stain, under the influence of osmic acid, and this stain distinguishes them from other regions, and allows of the delimitation of certain important lobules. The best fluid in which to make a rapid dissection of the nervous system is the blood of the insect itself. Permanganate of potash will reduce sections which have been blackened too deeply by osmic acid, and care must be taken, as too long treatment will result in the complete transparency of the sections.

Like others, M. Binet has found great use in corrosive sublimate. Pieces fixed with it may, after the method communicated to the author by M. de Nabius, be treated for a day with a 1 per cent. solution of sulphate of copper; they should then be washed for six hours, and then stained for twelve in a solution of 0·05 gr. hæmatoxylin, 15 ccm. of absolute alcohol, and 25 ccm. of distilled water; there should then be another bath of the same solution of sulphate of copper, and dehydration by various strengths of alcohol.

Staining Nervous System of Embryonic Crustacea.†—Mr. E. J. Allen found that embryos of the Lobster were the most convenient for his purpose, as the fibres are coarser than in most embryonic Crustacea, and the thoracic ganglia can be exposed with comparative ease. He is in the habit of keeping a standard solution of methylen-blue of 1/10 per cent. in normal salt solution; this is diluted with 15 or 20 volumes of a mixture of three parts of sea-water to one of fresh immediately before use. The staining is most satisfactory at a temperature of 20° to 25° C. The embryos are placed on a slide with the thoracic ganglia uppermost, and covered with methylen-blue solution. The process of staining may be watched under the Microscope; no cover-glass should be used. The preparations may be fixed in a solution of ammonium picrate containing an excess of ammonium carbonate, and mounted in glycerin diluted with an equal volume of the fixing solution. They do not appear to be quite permanent, and the best way is to examine a very large number of fresh preparations. In dealing with methylen-blue it must always be remembered that one cannot be sure that the whole of the element has taken up the blue.

Staining of Myelin and Fat by Osmic Acid or Tannin.‡—Dr. L. Azoulay has tried to fix osmic acid on the myelin of nervous tissue or on fat, and then to reduce it by tannin or its analogues. To do this he

* Journ. de l'Anat. et de la Physiol., xxx. (1894) pp. 468–74.
† Quart. Journ. Micr. Sci., xxxvi. (1894) pp. 461–4; 483–5.
‡ Anat. Anzeig., x. (1894) pp. 25–8.

makes very fine sections of pieces which have been for some months in Müller's fluid; after putting them in 90 per cent. alcohol he washes them lightly with water to get rid of the alcohol. They are then immersed for from 5 to 15 minutes in a 1/500 or 1/1000 solution of osmic acid, washed in water, and then immersed in a solution of 5 per cent. or 10 per cent. tannin, and heated to 50° to 55°; after about 5 minutes they may be washed several times in water, have a double stain or carmine or watery solution, and be mounted in the usual way.

The sections thus treated are brown or black in the white substance, and grey in the grey; it is only the myelin that is stained. An advantage of this method is that, the coloration not being diffused as by the Weigert or Weigert-Pal method, the fine structure of the fibres can be studied.

The sections should be thin; if they are too thick they should, after the final washing in water, be decolorized by Pal's method.

Another method is to take fine sections from the alcohol in which they have been lying and to wash them lightly with water, put them in a warm bath of 5 or 10 per cent. tannin for 3 to 10 minutes, wash in water, decolorize or not, wash for a long time in water, double stain or not, and mount in the ordinary way. This method is simple, rapid, safe, and cheap. Could more be demanded of it?

Staining of Centrosomes.*—Herr G. Karsten states that the same staining reagents are not applicable for bringing out the directing spheres (centrosomes) in the case of plants as of animals. No one reagent has been found to answer in all cases. The best results were obtained by the following method of treating vegetable cells:—The material was fixed either by a mixture of 0·5 gr. chromic acid and 0·2 gr. osmic acid in 100 of water, or by one of 0·5 gr. platinum bichloride and 0·5 gr. chromic acid in 100 of water, or by absolute alcohol. The staining reagent used was a mixture of Weigert's acid fuchsin and Grubler's methyl-green 0·0. After allowing a sufficient period, the centrospheres and protoplasm are coloured red or rose, while the nuclear chromosomes retain their green colour even after washing with absolute alcohol. Coccinin may also be used with advantage for staining the protoplasm and the centrospheres.

Staining Reaction of Sputum.†—Dr. C. Zenoni, not being satisfied with Schmidt's method for the differential diagnosis of pneumonia and bronchitis, adopted a saturated solution of safranin instead of the Biondi triple stain, which imparted to mucoid bronchitic sputum a greenish-blue hue, and to the pneumonic a red, tending to violet. With the safranin the mucoid elements are stained sulphur yellow to brownish yellow, the albuminous red or reddish yellow. The cover-glass preparations are first fixed for 1/4 hour in alcohol, and then stained with a semi-saturated solution of safranin. Leyden's spirals showed a difference of colour in the central and outer parts of the spiral. According to the author, the method is very good for making a differential diagnosis between bronchitic and pneumonic sputum, even on macroscopic examination.

* Journ. de Bot. (Morot), viii. (1894) p. 245.
† Centralbl. f. wiss. Med., xv. (1894) p. 257. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 667.

Eosinophilous Cells of Gonorrhœal Pus.*—Dr. G. Caneva stains cover-glass preparations of gonorrhœal discharge with a saturated solution of eosin, and in this way is able to distinguish two kinds of eosinophilous elements, the difference consisting in the size of the granules. The first kind of eosinophilous cell is of medium size, usually mononuclear, and the granules are about the size of gonococci. These are of rare occurrence in the acute form of gonorrhœa. The second sort of eosinophilous cell contains very fine granules, and the cell may be mono- or polynuclear. In the acute form these cells predominate. If the eosin stain is followed by saturated methylen-blue solution the microscopical picture is altered. The rose-red gonococci now become blue and are easily distinguished from the first described granules. If the methylen-blue solution be allowed to act longer than five minutes, the second kind of granules become decolorized and the decoloration is hastened by the addition of phenol or alcohol to the staining solution. The gonococci are invariably found in the eosinophilous cells of the second kind and never in the first. In cases of chronic gonorrhœa the number of cells of the first kind and of free gonococci increases. The latter are stainable by Gram's method if, instead of using alcohol as a decolorizer, anilin oil be mixed with an equal volume of xylol or oil of cloves.

Media for distinguishing between Bacillus typhi abdominalis and Bacillus coli communis.†—Herr Marpmann has found that media to which reduced pigments have been added are extremely suitable for diagnosis, and has applied this method for distinguishing between *Bacillus typhi abdominalis* and *Bacillus coli communis*. In the first series 1·grm. of fuchsin is dissolved in 100 parts of water and decolorized with sodium bisulphite solution, and after having been mixed with 2 per cent. agar or gelatin is placed in test-tubes and sterilized. The red colour reappears on the addition of an aldehyde, and as the same reaction occurs after inoculation with certain cultures, it would seem to follow that these microbes produce aldehyde.

In the second series malachite-green is used instead of fuchsin, and this pigment appears to be more suitable for the purpose, as with fuchsin it is necessary to add a greater quantity of bisulphite, which is sometimes detrimental to cultures. Malachite-green, which in itself is very sensitive, is better used in conjunction with agar than with gelatin, and affords a means of discriminating between different species of bacteria by the colour of the growth, that of *B. typhosus* being dark green, and that from *B. coli com.* being greyish white. *Vibrio choleræ*, *V. Metchnikovi*, *Bac. liquefaciens*, *B. typh. murium*, are green, while *Spirillum rubrum* and some cocci and Saccharomycetes are colourless.

In a third series agar was blackened by means of indulin or nigrosin, aqueous solutions of these pigments being added until the agar became non-transparent. On such media micro-organisms grew well, and differences were observable between the typhoid-like bacteria.

Staining Anthrax.‡—Dr. Johne gives a method for staining the gelatinous sheath of anthrax bacilli, and the procedure is as follows:—

* La Riforma Med., 1894, No. 25. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 654. † Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 817–20.

‡ Deutsche Tierärztliche Wochensch., 1894, No. 35. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 871.

The cover-glass preparation, dried in air, is covered with 2 per cent. aqueous gentian-violet solution, and warmed until it begins to vaporize; after this it is washed in water, and next treated with 2 per cent. acetic acid for 6–10 seconds, and then washed in water again.

New Staining Process.*—Dr. O. Zacharias recommends the following process for both animal and vegetable preparations. The material is laid in 70 per cent. alcohol, and then, for from 16 to 54 hours, in acetic-carmine, prepared by boiling 1 gr. powdered carmine for 20 minutes in 150–200 gr. dilute acetic acid, and filtering when it has become cold. The preparation is washed in dilute acetic acid, and then placed for from 2–3 hours in ferric-oxide-ammonium-citrate.

Staining and Fixing of Diatoms.†—Dr. P. Miquel finds the staining reagent best adapted for demonstrating the gelatinous envelope of diatoms to be an aqueous or boric solution of methylen-blue, which is not taken up so readily by the gelatinous stipe. The same reagent, especially in a slightly ammoniacal solution, may be used for demonstrating the nucleus, which is stained blue, while other substances contained in the cell take from it a dark blue-violet stain. For fixing, the author uses a solution of 65 gr. corrosive sublimate and 15 gr. sodium chloride in 100 ccm. of water.

Easy and Rapid Method for Removing Picric Acid from Tissues.‡—Herr O. Jelinek uses both picric acid alone and in conjunction with sublimate as a fixative. In the first case it is a saturated aqueous solution, in the latter it is a saturated aqueous solution of picric acid with an equal bulk of a saturated solution of sublimate in physiological salt solution. The piece of tissue should be very small, and immersed in 30–50 times its bulk of fluid for 1–24 hours. To 100 ccm. of the fluid it is often useful to add 5 ccm. of acetic or formic acid. When properly fixed the pieces are to be transferred to alcohol, the strength of which must be gradually increased until absolute alcohol is reached. The pieces should be often moved about and the alcohol frequently renewed. By transferring the sections (celloidin sections) to a saturated solution of carbonate of lithia the picric acid is easily dissolved out. Afterwards they are washed in distilled water and stained in the usual way with hæmatoxylin or other dyes.

By a similar process picric acid may be removed from comparatively large pieces. In this case it is best to proceed as follows:—To a saturated aqueous solution of lithium carbonate add a few drops of 95 per cent. alcohol until a faint white precipitate falls. In this turbid fluid immerse the object to be fixed. Then keep on adding to the fluid, which has now become clear, solution of lithium carbonate until the precipitate no longer dissolves, and alcohol, which of course must be frequently changed so long as the yellow colour shows itself. The tissue or piece then appears white, just as if it had been fixed in sublimate. Last of all transfer it to 95 per cent. spirit to free it from the last traces of lithia, and thereupon treat in the usual way.

* Forschungsber. Biol. Stat. Plön (Zacharias) Pts. 1, 2, 1893, 94. See Bot. Centralbl., lx. (1894) p. 137.
† Le Diatomiste, ii. (1894) pp. 107, 112.
‡ Zeitschr. f. wiss. Mikr., xi. (1894) pp. 342–6.

Neutral Red.* — According to Prof. Ehrlich this new pigment, neutral red, is excellently adapted for biological researches and vital staining, as it possesses a striking affinity for living tissues. If tadpoles be placed in solutions of 1–10,000 up to 100,000 the animals become stained in quite a short time, and during the first and second day of their immersion absorb so much of the pigment that all their tissues become dark red. The pigment may be seen in the cells as minute granules. Larger animals may be subcutaneously injected, and even feeding with the pigment gives good results. In germinating plants the author obtained successful staining results, and by combination with other pigments, e. g. methylen-blue, &c. a double or triple staining.

Demonstration of the Presence of Iron in Granules of Eosinophile-Leucocytes.† — Dr. L. F. Barker, after noticing Dr. A. B. Macallum's ‡ method for the demonstration of iron in chromatin, gives the following account of his own method for the micro-chemical demonstration of iron. "In my experiments cover-glass preparations, such as are employed for the colour analysis of the leucocytes according to the methods of Ehrlich, were heated on the copper bar at a temperature of 120° C. for from one to two hours, and were then treated in the following way :—A drop of solution of ammonium sulphide, prepared just before using, was placed upon the smeared surface of the cover-slip, and this was immediately laid upon a drop of glycerin, the glycerin and sulphide solution mixing, upon a large thick glass slide. The preparation was then placed in the thermostat at 60° C. Once as early as after 6 hours, but usually at the end of 24 hours, and more markedly at the end of 48 hours, the greenish-black iron reaction in chromatin of the nuclei of the white corpuscles was apparent in the specimens. By this time the hæmoglobin of the red corpuscles had assumed only a slight greenish tint. In an occasional leucocyte, however, granules of the size and shape of the eosinophile granules were very distinctly stained yellowish-green.

To make sure that the granules were really those of the eosinophile leucocytes (although the morphology of these granules is in itself so typical that they can, as a rule, be recognized in fresh unstained specimens of blood), some cover-slip preparations, known by control-studies of slides stained with the triple stain to contain a much larger number of eosinophile leucocytes than normal, were submitted to the same test. In these too, the eosinophile granules stained sharply. The blood taken from a patient whose blood contained 18 per cent. of eosinophiles yielded very striking pictures.

The granules in the sulphide-glycerin preparations do not assume quite the same tint as do the nuclei of the leucocytes; the latter are stained greenish-black and have a dull appearance. The eosinophile granules, by contrast, are more highly refractive, and while stained greenish-black show also a slight yellowish tint.

Osmic-Iron-Hæmatoxylin Staining Method.§ — Dr. Kaiser treats the central nervous system in the following way :—The pieces are placed

* Allgem. Med. Centralzeit., 1894, p. 20. See Zeitschr. f. wiss. Mikr., xi. (1894) p. 250.
† Bull. Johns Hopkins Hospital, v. (1894) p. 93.
‡ Proc. Roy. Soc., l. (1892) pp. 277–86. See also this Journal, 1891, pp. 82–9.
§ Neurol. Centralbl., xii. (1893) pp. 363–4. See Zeitschr. f. wiss. Mikr., xi. (1894) pp. 249–50.

in Müller's fluid, and after two or three days they are cut down to slices of 1–2 mm. thick. These slices are immersed in Marchi's fluid (Müller's 2 parts, 1 per cent. osmic acid 1 part) for 8 days. After removal they are washed, then hardened in alcohol, and imbedded in celloidin. The sections are now placed for about 5 minutes in a mixture of Liq. ferri perchlor. 1 part, H_2O 1 part, rectified spirit 3 parts, and then in Weigert's hæmatoxylin solution, which is heated for a few minutes. The fluid must not boil, as the celloidin is easily crumpled. After washing in water they are differentiated by Pal's method. The oxalic acid is neutralized by washing in ammoniated water, by which the colour is often intensified. The nerve-fibres are stained dark brown or black. The nuclei of the ganglion cells are a blackish brown.

Ehrlich's Triple Stain.*—Dr. G. Reinbach gives a formula for the triple stain as improved by Ehrlich. The author used it for staining cover-glass preparations of blood. Its composition is as follows:—Saturated aqueous solutions of orange G, 120 grm.; acid rubin, 80 grm.; methyl-green, 100 grm.; H_2O, 300 grm.; absolute alcohol, 180 grm.; glycerin, 50 grm. The aqueous solutions must be saturated. The mixture is not to be shaken, but the necessary quantity should be pipetted off. The fixed cover-glass film is treated with the solution for 5 to 10 minutes; the superfluous stain is washed off with distilled water, the surface dried with blotting-paper, and the preparation mounted in balsam.

Flagella-Staining.†—Herr R. Bunge obtained very good results from using cultures which had been incubated for 24 hours and then kept at the room temperature for another two days; even cholera spirilla were very successful. The preparations must not be too strongly fixed with heat. Instead of carbol-fuchsin, carbol-gentian-violet was used. The mordant used was that already noticed in this Journal.‡ One very important result of the author's experiments was that a differential diagnosis between *B. typhosus* and *B. coli commune* could not be made by the number of flagella, for the latter microbe often had more than the former. The author was also able to demonstrate at the same time in the organisms examined by him, *Proteus*, *B. coli*, *B. typh.*, cholera, subtilis, both flagella and capsules. The method was as follows:—The cover-glass preparations are first treated as already described.§ They are then immersed for 1/2–1 minute in 5 per cent. acetic acid, after which they are washed and dried. The preparations are thereupon mordanted three or four times, the washing being done after the manner of Nicolle and Morax. This over, the preparations are dried, and then stained with gentian-violet; this step is followed by 1/2–1 minute in 1 per cent. acetic acid. After this, they are washed in water and dried. A three days' old culture is best suited for this procedure.

BOECK, C.—**Neues Verfahren bei der Färbung der Mikroparasiten auf der Oberfläche des Körpers.** (New Process in Staining Micro-parasites on the Surface of the Body.) *Mtsh. f. Prakt. Dermatol.*, 1894, pp. 467–70.

* Arch. f. Klin. Chirurg., xlvi. (1893) pp. 486–562 (1 pl.). See Zeitschr. f. wiss. Mikr., xi. (1894) pp. 258–60.
† Fortschr. d. Med., xii. (1894) No. 17. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 700–1. ‡ 1894, p. 640. § Loc. cit.

BUNGE, R.—Ueber Geisselfärbung von Bakterien. (Staining Flagella of Bacteria.) *Fortschr. d. Med.*, 1894, pp. 462–4.

VINCENT, H.—Sur un nouveau mode de coloration des microorganismes dans le sang. (On a new Means of Staining Micro-organisms in the Blood.) *Compt. Rend. Soc. Biol.*, 1894, pp. 530–1.

(5) Mounting, including Slides, Preservative Fluids, &c.

Preservation of Sea-weeds.*—Dr. J. P. Lotsy recommends the following method of preserving specimens of Florideæ, which prevents swelling of the cell-walls or contraction of the protoplasm, and preserves the chromatophores uninjured. The specimen is first laid in a 1 per cent. solution of chrome-alum in sea-water, and kept there for a period varying from 1 to 24 hours, according to the size and texture of the species. The chrome-alum is then completely washed out, and the specimen placed in a mixture of 5 ccm. of 96 per cent. alcohol in 100 ccm. water, and vigorously stirred. The amount of alcohol is then increased by increments of 5 ccm. every quarter of an hour until it amounts to 50 ccm. The specimen is then removed, and placed in a mixture of 25 per cent. alcohol in distilled water, and the quantity of alcohol again increased in the same way till it amounts to 50 ccm. alcohol to 100 ccm. of water. The same process is again repeated with 50, 60, 70, 80, and 90 per cent. solutions of alcohol in distilled water; the specimens being finally preserved in the last.

New Fixing-material.†—Under the name "chrome-potash-sublimate-glacial-acetic-acid" (*Chromkali-sublimat-Eisessig*) Herr Zenker recommends a fixing material for vegetable tissues which has the advantage of penetrating the tissue readily, without producing any shrinking. Its composition is as follows:—100 parts distilled water, 5 sublimate, 2·5 double potassium chromate, 1 sodium sulphate, 5 glacial acetic acid. It may also be used for preparations of the nervous system.

(6) Miscellaneous.

Cobalt-test for Transpiration.‡—The property of salts of cobalt of changing in colour according to the degree of moisture in the air, is employed by Prof. E. Stahl to determine the intensity of the transpiration from leaves. A useful material for that purpose is Swedish filter-paper which has been soaked in a 5 per cent. solution of cobalt chloride. This, when dry is intensely blue, passing, when moistened, through all shades to pale red. The freshly gathered leaf, or other part of the plant, is placed between two glass plates covered with freshly dried cobalt-paper. The amount of vapour given off by the leaf is shown by the extent of change in the colour of the paper.

Action of Chemical Reagents on Vegetable Spermatozoids.§—M. W. Belajeff states that if spermatozoids (of Characeæ) are subjected to a 10 per cent. solution of sodium chloride, the central portion is quickly dissolved; if previously stained with iodine-green, a rapid

* Bot. Centralbl., lx. (1894) pp. 15–6.

† Münch. Med. Wochenschr., xxvii. (1894) p. 532. See Bot. Centralbl., lx. (1894) p. 45.

‡ Bot. Ztg., lii. (1894 1te Abtheil., pp. 118–9.

§ Flora, lxxix. (1894) Ergänzungsbd., pp. 40–3.

swelling of the coloured portion is observed. The anterior and posterio-ends are unchanged, as well as the cilia, but the two ends remain connected by a fine thread. If the same solution is applied to the spermator genous cells, the nuclei swell up, and finally are dissolved.

If the spermatozooids are immersed for 24 hours in 0·5 per cent. hydrochloric acid, the central portion contracts, though it is still stained by iodine-green; the number of coils is reduced from $2\frac{1}{2}$ to scarcely one. The anterior portion and the cilia undergo no essential change; numerous refringent granules or drops appear in the swollen posterior portion. This solution produces but little change in the spermatogenous cells.

In a mixture of 1 part pepsin-glycerin and 3 parts 0·2 per cent. hydrochloric acid, after 24 hours the anterior end and the cilia of spermatozoids are still retained within the mother-cell disappear; the central portion and the coils become narrower and closer. If free spermatozoids are placed for some minutes in gastric juice, the anterior end becomes finely granular, the cilia disappear, the central portion becomes shorter and strongly refringent, the posterior end swells and becomes coarsely granular.

In a fluid containing trypsin prepared after Kühne's method, the spermatozoids are finally completely absorbed, the process beginning with the central portion.

These chemical reactions point to the same conclusion as the staining reactions, viz. the correctness of Belajeff's view,* that the central portion only of the spermatozoid is derived from the nucleus of the mother-cell, the anterior and posterior ends and the cilia from the cytoplasm.

Determination of Coniine and Curcumine.†—Herr A. Rossol gives the microchemical reactions, and the mode of demonstrating the presence of these two substances, the former in the tissues of the hemlock, the latter in the rhizome of *Curcuma longa*. Coniine he finds especially in the meristem of the growing point, and in the parenchyme of the sieve-portion of the vascular bundles. The action of potassium biniodide causes a red-brown precipitate soluble in sodium hyposulphite. Curcumine occurs in the parenchyme of the rhizome dissolved in an etherial oil. It is nearly insoluble in cold water and in glycerin, soluble with difficulty in hot water, in benzol, and in carbon bisulphide, readily soluble in alcohol and in ether, the latter solution showing a green fluorescence. Alkalies dissolve it with a red-brown, acids with a carmine-red colour; this reaction with concentrated or moderately dilute sulphuric acid is the most useful.

Sounding for Diatoms.‡—In the most recent of his series of papers on the technique of diatoms, M. J. Tempère describes the best modes of sounding (*sondages*) for diatoms, and of extracting them from the material thus obtained. When mud or sand has been obtained by dredging, the best mode of determining the presence of diatoms is the system of floating (*flottage*). The material is repeatedly agitated in water in a basin, and the scum which forms on the surface ladled off by

* Cf. this Journal, 1893, p. 662.

† JB. Nieder-öst. Land-Oberrealsch. Wiener-Neustadt, 1894. See Bot. Centralbl., lx. (1894) p. 174.

‡ Le Diatomiste, ii. (1894) pp. 122–5.

a spoon. In this will be found the diatom-frustules, supported by the air which they contain, and they have then simply to be separated by repeated filtering.

Isolation of Rennet from Bacteria Cultures.*—Prof. H. W. Conn describes seven bacteria which possess the power of producing a rennet ferment in large quantities. For the detailed description of the microbe the original should be consulted. The method of isolating the ferment is as follows:—"The bacteria in question are cultivated in milk for several days, and in some cases for two weeks. By this time the curd is precipitated and at least partially dissolved, and the result is a somewhat thick liquid containing of course immense numbers of bacteria. This liquid is filtered through a porcelain filter to remove the organisms, and a clear, usually amber coloured filtrate is thus obtained. The filtrate contains in solution all of the soluble chemical ferments which may have been formed by the bacteria. This filtrate is now acidified with H_2SO_4 and then common salt added to a state of supersaturation. When this condition is reached there appears on the surface of the liquid a considerable quantity of snow-white scum. This scum is removed from the liquid, purified if necessary by precipitation, and then dried. It produces a snow-white powder, which upon experiment is found to be active in this curdling action upon milk, and to have all the essential characters of rennet. The ferment thus obtained is not chemically pure, containing, besides the rennet ferment, a varying amount of the tryptic ferment formed at the same time; but the rennet ferment is most abundant and very active. This ferment can be kept indefinitely, is killed by heat, acts best at a temperature of 30–35° C., and curdles sterilized milk under proper conditions in half an hour. Experiment shows that no organisms are present in the curdled milk, and there is thus no doubt left that we are dealing with a chemical ferment similar to rennet, and which is produced by the growth of these micro-organisms in milk. The ferment does not appear to be exactly identical with rennet, some of its chemical tests being different. This may be due to the impurities which are present or to an actual difference in the ferment."

Buttersack's Vaccinia Microbe.†—Dr. A. Dräer has examined preparations made from vaccine pustules, serum, blood, saliva, and egg albumen, for certain forms described by Buttersack as occurring on vaccinia pustule. In 64 per cent. of the preparations the Buttersack body was present, and the author comes to the same conclusion as Landmann, viz. that these appearances are entirely artificial, and can be produced in any albuminous fluid by the method of preparation.

The method was to treat cover-glass films for 15 minutes with a 7 per cent. nitrate of soda solution, and then for an equal length of time with 5 per cent. sulphuric acid. The cover after having been washed for an hour was dried, placed on a slide, and examined. The cover was fixed by small bits of wax, and the medium through which the preparation was viewed was, of course, air.

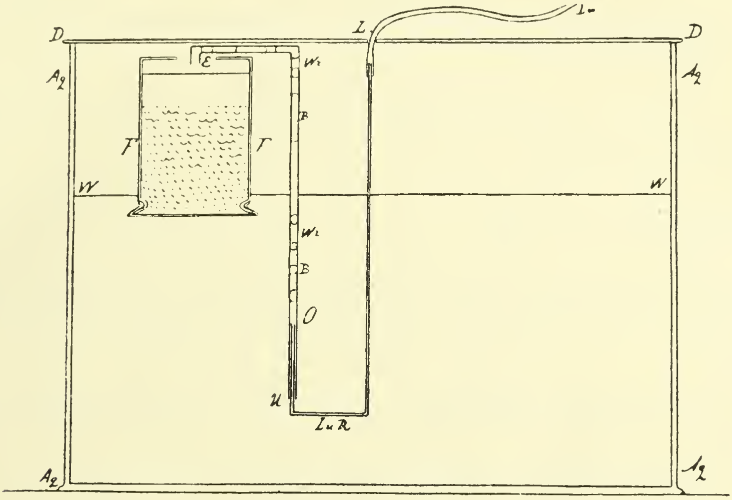
* Science, xx. (1892) p. 1892; and also Fifth Report of the Storrs School of Agriculture, 1892, pp. 106–26.

† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 561–4.

Aquarium Filter.*—Prof. R. v. Lendenfeld has devised a simple method for filtering sea water in an aquarium without pouring out the water and without disturbing the sand layer at the bottom.

In the aquarium A_2 (fig. 25) which is closed with a cover, the level of the water stands at W. For freshening the water air is introduced by the tube L *u* through the hole L in the cover, and passing down the thin tube L *u* R rises in bubbles from the end O. The end of the thin tube

Fig. 25.



L *u* R passes up into a wider tube W *r*, which after a double bend dips into the filter F. In this tube the air-bubbles rise and carry with them water which enters at its lower end and flows out at E into the filter.

By regulating the stream of air it is possible to regulate the amount of water so that the filter shall always be nearly full, but not run over.

Ink-Crystals.†—Dr. E. Trouessart says that ink-crystals can be procured by allowing a drop of ink to dry on a slip of glass, and be seen by powers magnifying from 50 to 200 diameters. Different inks give somewhat different crystals, but the chemical composition of none of them is yet exactly known.

* Zool. Anzeig., xvii. (1894) pp. 431–2.
† See Nature, li. (1894) pp. 60 and 1 (1 fig.).

PROCEEDINGS OF THE SOCIETY.

Meeting of 19th December, 1894, at 20 Hanover Square, W.
The President (A. D. Michael, Esq., F.L.S.) in the Chair.

The **Minutes** of the meeting of November 21st, 1894, were read and confirmed, and were signed by the President.

The **List of Donations** (exclusive of exchanges and reprints) received since the last meeting was read, and the thanks of the Society were given to the Donors:—

	From
2 Compressors	*Mr. T. V. Hodgson.*
4 Slides of Microscopic Ruling	*Mr. H. J. Grayson.*

Notice was given from the chair that the next meeting would be made special for the purpose of suspending the Bye-law No. 36, in order to enable the present President to be re-elected for another year.

The following **Nominations** were submitted by the Council for election as Officers and Council of the Society during the ensuing year:—

President—Albert D. Michael, Esq., F.L.S.

Vice-Presidents—Lionel S. Beale, Esq., M.B., F.R.C.P., F.R.S.; Richard G. Hebb, Esq., M.A., M.D., F.R.C.P.; Edward Milles Nelson, Esq.; Thomas H. Powell, Esq.

Treasurer—William Thomas Suffolk, Esq.

Secretaries—Prof. F. Jeffrey Bell, M.A., and Rev. W. H. Dallinger, LL.D., F.R.S.

Twelve other Members of Council—Thomas Duncan Aldous, Esq.; Conrad Beck, Esq.; Alfred W. Bennett, Esq., M.A., B.Sc., F.L.S.; Robert Braithwaite, Esq., M.D., M.R.C.S., F.L.S.; Rev. Edmund Carr, M.A., F.R.Met.S.; Frank Crisp, Esq., LL.B., B.A., V.P. and Treas. L.S.; Edward Dadswell, Esq.; George C. Karop, Esq., M.R.C.S.; Charles F. Rousselet, Esq.; Henry Clifton Sorby, Esq., LL.D., F.R.S.; John Jewell Vezey, Esq.; Thomas Charters White, Esq., M.R.C.S., L.D.S.

Mr. E. M. Nelson read the following report of the result of his examination of the slides of micro-ruling mentioned in the list of donations:—

"I have examined with much interest the bands ruled by Mr. H. J. Grayson of Melbourne. The ruling seems to be very perfect, and inequalities in spacing, often seen in Nobert's plates, could not be detected. The tenth band on the closer ruled plate was resolved; another similar plate was too faintly ruled for resolution in the higher bands. Both the coarser ruled plates were of course completely resolved, but one was stronger than the other. I think the lines might be cut deeper with advantage; the very faintly cut plates are not of much use for Microscopical purposes; even the coarse bands are too faint for micrometrical work. There is one suggestion I would like to make, viz. that the lines be mounted on the slip so that they may be parallel to the long side of the slip; this seems a very small matter, but it is a most important one, for the bands are nearly useless as mounted at present. I do not know what cement is used for fixing the cover to the slip, but indications of crystallization are already apparent. I know nothing whatever about microscopical cements, but I am informed that if shellac is present it is merely a matter of a year or two before crystals are formed all over the cover. I can, however, testify to the loss of valuable slides from crystallization. Nobert's bands were fixed with balsam, and were quite permanent."

Mr. E. B. Green exhibited a large number of drawings and specimens of the roots and root-hairs of plants, with their parasites.

Mr. A. W. Bennett, in reply to the President, said he had nothing farther to say on this subject beyond the remarks which he made when the matter was before them at the October meeting of the Society. He thought the subject was one worth consideration, and that many of the points raised by Mr. Green were of considerable interest. As he mentioned before, his own interpretation was not quite in accord with that of Mr. Green, but he believed that the investigations upon which Mr. Green had entered were not only interesting, but might lead to important results.

The President, in proposing the thanks of the Society to Mr. Green for bringing this large collection of specimens and drawings for exhibition, trusted that he would continue to pursue the subject, which was evidently one likely to prove of considerable interest.

Dr. R. G. Hebb said he had placed under a Microscope for exhibition some glucose crystals from diabetic urine, which he thought would be of interest as they were exercising the minds of the medical profession at the present time, because some chemists were of opinion that they were a certain indication of the presence of sugar in the urine. In their preparation the urine was treated with phenol hydrate and sodium acetate, and boiled for half an hour to an hour. He found, however, that if they kept on boiling they got one set of crystals down at the boiling point which were long and needle-shaped, radiating from spots, and that afterwards they got crystals which were formed in small stellate groups, and later still, a number of granule-shaped crystals were formed. This induced him to think that the deductions drawn from their presence in a particular form were not to be implicitly relied upon. As microscopic objects, moreover, they were very pretty when successfully made.

The thanks of the Society were voted to Dr. Hebb for his interesting exhibit and remarks.

Mr. E. M. Nelson read a paper "On some points in connection with Microscopic Drawing," illustrating upon the blackboard the effects referred to as "barrel" distortion and "pincushion" distortion.

Mr. Conrad Beck inquired if Mr. Nelson had carefully measured the amount of distortion obtained with a grating eye-piece when the drawing was made on a plane surface instead of a curved surface?

Mr. Nelson said he had been doing that, and hoped at another time to give the results. It varied, of course, according to the size of the picture, and amounted in a 3-in. picture to 1/10 in.; but in a 2 in. picture it was very small indeed, being no more than ·0033 in.

The President said that no doubt Mr. Nelson had pointed out a very sensible source of error in drawing with ruled squares, but he thought they were all fully aware that no method was known which was entirely free from error. He was himself still of opinion that ruled squares in the eye-piece gave about the best results of any method, and he fancied the eye more quickly recognized any error with squares and was therefore more likely to correct it, because in any such drawing there was always a margin left for correction. No doubt Mr. Nelson was perfectly correct in saying that absolutely accurate drawings were not to be made by any method known to them at present.

Mr. J. W. Gifford read a paper on "Photography by Monochromatic Violet Light," illustrating the subject by lantern photographs shown upon the screen.

Mr. E. M. Nelson could not say much about this paper until he had an opportunity of reading it, but he thought the subject was a most interesting one. He looked to the use of screens as a means likely to lead to great developments in photomicrography, the effect of their use being to cause the lens to act as if it was better corrected, and to sharpen up the image wonderfully, so that a proper screen really gave the means of making a violently coloured lens equal, for photographic purposes, to an apochromatic. It was said that they enabled the ultra-violet rays to be used, but for his own part he did not believe that they got through at all. Mr. Gifford had given them a most interesting paper, and he should be very glad to have the opportunity of reading it.

Dr. W. H. Dallinger said he had used screens for a long time with the greatest pleasure and the fullest profit, and was quite certain that in the future, as their value became more generally recognized, they would be much more generally used. He should not be at all surprised to find during the next ten years that they had reason to be much indebted to Mr. Gifford for working out the subject. If they could so simply get monochromatic light, they had at hand a ready means of making bad lenses into good ones and good lenses into better.

Mr. Beck said that any one used to making objectives was aware that all final corrections had to be done by visual tests in the Microscope, and realizing as he did how extremely difficult it was to see these deep violet rays at all, it was almost too much to expect opticians to correct the violet lines alone. It was so difficult to see these rays that it was hardly possible to get perfect corrections for them.

Mr. Gifford had thought the same thing when he began to work at this subject, but he had since found that it was not so difficult after all. He used a 3-in. quartz condensing lens, but found there was quite enough light to see to focus by, even when a magnification of × 1000 was employed. It was necessary to remain in the darkened room for five or ten minutes before the eye became sufficiently accustomed to the conditions, but there was no difficulty in seeing the lines afterwards. For opticians' purposes it would be well to select a sunshiny day, and with the help of a heliostat there would be no difficulty in the matter.

Mr. T. Comber asked if they were to understand that in most lenses it was so difficult to correct for the violet ray that this was seldom done? When they remembered that a photograph was practically taken by that ray it appeared to him to be very important to those who used the lenses for photographic purposes that the violet ray should be properly corrected.

Mr. Gifford asked if Mr. Beck would define what he meant by the violet ray.

Mr. Beck said he meant that portion of the spectrum about H, or the H line chiefly. G was very easily seen, and there was not much trouble to half-way between G and H, but H was very difficult.

Mr. Gifford said he could get through all up to H, but not beyond; what he would recommend would be line G.

Mr. J. E. Ingpen thought personal equation must enter largely into a question of this kind. There were many cases in which persons were affected with yellow crystalline lens, and this considerably altered their appreciation of colour at the violet end of the spectrum. In his own case he found this to be very marked, but after the operation he underwent he found that his appreciation of the blue end was largely in excess of that of most persons, and he certainly saw much farther into violet than was usually possible. This power gradually became less until at the present time his perception of colour was nearly normal.

Mr. R. Smith asked if there was any difference in the focus with and without the screen?

Mr. Gifford said there would be no difference in the case of the malachite-green, but there would be with violet.

Mr. Nelson said that in using a dark-vision spectroscope the light ceased at a particular line, but the moment he put on a methyl-blue screen then the spectrum shot out considerably beyond that line.

Mr. Gifford said there was no doubt about this being experienced, but he suggested that it might after all be a case in which the eye had been fatigued.

The President thought that the amount of discussion which this paper had evoked proved the interest which had been taken in the subject. He trusted Mr. Gifford would continue to pursue his investigations in this direction, as there could be no doubt as to their importance.

The thanks of the Society were voted to Mr. Gifford for his paper.

Dr. Dallinger stated that the Society had the right to nominate one student to work at a table at the Marine Biological Association's Laboratory at Plymouth for one month till the 31st of May next.

The President said that as their next meeting would be their Annual Meeting, it was necessary on the present occasion to appoint two Fellows as Auditors of the accounts. On behalf of the Council he appointed

Mr. J. J. Vezey as one Auditor, and asked the Fellows present to appoint the other.

Mr. J. Mason Allen was accordingly proposed by Mr. G. E. Mainland, seconded by Mr. T. E. Freshwater, and unanimously elected Auditor on behalf of the Fellows.

The following Instruments, Objects, &c., were exhibited:—

The Society:—Mr. H. J. Grayson's Rulings.—Mr. T. V. Hodgson's Compressors.

Mr. T. D. Ersser:—Bacillus of Anthrax, under the Binocular.

Mr. J. W. Gifford:—Photomicrographs illustrating his paper.

Mr. E. B. Green:—Drawings and Specimens of Parasitic Root-hairs.

Dr. R. G. Hebb:—Glucose Crystals from Diabetic Urine.

Mr. E. M. Nelson:—Messrs. Watson's "Grand Model Van Heurck" Microscope.

New Fellows.—The following were elected *Ordinary* Fellows:—Mr. Alfred George Fryett and Mr. Cuthbert Vaux.

ANNUAL MEETING HELD 16TH JAN. 1895, AT 20 HANOVER SQUARE, W.
THE PRESIDENT (A. D. MICHAEL, ESQ., F.L.S., &C.) IN THE CHAIR.

The Minutes of the Meeting of 19th December last were read and confirmed, and were signed by the President.

Prof. F. Jeffrey Bell said that as that was their Annual Meeting it was not necessary to make it special in order to move the suspension of Bye-law No. 36, of which motion notice was duly given at the preceding meeting. The first clause of the Bye-law in question read as follows:—"The President and Vice-Presidents shall be ineligible for election to their respective offices for more than two years in succession"—and in pursuance of notice given at the previous meeting, he had pleasure in moving: "That notwithstanding Bye-law No. 36 or any other Bye-law, Mr. A. D. Michael be and is hereby declared eligible for election as President of the Society for a third year."

Mr. T. Charters White having seconded the motion, it was put to the meeting and carried unanimously.

Prof. Bell then read the following list of nominations for Officers and Council for the ensuing year:—

President—Albert D. Michael, Esq., F.L.S.

Vice-Presidents—Lionel S. Beale, Esq., M.B., F.R.C.P., F.R.S.; *Richard G. Hebb, Esq., M.A., M.D., F.R.C.P.; *Edward Milles Nelson, Esq.; Thomas H. Powell, Esq.

Treasurer—William Thomas Suffolk, Esq.

Secretaries—Prof. F. Jeffrey Bell, M.A.; Rev. W. H. Dallinger, LL.D., F.R.S.

Twelve other Members of Council—*Thomas Duncan Aldous, Esq.;

* Those with an asterisk (*) had not held during the preceding year the office for which they were nominated.

Conrad Beck, Esq.; Alfred W. Bennett, Esq., M.A., B.Sc., F.L.S.; *Robert Braithwaite, Esq., M.D., M.R.C.S., F.L.S.; Rev. Edmund Carr, M.A., F.R.Met.S.; *Frank Crisp, Esq., LL.B., B.A., V.P. and Treas. L.S.; Edward Dadswell, Esq.; George C. Karop, Esq., M.R.C.S.; Charles F. Rousselet, Esq.; *Henry Clifton Sorby, Esq., LL.D., F.R.S.; John Jewell Vezey, Esq.; Thomas Charters White, Esq., M.R.C.S., L.D.S.

The President having appointed Messrs. J. M. Allen and C. Lees Curties to act as Scrutineers, the ballot was then proceeded with, and the Scrutineers subsequently reporting that the whole of the above named gentlemen were unanimously elected, this result was duly declared from the chair.

Prof. Bell then read the Annual Report of the Council for the year 1894 as follows:—

REPORT OF THE COUNCIL FOR 1894.

Fellows.

Ordinary.—During the year 1894, 27 new Fellows were elected, whilst 8 have died and 17 resigned. Although the number of new Fellows elected is not so great as last year by 10, the number of resignations has decreased by the same number; the Council have, to their regret, had to remove no less than 18 Fellows from the list for non-payment of subscriptions and other causes.

Among the Fellows who have died the Council regret to notice the names of Dr. G. E. Blenkins, one of its Secretaries from 1858–1867, and Mr. C. Haughton Gill, well known to present attendants at the meetings. Obituary notices of these Fellows appeared in last year's Journal.

Honorary.—One Honorary Fellow, Prof. P. J. van Beneden, has died. In his place has been elected his distinguished son, Prof. Edouard van Beneden, of Liège, who was one of the few biologists honoured by the degree of D.C.L. on the meeting of the British Association at Oxford in August last.

The list of Fellows now contains the names of 603 Ordinary, 1 Corresponding, 50 Honorary, and 86 Ex-Officio, or a total of 740.

Finances.

Subscriptions.—The Council are glad to report that through the exertions of the Treasurer the annual income from subscriptions has increased during the past year, though with a smaller list of Fellows; but they must continue to urge on the Fellows the duty of promptly paying their annual dues.

Journal.—The amount received from their publisher for the sale of the Journal is 324*l.* 13*s.* 3*d.*, as against 342*l.* 9*s.* 10*d.* paid during the preceding year. This apparent falling off is perhaps to be explained by the fact that in the previous year one of the few remaining complete sets of the Journal was sold.

During the past year the Treasurer pressed upon the Council the advisability of lightening the weight on its income due to the printing bill having accumulated during previous years. To rid the Society of this incubus, the Council directed that 400*l.* of India 3 per cent stock, part of the Society's investments, should be sold, and that the outstanding account should be paid off. This having been done, it was possible to arrange for easier terms from the printers. The Council hope that for the future the Society will be able to pay all further accounts out of its annual income and payments from non-Fellows, and the Editor will keep this object steadily in view.

The Treasurer has, with the approval of the Council, effected an insurance for 500*l.* on the stock of the Journal which is in their publisher's hands.

Advertisements.—The Council are pleased to note that the amount received for advertisements is nearly three times more than that received during the preceding year, being 105*l.* 11*s.* as against 38*l.* 1*s.* in 1893.

Mortgage.—The mortgagee has paid off the mortgage of 1200*l.* which he borrowed from the Society. Negotiations are now in progress to invest the proceeds of the mortgage on advantageous terms.

Rooms.

The Council would again direct the attention of the Fellows to the advantage of the rooms being open on Wednesday evenings. They regret to find that little use has been made of this arrangement, only two Fellows having used the rooms on those evenings during the past year; unless the Council see that more use is made of the Library on Wednesday evenings during the coming year, they will consider whether there is any necessity for the Library to be opened.

Instruments and Apparatus.

The Fellows will be pleased to hear that Mr. T. D. Aldous, whose name is submitted for the Council of the Society, has rendered valuable aid in preparing an inventory of the Society's instruments; this is a work of peculiar difficulty, as has been explained at various meetings, and the Council have again to ask that any Fellow who has the requisite historical knowledge will assist in the preparation of a catalogue which shall be creditable to the Society and of scientific utility.

Library.

The Council are glad to note that the Fellows have made considerable use of the Library during the past year. Nearly 200 volumes have been bound, and some judicious weeding of unnecessary volumes has also been done.

But little progress has been made with the Catalogue, as during the vacation the Librarian was engaged with the inventory of the instruments.

Conversazione.

The Fellows will remember that the Conversazione was held at St. Martin's Town Hall on 4th April last. The Council are glad to report that it was considered a great success, and that 378 persons attended. The best thanks of the Society are due to Mr. E. Dadswell, who so successfully carried out the arrangements which, at the request of the Council, he undertook to make.

The Marine Biological Association's Laboratory.

The Council would remind the Fellows that the Society, as one of the founders of the Marine Biological Association, has the right to nominate a student to a table at the Association's Laboratory at Plymouth for one month in each year. The new year of the M. B. A. commences on June 1st next.

Mr. E. J. Allen, now Director of the Association, was nominated to a table last year to enable him to continue his studies on the Decapod Crustacea.

Journal.

The Council regret to report that the communications judged appropriate for the last set of Transactions fell to 10, having been 13 in 1893, 12 in 1892, and 11 in 1891; it is true that the Council have been led by the reports that have been furnished to them to refuse a place in their Transactions to various papers that have been offered to them, and they will not cease to zealously investigate the claims of authors to a place in their Transactions; while they will thus do their part to ensure the high reputation of their publications they hope that the Fellows will, in larger numbers, offer material worthy of publication.

The part of the Journal devoted to abstracts has been carried on on the old lines, and continues to be found most useful to workers.

During the past year the hundredth number of the Journal appeared, and the editor has taken into consideration the question whether the classification of the zoological subjects could be said to be—not ahead of the time, for that a record should never attempt to be—but whether it adequately represented current zoological teaching. In these points the arrangement of the zoological material was far behind the times: (1) the sharp demarcation between the Vertebrata and Invertebrata; (2) the retention of the group Molluscoidea; and (3) an assemblage of heterogeneous groups under the head of Vermes. The editor was, naturally, unwilling to disturb arrangements which had existed so long, but he was, on the other hand, unwilling to perpetuate, for perhaps another century of parts of the Journal, an antiquated and unscientific classification. With the assistance of some of his zoological friends he has devised an arrangement which combines the minimum of change with an arrangement which his most advanced colleagues are satisfied to accept. The Council hope and believe that the alteration will be of advantage to the Journal and the numerous students who consult it.

Mr. W. T. Suffolk, the Treasurer of the Society, read the balance sheet for the year. He pressed upon the attention of the Fellows of the Society the desirability of their trying as far as possible to add to their numbers, as it was only by adding to their income in this way that they could hope to do more than publish the Journal as at present. There was much good work which they might do as a Society in other directions if the means were placed at their disposal.

Mr. T. Comber had much pleasure in moving that the report of the Council and the Treasurer's statement of account be received and adopted. He did not think it was necessary for him to say anything with regard to the Report, which he felt sure would be regarded as

Dr. THE TREASURER'S ACCOUNT FOR 1894. Cr.

1894.		£ s. d.
To Balance 31st December, 1893		36 10 8
„ Admission Fees		56 14 0
„ Compositions		63 0 0
„ Annual Subscriptions—		
1889	£5 5 0	
1890	5 5 0	
1891	14 14 0	
1892	28 10 6	
1893	74 10 3	
1894	673 1 10	
1895	25 9 6	
1896	0 6 0	
		827 2 1
„ Interest on Investments		62 18 3
„ Sale of 400*l.* India 3 per cent. Stock		397 19 0
„ Mortgage paid off		1200 0 0
„ Sale of Journal		328 16 5
„ Advertisements		105 11 0
„ Books sold		5 0 0
„ Reprints sold		2 18 1
„ Catalogues and List of Fellows sold		0 2 6
		£3086 12 0

1894.	£ s. d.
By Rent, Coals, and Attendance	133 14 0
„ Salaries, Reporting, and Commission	169 11 5
„ Books	78 10 4
„ Binding	17 4 5
„ Expenses of Journal	1185 3 11
„ Postage of Journal	75 0 7
„ Reprints of Papers	11 1 7
„ Stationery and Miscellaneous Printing	29 5 9
„ Conversazione Expenses	34 2 0
„ Refreshments at Evening Meetings	10 15 6
„ Fire Insurance	2 0 0
„ Petty Cash	40 16 2
„ Law Charges	4 4 0
„ Balance in hand 31st December, 1894, including 1200*l.* Mortgage repaid	1295 2 4
	£3086 12 0

Investments, 31*st December*, 1894.

380*l.* 17*s.* 3*d.* India Three per Cents. (including 100*l.* Quekett Memorial Fund).

W. T. Suffolk, *Treasurer.*

We have examined the foregoing Account and compared the same with the Vouchers and Documents in the possession of the Society, and find the same correct.

J. J. Vezey
J. Mason Allen } *Auditors.*

satisfactory; and with regard to the Treasurer's statement, he would only say, as a business man, that it was rather a matter of regret that the mortgage investment had been repaid at a time when it was so difficult to obtain an equally good investment for their capital.

Mr. F. W. Hembrey having seconded the adoption of the Report, the President put the motion to the meeting and declared it carried unanimously.

The President then read his Annual Address (see *ante*, p. 1), which took the form of an interesting *résumé* of the history of the Society from its inception in December 1839 and its establishment in 1840 as the "Microscopical Society of London," under the presidency of Mr. (afterwards Sir Richard) Owen, to the present time.

Mr. H. Virtue Tebbs moved "That the best thanks of the Society be given to the President for his very interesting address, and that he be requested to allow the same to be printed in the usual way." In reference to that portion which related to the future of the Microscope, perhaps he might be allowed to recall a remark which was made to him many years ago by the late Dr. Bowerbank, who, when speaking upon the same subject, expressed his opinion that the instrument had then attained to such a pitch of perfection that it was not probable, and indeed he thought it was not possible, that it could be further improved; and yet those who were present that evening had lived to see changes and improvements of a remarkable kind in mechanical construction, in the introduction of immersion and apochromatic lenses, and in the system of staining preparations which had led to so many valuable results. As also an instance of the progress made in America, he might mention the fact that when, in 1848, the U.S. Government were sending out an exploring expedition to the Pacific it was thought desirable that a Microscope should be provided for investigations, but the country was searched in vain for one, until at length it was found that an English doctor visiting the country had one in his possession, and this was borrowed for the occasion.

Prof. Bell said that as he had been in some sense responsible for the line adopted by the President in the address which they had just heard, he thought he might with great propriety second the vote of thanks. In the course of his remarks, he fancied that the President did not appear to attach so much importance to the historical side of the matter as he did himself, for he was strongly of opinion that every student should make himself thoroughly acquainted with the history of every subject at which he worked. Of those who had been mentioned by the President as having been associated in the formation of their Society, the names of Owen, of Bowerbank, and of Quekett would remain in this country and in this metropolis famous as long as two great institutions survived—the Natural History Museum, which owed so much of what it was to Owen, and which owed to Bowerbank his magnificent collection of sponges; to the energy of John Quekett the fine collection in the Museum of the Royal College of Surgeons was largely indebted, whilst the name of Lister would always be associated with the advances in surgery which had so largely added to the reputation of the profession in England. It was a difficult matter for a Society like theirs, which had taken so great a part in rendering assistance to those whose work lay in so many directions, to say what was the best for it to do at this moment, for there did not seem to be any particular line which could be put before the Society as a whole; but it seemed quite possible that some of those present might live to see a complete change in the methods of procedure in connection with microscopical science. The President had referred to certain addenda to his address which he did not read, but having himself had the opportunity of perusing the whole he could tell the Fellows of the Society that when they were able to go through it in print they would find it to be a very valuable addition to their series of annual addresses. He might perhaps add that the question of an annual address was one of considerable difficulty, but for which, he believed, they might have within their choice the most eminent amongst men of science as their Presidents. Indeed, he would almost venture to surmise that it was a matter of anxiety to every President from the third Thursday in January to the third Wednesday of January in the following year, whilst to himself it was always more or less a matter of uncertainty whether he should ever get it in time for printing in the next number of the Journal.

The motion having been put to the meeting, was carried unanimously, amidst great applause.

The President having thanked the Fellows for the kind manner in which his address had been received, said that he had a further duty to perform, namely, to propose that the best thanks of the Society be given to the Treasurer and the other officers of the Society for their services during the past year, a motion which he felt sure needed no recommendation from him.

Mr. J. J. Vezey having seconded the proposition, it was put to the meeting and unanimously carried.

Prof. Bell, in acknowledging the compliment, thanked the President and the Fellows present, on behalf of himself and his colleagues, for the vote of thanks which had been so heartily proposed and responded to.

New Fellows.—The following were elected *Ordinary* Fellows:—Mr. Frederick John Reid and Mr. Charles H. Clarke.

You have before you a photograph of Podura taken in this way (plate I. fig. 7) which is not bad. But it is not nearly so good as the two following (plate I. figs. 8*a* and *b*) taken with the malachite-green screen.

In concluding, I want to draw your attention to methyl-green. It will give as good results as malachite-green and transmits so little red and ultra-violet, that for all except the most exact work, it can be used without the blue glass. A cell containing a glycerin solution of methyl-green may be made up with two thin cover-glasses and a metal ring only. Such a screen is very light, very thin, and will not break with any ordinary amount of knocking about.

V.—*On the Variations observed in large Masses of Turbinaria.*

By F. Jeffrey Bell, M.A., Sec. R.M.S.

(*Read 20th March*, 1895.)

Plates II. and III.

In the closing month of 1893 and the opening of 1894, the Trustees of the British Museum were so fortunate as to have sent them by Mr. Savile Kent some remarkably large specimens of *Madrepora* and of *Turbinaria*, to the acquisition of which he had been incited by Dr. Günther, F.R.S., the Keeper of the Zoological Department.

While the great size of some of these specimens gives them a peculiar interest, I desire to draw particular attention to the most important lesson which they teach in a very forcible way, and that is that great differences in the form of calicles may be seen in every few square centimetres of any one mass, and in any part of it. The two plates which illustrate this note show this point very much better than anything I could say, and the moral which the systematist should draw from it is so obvious that there can be no need to press that point.

From the point of view of a curator of a public museum—the interest which specimens excite and the information they give—it may be said that these recent accessions will produce a far truer idea of the composition and appearance of a Coral Reef than the fragments, rarely of any considerable size, which have been sent home in the spirit in which the Greek brought a brick of the house he wished to sell. Now we have in the British Museum two specimens of *Turbinaria mesenterina* which occupy irregularly shaped areas, the boundaries of which are respectively 16 ft. and 16 ft. 8 in.*

It is the vision of objects such as these that gives rise to the natural and convincing remark, "Now I know why ships are destroyed by coral reefs." It is not with corals as with whales; take only a vertebra of a whale, and the imagination can shape a not erroneous figure of its former owner; chip a flat, free expansion of a coral, and no man is likely to guess that it came from a mass which, when dry and dead, weighed as much as 1500 lb.†

Explanation of Plates.

Plate II.—A piece of *Turbinaria mesenterina* reduced to 2/3 of its natural size.
Plate III.—A piece of another mass of the same species reduced to 1/3 of its natural size.

* In the Report of the Madras Government Museum for 1893–4 I read that there is now exhibited in that Museum an example of *Montipora exserta* which measures 38 by 33 in.

† The following are the details as to the weight of the *Turbinariæ*:—The two specimens of *T. bifrons* weighed respectively $3\frac{1}{4}$ cwt. or 364 lb., and $5\frac{1}{2}$ cwt. or about 600 lb.; of the two specimens of *T. mesenterina* the weights were 12 cwt. or 1344 lb., and $13\frac{5}{8}$ cwt. or about 1500 lb., or nearly 700 kg.

As I have already said, the specimens are full of interest from the points of view of variation and of specific distinctness; a reference to plates II. and III. will show the marked differences in the size of the calicles in *T. mesenterina.* In plate II., which gives a photographic representation of 9 in. of one specimen, there are to be seen such great differences as calicles twice, or even more than twice, as large as others; again, calicles are so closely packed that five are to be found, where, near them, there are only three in a space of the same length ; here the growth is flat, there there are projecting knobs. So, again, at some other point, there may be seen a large flat plate with a free rounded edge, the whole made up of subequal calicles, while there is to the left a projecting rounded clump of calicles twice as large. But it would be a waste of time, with such figures as those taken by Mr. Highley before the student, for me to expatiate on differences that will strike the least attentive.

A close inspection of the figures just referred to shows that each contains portions which, if separated from one another and sent to a cabinet naturalist without any warning, would assuredly be described by him as different and distinct species. A study of the specimens as a whole will show that the figures here given are fair and typical examples of what is to be seen in many parts of the coral. Variation as extensive as this is certainly unexpected. I, perhaps, who had the advantage of watching the investigations of my lamented friend George Brook, am better prepared for variability in Corals than those who have not at hand a large collection, but I must confess that I was not a little astonished at the differences which I found in a few square inches of *T. mesenterina.* A knowledge of this variability will help us to understand the difficulty which, it is well known, all students of Corals have in determining specimens of the genus *Turbinaria.* By specimens here I mean, of course, those more or less scrappy pieces which have hitherto satisfied the collector.

With regard to the collector of the future, it must be said that he must not content himself with chips and scraps. The difficulty of sending corals weighing several tons will remain so great that it is not necessary to warn him that there are limits to the part of a Museum that can be devoted to the exposition of Corals.

For the future describer of Corals the matter is more serious; it becomes at once obvious that it is impossible to frame anything like a satisfactory diagnosis of any Coral of encrusting habit unless a piece of some size is at his disposal; while it is no less clear that it would be no difficult task to give different specific names to pieces which might be shown by a larger example to be but parts of "one stupendous whole."

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.

*Including Original Communications from Fellows and Others.**

ZOOLOGY.

VERTEBRATA:—Embryology, Histology, and General.

a. Embryology.†

Epigenesis or Evolution.‡—Under this title Mr. G. C. Bourne has an interesting review of Prof. Hertwig's recent work on preformation or epigenesis. He agrees with Hertwig that Weismann's explanation is nothing more than a renunciation of an explanation; his doctrine of determinants leads into an invisible world in which there is no foothold for research. For this reason, if for no other, Mr. Bourne welcomes Prof. Hertwig's invitation to return to the paths of epigenesis. He urges that a theory which has a formal answer for every question, which regards everything that we can see and lay hold of as predetermined and unalterable, which relegates the causes of phenomena to the unseen and unknowable—such a theory, if accepted as true, does not stimulate but stifles enquiry. Mr. Bourne points out further that Hertwig has failed to supply an acceptable alternative to Weismann's scheme. But his attempts indicate the paths along which research may be conducted, and he is very right when he claims that it is the great merit of his conception of the developmental processes, that it opens the gates once more to research.

A review of Hertwig's book is also published by Herr V. Wagner.§

Blastocysts of Mammalia.||—Prof. A. W. W. Hubrecht doubts the accuracy of Dr. Robinson's speculations, and finds decisive contradictory

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, &c., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called. but also those dealing with Evolution, Development and Reproduction, and allied subjects.

‡ Nature, li. (1895) pp. 265–8.

§ Zool. Centralbl., i. (1894) pp. 747–9.

|| Rep. Brit. Assoc., 1894, pp. 681–3.

evidence in the insectivorous *Tupaia javanica*. Sections of the ovum of this mammal show that during the early stages of cleavage there is no sensible difference in the size of the cells then arising; as early, however, as the solid morula stage there is an unmistakable outer layer and inner core of cells. When there are more than a dozen of the latter a cavity arises, the outer layer becomes the wall of this early monodermic phase, and the inner core is massed together almost simultaneously. The inner core differentiates into a layer of flattened cells and a knob of more cubic ones; the former arrange themselves into the inner wall of what then becomes a didermic blastocyst. The latter at the outset form a local thickening of this inner layer. The outer layer is what the author has called the trophoblast, the inner layer is the hypoblast. Prof. Hubrecht describes further stages in the development of this didermic blastocyst, and comes to the conclusion that the phenomena observed by him leave no doubt that the wall of the transitory monodermic stage is epidermic in nature and not hypoblastic as Robinson would have it. The author believes that in the formation of the mammalian blastocysts, cænogenetic processes play a prominent part. It is by a precocious segregation that cell matter of epiblastic and of hypoblastic ancestry is arranged into a two-layered vesicle, whilst the really formative matter out of which the embryo would be built is yet quiescent in the embryonic knob. If we desire to have a clear conception of the real nature of the mammalian blastocyst we must acknowledge that the holoblastic segmentation of the mammalian ovum is something totally different from the holoblastic segmentation of very many Invertebrates and of *Amphioxus*. It is all the more misleading because it appears to be a palæogenetic feature.

Attachment of Mammalian Embryo to the Walls of the Uterus.*—Mr. R. Assheton has made an investigation of the causes which lead to the attachment of the mammalian embryo to the walls of the uterus. He finds that the blastodermic vesicle of the Rabbit becomes first attached to the walls of the uterus by its lower pole. He regards this attachment as the result of a mechanical pressure of certain spots, or knobs, of thickened epiblast of the blastodermic vesicle upon the epithelium of the uterus. This pressure is hydrostatic within the vesicle and results in the uterine epithelium being pierced, when the knobs of epiblast become imbedded in the connective tissue below. He regards these knobs of epiblast as being the direct result of a destruction of the equilibrium between the rate of increase of the hydrostatic pressure within the blastodermic vesicle and the rate of growth of the cellular wall of the vesicle. The primary cause of "inversion" is the fact that the embryonic area is at one time a region of less activity, and is surrounded by a zone of greater activity, in connection with the future formation of the placenta. Inversion is determined by the heaping up of cells at an early stage by this zone of greater activity, whereby the embryonic area is forced inwards. Inversion is prevented by such causes as impede the heaping up of tissues around the embryonic area. Foremost amongst such causes is the presence of an investing coat, and the thicker and more lasting the coats are, the more marked are the intrinsic characters

* Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 173–90 (1 pl.).

of the blastodermic vesicle, and the longer deferred is the impression of characters due to the physical effects of the uterine walls.

Formation of the Decidua.*—Dr. F. Nordmann discusses some vexed questions, and states the results of his observations. The lower uterine segment belongs, so far as its musculature is concerned, to the corpus uteri, differing very markedly from the cervix; it is covered by a mucous membrane which in its structure must be reckoned to that of the uterus, and, like it, shares in forming the decidua. The mucous membrane of the cervix takes no part in forming the decidua; the cervix remains normally closed during the whole period of pregnancy. The inner orifice (*Muttermund*) lies where the musculature of the corpus uteri suddenly thins off and the unchanged mucous membrane of the cervix begins.

Early Stages of the Development of the Rabbit.†—Mr. R. Assheton has re-investigated the early stages of the development of the Rabbit, on which Van Beneden published his classical observations fifteen years ago. He comes to the conclusion that that author's description of segmentation was inaccurate; he can find no trace either of his blastopore or of any gastrulation; nor is he any happier with the speculations of Robinson concerning the existence of a hypoblastic wall to the blastocyst surrounded subsequently by the epiblast, for he can find no evidence in support of it. Rauber's layer fuses with the inner layer of epiblast as described by Balfour and Heape, but this fusion has but slight morphological significance, as the existence and disappearance are caused mechanically by ontogenetic conditions. The growth round of the hypoblast is apparent only, being due to the presence of a zone of specially active epiblast surrounding the embryonic disc.

Primitive Streak of the Rabbit.‡—Mr. R. Assheton discusses the causes which may determine the shape of this streak and the part of the embryo formed by its activity. He points out that in recent years the theory of concrescence has been used to account for the growth in length of the Vertebrate embryo. No trace of such an occurrence can be found in the Rabbit, and the growth in length of the embryo can, he thinks, be much more easily accounted for by a process of addition of new cellular units between the pre-existing embryo and an area of rapid cell-production. He commences by discussing the earliest signs of the formation of the secondary area of proliferation, but much of this part of his essay would be unintelligible without constant reference to his figures. It may be said, however, that he finds that the secondary area of activity arises as a small spot placed excentrically to the primary centre of activity. It increases in magnitude, elongates, and becomes much reduced in breadth towards the centre of its length, and it is deeply grooved. This groove, after attaining its greatest length, rather suddenly disappears altogether. Instead of a groove a ridge appears along the median line of the area, and the area itself shortens and diminishes in size, but does not finally disappear until the last segment has been formed. The process of elongation of the primitive streak

* Verh. Phys. Med. Ges. Würzburg, xxviii. (1894) pp. 45-62.
† Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 113-64 (5 pls.).
‡ Tom. cit., pp. 191-221 (3 pls.).

is fully described, and an attempt is made to determine which portion of the embryo is derived from the cells proliferated from the primitive streak.

Fusion of Epiblastic Layers in Rabbit and Frog.*—Mr. R. Assheton points out that in the Frog as well as in the Rabbit there is a fusion of two epiblastic layers. He gives an account of what may be seen in *Rana temporaria.* With regard to the pigmentation of the cells in the Frog, he points out that, as pigment is present in the unfertilized egg, as a superficial layer covering the upper pole, we find that the superficial layer of cells after segmentation is more deeply pigmented in the more internally situated segments. Secondly, the pigment seems to be in some way connected with actual protoplasmic activity, as it appears internally wherever the division of cells takes place. Although his evidence is, he allows, very far from being conclusive, Mr. Assheton thinks that it points very strongly towards the inference that the epidermic layer or epiblast in the Frog gives rise to the spongioblastic elements, and the nervous layer to the neuroblasts. A brief comparison is instituted between the Rabbit and the Frog.

Development and Structure of the Whale.†—Under this title Drs. G. Guldberg and F. Nansen publish a beautifully illustrated volume containing several essays on various Cetacea. After a historical survey of our knowledge regarding the development of the Whale, the development of *Lagenorhynchus acutus* is discussed. Of this whale they were so fortunate as to obtain an embryo no more than 8 mm. long; it was remarkable for its already long tail. Embryos 26 and 30 mm. long were at first sight regarded as distinctly mammalian, but closer consideration showed that the Cetacean type had, even at this stage of development, set its peculiar stamp upon these embryos. The relatively great distance between the nasal and the oral apertures, the external nasal apertures fused into one transverse cleft, the short neck and the long tail, the absence of external ears and external hind extremities, while the fore extremities are already well developed, mark the embryo as Cetacean. The characteristics of the class and order are thus even at this stage intermingled, and we do not, as we are ordinarily taught to suppose, see only general or phylogenetic characters. The authors appear to be much struck by this, but our readers will probably remember Mr. Sedgwick's essay on Von Baer's law.‡ Put into a few words, they say the embryo seeks by the most direct way to attain to the likeness of its parents. There is a short notice of *L. albirostris*, the smallest fœtus of which measured 720 mm. In it the distribution of colour was already so strongly marked that several of the specific characters were disclosed. The development of the common Porpoise is discussed in greater detail; the powerful development of the tail at an early stage leads to the expression of the general law that an organ which plays a conspicuous part in the independent existence of the animal appears early, and even in its first embryonic development grows rapidly and assumes a more or less prominent position. An embryo

* Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 165–71 (1 pl.).
† Bergens Museum, v. (1894) large 4to, 70 pp., 7 pls. and 6 figs.
‡ See this Journal, 1894, p. 433.

less than 17 mm. long was perhaps more remarkable for the vanishing remnants of its hind extremities. With regard to the rudiments of hind limbs, it seems that they appear in the Delphinidæ as oval, rounded paddle-like organs at a stage when the visceral clefts are still distinct. Their position on each side of the body corresponds exactly with the place where the external commencement of hind limbs generally appears in the higher Vertebrata. From the very beginning they are small, they are soon left behind in development and undergo rapid retrogression; as they disappear the Cetacean characters appear. So small indeed are these appendages that we may be allowed to doubt whether any true Cetacean ancestor ever had hind limbs in use. The Killer (*Orca gladiator*) is the subject of the next essay. In it the generic and specific characters appear to be developed earlier than in any other Odontocete. It is remarkable that in a fœtus hardly one-fifth the length of the newly-born animal, the generic characters are distinctly marked. When the fœtus attains to half its full size the specific characters are distinctly visible, even to the distribution of colour. The fœtal membranes of the Odontoceti form the subject of the next essay; they have been observed in *L. acutus*, *Orca gladiator*, and *Phocæna communis* (the common Porpoise). Finally, the duration of pregnancy is discussed. *L. acutus* would appear to carry its young for about ten months. As to *L. albirostris* no certain conclusions can be drawn. The female *O. gladiator* would appear to be gravid for about a year, while the common Porpoise carries its young a month or two less than the year.

Blood of Embryo Chick.*—Dr. C. S. Engel shows that the elements of the embryo chick's blood are very different from those in the adult. The first blood-corpuscles are nucleated cells, rich in hæmoglobin, larger than red blood-corpuscles and spherical, and with a large nucleus which often shows nuclear segmentation. They are metrocytes of the first generation, and on the fourth or fifth day they give rise to a second generation. These daughter-cells do not divide by karyokinesis, but have sometimes several nuclei. From the fifth day onwards they divide into (1) a nucleated portion with associated pigmented protoplasm and (2) a non-nucleated pigmented portion. The former becomes a red blood-corpuscle, the latter comes to nothing.

In embryos three days old elements are seen like lymph-corpuscles, or like metrocyte nuclei with degenerated cytoplasm. It seems as if the nucleated half of the metrocyte of the second generation might either increase in hæmoglobin and become a red corpuscle, or lose its hæmoglobin, divide directly, and form white blood-corpuscles. The eosinophilous cells have nothing to do with metrocytes, and do not occur in the blood until after the formation of blood-forming organs, i. e. about the fifth day.

Growth in Length of the Frog Embryo.†—Mr. R. Assheton believes that in the Frog, as in the Rabbit, there is evidence to show that the embryo is derived from two definite centres of growth—the first, and phylogenetically the oldest, is a protoplasmic activity which gives rise to the anterior end of the body (= gastrula stage). The second gives

* Archiv f. Mikr. Anat., xliv. (1894) pp. 237-48 (1 pl.).
† Quart. Journ. Micr. Sci., xxxvii. (1894) pp. 223-43 (2 pls.).

rise to the growth in length of the embryo; and these centres of growth occupy the same relative positions in location and in sequence of time, and probably to each are due the same parts of the embryo. He believes that the best way to regard the area of secondary proliferation is to consider it as a single area whose sole function is the addition of cellular units to the posterior end of the previously existing embryo.

Transformation of the Aortic Arches in the Frog.*—M. S. Jourdain finds that the statements regarding these arches current in text-books are not as correct as are ordinarily supposed. The tadpole, as is well known, has four pairs of gills; they are supplied by blood-vessels, for which the author proposes a new terminology. He proposes the term bulbar arch for the four large vessels which bring venous blood to the gills. The subdivided part of each of these arches he calls the hypobranchial vessels, while the epibranchial vessels are those which carry the blood to the arteries. The epibranchials on each side are connected with one another by anastomosing branches which he calls the connective branches. Finally, it is important to note the presence of an anastomosing plexus which he calls the interbranchial. This establishes a communication between the hypo- and epibranchial vessels. In the first arch the vascular network which represents the interbranchial establishes a direct communication between the first bulbar arch and the carotid-lingual. The interbranchial becomes the carotid gland; the connective between the first and second arch disappears. In the second arch a wide canal is formed by means of the interbranchial between the second bulbar arch and the origin of the aorta. The connective between the second and third arch disappears. The transformation of the third and fourth arches is more complex. By the intermediation of the third interbranchial and the connective between the third and fourth arches, the third bulbar arch becomes continuous with the afferent vessels of the lung or pulmonary artery, the chief origin of which is the epibranchial of the fourth arch. The fourth bulbar arch, which is only a subdivision of the third, becomes useless and atrophies. The pulmonary artery of the adult formed by these various branches gives rise at the level of the third gill to a vessel which forms the cutaneous branch of the pulmonary artery.

Ova of British Fishes.†—In the fifteenth of his 'Notes from the St. Andrews Marine Laboratory' Prof. W. C. M'Intosh has notes on the ova and larvæ of *Gadus virens*, and on the ova and larva of the Turbot (?), and on an egg resembling that of *Arnoglossus megastoma*. It is found that the Green Cod closely approaches the Cod in its development, but the arrangement of the pigment distinguishes it from a very early stage.

Larval Excretory System of Calamoichthys.‡—Herr J. Lebedinsky finds in the larvæ of *Calamoichthys calabaricus* Smith two lateral strands of lymphoid tissue, arising as cœlomic diverticula, and containing the excretory system. The funnel-canal of the pronephros is long, with 2–3 spiral coils; that of the mesonephros is short and without any

* Comptes Rendus, cix. (1894) pp. 98–100.
† Ann. and Mag. Nat. Hist., xv. (1895) pp. 90–7.
‡ Archiv f. Mikr. Anat., xliv. (1894) pp. 216–28 (1 pl.).

winding. The mesonephros shows a glandular sac, the pronephros none. The mesonephros consists of numerous external funnels metamerically arranged; the pronephros is sporadically disposed, without relation to segments. In segments with pronephros there is also mesonephros; both occur together. The system differs from that of *Amia* and *Acipenser* in many ways, e.g. in the number of external funnels, in having a straight pronephric duct, in the union of the pronephric ducts in a cloaca, in there being no transitional area between pronephros and mesonephros.

Spermatogenesis of Selachians.*—M. A. Sabatier, finding that notwithstanding previous researches many parts of this subject remain obscure, has made a series of fresh observations on the lower surface of the testicle of *Scyllium catulus.* There is a longitudinal band of germinal tissue, formed of flat nuclei situated in a reticulated protoplasm. At certain points of this band the nuclei multiply by amitosis; they then grow and form large lenticular masses. Each of these groups forms a nest of germs, and will be the origin of a testicular ampulla. Often one of the nuclei very early grows much larger than the others, and it is this which has been wrongly considered as a female cell of the testicle. Each nest of germs grows, and there is formed at the centre of the protoplasm a lacuna which increases in size and becomes the central cavity of the ampulla. The nuclei or germs commence to divide, and arrange themselves in a layer which is applied to the membranous envelope of the ampulla. At the same time some of them may acquire a proper cellular body. Further changes occur, and all the cells enclosed in the ampulla become protospermatoblasts, which are similar to one another and have the same value and the same destination. Each divides into two smaller cells—the deuto-spermatoblasts, which in their turn divide and become trito-spermatoblasts. Other elements appear in the ampulla which are altogether foreign to the spermatoblasts already formed. They represent the point of departure of the future generation of spermatoblasts and spermatozoa. Other difficulties in the spermatogenesis of Selachians remain, which the author hopes to resolve.

Development of Teeth in Teleostei.†—Miss Albertina Carlsson has studied this in *Salmo salar, Cottus quadricornis, Abramis brama,* and many other Teleosteans. The following conclusions are reached:—An enamel ridge of considerable breadth extends uninterruptedly along the whole length of the tooth-bearing bones; the first hints of teeth are seen in the elongation of cells at the base of the ridge; the teeth do not develop in a continuous series, but new ones appear from the unexhausted ridge between those which have already been formed; the ridge usually persists throughout life, but may be absorbed on the middle part of the jaw between the teeth, as in the pike; the germs of replacing teeth arise either from the base or from the lingual side of the ridge; sometimes there are more teeth or rudiments of teeth in the young than in the adult; the constriction from the ridge is late of being effected, and there is no relation between the formation of dentine and the ossification of the tooth-bearing bones.

Endocardium of Bony Fishes.‡—Mr. A. T. Holbrook has made a special study of the Cod and some allied fishes, and finds that their

* Comptes Rendus, cxx. (1895) pp. 47–50.
† Zool. Jahrb. (Abth. Anat. Ontog.), viii. (1894) pp. 216–44 (2 pls., 2 figs.).
‡ Bull. Mus. Comp. Zool., xxv. (1894) pp. 79–97 (5 pls.).

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TRANSACTIONS OF THE SOCIETY.

IV.—*Monochromatic Violet.*

By J. William Gifford, F.R.M.S.

(*Read* 19*th December*, 1894.)

Plate I.

Some of the Fellows will perhaps remember that this time last year I brought to their notice a malachite-green screen. Since then I have been taking photographs of absorption spectra, in the hope of being able to construct an equally efficient violet screen. This is now accomplished, and the screen has in great measure failed, though the failure is not, I venture to think, from any inherent faults of its own. But before stating where the fault lies, let me describe this screen.

If the sun's rays, after passing through a saturated solution of methyl-violet, be examined by a small spectroscope, it will be found that all rays in the solar spectrum from line B to a position between lines F and G have been absorbed. The remaining spectrum consists of a narrow red band and a broad violet band. If solutions of ethyl-violet and gentian-violet be used much the same effect is obtained; but with the former the violet band extends more into the blue and is broader, with the latter it extends less into the blue and is narrower.

If we impress such a spectrum (methyl-violet) on a photographic plate sensitive to all colours, it will be seen that the violet band extends into the ultra-violet beyond H_1H_2 (plate I. fig. 1).

On placing a piece of the blue glass known as signal-green behind the solution, and again looking through our spectroscope, it will be seen that the red band is cut off, and if a photograph be taken the invisible violet beyond the H lines also disappears, a band of more or less visible violet alone remaining (plate I. fig. 2).

The solution, made by preference with glycerin and the blue glass, may without much trouble be combined in one mount. I have adopted this form lately for the malachite-green screen, using the blue glass instead of picric acid to get rid of the ultra-violet, for I found that sooner or later the picric acid combined with the cement.

Having described the violet screen I will now show you a photograph of the spectrum taken through it on a bromide film, such as is used for ordinary lantern-slide work (plate I. fig. 3).

Immediately below is the spectrum taken on such a plate without any screen (plate I. fig. 4).

You will see that if a line be drawn through the centre of both, it will occupy very nearly the same position. And if lines be drawn representing the mean of average intensity, they will be still more nearly in the same relative position.

The deduction is sufficiently obvious. We can focus our micro-objective or astro-telescope or photographic lens with such a screen, and then remove the screen altogether for the exposure, and this has been borne out in practice.

But the difficulty comes in here. You have before you a photograph of the Podura scale, taken in this way with a Powell and Lealand semiapochromatic of 1·5 N.A. (plate I. fig. 5) and another (plate I. fig. 6) similarly taken with the malachite-green screen. These are very poor photographs of Podura, and I have only chosen them because both are in the same focus, and both were taken with the full available aperture (about ·95). The one taken with the violet screen is very "fuzzy," but the other is fairly sharp.

The question of using the extreme violet for purposes of photomicrography has already been taken up by Mr. Nelson, and I believe I may use his authority for saying that the lenses he used he found so imperfectly corrected for spherical aberration as to be useless. I also have worked through a number of lenses, including apochromatics, in the hope of finding one properly corrected for it, but have entirely failed to find such a lens.

I am well aware that opticians will tell me that first-rate results may now be obtained without the use of any screen, but my experience has been that an apochromat with the malachite-green screen, which takes most lenses at their best, carries results much further than an apochromat without a screen. I would ask whether some one is not prepared to construct a lens in which everything has been sacrificed to spherical correction for the violet. If this were done we should combine the good points of a screen with the advantages of working without one, making use of rays of great resolving power on the one hand, and photographing with considerable rapidity on the other.

But the screen may even now be useful. By diluting the solution somewhat, the band widens out towards line F, and finally overlaps it. It is now, of course, not so monochromatic, and we should suppose would give inferior results. But we find that the spectrum obtained with the diluted solution very nearly coincides with that impressed on a bromo-iodide (ordinary) photographic plate without a screen, and takes in a portion of the spectrum covered by the malachite-green screen, for which lenses, generally speaking, are more spherically correct.

heart, like that of other bony fishes, is formed by the union in the median plane of the lateral plates of the mesoderm. He describes his observations in detail and discusses the origin of the solid mass of enclosed cells which give rise to the endocardium. He points out that there are five ways in which these cells may be supposed to have arisen, and every one of these has been defended. For himself he thinks that this intermediate cell-mass arises from the lower inner margin of the protovertebræ.

Yolk-syncytium and Blastoderm-rim in Salmonidæ.* — Herr H. Virchow, with the help of several figures, describes the changes which take place during the development of the Salmonid egg in the yolk-syncytium (parablast, periblast, yolksac-endoblast) up to the time of its commencing degeneration. The various differentiations which the syncytium exhibits are shown to be connected with corresponding changes in the overlying segmented portion of the egg. The author is very sceptical as to any possible wandering of nuclei in the syncytium, as the distribution of the nuclei is generally uniform. The nuclei of the syncytium are admittedly derived from nuclei of the segmented part of the germ; but the author opposes the idea that they undergo any changes of position other than the displacements caused by growth. Balfour's view that the edge of the germinal disc represents the lip of an enlarged blastopore is supported.

Formation of Mesoderm, Heart, Blood-vessels, and Blood in Salmonidæ.†—Herr Sobotta deals with the origin of the mesodermal tissues in the egg of Salmonidæ. As stated by Virchow, the blastoderm at an early stage consists of a lenticular disc of cells separated from the yolk by a cavity. An internal proliferation of the circular edge of the lower ("nervous") layer of the disc gives rise to a ringlike fold. This fold first appears at the hinder end of the blastoderm, but quickly extends along its whole periphery. The sides and anterior end of the fold consist only of mesoderm; the hinder end of mesoderm and endoderm. During the formation of the embryo as a swelling at the hinder end of the blastoderm, the hinder part of the meso-endodermal fold grows beneath the embryonic ectoderm, and separates in the middle region of the embryo into two layers—an upper layer of mesoderm, and a lower of endoderm. The notochord is differentiated from the endoderm at the time of the formation of the lateral mesoderm plates, and is at first connected with them; it soon becomes marked off from the mesoderm, however, and in a later stage is separated from the endoderm. The body-cavity arises as a schizocœle. The endothelium of the heart is not derived from endoderm, but from certain cells which separate from the mesoderm masses and come to lie on the ventral side of the gut. The cardinal veins and aorta take their origin in a peculiar paired cell-mass lying beneath the notochord and derived from the inferior median angle of the mesoblastic somites. The pronephric tubules arise as true diverticula of the cœlom; the pronephric duct, on the other hand, arises as a solid fold of the somatopleure in which a lumen subsequently appears. The ectoderm takes no part in the formation of the pronephros or its ducts.

* Anat. Anzeig., Ergänzungsheft, ix. (1894) pp. 66–77 (8 figs.).
† Tom. cit., pp. 77–84.

Vascular System of Salmonid Embryos.*—Herr Ziegenhagen has carefully studied the successive phases of the circulation in Trout embryos, and describes the changes which take place in the vessels of the yolk-sac and the connecting trunks (sub-intestinal and hepatic veins). His results are based upon camera drawings of the living object at successive stages, upon injections of the vessels, and upon an extensive series of microphotographs of living embryos.

External Views of the Developing Trout-egg.†—Herr Fr. Kopsch describes the successive external changes in the developing blastoderm of the Trout, from the morula to the tailed embryo stage possessing 30–40 somites and three pairs of gill-slits. By means of a diagram he shows that the germinal disc grows backwards round the yolk, uniformly with the elongation of the embryo, until one-half of the yolk is covered. When the edge of the germinal disc, however, has passed the equator of the egg it grows more quickly below (i. e. away from the embryo) than in its upper part, and the rudiment of the embryo increases only slightly in length.

A Zoophyletic Law of Development.‡—Herr Tornier, as a result of his studies on the origin of the forms of joints, concludes that multi- and uni-functional joints have been derived phylogenetically from "universal" joints. He now points out that a similar law holds good for the evolution of the Vertebrate foot as a whole; viz. that feet capable of only a minimal number of movements have been derived phylogenetically from feet capable of all kinds of movement. Not only is it true that the "universal" foot has preceded the multi- or uni-functional foot in phylogeny (cf. the evolution of the Perissodactyle limb), but it is also pointed out that "universal" Vertebrate-feet can be arranged in an ascending series according to the degree of differentiation exhibited by their joints. What is true of the individual foot is also true of the individual Vertebrate, considered as a machine for locomotion. There are land Vertebrates which can display all methods of locomotion, and others which can display only a definite number, or only one kind of locomotion. The forms possessing limited modes of locomotion have been derived from forms possessing every mode. This law the author would extend to the evolution of all other organisms and organ-systems. Animals adapted to a maximum of life-conditions are "universal" animals; and these may be arranged in an ascending evolutionary series. At the base of this series stand those universal animals in the organization of which no division of labour has yet appeared, whose functions are not yet localized, and whose organs are not yet specialized; and the higher stages of the series are furnished by animals showing increasing amounts of localization of function and specialization of organs. When an animal in the struggle for existence has become adapted to a reduced or minimal number of life-conditions, it has actually lost certain functions and certain organs, and must be ultimately derived from an ancestor of the "universal" type. Herr Tornier's law may be summed up in the familiar statement that the specialized is derived from the generalized, and that the generalized

* Anat. Anzeig., Ergänzungsheft, ix. (1894) pp. 84–9.
† Tom. cit., pp. 60–6 (1 fig.). ‡ Tom. cit., pp. 102–8.

may be arranged in an ascending series proceeding from the undifferentiated to the differentiated.

Experimental Embryology.*—Prof. O. Schultze has experimented as to the influence of cold on the development of the frog. He finds that after three days at zero, during which development was quite inhibited, there was not the least injurious effect observable. In the case of others kept fourteen days in the same conditions, those which had reached the stage with closed medullary canal perished, but all the rest, on to the stage of completed gastrulation, were unaffected. While Hertwig found twenty-four hours of zero temperature to be productive of injury to the ova, Schultze got normal embryos after twenty days.

Prof. Schultze † has also experimented as to the influence of gravity on the developing ova of frogs. He has repeated and confirmed some of Pflüger's well-known experiments. Pflüger showed that the first two cleavages were always vertical, whatever the angle (normally nil) between the egg-axis and the direction of gravity; that the rapidity of cell-division is dependent on the action of gravity; and that gravity influences the disposition of the organs. These results have been confirmed by zoologists, e. g. Rauber, Born, and the author, and also by botanists.

To keep the ova in an abnormal position, Schultze compressed them between horizontal glass plates. Eggs thus inverted showed equal segmentation and other peculiarities. The degree of abnormality is proportional to the angle between the normal egg-axis and the direction of gravity. With great regularity a simple turning of the fixed ovum through 180° is followed by the production of a double embryo, and the author justly expands on this interesting result, and on analogous phenomena. Occasionally the double larvæ reached the swimming stage, with double brain, spinal chord, and notochord.

We need not summarize Schultze's clear criticism of Roux's disappreciation of Pflüger's results, nor explain his machine for subjecting ova to rotation (at once fatal if on a vertical plane); his general argument is, that if definite modifications in the action of gravity produce definite abnormalities, then it must be allowed that the action of gravity is a condition of normal development.

β. Histology.

Cell-structure.‡—Herr G. Schloter describes in the cells of the Salamander (1) a coarse nuclear framework with "nuclear sap" in the interstices; (2) the granulation of the framework, some of the granules being, probably, plasmosomes; (3) the granulation of the "nuclear sap" or paralinin with achromatin granules. The author agrees both with Heidenhain and Reinke, and adds Altmann's granula to the "oxychromatin," "œdematin," &c., which are now described. The achromatin-granulation is Altmann's granulation, "oxychromatin" and "cyanophilous granulation" are independent structural parts of the chromatin framework. Reinke has, though he may not think so, left out Heidenhain's oxychromatin; and Heidenhain has left out Reinke's

* Anat. Anzeig., x. (1894) pp. 291–4.
† Verh. Phys. Med. Ges. Würzburg, xxviii. (1894) pp. 23–44.
‡ Archiv f. Mikr. Anat., xliv. (1894) pp. 249–59 (1 pl.).

œdematin. The author recognizes both and is likewise eclectic in regard to the plasma.

Physiological Meaning of the Different Forms of Endothelial Cells.*—Dr. G. Muscatello points out that the contour of endothelial cells in the vascular system and pleuroperitoneal cavity, which may be straight, sinuous, denticulate, or otherwise, varies in relation to the expansion or contraction of the organs. Klein has pointed out that the endothelial cells of the lymphatic capillaries vary in appearance in relation to the contraction or dilatation of the tissues with which they are connected; Muscatello has generalized this. Schwarz has also shown that the size of endothelial cells varies according to the state of the invested organ, but he has not noticed the margin.

Attraction-spheres and Centrosomes.†—Dr. J. Eismond maintains, as the result of a critical investigation, that the attraction-spheres are not more than regions in the cell-substance, solely characterized by a relatively finer and denser plasmic texture. They show no certain biochemical peculiarities nor morphological definiteness, and are excessively variable. They and their archiplasmic fibrils can be mimicked in Bütschli's emulsion; they represent inert centres of a dynamic system, or, more cautiously, they represent *regions* defined by their specific relations to the rest of the cell-substance.

Anatomy of the Nerve-centres.‡—Prof. J. Dejerine has, in collaboration with his wife Dr. Dejerine-Klumpke, published the first volume of a great work on the anatomy of the nerve-centres. The first part deals with methods, development, histogenesis, and general histology; the second with the macroscopic structure of the cerebrum, its topographical anatomy in horizontal, transverse, and sagittal sections, the histology of all the parts, the associational and commissural fibres, and so on.

Genesis of Intestinal Epithelium.§—M. E. de Rouville has been struck by the resemblance which may often be discovered between the epithelial elements of the digestive tube and the elements of the subjacent connective tissue; Frenzel has indeed been already struck by this. In a large number of his preparations the author has been able to convince himself of the fact that the limit between the epithelium and the connective tissue on which it lies is not always as distinct and well marked as one would think from the figures given by preceding writers. He has even observed the passage of the nuclei of the connective tissue above the epithelial cells, and their fall into the lumen of the intestine. This observation leads him to be inclined to regard the connective tissue not as being merely destined to bind together the different tissues, but as capable of playing an eminently active part—the rôle of formative tissue. Sabatier, indeed, has already said that "the connective tissue continues more or less throughout life to be a matrix whence arise the elements of other tissues . . . it is a post-embryonic blastoderm. Epithelia are in many cases at any rate only the form which binds the free surface of connective tissue."

* Anat. Anzeig., x. (1894) pp. 173–6 (2 figs.).
† Tom. cit., pp. 229–39, 262–72 (6 figs.).
‡ 'Anatomie des centres nerveux,' i., Paris, 8vo, 816 pp., 410 figs. and 45 col. ill.
§ Comptes Rendus, cxx. (1895) pp. 50–2.

γ. General.

Temperature as a Factor in the Distribution of Marine Animals.*—Dr. O. Maas points out that in the discussion of the influence of temperature on marine animals, no sufficient distinction has hitherto been made between three classes of facts—(1) between the animals of the plankton, the benthos, and the nekton; (2) between the vertical and horizontal differences of temperature; and (3) between eurythermal animals which can stand great differences of temperature and the stenothermal which cannot. Eurythermal animals must not be appealed to in proof of anything regarding temperature. For the stenothermal animals the average temperature of a locality is of small zoogeographical value, while the extent of variation is the most important factor. The nekton animals are more eurythermal; otherwise their power of swimming, which brings them into very different temperatures, would be of no use to them. It is possible to make a geographical distribution of the animals of the open ocean chiefly because of the currents. The Geryonidæ are found in every ocean basin not to go beyond a certain north and south latitude. In the scale of plankton animals, they occupy a similar portion of the map to the corals of the benthos.

Fauna of Lakes.†—M. F. A. Forel, who has devoted a large amount of time to lacustrine zoology, has a general essay on this subject. He points out that the whole fauna has immigrated into the lake. The littoral fauna arises directly from river or marsh species brought to the lake by streams or other methods. The pelagic fauna is remarkable for its cosmopolitan character, the same species are found always identical in all the lakes of the same continent and even on different continents. A number of species are common to the Old and New World. This dissemination is effected by the transport of germs, and, perhaps, even of living animals, on the skins of migratory birds. The deep fauna of the lake has been differentiated in the lake itself; the deep fauna of one lake can have no direct contact with the deep regions of other lakes. The fauna has probably arisen partly by some individuals of the littoral species being by some accident carried, or frightened to actively emigrate into the deep. Where they survived the transplantation they became adapted to the fresh conditions of the surrounding medium. Other individuals are probably derived from subterranean waters which open into the deep region of the lake, and which have found the conditions of the surrounding medium sufficiently similar to that of their primitive habitat to be able to dwell there and reproduce their kind.

Origin of Irish Land and Freshwater Fauna.‡—Dr. R. F. Scharff discusses the origin of the Irish Land and Freshwater Fauna, and comes to the conclusion that Ireland was in later Tertiary times connected with Wales in the south and Scotland in the north, whilst a freshwater lake occupied the present central area of the Irish Sea. The southern connection broke down at the beginning of the Pleistocene period, the northern connection following soon after. There is no evidence of any subsequent land connection between Great Britain and Ireland.

* Rep. Brit. Assoc., 1894, pp. 687–8.
† Arch. Sci. Phys. et Nat., xxxii. (1894) pp. 588–605.
‡ Proc. Roy. Irish Acad., iii. (1894) pp. 479–85.

Effect of External Influences on Development.*—Prof. A. Weismann's Romanes lecture, of which we had a notice at the time of its delivery,† is now published in full, and fifteen notes, controversial and otherwise, have been added to it.

Conception of Species.‡—Mr. N. L. Britton discusses our conception of species as modified by the doctrine of evolution. He appears to think that species as we now understand them, whether recent or extinct, will gradually be invalidated, and he prophesies that our present methods of nomenclature will prove insufficient to meet the necessities of the new biological era which is so rapidly opening before us.

Tunicata.

Budding in Goodsiria and Perophora.§—Dr. W. E. Ritter has a preliminary notice of his more important results in the study of *G. dura* sp. n. The bud is pallial as in the Botryllidæ, and arises as an evagination of the wall of the peribranchial sac. Buds appear never to arise from fully adult ascidiozooids, and become entirely severed from the parent at a very early stage of development, i. e. before there is any trace of differentiation of organs. There exist in the common testicular mass great numbers of much branched, anastomosing vessels which terminate in large ampullæ. These vessels contain no partition such as exists in the stolo prolifer of some other Ascidians, and plays so important a part in the production of blastozooids. The development of the organs of the blastozooids is in general quite similar to that which takes place in *Botryllus.* It is noted, however, that the common neurohypophysial rudiment arises at an early stage as a wide evagination from the dorsal portion of the so-called endoderm. The pericardial vesicle is present at an early stage in the development of the ascidiozooid, but the author has not yet been able to determine its origin. The heart developes from the pericardial vesicle in the usual way. It is suggested that *Goodsiria* and *Botryllus* will be found to be more closely allied than has hitherto been supposed. With regard to *Perophora* the author finds that numerous errors have crept into the descriptions that have been given by previous writers. When the endoderm becomes differentiated into the branchial and two peribranchial sacs it does so in such a way that the developing blastozooid is connected with the double-walled partition of the stolon, not by the branchial sac, as has been hitherto supposed, but by the left peribranchial sac. This communication is entirely severed at an early stage in the development of the bud, and the author claims to have established that in *P. annectens* and *P. Listeri* there cannot be an epicardium corresponding to the structure so called in *Clavelina.* The common rudiment of the central nerve-ganglion and the dorsal tube is one of the very first organs to appear, and every step in the differentiation of this rudiment into nerve-ganglion and dorsal duct can be followed with great ease and clearness. It appears to be certain that this common rudiment does not arise from

* London, 8vo, 1894, 69 pp. † See this Journal, 1894, p. 434.
‡ Trans. New York Acad. Sci., xiii. (1894) pp. 132–5.
§ Anat. Anzeig., x. (1895) pp. 364–8.

the ectoderm. What evidence there is as to its origin, points to its development from the free cells of the blood.

Budding of Distaplia magnilarva.* — Dr. J. Hjort and Herr F. Bonnevie find that the various stages of the budding of *Distaplia* are anatomically most like the buds of *Botryllus* and *Polyclinum.* The nervous system and hypophysis arise from the inner vesicle which is of endodermic origin. The outer vesicle is of no importance in the formation of the internal organs and only forms the integument of the adult bud. It follows therefore, that gemmation in *Distaplia,* as in *Botryllus* and *Polyclinum,* proceeds on essentially different lines to gemmation amongst other forms of animals. Regeneration, as much as larval development, is a process of new formation. The authors have not yet been able to decide the relation the bud of compound Ascidians bears to the bud of *Pyrosoma* and the Salpidæ. They believe, however, that the same laws hold for the compound Ascidians as for the others.

Supposed Vertebration of the Tail in Appendicularia.†—Mr. J. Rankin has investigated the tail of *Oikopleura dioica* and *Fritillaria furcata,* and finds it impossible to admit that its structure shows metameric segmentation. The axial chord is allowed by all to be unsegmented; the nerve-cord shows a very irregular distribution of ganglia; the interruptions in the musculature are *artificial fractures along transverse lines of weakness,* but are remarkably constant in number, usually nine in *O. dioica.* For these and other reasons the author denies the alleged vertebration. Recent investigations of the same subject by Lefevre and Seeliger are duly taken note of and criticized.‡

Development of Salpa democratica.§ — Prof. A. Korotneff notes that three sets of elements are involved, (1) the blastomeres, (2) the gonoblasts or kalimmocytes, derivatives of follicular cells, probably to a very small degree formative, if at all; and (3) what he proposes to call histogens which spring from blastomeres, and are intermediate between them and tissues.

Around the fertilized ovum, there is (*a*) a follicular capsule, and (*b*) a "brood-sac" which arises from a duplicature or insinking of the epithelium of the branchial cavity. The gonoblasts insinuate themselves among the blastomeres; at the same time the cells of the lower layer of the "brood-sac" form a loose mass in common with the gonoblasts; and in this the dividing blastomeres proliferate.

The blastomeres collect in the centre and multiply; their derivatives form "histogens," but some acquire large expanded nuclei and gradually degenerate into food-material. Some histogens multiply rapidly and form the mesenchyme—connective tissue and blood.

The histogens accumulated in the centre make a passage into the cleft of the brood-sac and fill up the lumen, forming a continuous ectoderm. After this is formed, the cells of the inner layer of the roof of the brood-sac separate from one another, and have the ectoderm covered only by the epithelial cells of the branchial cavity duplicature alluded to

* Anat. Anzeig., x. (1895) pp. 389–94 (3 figs.).
† Zool. Jahrb. (Abth. Anat. Ontog.), viii. (1894) pp. 289–300 (1 pl.).
‡ See this Journal, 1894, p. 557.
§ Biol. Centralbl., xiv. (1894) pp. 841–6 (6 figs.),

above. Soon this also goes, separates from the embryo, and forms at its sides the enveloping fold (*Faltenhülle*) seen in other Salpæ.

The inner mesenchyme mass divides the histogens into two groups in which two clefts appear. These unite as the branchial cavity. From the base of this the gill is constricted off. The cloaca is simply a part of the branchial cavity. The heart is a constriction, the gut an outgrowth, of the same cavity; but all the other organs arise from histogens without relation to ectoderm or endoderm.

In another investigation * Korotneff has studied in detail the stolon of Salpæ. Besides the genital strand, the nerve-strand, and the two cloacal tubes, described by Kowalevsky, the author discovers a fifth or pericardial strand. To an account of this a chapter is devoted.

The author then describes the extraordinary phagocytosis in the elæoblast, placenta, and "blood-bud" (*Blut-knospe*) of *Salpa pinnata.* Where the "Zellenkampf" is keenest, he finds colossal cells, whose possible function is suggested in the title "nephrocytes." These are of course in addition to the five kinds of free cells which Salensky has distinguished, and they add a new complication.

What the author has to say in regard to the relation of blastomeres and kalimmocytes has been already referred to. As to the difficult question of metagenesis, his opinion is as follows:—

There is a reproductive division of labour, one generation simply producing germ-cells, the other nursing. "The germ-cells arise exclusively in the first generation, which may be therefore called the germ-producer or *Gonogen;* the second generation forms no germ-plasm, but is merely a nurse, and may be called the brood-animal or *Gonotroph.*"

Development of Diplosoma Listeri.†—Prof. W. Salensky makes another detailed contribution to the embryology of the Synascidians.

The ovum has three concentric envelopes,—an external cellulose sheath, an ectoderm sheath, and a follicular layer. In the regular total segmentation, the bilateral symmetry which E. van Beneden and Julin demonstrated is very clearly illustrated. As to the bilateral development of the nerve-cord, nothing was observed; it appeared as an axial thickening of ectoderm after the closure of the blastopore. The primitive mesoblasts, however, show thorough symmetry.

Salensky describes the organogenesis in detail,—the closure of the medullary groove (with an explanation of the *Dachzelle*); the differentiation of endoderm from the common meso-endoderm; the origin of somatic mesenchyme and caudal muscle-plates from one and the same rudiment; the development of the peribranchial sacs; the formation of the cellulose mantle from the kalimmocytes exclusively (though in post-embryonic stages the mesenchyme may share), and the final development of the twin individuals.

Theory of Ascidian Buds.‡—Dr. J. Hjort returns to the difficulty raised by what he believes to be a fact—that in Botryllid-buds, the nervous system, gut, and peribranchial sac all arise from a common vesicular rudiment, which in turn is formed by an evagination of the peribranchial sac of the parental organism (whether larva or bud). Thus the young

* MT. Zool. Stat. Neapel, xi. (1894) pp. 325–67 (3 pls., 9 figs.).
† Tom. cit., pp. 368–474 (4 pls., 1 fig.).
‡ Anat. Anzeig., x. (1894) pp. 215–29 (5 figs.).

Botryllid bud is wholly *ectodermic*, excepting some migrant mesoderm cells. The fact has been confirmed by several workers, and Hjort now investigates the problem in *Glossophorum sabulosum.* Here the outer vesicle of the bud is, as before, continuous with the ectoderm of the parent animal, but this outer layer is passive in the bud-formation; the inner vesicle of the bud is continuous with the epicardium of the parent animal and *endodermic.* Thus in the *Botryllus*-type, the bud-rudiment is practically ectodermic, while in the *Polyclinum*-type it is endodermic. Can we suppose that the rudiment in each case, though topographically referable to ecto- or endoderm, is still potentially indifferent and undifferentiated, or what can we suppose?

INVERTEBRATA.

Physiological Morphology.*—Dr. J. Loeb has described some of his interesting experiments in one of the Wood's Holl Lectures. If apex and root-end be cut from an *Antennularia*, and the stem be hung in water in its original position, a new apex with lateral twigs and polyps is formed at the upper end, while new roots grow at the lower end. But invert the stem, and the original upper end, brought lowest, forms roots. When organs grow out of their proper place, Loeb speaks of heteromorphosis. If the stem be fixed horizontally, the downward arms become roots, and new stems are developed above (Geotropism). In the polyps *Margelis* and *Pennaria*, roots grow only when in contact with solid bodies, and polyps only when freely washed with water (Stereomorphism). An excised portion of *Cerianthus membranaceus* forms tentacles only at the oral end (polarization). In diluted sea-water, *Tubularia mesembryanthemum* grows more quickly than in the normal, and *vice versâ*; and great importance is attached to the osmotic factor in growth.

Sea-urchin ova at the 2-, 4-, or 16-celled stages, were placed in sea-water diluted with an equal volume of distilled water; the ova absorbed water, the membrane burst at one place, and part of the protoplasm protruded in a drop. Replaced in normal sea-water the eggs formed double or triple embryos; even a non-nucleated protruding drop is said to have gained a nucleus and developed into a normal embryo!

In the blastula, the cells, whose specific gravity has been decreasing, are in contact internally with fluid more dilute than that externally, hence a condition of invagination. In diluted sea-water, the tendency is rather to evagination.

Cardiac Activity of Invertebrates.†—Dr. Ph. Knoll has studied the heart-beats of various Invertebrates, e. g. *Mysis*, *Porcellana*, *Squilla*, *Daphnia*, *Pterotrachea*, and *Salpa*, especially in relation to the influence of altered temperature. At temperatures between 15° and 22° C., the number of heart-beats per minute differs widely in different forms. Thus the beats are uncountable in Copepods, 260 per minute in *Mysis*, 23–25 in large Tunicates. In small animals and in small species the beats are less frequent than in larger forms. Knoll directs attention to the "explosive" abruptness of the diastole, especially at temperatures

* 'Biological Lectures delivered at the Marine Biological Laboratory of Wood's Holl, Boston, 1894. Biol. Centralbl., xiv. (1894) pp. 846–8, summary by Prof. J. Rosenthal.

† SB. K. Akad. Wiss. Wien, cii. (1893) pp. 387–405.

between 20° and 30° C. Lowered temperature lessens the frequency of the beats, and increases the changes in volume, as well as the duration of the systole in relation to the diastole. Increased temperature has an opposite effect, also in agreement with what is true of Vertebrates. The beats ceased about 40° C., and the facts are against the supposition that the cessation is due to a coagulation of muscle-plasma, but in favour of the supposition that the change in metabolism (e. g. an accumulation of katastates) inhibits vitality. No ganglion-cells or nerve-fibres were visible in sections of the hearts of *Salpa*, *Ciona*, or *Pterotrachea*.

Blood-corpuscles of Invertebrates.*—Dr. Ph. Knoll has studied these in Lamellibranchs (*Pectunculus*, *Arca*, *Solen*, *Unio*, &c.); Polychæta (*Notomastus*, *Dasybranchus*, and others); Echinoderma (*Cucumaria*, *Strongylocentrotus*; Tunicata (*Ciona*, *Styela*, *Phallusia*, &c.); Cephalopoda (*Sepia*, *Eledone*, *Octopus*); Gastropoda (*Murex*, *Dolium*, *Aplysia*, &c.); Thoracostraca (*Astacus*, *Homarus*, *Squilla*, *Palinurus*, *Pagurus*, &c.).

The corpuscles are all demonstrably nucleated, except in a few cases, where the granulations probably hide the nucleus. But the size of the nucleus in relation to the cytoplasm varies widely in the same order, or even in the same individual. In Tunicates the nucleus appears disproportionately small.

The typical structure of the nucleus is a reticulum with thickenings at the nodes. All signs of division, whether of coloured or colourless corpuscles, were amitotic.

Knoll discusses the various granules contained in the corpuscles, many of which seem to be signs of active assimilative processes, while others, e. g. in the leucocytes of *Notomastus*, appear to be excretory; the changes of shape in coloured as well as colourless corpuscles; and the probability that amitotic multiplication occurs in part in the fluid blood.

Mollusca.

γ. Gastropoda.

Anatomy of Mollusca.†—Dr. L. Plate has found on the coast of Chili a number of *Phidiana inca*, and has taken the opportunity of making careful dissections of it. He has further some notes on the anatomy of *Siphonaria concinna*, the renal organ of which was found to consist of a ventral and a dorsal lobe. The former lies in the floor of the mantle-cavity, and is smaller than the latter. The dorsal lobe opens near the respiratory cleft by a small papilla. The organ is spongy in texture, and has no special ureter.

Subtropical Miocene Fauna in Arctic Siberia.‡—Mr. W. H. Dall has examined a small collection of fossils, comprising six species of Mollusca brought in 1855 from the Gulf of Penjinsk. The evidence afforded by them indicates unmistakably that the fauna included species that must have flourished in waters at least as warm as those now found in the Sea of Japan, or at a distance more than a thousand miles to the southward. The species themselves point to a distinct analogy with those of the seas of China and South Japan, and like the existing fauna

* SB. K. Akad. Wiss. Wien, cii. (1893) pp. 440–78 (2 pls.).
† SB. Akad. Wiss. Berlin, 1894, pp. 219–24.
‡ Proc. U.S. Nat. Mus., xvi. (1894) pp. 471–8 (1 pl.).

of those seas, they indicate bonds of relationship with the West Coast of Africa and the coast of Australia, rather than with the Indo-Pacific fauna of North-east Africa and the Malay Archipelago.

Mechanical Cause of Folds in Aperture of Shell of Gastropoda.*—Mr. W. H. Dall has a short but interesting essay, in which he attempts to trace to a mechanical cause the folds which are frequently present on the columella and lip of the aperture of the shells of Gastropoda. Reduced to its ultimate terms all we have is a twisted, shelly, hollow cone inside of which is a thin loose epithelial cone, the mantle, of which the external surface is shell-secreting. Inside the mantle is a more or less solid third cone consisting of the foot and other external parts of the body of the animal, which can be extended beyond the mantle-cone outwardly, as the mantle-cone can be beyond the shell-cone. The two outer cones constitute a loose flexible funnel within a rigid inflexible funnel, while the body-cone forms a solid elastic stopper inside of all. When the mantle-cone is withdrawn into a part of the shell-cone too small for the natural diameter of the contracted mantle-cone, it is clear that it must wrinkle longitudinally. The wrinkles will first come at the angles of the shell-cone and they will be most numerous between them and the aperture. Enough has been said to show the lines of Mr. Dall's arguments.

Connective Cells of Gastropoda.†—M. J. Chatin has come to the conclusion that the connective cell of the Gastropoda is not the simple unalterable structure which it is ordinarily supposed to be, and he describes a number of different stages. It should first be studied in its youth, when it is generally polyhedral in form and consists of homogeneous protoplasm and a relatively large nucleus; the nuclear membrane is difficult to demonstrate. As the cell grows the large size of the nucleus appears to diminish, but in some cases karyomegaly exists, as in the mantle of *Zonites*, of slugs, and of Prosobranchs, the circumcerebral tissue of snails, and the tissue around the otocyst in *Cyclostoma*. As the cell grows it alters in form so that it may be oval, fusiform, rounded or stellate. This last condition is by no means infrequent, and it may be seen, for example, in the nerve-centres of the snail. As the cell grows its internal structure may undergo secondary modifications, and a complex network may appear in it. Considering the activity of this element, one cannot be surprised at the formation of products in its interior. Of these, pigmented bodies are the most common.

Arthropoda.

α. Insecta.

Greenland Insects.‡—Prof. C. H. Fernald calls attention to the very dark colour of the insects in a small collection from Greenland. He explains the fact by their resting on lichen-covered rocks, where the lichens are dark-brown or black. Natural selection would lead to the establishment of a dark race through the elimination of light-coloured individuals.

* Amer. Nat., xxviii. (1894) pp. 904–14 (3 figs.).
† Comptes Rendus, cxix. (1894) pp. 922–4.
‡ Ent. News. v. p. 132. See Amer. Nat., xxviii. (1894) p. 964.

Physiology of the Compound Eye.* — Herr A. Kiesel found a periodic displacement of pigment, first in one direction and then in the other, in the eyes of nocturnal Lepidoptera *which were kept permanently in the dark.* He believes that the phenomenon is the accompaniment of the insect's sleep. He suggests using the displacement of pigment as a test for discovering the range of light to which an insect is sensitive; thus he finds that ultra-red rays are perceived by *Plusia gamma.* The second part of Kiesel's paper seeks to explain how an insect requires but a small visual angle in order to perceive its surroundings and how it is thus saved from being blinded as it flies in the glare of the sun.

Histology of Nervous System in Insects.†—Sig. R. Monti describes the nerve terminations in the muscles of Orthoptera, Coleoptera, Lepidoptera, and Hymenoptera, in larvæ as well as adults. He used Ehrlich's intra vitam methylen-blue method. In Orthoptera the nerves generally show free terminations; in larval Coleoptera the fibrils of the nerves end in clearly raised plates (*collines* of Doyère), and sometimes, as in the adults, in a cellular reticulum; in larvæ of Lepidoptera there are plates, in the adults the nerve-fibres give off lateral fibrils which ramify around the muscle-fibres and end in little knobs; in the larva of *Cimbex variabilis* a terminal plate beneath the sarcolemma is very clearly seen.

In the central nervous system of *Gryllotalpa vulgaris*, the nerve-cells seem all unipolar; their prolongation may be traced into a nerve-fibre issuing from the ganglion, or it may be lost in ramifications. The granular substance of Leydig consists of a very fine coil of fibrils derived from the subdivision of the prolongations of the cells and from the subdivision of the fibres. But, in short, what Golgi has shown for Vertebrates seems also to be true of insects.

Pigments of Pieridæ.‡—Mr. F. G. Hopkins publishes an abstract of a contribution to the study of excretory substances which function in ornament. The wing-scales of the white Pieridæ are shown to contain uric acid, which substance bears the same relation to the scale as do the pigments in the coloured Pieridæ, so that it practically functions as a white pigment. The yellow pigment found in the majority of the Pieridæ is a derivative of uric acid. The yellow pigment may be artificially produced by heating uric acid with water in sealed tubes at high temperatures, and the identity of the natural and artificial products may be demonstrated by the similarity of their spectrum. Mr. Hopkins believes that this yellow substance, which may be called lepidotic acid, together with a closely allied red substance, will account for all the chemical pigmentation of the wing-scales of the coloured Pieridæ, though modifications may be produced by superadded optical effects. These uric acid derivatives, though universal in the Pieridæ, are apparently confined to this group among the Rhopalocera. This fact leads to the interesting observation that where a Pierid mimics an insect belonging to another family, the pigments in the two cases are chemically quite distinct. The fact that the scale-pigments are really the normal excre-

* SB. K. Akad. Wiss. Wien, ciii. (1894) pp. 97–139 (1 pl., 6 figs.).
† Rend. R. Ist. Lomb., xxv. (1892, received Feb. 1895) pp. 533–50.
‡ Proc. Roy. Soc., lvii. (1895) pp. 5 and 6.

tory products of the animal utilized in ornament is emphasized by the observation that the yellow Pierids on emergence from the chrysalis are apt to void from the rectum a quantity of uric acid, coloured by a yellow substance, which exactly resembles the pigment of the wing.

Social Insects and Evolution.*—Prof. C. V. Riley uses these insects as a basis for a discussion of the question whether acquired characters are transmitted. He believes that the variations in social insects have been guided by natural selection among colonies, but that there has also been social selection among individuals. He believes, moreover, that both the colony selection and the social selection have not been only along lines that were and are useful to the species, but along lines of secondary utility and even along lines which are purely fortuitous, and still most variable and unfixed. He calls attention to the significant fact that just as in Man, among Mammalia, the higher intellectual development and social organization are found correlated with the longest period of dependent infancy. We are justified in concluding that this dependent infancy is in social insects as much as in Man the prime cause of the higher organization and division of labour so characteristic of them.

A Fig-eating Caterpillar.†—M. Decaux has a note on the caterpillar of *Simaethis nemorana* Curtis, or *Tortrix nemorana* Hubner, or *Asopia incisalis* Treits, or *Xylopoda nemorana* Duponchel, which is not uncommon in the Mediterranean region, and has recently shown itself very destructive of the leaves and fruits of figs in the district of Puget-Théniers.

Production of Males and Females in Meliponites.‡—M. J. Perez has been able to study the internal economy of the colonies of these exotic bees, and finds that there is no essential difference from what happens with the French domestic bee. On the other hand, *Trigona clavipes* was observed for several weeks, and found to contain a large number of males but not a single female. He has kept a hive of a small *Trigona* from Uruguay under observation for nearly three years, and found that it gave rise to a queen in the second year, and virtually several queens in the third year, but never to a single male. The premature death of the queen stopped the observation and left it undecided whether she would have continued throughout the whole of her life to produce nothing but females, or if she would not have given birth later to some males. In any case the non-simultaneous production of individuals of the two sexes in one and the same colony of certain species of *Meliponites*, shows the necessity for cross-fertilization, the advantages of which are well known to naturalists.

Nests of Vespa crabro.§—M. C. Janet has studied in detail the development of the nests of this wasp. He has directed particular care to the order of appearance of the first cavities, and has discovered a special symmetry to which he calls attention. The first envelope is constructed entirely by the mother and remains intact until the appearance of the first workers. These construct fresh and larger envelopes, and then demolish the primitive envelope, which has become insufficient.

* Rep. Brit. Assoc., 1894, pp. 689–91.
† Comptes Rendus, cxix. (1894) pp. 695–6. ‡ Op. cit., cxx. (1895) pp. 273–5.
§ Op. cit., cxix. (1894) pp. 1282–5 (8 figs.).

Parasitic Hymenoptera of St. Vincent.* — Messrs. C. V. Riley, W. H. Ashmead, and L. O. Howard have a report on the parasitic Hymenoptera collected by Mr. H. H. Smith for the West India Committee. It is said that the material collected has proved of great interest. In addition to a large number of new species, many of those found by Guilding have been rediscovered. Though a number of the forms are found within the United States, they are species of wide distribution, and the characteristic fauna of St. Vincent is much more nearly like that of northern South America than of North America, or even of the sub-tropical portion of the Floridan peninsula.

Salivary Glands of Bees.†—M. Bordas finds in the workers of *Apis mellifica*, two new salivary glands which he names internal mandibular and sublingual. In the drone, he describes post-ocellary glands and a very large sublingual. Bees also possess thoracic, post-cerebral, supra-cerebral, and external mandibular glands.

Morphology of Stylops melittæ.‡—Herr N. Nassonoff finds that the females of this species have much resemblance to the free-living larvæ. The integument consists of the matrix and of three chitinous layers somewhat separated from one another. The outermost arises from the last larval ecdysis, and corresponds to the cocoon of the male; the second (pupal layer) probably corresponds to the investment of the male pupa. The innermost layer (imaginal layer) alone represents the chitinous covering of the adult insect. The interior of the body of the adult female is filled with eggs, amongst which lie fat-cells. We may find eggs in all stages of development; at the same time the females observed by the author probably reproduced themselves parthenogenetically. It would appear that the multiplication of the Strepsiptera is an example of pseudopædogenesis, the females never being completely developed.

Seat of Life in the House-fly.§—Dr. J. B. Smith, remarking that the house-fly is capable of standing a good deal of mutilation without manifesting pain and without dying at once, made various experiments to test what injury would kill immediately. Decapitated flies lived from 10 to 16 hours, and would run or fly when disturbed, though without any idea of direction. When the abdomen was cut off, flies lived from 6 to 10 hours and for the greater part of the time were active, running and flying readily. When head and abdomen were both removed these parts died in a few minutes, but the thorax retained life for more than 6 hours, and could be readily induced to walk. Dividing the insect between the first and second pair of legs killed all the posterior parts at once, while the anterior parts remained alive from 4 to 5 hours. Cutting an insect through the prothorax just above the fore-legs killed it at once. Dr. Smith concludes that the vital point lies in the large ganglion in the prothorax.

Luminosity of Midges.‖—Mr. P. Schmidt discusses the causes of the luminosity of Midges. He fails to come to any final conclusion, as

* Journ. Linn. Soc. Lond., xxv. (1894) pp. 56–254.
† Comptes Rendus, cxix. (1894) pp. 693–5.
‡ Entomol. Untersuch. Warsaw, pp. 75–92; see Zool. Centralbl., i. (1894) pp. 766–7.
§ Proc. Amer. Assoc., 1893–4, pp. 230–1.
‖ Zool. JB. (Syst.), viii. (1894) pp. 58–66.

all the points adduced are only indirect and not direct proofs. He is inclined, however, to regard Bacteria as the cause of the phenomenon. The characteristics of this luminosity appear to be, that it is not confined to peculiar, specially luminous species, but is found in the most common and widely distributed. It is not a localized luminosity, but extends over the entire body and all its appendages. It is entirely independent of the whole animal, and persists for a long time even in alcohol. No observer seems to have been able to detect any structures which resemble luminous organs, although well preserved midges have been investigated. As the males are luminous as much as the females, the luminosity cannot be of service from a sexual point of view, nor can it serve as a lure, for midges are not predaceous insects.

Life-history of Chermes abietis.*—Herr N. Cholodkowsky withdraws his previously expressed opinion that the normal host of *Chermes abietis* L. might in the north be *Pinus sylvestris* and not the larch. He finds that the insects do not survive the winter on the fir. But more important is his conclusion that the species includes two distinct races —a yellow and a green. The yellow race is commoner in North Russia, where the green race only occurs in parks and gardens. Linnæus described the yellow race as *Ch. abietis*, Ratzeburg described the green race as *Ch. viridis*. Similarly *Ch. strobilobius* includes two distinct races, one of which the author had described as *Ch. lapponicus*.

Systematic Position of Siphonaptera.†—Prof. A. S. Packard has a critical notice of recent work on these insects, and comes to the conclusion that they form an order independent of the Diptera, though on the whole more closely allied to them than to any other order of Insects. After comparing their embryonic stages with those of the Diptera, he passes to the differences in the adult condition. Among their characteristics may be noted the absence of a clypeus and labrum, the homology of their thoracic segments, and the great development of the legs, though this, of course, is an adaptive character. He sums up in a few words the characteristics of the group, and concludes with some hints as to their origin. It is difficult to say whence the Diptera arose, for, owing to the high degree of the specialization of some of their organs and the atrophy of others, they diverge widely from the primitive forms of the Insecta. Like the Diptera, the Siphonaptera have no traces of temporary abdominal legs, and this seems to show that they are the most extremely modified of all insects. We must, it appears, be content to say that the Siphonaptera stand nearer to the Diptera than to any other order, and that they must have diverged from the ancestral stem before the existing flies had become so extremely specialized as we now find them to be. Information is wanted as to the presence or absence of temporary abdominal legs, of the imaginal discs of the wings, and of rudiments of wings in the pupa, as well as to the development of the labium.

Spermatogenesis of Caloptenus femur-rubrum.‡—Mr. E. V. Wilcox has a preliminary notice of the spermatogenesis of this Orthopteron, the testicular follicles of which are long blind tubes. In the early prophases

* Zool. Anzeig., xvii. (1894) pp. 434–7.
† Proc. Boston Soc. Nat. Hist., xxvi. (1894) pp. 312–55 (35 figs.).
‡ Anat. Anzeig., x. (1894) pp. 303 and 4.

of the first maturation division a coiled thread with chromatic granules scattered along its entire length is to be seen. This thread breaks up into twelve segments, which become associated in pairs in such a way as ultimately to form rings. Each ring becomes a "Vierergruppe" by the concentration of the chromatic substance into four chromosomes. The two maturation divisions which follow result in giving each spermatid six chromosomes.

According to the author's observations on *Caloptenus*, both maturation divisions are reduction divisions in Weismann's sense, but there is no longitudinal splitting of the chromatin thread just before the last two divisions; hence there are no identical pairs of chromosomes, and neither of two maturation divisions can be an equation division.

Biology of Horse-Bot.*—Prof. H. Osborn finds that the eggs of the Horse-Bot do not hatch unless they are assisted by the horse's tongue; the hatching of the larvæ takes place most readily during the third to fifth week after deposition. The majority of the larvæ die after 35 to 40 days. It is possible, though not normal, for eggs to hatch without moisture or friction. It is concluded that scraping off the eggs or their destruction by means of washes will be very effective, even if not used oftener than once in two weeks during the period of egg deposition.

β. Myriopoda.

Copulatory Appendages of Iulidæ.†—Dr. C. G. Attems finds that there is essential resemblance in the copulatory appendages throughout the whole genus *Iulus*. As is well known, the copulatory appendages occur on the seventh ring; the first pair are flat lamellæ which may bear a flagellum (a long hooked bristle with a swollen bulbous base); the second pair are more complex and more variable. On a groove of the second appendage in which the seminal fluid flows there opens the duct of a (prostate?) gland hitherto overlooked. The author explains the structure in the various types of *Iulus*, and thinks that it is unwarrantable to split up the genus (into 5 genera and 14 subgenera) as Verhoeff has proposed. He would recognize only two subgenera—*Mastigoiulns* and *Enantiulus*, respectively with and without flagellum.

δ. Arachnida.

Structure and Development of the Endosternite.‡ — Herr W. Schimkewitsch gives an account of what he and others have observed as to the endosternite and its related musculature. He describes the ectodermic endoskeleton of *Galeodes caspius*. The tissue of the endosternite consists of fibrils united in bundles and of complexes of cells which lie in cavities. It arises from cells which grow inwards from the parietal muscular layer, and is a special case of a general tendency to replace an ectodermic endoskeleton by a mesoskeleton.

Development of Acarina.§—Sig. F. Supino gives some account of the development of Acarina, e. g. *Psoroptes ovis* Gerl., *Aleurobius farinæ*

* U.S. Dept. Agric. Div. Ent. Bull., xxxii. p. 48; see Amer. Nat., xxviii. (1894) p. 964.
† Zool. Anzeig., xvii. (1894) pp. 356-9.
‡ Zool. Jahrb. (Abth. Anat. Ontog.), viii. (1894) pp. 191-216 (2 pls.).
§ Atti Soc. Trentina Sci. Nat., ii. (1895) pp. 242-61 (3 pls.).

De Geer, *Freyana anatina* Koch. He begins with notes on the ova—their form, envelopes, &c.; he describes a very distinct germinal vesicle in *Psoroptes ovis*, though this body is usually not to be detected in the ova of Acarina. The blastoderm plate shows five pairs of rudimentary appendages; the first give rise by proliferation to mandibles and palps, the other four become limbs. The author lays emphasis on the clearness with which he has been able to show four pairs of limbs in the embryo. When the larva issues from the egg it has only three pairs of limbs, but in the succeeding nymph-stage there are again four. On account of the developmental peculiarities of Acarina, the author would rank them as a distinct sub-class of Tracheata.

ε. Crustacea.

Physiology of Decapoda.*—M. C. Saint-Hilaire thinks that his work has been inadequately appreciated by Cuénot. For before Cuénot he pointed out that food was absorbed in the midgut gland. He adheres to his conclusion that the vacuolated cells do not produce the ferment. According to Cuénot, the vacuolated cells, besides producing ferment, eliminate injected pigment directly from the blood. Except methyl-blue the pigments simply diffuse out, but are not "excreted." According to Saint-Hilaire, the injected pigments penetrate first into the cavities of the tubes and are then absorbed by the vacuolated cells; it is impossible to fix a limit between excretion and osmotic penetration as Cuénot does. Saint-Hilaire's general view is that the midgut gland regulates the composition of the blood and of the formed juices.

Lobster Reproduction.†—Prof. S. Garman draws attention to a report of his, published by the Massachusetts State Fishery Commission, in which he appears to have anticipated many of the results recently related by Mr. F. H. Herrick.‡ He found that the female Lobster lays eggs but once in two years. As the normal time of laying is when the water has reached its summer temperature, that time varies in different seasons and places. The eggs do not hatch before the summer following that in which they were laid, and the time of hatching also varies as the temperature.

Action of Gravity on Nucleolus of Lobster.§—Mr. F. H. Herrick has a note on an unexplained phenomenon in the egg of the American lobster. He finds that the nucleoli of all eggs are eccentric and all lie on the same side of the nucleus. Experiments showed that the supposition that this was due to gravity acting directly upon the nucleolus was correct. The ovary of a lobster was cut into several parts, and these were hardened in different positions. It invariably followed that the nucleolus fell, from its own weight, to the lower side of the nucleus like a shot within a tennis ball. It is pointed out that this phenomenon is a direct result of the structure of the nucleus and the action of gravity. There is no trace whatever of a nuclear network.

Development of the Body of the Prawn and the Crayfish.‖—M. L. Roule has for some years been engaged in the study of the development

* Zool. Anzeig., xvii. (1894) pp. 349–52. † Tom. cit., xviii. (1895) pp. 38–40.
‡ See this Journal, 1894, p. 677. § Anat. Anzeig., x. (1895) pp. 337–40.
‖ Comptes Rendus, cxx. (1895) pp. 27–3.

of *Palæmon serratus* and *Astacus fluviatilis*. He points out the differences of the mode of development from *Porcellio*, which he has lately described, and directs particular attention to the mode in which the body becomes curved.

Deep-sea Crustacea from the Bay of Bengal.*—Drs. A. Alcock and A. R. Anderson give an account of a collection of deep-sea Crustacea containing 96 species, exclusive of Paguridæ, obtained between 91 and 1370 fathoms. Of these 96 species, 31 appear to be undescribed, while 15 are new to the Indian fauna. The most interesting appear to be *Engystenopus*, a deep-sea Stenopid allied to *Stenopus*, *Bathyankyristes*, a Galatheid allied to *Munidopsis*, and *Archeoplax*, a crab of a remarkable antique facies, which seems to be closely allied to *Cymopolia*.

Blind Crayfishes of Indiana.†—Mr. W. P. Hay found in the Siloh cave a number of blind Crayfishes. They did not appear to be at all sensitive to light, nor did they notice a loud call or a shrill whistle. Disturbance of the water does not seem to affect them, and it is only when they are touched that they manifest fear. Large specimens could inflict a pretty severe nip, but they did not appear to be as strong as outside species. When first taken from the water they were of translucent pinkish-white colour, with the stomach showing through as a blue body. Immersion in alcohol soon changed the colour to an opaque white, and obscured all traces of the internal organs. On examination the species was determined to be *Cambarus pellucidus*; the variation in length of the rostrum and the general spininess of the body is very great. It is stated that as a rule this Crayfish is smoother the further north it occurs.

Atyidæ.‡—Mr. A. E. Ortmann has made a study of the systematic and geographical distribution of this family of Decapoda. The Atyidæ are confined to the fresh waters of the tropics and sub-tropics, since they cannot endure cold, are true fresh-water animals, and, being of an ancient type, are probably restricted by the occurrence of other fresh-water animals.

Crustacea of the Caspian Sea.§—Prof. G. O. Sars has a further contribution on this subject.‖ He continues his account of the Gammaridæ and describes nine new species of the genus *Gammarus*. The genus *Niphargoides* is founded on Grimm's *Niphargus caspius*, with which genus it has no close affinity as nearly all the appendages are very differently constructed—indeed its nearest ally appears to be *Pontoporeia*.

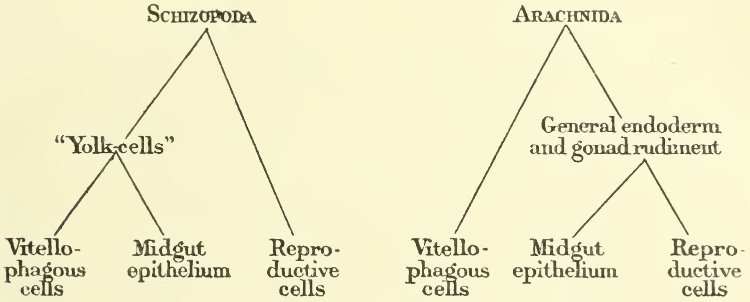
Development of Schizopods.¶—Herr J. Wagner withdraws a previous note on the development of *Neomysis vulgaris*. In regard to the origin of the germinal layers, he agrees in general with Bergh. At the beginning of the tail formation, the embryo shows (1) a heart-shaped ectodermic thickening, the true embryonic streak; (2) mesoderm cells,

* Journ. Asiatic Soc. Bengal, lxiii. (1894) pp. 141–85 (1 pl.).
† Proc. U.S. Nat. Mus., xvi. (1894) pp. 283–6 (2 pls.).
‡ Proc. Acad. Nat. Sci. Philad., 1894, pp. 397–416.
§ Bull. Acad. Imp. Sci. St. Petersburg, i. (1894) pp. 343–78 (7 pls.).
‖ See this Journal, 1894, p. 679.
¶ Zool. Anzeig., xvii. (1894) pp. 437–40.

in fairly regular rows, in the posterior portion of the embryonic streak; (3) a small plate of cells which Bergh (erroneously) calls the endoderm disc; and (4) the so-called yolk-cells, a layer of large vesicular cells lying on the yolk.

These yolk-cells, which Bergh leaves unheeded, surround the yolk, increase in size, become pyramidal in form, and absorb the yolk. But before the formation of the stomodæum, some of the yolk-cells separate off in the region where that invagination will occur; these form the midgut epithelium. The other yolk-cells subsequently degenerate. What Bergh calls the endoderm disc turns out to be the rudiment of the gonads.

Wagner gives this comparison between the development of Schizopods and Arachnids (Scorpion and Phalangidæ):—



Small Crustacea from New Mexico.*—Mr. C. L. Herrick reports that the valley of the Rio Grande contains pools in which, after heavy rain, there appear large numbers of Phyllopoda. Although the species are limited there is no lack of individuals. The numbers of *Moina* which appear in fresh rain pools is enormous, and amongst them is *M. rectirostris.* All the Calanidæ and Harpacticidæ found were new. The author describes several new species, for some of which he makes the new genus *Marshia.*

Development of Kidney and of General Cavity in Cirripedia.†—M. A. Gruvel, who found that in adult Cirripedes there was no communication between the kidney and the general cavity, has examined the arrangements which obtain in the young. He has studied a series of *Lepas pecturata.* There is in the larval stage a quite small cavity which communicates directly with the exterior by a pair of orifices, and which evidently represents the general cavity of the adult. At the bottom of this cavity there is a small mass of cells with a narrow central lumen, which is the commencement of the renal gland. As the general cavity increases in size the lumen of the gland increases more and more, and in quite young individuals, shortly after their escape from the larval test, there is a distinct communication between the general cavity and the kidney. As the animal grows, renal cells become more and more differ-

* Zool. Anzeig., viii. (1895) pp. 40–7 (28 figs.).
† Comptes Rendus, cxix. (1894) pp. 1228–30.

entiated, and the sac closes completely. It would seem that the general cavity of the adult was primitively a simple excretory canal. The author throws doubt on the correctness of the homology between the larval kidney of Cirripedes and the test-gland of other Crustacea.

Revision of the Cladocera.* — M. J. Richard has prepared what would appear to be the first part of a revision of the Cladocera, were it not that the second half has not appeared in the succeeding number of the 'Annales.' The author gives a full, if not exhaustive, bibliography of his subject by reciting 429 titles. He gives a general account of, and revises the species belonging to the Ctenopoda.

Annulata.

New Classification of Polychæta.†—Dr. W. B. Benham makes some suggestions for a new and, we may add, much needed classification of this group. He thinks they may be divided into two grades: (1) Eucephala, in which the prostomium retains its original condition as a lobe overhanging the mouth, and the peristomium shows no tendency to overgrow it; the body segments are all alike. The second grade may be called that of the Cryptocephala, as the peristomium grows forward and fuses or even entirely conceals the prostomium, which is greatly reduced. The body segments are differentiated into two groups indicated by the sudden alteration of the chætæ, and internally by certain differences. The Eucephala include four sub-orders:—

(1) Nereidiformia (= Errantia auct. together with Ariciidæ). Here the prostomium generally carries tentacles and palps and the peristomium usually carries special cirri. There is a pharynx which is frequently armed with jaws.

(2) Scoleciformia including the four families, Opheliidæ, Arenicolidæ, Scalibregmidæ, and Maldanidæ. There are no prostomial tentacles or palps, and the peristomium is without special cirri. There are no jaws, though the anterior end of the gut may be eversible.

(3) Terebelliformia (Cirratulidæ, Chlorhæmidæ, Sternaspidæ, Terebellidæ, &c.). The prostomium carries tentacular appendages, the achætous peristomium may carry filamentous processes; buccal regions not eversible.

(4) Capitelliformia includes the family Capitellidæ.

The second grade is divided into two sub-orders:—

(1) Spioniformia (Spionidæ, Magelonidæ, Chætopteridæ, Ammocharidæ); they retain the prostomium as a small lobe without definite tentacles or palps, but the peristomium is relatively large, and extends forwards on either side of the prostomium. This segment usually carries very long flexible tentacles; buccal regions eversible, but without jaws.

(2) Sabelliformia (Sabellidæ, Eriographidæ, Serpulidæ, Hermellidæ). The prostomium is in most cases entirely concealed by the great development of the peristomium, and may be reduced to mere sensory knobs, but the palps are very greatly developed and function as gills.

* Ann. Sci. Nat., xviii. (1894) pp. 279–389 (2 pls.).
† Rep. Brit. Assoc., 1894, pp. 696–7.

Blood of Magelona.*—Dr. W. B. Benham reports that the blood of this worm differs entirely from that of any other Chætopod hitherto examined. Instead of a red liquid plasma, in which a few nucleated and colourless corpuscles float, the blood-vessels of *Magelona* are completely filled with very small spherical globules of a madder-pink colour floating in an extremely small amount of colourless plasma. These globules are not cells; their colour is due to a pigment similar to hæmerythrin. The globules themselves, when shed, exhibit a marked tendency to run together like oil-drops and fuse with one another. This peculiar and rather viscous mass seems to be intermediate in some respects between the absolutely liquid coloured plasma of Chætopods generally, and the red corpuscles of Mammals which float in a comparatively small amount of colourless plasma; further, the globules in *Magelona* probably originate, as those of Mammals do, within cells from which they are released.

Cephalic Lobe of Euphrosyne.†—M. E. G. Racovitza recalls the structure of the cephalic lobe of *Amphinome*, and points out that if certain series of forms of the family are studied, two tendencies may be observed. In the modification of the anterior extremity the parapodia of the first three or four segments are carried more and more forward, so that their axis tends to lie in the sagittal plane of the body, or the mouth and the lips are carried further and further back, and the anterior pair of eyes with the paired antennæ tend to pass on to the ventral surface. It is probable that the second tendency is only a function of the first. These modifications are manifested in a very high degree in *Euphrosyne*, the details of which the author gives. In the course of his account he points out that the glandular organs of M'Intosh are only masses of pigment deposited in the posterior lobes of the brain. Similar masses are found along the pedal nerves, as well as in other Polychæta. In *Spinther* the tendencies described by the author are even more completely realised. The parapodia of the first segment are fused in front of the cephalic lobe. The caruncle, the lips, and the paired antennæ disappear.

Later Development of Polynoe Larvæ.‡—Dr. V. Haecker has followed the development of *Polynoe* from the formation of metameres to the beginning of the metamorphosis into adult form. In other words, he is mainly concerned with the *Nectochæta* stage, which is intermediate between the trochosphere and the adult form. This stage is marked by the following histological peculiarities:—(1) in the head region, especially in the degenerating ciliated ring, the epidermis shows large lacunæ containing a substance which stains pale violet with alum-cochineal: (2) at various parts of the body, but especially in the rudiments of the cirri, there are numerous intracellular glandular saccules whose secretion becomes dark carmine red when fixed with osmic acid and stained with alum-cochineal; (3) in the seven primary segments there are strongly developed provisional nephridia, whose contents give a similar reaction to that just noted; (4) in the anterior part of the gut there are isolated cells whose plasma shows a uniform and dense disposition of "pearl-

* Rep. Brit. Assoc., 1894, p. 696.
† Comptes Rendus, cxix. (1894) pp. 1226–8.
‡ Zool. Jahrb. (Abth. Anat. Ontog.), viii. (1894) pp. 248–88 (4 pls.).

like" drops, containing a substance which turns yellow with the osmic acid and cochineal treatment.

As more or less new, the author emphasizes what he has to say in regard to the lacunar state of the transitional epidermis, the development of the setæ, the genetic homology between cirri and elytra, the occurrence of unicellular glands in the rudiments cf the cirri, the structure of the ventral papillæ, whose central cells are regarded as luminous, the origin of the brain from three distinct parts, the extension of the area of growth in the terminal region of the body, the development of the gullet from a paired diverticulum of the stomodæum (cf. *Lopadorhynchus*), the formation of longitudinal canals within the degenerating "inner cellular layer" of the gullet, the arrangement of different cell-types as terms in a developmental series, the structure of the longitudinal muscle cells, the appearance of the ventral longitudinal vessel in the Nectochæta stage, the close connection between the ectoderm and a mesodermic proliferation in the formation of "secondary" segments, the provisional nephridia in the seven "primary" segments, the occurrence of rudimentary gonads in the most anterior segments of the Nectochæta, and the difference between the karyokinesis in the gonad-rudiments and that in the vegetative tissues.

History of the Archoplasm Mass in Spermatogenesis of Lumbricus.*—Mr. G. A. Calkins applies the term of Archoplasm mass to the body which acts like an attraction centre in the early germ-cells, and which finally becomes the middle piece of the mature spermatozoon. This mass is quite conspicuous, and not difficult to demonstrate if the proper stains are employed. Any nuclear stain is sufficient to reveal its presence, but Kleinenberg's hæmatoxylin and the iron-hæmatoxylin of Heidenhain give the best results. The spermatid is attached at one end to the spermatophore, and the division plane by which it is formed is radial. The elongation of the spermatid takes place radially to the centre of the sphere, and the centrosome is compelled to move through a right angle towards either the future tail end of the spermatozoon or the future head end. As a matter of fact it invariably moves towards the tail end. Preparations of different stages show that the archoplasm mass and the middle piece of the spermatozoon are one and the same substance. This identity furnishes a clue to the solution of the apparent contradiction between such cases as are afforded by Echinoderms on the one hand and the Axolotl on the other.

Excretory Function of Midgut in Worms.†—Herr W. Schimkewitsch finds that when *Dinophilus* is fed with pigment, e.g. Algæ coloured by indigo-carmine, the pigment is taken up by vacuole-like granules in the epithelial cells of the midgut. Similar results were got with Polynoidæ, and with *Phyllodoce maculata*, *Priapulus*, &c. It seems as if the midgut cells had the power of taking up pigments from the gut.

Earthworms of Florida and Georgia.‡—Dr. W. Michaelsen finds that the earthworms of this region are distinctly North American in

* Trans. New York Acad. Sci., xiii. (1894) pp. 133–9 (11 figs.).
† Biol. Centralbl., xiv. (1894) pp. 838–41.
‡ Zool. Jahrb. (Spengel) Abth. f. Systematik &c., viii. (1894) pp. 177–94.

type. He describes *Allolobophora Lönnbergi* sp. n., named after the collector, *All. caliginosa* Sav., *All. Beddardi* sp. n., *Pontodrilus ? bermudensis* Bedd., *Pontodrilus* sp., *Geodrilus Eiseni* sp. n., *Perichæta indica* Horst. The presence of the three species of *Allolobophora* points to the affinity of this region with the region characterized by Lumbricidæ (Siberia, Europe, North America); *All. Beddardi* is nearly related to *All. parva* Eisen of New England; *Geodrilus* is distinctively North American. The presence of *Pontodrilus* seems at first sight strange, but this genus is littoral, not terrestrial, therefore not limited by the same conditions as the terrestrial forms; and as for *Perichæta indica* it is probably carried by man. There are none of the characteristic West Indian forms.

New Oligochæta from Illinois.*—Mr. F. Smith publishes a preliminary account of the larger Oligochætes collected during the past summer. *Diplocardia riparia* is the name given to a new species which is closely compared with *D. communis*, and the differences between them are pointed out in a table. *Sparganophilus Eiseni* sp. n. is very abundant in the mud of the Illinois river. It agrees in many points with *S. tamesis*, lately described by Dr. Benham, but has a sufficient number of distinctive marks to justify its being regarded as a distinct species.

Funnels and Terminal Vesicles of Hirudinea.†—Dr. A. Graf has a preliminary note on this subject; as against Bolsius he agrees in most points with Bourne. He finds that in *Clepsine* the funnel resembles closely that of *Nephelis*. The connection between the nephridial gland and the funnel takes place within the ventral sinus. The funnel is surrounded by chloragogenous cells in the interior of the ventral sinus. In *Nephelis* the terminal part of the nephridial gland always goes close to the wall of the ampulla, in which the funnel lies. Opposite the terminal portion of the gland there is always an opening in the wall of the ampulla, and this opening always corresponds to the bottom part of the funnel. With *Aulostomum* the author was less successful than with the other genera, but he found that the funnels lie in sinuous vesicles dorsal from the testis, and at the side of the intestine. These funnels are closely surrounded by an enormous quantity of chloragogenous cells which seem to form a sort of gland with intracellular ducts. The funnel is many-lobed; the ciliated cells greatly surpass in number the ciliated funnel-cells of *Nephelis*. With regard to the terminal vesicles, the author finds that in *Hirudo* the terminal vesicle is spacious and lined with richly ciliated epithelium. The duct connecting the vesicle with the exterior (terminal duct) enlarges into a secondary vesicle. This terminal duct is surrounded by circular muscle-cells, the number of which is increased at the opening of the vesicle into the duct, and near the communication of the duct with the exterior.

New Discodrilid.‡—Under the name of *Pterodrilus*, Mr. J. P. Moore describes an American parasitic leech. It is remarkable for the presence on certain of the post-cephalic somites of paired dorsal appendages chiefly developed from the muscular layers of the body. These dorsal

* Bull. Illin. State Laboratory, iv. (1895) pp. 138–48.
† Trans. New York Acad. Sci., xiii. (1894) pp. 239–41.
‡ Proc. Acad. Nat. Sci. Philad., 1894, pp. 449–54 (1 pl.).

organs, which one would expect to be respiratory in function, appear to be entirely devoid of blood-vessels, so that it is not likely that these organs are respiratory, and perhaps no useful suggestion can be made until living examples have been studied in their proper habitat.

Platyhelminthes.

Valvular Apparatus in Excretory Organs of Trematodes.*—Herr K. Kampmann remarks that little is known as to the valvular apparatus of these organs in Trematodes, though a good deal has been discovered regarding the same apparatus in Cestodes. He finds in all the *Distoma* that he has examined that the collecting vessels open laterally into the terminal vesicle; this allows of a valvular closure of the orifice. The arrangements for closing are of two kinds. In *Distomum isostomum* and *D. mentulatum* the collecting tubes pass almost at a right angle into the vesicle, so that when the terminal vessel contracts they are closed by the valves which project into the cavity of the vesicle. In *D. cirrigerum*, *D. clavigerum*, and *D. endolobum*, the collecting vessels form an acute angle with the wall of the terminal vesicle and the wall of the tube, which is turned towards the vesicle, fuses with this wall to form a membrane, which is thicker at the base and thinner near the orifice of the tube; this membrane, on the contraction of the terminal vesicle, is forced by the pressure of the contents in front of the mouth, and closes it.

Ectoparasitic Trematodes of Japan.†—Mr. Seitaro Goto has an elaborate memoir on these worms. He commences with an account of their anatomy and histology, gives some biological notes on these parasites, and concludes with a systematic account of 32 species. Discussing the nature of the primitive retractile fibres which constitute the wall of the suckers in many genera, he urges that the indirect evidence is strongly in favour of the non-contractile nature of these fibres. He points out their differences from the ordinary muscular fibres of the body and from those of the suckers of various forms. If the suckers are non-contractile, the question arises how the suctorial action is to be explained. He regards the suckers as forming a bag with a thick elastic wall which constantly tends to be flattened out, but which is kept in proper shape by an external force, that of the muscular fibres that are attached to the bottom of the suckers. If these muscular fibres relax, the wall of the sucker becomes flattened out by virtue of its elasticity, and applied to its substratum—the body surface of the host. If the muscular fibres now contract, the sucker assumes the form of a bag, and thus a vacuum tends to be formed within which gives rise to suctorial action.

The penis seems to be most complete in structure in *Tristomum* and *Epibdella*. In these it is a hollow club-shaped organ, projecting by its distal portion into the genital atrium, with which its internal cavity is directly continuous, and it is provided with muscular fibres of its own. The connective tissue and chitinous penis of *Monocotyle* seem to the author to afford a starting point for another type of copulatory organ,

* Rev. Suisse Zool., ii. (1894) pp. 443–62 (2 pls.).
† Journ. Coll. Sci. Imp. Univ. Japan, viii. (1894) pp. 1–273 (27 pls.).

that of *Diclidophora* and *Calicotyle*. In the latter genus the bulbous penis is a kidney-shaped mass of fibrous connective tissue around the terminal portion of the vas deferens; the chitinous penis is replaced by hooks. The author in his descriptions nowhere makes use of a term corresponding to *Cirrusbeutel*, and this is done with an express purpose, for the term has been used to designate various structures by different writers, and, moreover, the structure in question is not a hollow organ, but merely a mass of specially modified tissue round the terminal part of the vas deferens.

The author believes that he has succeeded in demonstrating the existence of a prostate gland in monogenetic Trematodes generally. An account is given of the various views that have been held as to the nature of the genito-intestinal canal, and Mr. Goto gives a detailed account of his views as to its structure. He concludes that the vagina of Cestodes and the uterus of Trematodes are homologous structures. With regard to the protrusion of the penis, he thinks that there can be scarcely any doubt that the true penis, as well as the chitinous armature of the genital atrium, can be protruded. To the objection that the opening of the orifice is so small, he points out that the body of Trematodes is exceedingly soft and capable of both extension and contraction. The reader is reminded that in the paper before us the term oviduct is used for that portion of the female efferent duct which lies between the ovary and the "ootyp"; the ootyp for that portion which is distinguished by the presence of shell-glands round it; the uterus for that portion which lies beyond the ootyp.

With regard to the habitat of most ectoparasitic Trematodes, it is true that they live attached to the gill of the fish, but many lie in the mouth-cavity or on the general surface of the body. The majority of the species described in this memoir live on the slime of the host, but some are also able to extract its blood.

Echinococcus and Œstrus in Man.*—Prof. G. Sangalli describes a case of Echinococcus from the breast of a woman, and of an *Œstrus* larva in a boy's scrotum, and discusses in connection with each case the question of infection, our knowledge of which is unsatisfactorily vague.

Cysticercus cellulosæ in Human Skin.†—Dr. G. Lewin states that he has seen 14 cases of measly skin in human beings, and refers to 40 instances in which *Tænia solium* and *Cysticercus cellulosæ* were present in the same individual. The tumours vary from a lentil to a hazel-nut in size, and may not be prominent. In shape they are round or oval, and they are tense and cartilaginous in consistence; the surface is always smooth, and they vary in number from one to many.

Dipylidium Larva.‡—According to Sig. Diamare, the *Cysticercus rostratus* found by Mingazzini in the mesentery of *Zamenis viridiflavus* and in the liver of *Seps chalcides* is the larva of *Dipylidium echinorhyncoides* Sons.; and the *Cysticercoides* which Marchi found encapsuled in the liver of *Ascalabotes mauritanicus* (*Cyst. ascalabotidis*) the author thinks is

* Rend. R. Ist. Lomb., xxv. (1892, received 1895), pp. 1161–78 (1 fig.).
† Archiv f. Dermatol., xxvi. (1894) pp. 71–87, 217–39. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1894) pp. 312–3.
‡ Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 565–6 (1 fig.).

also a Dipylidium larva. The shape of the rostellum, the number, shape, and arrangements of the hooklets seem to decide the question.

Echinoderma.

Formation and Absorption of Skeleton in Echinoderms.*—Prof. H. Théel has an interesting note on this subject. After pointing out reasons for doubting the accuracy of Chun's results he describes his new observations on the process of absorption in living larvæ. The cells which effect the absorption and destruction of the larval skeleton are hardly to be distinguished from those which deposit inorganic substances, and they probably have their origin from them. Their activity almost conveys the impression that the process of absorption demands much more intense labour on the part of the cell than that of deposition. They give off pseudopodia which become extended into long, slender filaments; these branch and anastomose with each other, as well with the protrusions of other cells, and in this way there is formed a network of fine and wide meshes. The pseudopodia change incessantly, and the appearance of the cell is constantly altering; soon the pseudopodia may be observed to be withdrawn, and as the network which they formed disappears other protrusions give rise to new sets of meshes. When a cell begins to exercise its absorbent influence on a calcareous body it extends and flows round and over it so as to take it wholly into its protoplasm. For this reason the granular main portion of the cell may be seen to move incessantly, gliding slowly along the swallowed spicule until nothing remains of it. Prof. Théel has never seen the cell leave the spicule till absorption was completed. He thinks that the dissolved salts are gradually transferred through the pseudopodia to neighbouring cells, which either retain them till they are wanted, or use them immediately as materials for building up new calcareous bodies essential for the growing Echinoderm. The process of absorbing calcareous bodies commences when the skeleton becomes unsuited for further evolution of the larvæ, and when the sea-urchin, in process of growth, is in need of calcareous salts in great quantities, that is to say, when the pluteus has attained its mature state. At this period numerous organs all requiring abundance of calcareous salts begin to arise almost simultaneously, and we see the advantantage of a supply of calcareous substances in reserve within the body. This process of absorption goes on very rapidly, for instance, a calcareous plate almost too large for the body of a cell can be completely dissolved within two hours; so that the dissolving fluid must be present in great abundance.

Distribution of Echinoderms of North-eastern America.†—Prof. A. E. Verrill reports that about 200 species of Echinoderms are now known from the Atlantic Ocean, adjacent to the North American coast. Of these over 100 have been discovered in recent years since deep-sea dredging was undertaken. It was found that the abyssal genera and families are mostly very widely diffused over the three great ocean basins, while the species belonging to them are generally restricted in range to particular regions, or to a single ocean. The genera and species that

* Öfv. K. Vet. Akad. Förh., li. (1894) pp. 345–54 (3 figs.).
† Amer. Journ. Sci., xlix. (1895) pp. 127–44.

have the greatest bathymetrical range are also generally the most widely distributed geographically. Some range from very shallow water to 1000 fathoms or more, and may extend into all the great oceans. Some species that belong to the intermediate depths, 100 to 500 fathoms, often have a very wide geographical range. Many of them extend to European waters, and some even to the Pacific. Many peculiar and conspicuous genera and several remarkable families are nearly or quite confined to the abyssal zone. The abyssal species appear in many cases to be capable only of very slow dispersion, as compared with shallow-water species. This is, in many cases at any rate, due to the fact that many of them do not have free-swimming larvæ, but bring forth well-developed creeping young. In other cases the eggs are so large as to indicate that the larvæ, when known, will be found to be unlike those of shallow-water species, and not free-swimming. We must therefore conclude that the widely diffused abyssal genera, many of which range from the Arctic to the Antarctic Oceans, are of very great antiquity, and that there has been ample time since they occupied the deep sea for the minor differences characteristic of species to originate in different geographical regions, as a result of casual variations that have been conserved by isolation, perhaps aided in some cases by natural selection. In the majority of cases Prof. Verrill points out that there is no evident utility in the characters that separate one abyssal species from another of the same genus. Such differences as there are can hardly be of protective value in the darkness and quietness of the depth in which these creatures live. The author begins an account of the Starfishes of the area he has been studying, in the course of which he describes several new species.

Genital and Madreporic System of Regular Echinoids.*—Sig. A. Russo has made his observations chiefly on young stages of *Echinus microtuberculatus* and *Sphærechinus granularis.* The author agrees with Prouho that the formation of the genital cord takes its origin from the outer epithelial investment of the axial sinus, but he does not share Perrier's views that it has any connection with the ovoid gland. The gonads are at first solid swellings of the genital cord. The efferent ducts of the gonads arise as thickenings of the outer cell-layer of the *Anlage* of the gland. The author finds that the regular Echinoids show so much resemblance to the Ophiuroids that he regards them as being their nearest allies.

Echinoidea of Indian Seas.†—Dr. A. R. S. Anderson has a short report on the Sea-urchins dredged by the Indian Marine Survey. Twenty-five species appear to have been collected, of which two, *Dorocidaris tiara* and *D. Alcocki* appear to be new. The former was dredged in depths of 142 and 400 fathoms, while the latter came from 636 fathoms.

Cœlentera.

Digestion in Cœlentera.‡—Prof. S. J. Hickson has an interesting general survey of what is known of this subject. Attention is drawn to

* Bull. Soc. Natural. Napoli, viii. (1894) pp. 90–109 (1 pl.). See Zool. Centralbl., i. (1894) pp. 752–3.
† Journ. Asiatic Soc. Bengal, lxiii. (1894) pp. 186–95.
‡ Science Progress, ii. (1895) pp. 447–55.

the works of Metschnikoff, Lankester, Greenwood, and others. Their general result is to prove that in Hydroids there are two kinds of endoderm cells—secreting gland cells, and vacuolated cells for the absorption and storage of products of digestion in the fluid form, and that in some Hydroids, but not apparently in *Hydra*, the intercellular digestion of a portion of the food may occur. In Anthozoa the structure is more complicated than in Hydrozoa, and it may be supposed that there would be some separation of the cells which in the Hydrozoa perform the functions of digestion, and this is probably the case.

Corals from the Deep Waters of India.*—Dr. A. Alcock reports that in addition to three well-known species of deep-sea Madreporaria, there have been dredged by the 'Investigator' three new species, of which he gives short accounts.

Medusæ from the Bahamas.†—Mr. A. G. Mayer has a short account of some Medusæ obtained by Prof. A. Agassiz in the Bahamas. He observed that after the middle of February, the number of marine animals which came under daily notice gradually increased, and among them were many larval forms. An interesting characteristic in the distribution of pelagic life was the frequent occurrence of "Windrows," composed of vast numbers of individuals of a few species. In the harbour of Nassau on the night of March 12th, one could not drag a tow-net many feet without capturing thousands of the little discophore *Linerges mercurius*. After remaining so abundant for several nights they suddenly disappeared. The new species described are *Hybocodon Forbesii*, *Bougainvillia Niobe*, *Cubaia Aphrodite*, *Ireniopsis primordialis*, *Cannophysa Eysenhardti*, and *C. filiformis*. *Cubaia* and *Ireniopsis* are new genera, but the generic are not distinguished from the specific characters in the descriptions.

Development of Scyphomedusæ.‡—Miss J. H. Hyde has studied the development of *Aurelia marginalis*, *A. flavidula*, and *Cyanea arctica*. Her results confirm Goette's position. The gastrulation differs in the three species, and even in individuals, but there is agreement in essentials. The young planula gradually develops into what it is proposed to call a *scyphula*—a stage hitherto overlooked—which is characterized by an invaginated ectodermic gullet and radial enteric pouches. Of these characters the scyphostoma, which is formed by metamorphosis from the scyphula, shows little trace. There are no hydropolyp characters, the scyphula is thoroughly Anthozoon. The ectodermic gullet is not again evaginated. Part of the gullet is developed into the enteric folds, septa, pouch-processes, and gastral filaments; part becomes the œsophagus and the second pair of primary pouches. Thus the whole oral apparatus is ectodermic, while the main part of the gut (excepting the aforesaid ectodermic parts, and the mesodermic connective tissue) is endodermic. The tentacles are all inter-septal in their origin. The dominant number of parts (four) is shown in the pouches, septa, septal funnels, and longitudinal muscles. Thus the ancestral form of Scyphomedusæ and Anthozoa is regarded as a tetrapartite radial scyphula.

* Journ. Asiatic Soc. Bengal, lxiii. (1894) pp. 186-8.
† Bull. Mus. Comp. Zool., xxv. (1894) pp. 235-41 (3 pls.).
‡ Zeitschr. f. wiss. Zool., lviii. (1894) pp. 531-65 (6 pls., 4 figs.).

Larvæ of Velella.*—M. M. Bedot has studied the young stages of a *Velella* which he found in abundance at Nice. His investigations, whilst raising questions which can only be solved by study of more complete material, seem to dispose of the hypothesis which is generally accepted that the pneumatophore is formed by invagination of the ectoderm.

Minute Structure of Hydra.†—Dr. R. Zoja has used Ehrlich's methylen-blue method in studying *Hydra* (*H. viridis* and *H. grisea*), and finds that the stain demonstrates what look like nervous elements, much more complicated and abundant than was hitherto supposed. Thus there are numerous nodules from which fibrils diverge in all directions, and other elements like ganglion-cells, with a rich array of prolongations. Five forms of cell are described. He believes that these elements are nervous, for they stain specifically with methylen-blue, they are connected with the cnidoblast and myo-epithelial cells, and some of the cells resemble ganglion cells.

Porifera.

New Genus of Heterocœlous Calcareous Sponges.‡—Dr. R. Hanitsch has a note on a new Portuguese sponge (*Amphiute* n. g.) which combines the characters of *Ute* and *Utella*. The flagellate chambers are narrow and radially disposed; there are large longitudinally disposed rod-spicules on the dermal and gastral surfaces. He only knows as yet of one species, *A. Paulini*.

Protozoa.

Fresh-water Rhizopods.§—M. F. Le Dantec has made a comparative study of *Amœba proteus* and *Gromia fluviatilis*. The latter gives off a very rich plexus of anastomosed pseudopodia which adhere to the surface of solid bodies. These bodies are gradually surrounded by the protoplasm of the *Gromia*, and slowly brought into the interior of the test. There is no vacuole around these foreign bodies, which are thus from the first in direct contact with the protoplasm. If a non-nucleated mass freshly separated from a *Gromia* be met by the pseudopodia of the parent mass fusion immediately occurs, and almost at once all trace of the separation disappears. If, on the other hand, the pseudopodia of the *Gromia* should meet with a morsel of protoplasm which has begun to undergo degeneration, the contents of this sphere run into the pseudopodium. The author explains these facts as phenomena of nutrition. The first consists in the addition to a mass of protoplasm of another mass of identical composition. The second phenomenon recalls the passage of the protoplasm of an Infusorian into that of an *Acineta*. In all the preceding cases there has been no question of digestion, although the protoplasm is able to dissolve certain substances which bathe in its interior. Starch-grains, for example, are profoundly modified. If protoplasm be considered as a very special medium necessary to the life of a nucleus we may say that the protoplasmic medium is very little differentiated, and very little separated from the external medium in *Gromia*.

* Rev. Suisse Zool., ii. (1894) pp. 463–6 (1 pl.).
† Rend. R. Ist. Lombard, xxv. (1892, received 1895), pp. 700–12 (1 pl.).
‡ Zool. Anzeig., xvii. (1894) p. 433.
§ Comptes Rendus, cix. (1894) pp. 1279–82.

On the contrary, in *Amœba* there is an outer layer with considerable surface tension.

Contraction-phenomena in Pelomyxa.*—Prof. O. Israel has some interesting observations on the behaviour of *Pelomyxa palustris* Greeff. He first describes how the fresh margin of a divided *Pelomyxa* displays and often liberates spherules of protoplasm. At a temperature of 22°–24° C., an excised portion of a *Pelomyxa* moves vigorously, often losing pseudopodia in its efforts, but what interested the author was the appearance of striation in the marginal plasma. The striation was best seen on the finger-like pseudopodia and on the bridges formed when fragments are constricted off. These striæ owe their distinctness to granular threads lying in the direction of the streaming movement, and these threads consist of lines of Bacteria, which previous observers have noticed in this Rhizopod. The author compares this striation to similar phenomena in *Amœba*, &c., and leaves zoologists to follow up the quest.

Structure of Volvox.†—Dr. O. Zacharias returns, with a slight difference, to the view of Ehrenberg and Saville Kent, for he finds that the monads of *Uroglena volvox* are united to the centre by a dichotomising system of threads which appear to give coherence to the colony. Unless a monad is dividing, it has only one chromatophore; this is slightly spiral in shape, which may account for the general impression that there are two such bodies. The two flagella, the nucleus, &c., are described. Zacharias has also succeeded in observing the division of the colony into two or even three.

Cretaceous Foraminifera of New Jersey.‡—Dr. A. Woodward reports that he has succeeded in identifying 26 genera and 59 species of Foraminifera from the Cretaceous formation of New Jersey. In those cases in which he was in doubt he had the assistance of the late Mr. H. B. Brady.

Morphology and Classification of Coccidia.§—M. A. Labbé disputes the correctness of Schneider's classification of the Coccidia, as he found that the monosporic condition does not exist. He suggests that the term Polyplastidea be applied to those Coccidia that have an unlimited number of archispores, and that of Oligoplastidea to those in which the number of spores is definite. In the first group a distinction must be made between those which, like *Pfeifferia* and *Eimeria*, have the archispore giving rise directly to the sporozooite, and those which, like *Klossia* and *Benedenia*, have an archispore which becomes a group of sporozooites. In the second group the genus *Coccidium* is characterized by the possession of four archispores, and might be taken as the type of the Tetrasporia; *Diplospora*, and others which have only two archispores, will form the Disporia.

Parasitism in Cancer.‖—Though Prof. Cornil is no opponent of the parasitic theory of cancer, yet he is of opinion that proof of a parasitic

* Archiv f. Mikr. Anat., xliv. (1894) pp. 228–36 (1 pl.).
† Zool. Anzeig., xvii. (1894) pp. 353–6.
‡ Journ. New York Micr. Soc., x. (1894) pp. 91–141.
§ Comptes Rendus, cxix. (1894) pp. 1019 and 20.
‖ Mitteil. XI. Internat. Med. Kongresse in Rom. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 576–8.

origin has not yet been brought forward by any of its advocates. All the appearances, all the cancer bodies, which have been pointed to as in-indicative of parasites are, according to the author, merely the result of modifications of the cells and their nuclei; the nucleus and para-nucleus become, as it were, dislocated and fragmented, and in consequence of the growth of so many independent portions or of their altered position so are produced many of the extraordinary appearances observed in cancer. Besides this anomalous condition of the nucleus and para-nucleus, distinguishable by their blue and red staining reaction, the cell-plasma itself undergoes various degenerations, softening, vacuolation, keratinization, &c.

Transference of Cancer to Animals.*—MM. Duplay and Cazin, who have made about 120 attempts to inoculate or to implant malignant neo-plasms in animals (rats and dogs), conclude that cancer is not transferable from one animal to another, notwithstanding that some of their experi-ments were attended with successful results. In one series pieces of a tumour from the vagina of an old bitch were inoculated (implanted) on the prepuce of a dog. Numerous new tumours of the same structure as the original growth developed. Ten months after, tumours of a distinctly epithelial character were found on post mortem examination in the testicles; but as no secondary developments were found in the original dog, it would be risky to assume a connection between the primary and secondary infection growths. In another series a fibroma developed in the mamma of a rat after inoculation of the teat from a spontaneous tumour in another rat, the character of both growths being alike.

Coccidian Origin of Cancer.†—Dr. Fabre-Domergue has reviewed at some length the statements of numerous writers on the parasites of cancer, and after criticizing them fairly and fully, sums up the position as follows:—The parasitic theory of cancer, originating from the works of Pfeiffer, Darier, Wickham, and Albarran, is based on observations which have no connection or analogy among themselves. The forms described as Sporozoa have nothing in common with these animals save a morphological resemblance, and do not possess their true characters. All the pseudo-coccidia hitherto depicted are united by insensible gradations to the neoplastic cell from which they are derived by a process of degeneration.

The epithelial cancers of Mammalia, really homologous with those of Man, do not show any parasitic forms. In attempting to demonstrate the necessity of a parasitic ætiology by comparing epithelial cancers with galls on plants, and the infectious neoplasms of animals, the advocates of the parasitic theory have failed to recognize the essential nature of cancer, and they use terms which have nothing in common.

The author's paper is profusely illustrated with wood engravings and coloured plates, the latter being quite original and showing every possible phase of the "cancer body."

* Mitteil. XI. Internat. Med. Kongresse in Rom. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 574–5.

† Ann. de Micrographie, vi. (1894) pp. 59–77, 97–110, 145–64, 211–36, 579–87, 603–14 (5 coloured pls.).

Parasite of Molluscum contagiosum.*—Mr. J. J. Clarke describes certain flagellate bodies which he has found in molluscum contagiosum, the contents of which were expressed and kept for four days in a capsule on blotting paper moistened with sterilized water at a temperature between 15° and 20°. The flagellate bodies are possessed of a rounded head about the size of a red corpuscle, and a single strong flagellum in constant movement. While many of the molluscum corpuscles were unaltered, some were reduced to a thin shell filled with bacteria, and others presented the appearance of a central liquefaction in which were numerous highly refracting particles in constant movement.

Protozoa of Myomata.†—Dr. Vedeler finds that uterine myomata are infested by protozoa which are possibly the cause of these tumours. In size they vary from that of one to three or four times the bigness of a white corpuscle. Their shape is usually round to oval, though some possess a pseudopodal extension. They are possessed of a cytoplasm and nucleus with central nucleolus. In the larger specimens there is a vacuole. Though the parasites usually inhabit the cytoplasm of the muscle cell they are sometimes to be seen in the nucleus. They appear to multiply by fission and by spore formation.

In order to demonstrate these parasites a myoma removed during life would appear to be necessary. This should be fixed in 5 per cent. aqueous solution of sublimate, after-hardened in alcohol and stained with eosin and hæmatoxylin. Sections should be made parallel to the long axis of the fibres. The body of the parasite stains brownish yellow, its nucleus blue, while the muscle cells are also blue.

* Centralbl. f. Bakteriol. u. Parasitenk. (1te Abteilung), xvii. (1885) pp. 245-8 (3 figs.).
† Tom. cit., pp. 249-53 (52 figs.).

BOTANY.

A. GENERAL, including the Anatomy and Physiology of the Phanerogamia.

a. Anatomy.

(1) Cell-structure and Protoplasm.

Attraction-spheres and Centrosomes.*—Mr. J. H. Schaffner finds the following objects especially favourable for observing attraction-spheres and centrosomes:—young root-tips and resting-cells of the epiderm of old bulb-scales of *Allium Cepa;* resting-cells of the root-tip of *Vicia Faba;* root-tips of *Tradescantia rosea;* epiderm of the anther and ovary-walls of *Lilium longiflorum.* As the general result of his observations he concludes that centrosomes and attraction-spheres are present in non-reproductive as well as in reproductive vegetable cells; that they remain on the outside of the nucleus during its resting stage; and that they persist in cells which have ended their growth and division. He further states that in Phanerogams there are two of these bodies for each resting nucleus. During impregnation there is a union of those attraction-spheres and centrosomes which accompany the male nucleus with those of the female nucleus. The bodies migrate and divide, and are thus carried from one cell to another throughout the entire organism, whether plant or animal.

Structure of the Cell-wall.†—Herr C. Correns has undertaken a series of investigations on the structure of the cell-wall in different organs, and in a great variety of plants belonging to different divisions of the vegetable kingdom, especially in reference to the three following statements by Wiesner:—that the cell-wall contains protoplasm as long as it is in a condition of growth; that the cell-wall is, up to a certain period, a living structure, and its growth an active one; and that the cell-wall is composed of definite particles, the dermatosomes.

The use of all the various reagents for protoplasm has convinced Correns that in no case can the presence of this substance in the cell-wall be asserted with certainty (except in the case of enclosed particles or of connecting strands); while in the great majority of cases it is certainly absent. The substance which has been mistaken for protoplasm is tyrosin, or some other imperfectly known substance. In no case could a superficial growth of the cell-wall be due to the presence in it of protoplasm. There is no essential chemical difference between the dermatosomes and the substance which unites them together; in no case could the formation of the former out of plasomes or microsomes be determined. The red stain produced by Millon's reagent in lignified cell-walls is due not to the presence of vanillin, but probably to that of tyrosin.

* Bot. Gazette, xix. (1895) pp. 445–59 (1 pl.).

† Jahrb. f. wiss. Bot. (Pringsheim), xxvi. (1894) pp. 587–673 (1 pl. and 2 figs.). Cf. this Journal, 1892, p. 222.

(2) Other Cell-contents (including Secretions).

Formation of Secretions.*—Dr. A. Tschirch ascribes to all resins a uniformity in chemical composition, regarding them as compounds of aromatic acids with a peculiar group of alcohols which he calls resinols.

The author further announces the remarkable discovery that, in all normal cases which he has been able to examine, the formation of a secretion is a function of the cell-wall and not of the protoplasm. In schizogenous passages the secreting cells which clothe the canal contain a resinogenous layer, often of a vacuolar character; in schizo-lysigenous cavities the secretion is formed in peculiar caps of membrane belonging to the cells which enclose the space; in the oil-glands of the Labiatæ, Compositæ, &c., it is produced entirely in a subcuticular layer of the cell-wall; and this is the case also with the papillæ which project into the intercellular spaces of the rhizome and base of the leaves of *Nephrodium Filix-mas*, and in many, if not in all, extra-floral nectaries, the secretion lifting the cuticle off from the palisade-like secreting tissue. In all stigmas examined by the author the secretion is formed in the subcuticular mucilaginous layer of the papillæ, into which the pollen-tube makes its way. Similar observations were made on the oil of oil-glands, and on the resin formed in duramen. But, although the secretions are formed in the cell-wall, they are never produced by metamorphosis of the cellulose itself.

Formation of Secretions in Schizogenous Receptacles.†—Herr A. Bécheraz has studied this subject, especially in the elongated receptacles in the Abietineæ, Compositæ, Umbelliferæ, Burseraceæ, Clusiaceæ, &c. He finds the secretion to be present in these receptacles from the earliest stages of their formation; none is contained in the cells of the surrounding tissue. Resin could never be detected outside the resin-passages. A group of cells, early distinguished by their colourless contents, arising from the mother-cell of the canal, forms a coating of mucilage where these cells bound the epiderm, and this mucilage contains the resinogenous substances. The extent to which the canal is ultimately filled with resin varies greatly. A membranous structure, the inner pellicle, is formed at the point of contact of the resin with the layer from which it springs, and often contains granules of various kinds.

Influence of the Soil on the Production of Nectar.‡—According to M. G. Bonnier the production of honey or nectar in plants is greatly influenced by the nature of the soil. Thus *Sinapis alba* produces a much greater quantity on a calcareous than on an argillaceous soil; *Polygonum Fagopyrum* more on a siliceous than on a calcareous soil. An argillaceous soil is favourable to the production of honey in *Phacelia tanacetifolia*, a calcareous soil in *Isatis tinctoria* and *Medicago sativa*. *Onobrychis sativa* is nearly indifferent to the nature of the soil.

* Bot. Centralbl., lx. (1894) pp. 289–93. Cf. this Journal, 1894, p. 372.
† Mtthl. Naturf. Gesell. Bern, 1893 (1894) pp. 74–109. See Bot. Centralbl., lx. 1894) p. 20.
‡ C.R. Ass. Franç. pour l'Avance. d. Sci., 1893 (1894) pp. 567–9. See Bot. Centralbl., 1894, Beih., p. 419.

Myrosin.*—M. L. Guignard describes the mode of extraction of this substance from the plants in which it is found, and its behaviour with various reagents. The property which specially distinguishes it from other diastases is that of decomposing potassium myronate. In the leaves of *Carica Papaya* and *Sinapis nigra*, myrosin is accompanied by two other ferments, neither of which possesses this power. One of them has the properties of invertin, the other those of the diastase of germinating barley.

Poisonous Principle of the Cactaceæ.†—In *Anhalonium Lewinii* and some other species of Cactaceæ, Herr L. Lewin finds a poisonous alkaloid to which he gives the name *anhalonine;* its properties resemble those of strychnine.

Phosphorus in Vegetable Tissues.‡—Dr. G. Pollacci has established the general presence of phosphorus in vegetable tissue, and its necessity for certain vital processes. It was found to be absent from the cell-wall, but present in appreciable quantities in the protoplasm, and especially in the chromatin grains of the nucleus. It occurs also in the hyphæ and spores of Fungi. In the vegetative organs of the higher plants it is found to be accumulated especially in the meristem and in the conducting tissues. The parts of the flower most rich in phosphorus are the ovules and the pollen-grains; the nucleus of reproductive cells contains a much larger quantity than that of vegetative. In the seeds it is stored up especially in the embryo.

(3) Structure of Tissues.

Formation of Lysigenous Cavities.§—Dr. F. C. Newcombe has studied this subject in a large number of plants, and gives the following as his more important conclusions. Whether the cavity shall appear during or subsequent to primary growth depends on the cessation or retardation of extension in the tissue where the cavity appears, relatively to the extension of the more peripheral tissues. The mode of formation in primary growth is always at first schizogenous, and may also be schizogenous in secondary growth by the contraction of cells through the loss of turgor. But a lysigenous mode of formation always comes into play during primary growth. During secondary growth, the schizogenous factor, if present, is always small. In some species of plants the cavities in the pith are formed sometimes during primary, sometimes during secondary growth. The formation of a lysigenous cavity during primary growth may be somewhat deferred by preventing the normal primary extension of peripheral tissues; and generally, the formation of cavities during both primary and secondary growth may be greatly deferred by preventing the extension of the surrounding tissues.

Displacement of Bast-fibres.‖—Prof. S. Schwendener has investigated the cases of alleged displacement of bast-fibres, attributed by

* Bull. Soc. Bot. France, xli. (1894) pp. 418–28. Cf. this Journal, 1894, p. 468.
† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 283–90.
‡ Malpighia, viii. (1894) pp. 361–79. Cf. this Journal, 1894, p. 476.
§ Ann. Bot., viii. (1894) pp. 403–21.
‖ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 239–48 (2 figs.). Cf. this Journal 1885, p. 89.

v. Höhnel to cortical pressure; and gives reasons for believing that these displacements are not found in the living tissues, but are the result of the mode in which the preparations have been treated. The bast-fibres of different plants show a very different degree of sensitiveness to mechanical influences.

Absorption of the Secondary Cell-membrane in Seeds.*—Dr. T. Elfert has studied the various modes in which the secondary cell-membrane of seeds is absorbed during germination. These consist in the occurrence of the following changes. Shallow hemispherical projections and depressions make their appearance on the innermost boundary of the inner lamella. These projections and depressions become gradually deeper, until the thickened cell-wall assumes an irregular jagged form. The cell-wall then becomes absorbed as far as the central lamella, and a thin-walled parenchymatous tissue remains consisting of nothing but the central lamella. This absorption of the thickening masses is accompanied by the appearance of starch-grains. The seeds examined may be divided into two classes,—those in which the thickened cell-walls do not, and those in which they do consist of reserve food-materials; and this food-material may be composed either of cellulose or of amyloid.

Structure and Formation of Stomates.†—Sig. F. Tognini has examined the mode of formation of the stomates in the cotyledons, foliage-leaves, petals, and stem of 34 species belonging to different orders of Dicotyledons, and asserts that the usual statement that this is uniform for the same species can only be accepted with great modification; it may vary even in the same organ of the same plant; the greatest variation is observable in the cotyledons. The immediate formation of the mother-cell of a stomate from a complete epidermal cell occurs in *Eucalyptus globulus*, *Hypericum hircinum*, *Acer Pseudo-platanus*, *Vitis vinifera*, *Syringa persica*, and *Apocynum cannabinum*. In *Lactuca virosa* the mother-cell is produced by four successive divisions in four different directions. From the facts above stated it follows that the mode of formation of the stomates cannot be used as a systematic character in plants. The cotyledons of the Phaseoleæ are not always destitute of stomates, as has been stated. As a general rule the mode of formation of the first stomates of an organ is much more simple than that of the later ones.

Wood of the Magnoliaceæ.‡—Dr. R. Groppler has examined the structure of the wood in a large number of species of Magnoliaceæ. He finds an intermediate stage between the simple structure of *Drimys*, *Illicium*, &c., and the complicated one of *Magnolia* and *Liriodendron*, in several genera, of which *Michelia* may be taken as a type. The variations in the structure of the wood correspond, in general terms, to the accepted classification into suborders. In all the species a scalariform marking occurs in the vessels, which passes over into bordered pits. Spiral thickening was seen only very rarely. Libriform is almost

* Biblioth. Bot. (Luerssen and Frank) Heft 30, 1894 (23 pp. and 2 pls.).
† Atti R. Ist. Bot. R. Univ. Pavia, iv., 42 pp. and 3 pls. See Bot. Centralbl., 1894, Beih., p. 423.
‡ Biblioth. Bot. (Luerssen and Frank) Heft 31, 1894 (51 pp. and 4 pls.).

invariably present. Xylem-parenchyme is much more frequent than had previously been stated. The medullary rays are composed of from two to twelve layers of cells. No anatomical characters are of themselves sufficient for the discrimination of the genera.

(4) Structure of Organs.

Inflorescences.*—M. F. Hy proposes the classification of the different forms of simple inflorescence under six heads, viz.:—A. Inflorescences with alternate bracts and pedicels: (1) The Raceme (under this head are included also the spike, the umbel, and the capitule), indefinite; (2) The Anthele, a mixed inflorescence; (3) The Cyme, definite; B. Inflorescences with opposite or verticillate bracts and pedicels: (4) The Thyrse, definite; (5) The Thyrsoid, a mixed inflorescence; (6) The Dichase, definite. Compound inflorescences may be homogeneous, where the branches of different degrees reproduce the same type or nearly so; or heterogeneous, where the different degrees of branching belong to different types. A number of examples are given of the different combinations, illustrated by diagrams.

The following general remarks are appended. Inflorescences of the racemose type are often simple; while antheles are usually compound. The cymose type is rare or altogether wanting in compound inflorescences of the first degree; it is confined to terminal branches. The thyrse and thyrsoid types, on the other hand, are frequent in the lower, rare in the higher degrees. Combinations are common between the thyrse, thyrsoid, and dichase.

In another paper † the author describes in detail the various forms of inflorescence intermediate between the primary types.

Morphology of the Cone of Abietineæ.‡—Dr. F. Noll points out that the male and female inflorescences of the Abietineæ are not morphologically equivalent. The anthers are pollen-bearing leaves of the main axis. The scales of the female cones, on the other hand, originate as lateral shoots in the axils of the primary leaves, which may or not be persistent in the mature cone. They are, in fact, a kind of placenta, as has been maintained by Sachs, Eichler, and Goebel, a view which is greatly confirmed by a comparison with the structure of the leaves of the Ophioglossaceæ. The view here advocated is supported by considerations drawn from abnormal examples.

Dehiscence of the Fruit of the Squirting Cucumber.§—M. E. Roze has investigated the conditions which give rise to the sudden expulsion of the ripe seeds through the opening in the fruit of *Ecballium Elaterium* caused by its detachment from its peduncle. It appears to be due to the great expansion of the fluid within the loculi, together with the very rapid increase in the size of the seeds, and a certain contraction of the pericarp, aided by the action of a hot sun.

* Rev. Gén. de Bot. (Bonnier), vi. (1894) pp. 385–408 (15 figs.).
† Op. cit., vii. (1895) pp. 5–14, 103–22 (9 figs.).
‡ SB. Niederrhein. Gesell. Nat. u. Heilkunde Bonn, 1894, pp. 38–42.
§ Journ. de Bot. (Morot), viii. (1894) pp. 308–18.

Erythrism of Flowers.*—By the term *erythrism*, Dr. X. Gillot proposes to designate the converse of albinism, the occurrence of a red tint in flowers ordinarily white. Familiar examples of this phenomenon are presented by *Spiræa Ulmaria* and many other species of Rosaceæ, *Achillæa Millefolium*, *Bellis perennis*, a considerable number of Umbelliferæ, &c. According to the writer it is promoted by an abnormally high temperature or an unusual degree of light.

Arctic and Alpine Plants.†—M. G. Bonnier compares the structure of the same plant growing in Arctic and in Alpine regions in the case of a number of species belonging to Spitzbergen or Jan Mayen Land on the one hand, and to the Alps or Pyrenees on the other hand. He finds, in all the species examined, that the arctic plant exhibits the following characters, more or less strongly accentuated, as compared with the same species from alpine localities. The lignified elements are reduced in number, their walls are thinner, and the diameter of the vessels is smaller. The leaves are thicker but less differentiated; the palisade tissue is much less strongly developed, the lacunæ or intercellular spaces much more so. The epiderm of the leaves and stem is less coherent, and its cuticle thinner. All the tissues of the leaf, stem, and root exhibit a greater or less tendency to a rounding of the cells, which often form trabecules separating large intercellular spaces filled with air. These differences are attributed by the author mainly to different conditions as to the moisture of the air and to light. In arctic regions the air is more charged with moisture, and the light is more continuous but less intense, than in alpine regions.

Ombrophilous and Ombrophobous Vegetation.‡—Prof. J. Wiesner calls attention to the character of the foliage displayed both in temperate (Austria) and in tropical (Java) climates, by plants which, on the one hand are uninjured (*ombrophilous*), and on the other hand are injured (*ombrophobous*) by excessive rainfall. These characters do not necessarily go with an adaptation for a moist or a dry soil. Some species—e. g. *Impatiens noli-tangere*, *Prenanthes purpurea*—growing in moist shady situations, are nevertheless ombrophobous. Xerophilous plants, on the other hand, are hardly ever ombrophilous. As a rule, the power of resistance to rain increases with the growth of the leaf, reaches a maximum, and then again diminishes. Leaves the upper surface of which can be moistened are usually ombrophilous, those in which the upper surface is covered by a coating of wax ombrophobous. The protection of ombrophilous leaves against the injurious action of excessive rain appears to be afforded by the presence of antiseptic substances.

In tropical forests it is common for the peripheral leaves to assume a vertical position, so as to be but little affected by the rain, while the central leaves retain a normal horizontal position. When young no large formation of chlorophyll takes place in the leaves. The sensitive folding up of the leaves of *Mimosa* under concussion is a protection against the injurious effects of excessive rainfall.

* Bull. Soc. Bot. France, xl. 1893 (1894). Sess. Extraord., pp. clxxxix–cxciv.

† Rev. Gén. de Bot. (Bonnier) vi. (1894) pp. 505–27 (4 pls.).

‡ SB. K. Akad. Wiss. Wien, cii. (1893) pp. 503–21, ciii. (1894) pp. 169–91. Cf. this Journal, 1894, p. 82.

Influence of a Dry Soil on the Size of Leaves.*—From a series of experiments made on a variety of herbaceous plants, M. E. Gain comes to the conclusion that the statement made by nearly all writers that dryness of the soil acts prejudicially on the development of the surface of leaves is far too general. On some plants it has precisely the opposite effect; other conditions, such as the natural habit and the need of the species for shade or for insolation, must also be taken into account.

Frost-forms of Leaves.†—Prof. C. Luerssen describes the modifications observed in Prussia in the winter-forms, chiefly of the leaves of *Nephrodium Filix-mas* and *Athyrium Filix-femina*, and in *Equisetum sylvaticum*. They consist mainly in a reduction in length of the pinnæ of the leaves of the ferns, in a partial suppression of the parenchyme of the upper portion of the leaf or of the pinna, and in a persistent circination of the apices of the pinnæ. The leaves are usually fertile, but the sori are often small.

Variation in Cotyledons.‡—Herr H. de Vries points out how greatly the number of cotyledons is liable to vary among Exogens, even in the same species, and proposes the following terms:—*Tricotyledons*, with three cotyledons; *Hemitricotyledons*, with one normal and one divided; *Tetracotyledons*, with four; *Hemitetracotyledons*, with two divided, or two normal and one divided; *Syncotyledons*, with the two cotyledons coalescent into a single leaf; *Amphicotyledons* when the two united cotyledons form a cup. These can all, to a certain extent, be perpetuated by heredity. The first is by far the most common.

Fasciation.§—From the examination of a large number of instances, Dr. A. Nestler has come to the conclusion that fasciation is not the result of the coalescence of two or more axes, but of the broadening of a single normally cylindrical axis, caused by a peculiar change in the growing apex. True fasciation must therefore be distinguished from abnormal growths, the result of cohesion or adhesion. An excessive supply of food-material cannot be regarded as the primary cause of fasciation.

Aerial Bulbils of Lilium tigrinum.‖—According to M. L. Dufour, the bulbs on the stem of this lily can be greatly increased in size by removing the flowers and the upper portion of the stem. They do not lose their power of germination by drying to a large extent. Up to a certain point the strength of the plant is not proportioned to the size of the bulb from which it springs.

β. Physiology.

(1) Reproduction and Embryology.

Gynodiœcism.¶—Mr. J. C. Willis records the results of further observations on this phenomenon, especially among the Labiatæ. He finds

* C.R. Ass. Franç. pour l'Avance. d. Sci., 1893 (1894) pp. 585–91. See Bot. Centralbl., 1894, Beih., p. 418.

† Biblioth. Bot. (Luerssen and Frank) Heft 28, 1894 (58 pp. and 23 pls.).

‡ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 25–39 (1 pl.).

§ Oesterr. Bot. Zeitschr., xliv. (1894) pp. 343–6, 369–74, 410–5, 456–9 (2 pls. and figs.); SB. K. Akad. Wiss. Wien, ciii. (1894) pp. 153–68 (2 pls.).

‖ C.R. Ass. Franç. pour l'Avance. d. Sci., 1894, pt. ii. pp. 527–33. See Bot. Centralbl., lx. (1894) p. 117.

¶ Proc. Cambridge Phil. Soc., viii. (1894) pp. 129–33. Cf. this Journal, 1893, p. 503.

that the same individual plant (in *Origanum vulgare*) may be either female or hermaphrodite, according to its external conditions. The proximate cause of one flower being female and another hermaphrodite appears to be some difference in nutrition. The phenomena vary greatly with the nature of the soil and climate, with the season of the year, and other conditions. But, while greatly dependent on external causes, they may also be to a large extent fixed by natural selection and heredity. Androdiœcism, which is very rare, is certainly due to lack of nourishment. The author regards diœcism, in Angiosperms, as descended from hermaphroditism. Cleistogamy is also a very variable phenomenon, appearing sporadically in many plants, constantly in others. It varies with the time of year, soil, climate, and temperature.

Flowers of Ruppia.*—M. E. Roze describes the structure of the flowers and the mode of pollination of the flowers of *Ruppia maritima* and *rostellata*, the two species agreeing with one another in all important points except the number of ovaries. The pollen-grains have a double coat; at first nearly spherical, they become three-lobed when mature. The stigma has a longitudinal crevice furnished with a certain number of papillose cells. When the spadix, which consists of both male and female flowers, emerges from its spathe, the anthers usually become detached, and rise to the surface of the water, which becomes covered with pollen. But in other cases the anthers do not become detached, and then they open in the ordinary way in the air. *Ruppia* appears, therefore, to present a transitional mode of pollination, between aerial and aquatic.

Abnormal Willow-catkins.†—Herr J. Haring has observed numerous examples of *Salix caprea* and *S. cinerea*, in which the male catkins have assumed a more or less completely pistilliferous, and the female catkins a more or less completely staminiferous character.

Cross-pollination and Self-pollination.—Herr E. Loew ‡ has collected the results of a very large number of observations with regard to the pollination of the native plants of Central and Northern Europe, and of Greenland. The contrivances for autogamous pollination are more numerous in the higher than in the lower alpine region, and this increase is most strongly exhibited in the high alps of Norway, and in the arctic flora of Greenland. The arctic flora of Greenland, Nova Zembla, and Spitzbergen also includes a very large proportion of species with exposed or only partially concealed honey. Anemophilous species are also more numerous, as contrasted with entomophilous, in the most northerly latitudes.

Mr. M. S. Evans § describes the mode of pollination in two South African species of *Loranthus*, *L. Kraussianus* and *Dregei*. In the former species the pollen is violently scattered by the sudden release of the anthers from the corolla-tube; but the pollen does not in this way reach the stigma; this is pollinated exclusively by a sun-bird (*Cinnyris oli-*

* Bull. Soc. Bot. France, lxi. (1894) pp. 466–80 (1 pl.).
† Oesterr. Bot. Zeitschr., xliv. (1894) pp. 386–7, 415–8.
‡ Blütenbiol. Flor. d. mittler. u. nördl. Europa u.s.w., Stuttgart, 1894, viii. and 424 pp. See Bot. Centralbl., lx. (1894) p. 303.
§ Nature, li. (1895) pp. 235–6.

vaceus), which abundantly visits the flowers in search of nectar. If the visits of these birds are excluded, the flowers are quite sterile. A somewhat similar process takes place in *L. Dregei*, except that the anthers themselves are here broken off, scattering the pollen as they fly. The visiting birds are here also sun-birds.

According to Dr. L. Nicotra,* *Helleborus siculus* is so strongly proterogynous that self-pollination is impossible.

Mr. C. Robertson † gives a list of the insect visitors of a very large number of species of American Rosaceæ and Compositæ. With the exception of *Potentilla norvegica*, which is usually self-pollinated, all present evidence of adaptation to the visits of pollinating insects.

Mr. J. H. Burkill ‡ describes the mode in which the flowers of *Medicago* (chiefly *M. sativa*, *falcata*, *sylvestris*, and *lupulina*) are "exploded," so as to scatter the pollen by the agency of insects, without which process the flowers appear to be infertile. The explosion cannot be effected by the wind, and the only insects which seem to be able to bring it about (in *M. sativa*) are species of *Bombus* and *Apis*. A long list is appended of the insect-visitors of these species.

From Mr. J. C. Willis § we have a contribution to our knowledge of the arrangements for pollination in *Brodiæa ixioides*, *Stanhopea tigrina*, *Pimelea decussata*, *Cotyledon Umbilicus*, *Hydrolea spinosa*, *Nemophila maculata*, and *Ziziphora capitata*. Mr. Willis also discusses the conditions under which cleistogamous flowers are formed in *Salvia verbenaca*.

Mr. A. G. Hamilton ‖ describes the mode of pollination of several species belonging to the Australian genera *Scævola*, *Stelliera*, and *Brunonia*, of Goodeniaceæ. In most of them he considers that the contrivances in the flower all point to cross-pollination by insects, but that, in case of that failing, the same contrivances ensure pollination by the plant's own pollen.

(2) Nutrition and Growth (including Germination, and Movements of Fluids).

Germination of Dormant Seeds.¶—Further experiments on this subject by Herr A. Peter have led to no very decisive results, but confirm the conclusion previously arrived at, that the seeds of many plants, especially when very small, will retain their vitality, when buried deep in the soil, for a much longer period than has generally been supposed.

Germination of Keteleeria.**—Sig. R. Pirotta has investigated the mode of germination of the seeds of *Keteleeria Fortunei*, and finds it to differ from that of other Abietineæ in being hypogæous; the number of cotyledons is also only two, as in other hypogæous Coniferæ. Both

* Bull. Soc. Bot. Ital., 1894, pp. 263–4. Cf. this Journal, 1894, p. 589.
† Trans. Acad. Sci. St. Louis, vi. (1894), pp. 435–80.
‡ Proc. Cambridge Phil. Soc., viii. (1894) pp. 142–53.
§ Journ. Linn. Soc. (Bot.), xxx. (1894) pp. 284–98 (2 pls.).
‖ Proc. Linn. Soc. N.S. Wales, ix. (1894) pp. 201–12 (1 pl.).
¶ Nachr. K. Gesell. Wiss. Göttingen, 1894, pp. 373–93. Cf. this Journal, 1894, p. 368.
** Atti R. Accad. Lincei, iii. (1894) pp. 286–9.

these points are regarded as indicating that *Keteleeria* represents an archaic type of Gymnosperms.

Habit of Lemna.*—Mr. H. B. Guppy records a series of observations on the growth of *Lemna minor*, *gibba*, and *polyrhiza* under different conditions of substratum and temperature. *L. minor* thrives and fructifies quite as well on wet mud as on water. In the winter, the fronds of *L. gibba* are flat, and scarcely distinguishable from those of *L. minor*. *L. polyrhiza* has also a winter form, consisting of rootless reniform fronds; these almost always sink when detached. This species is also able to go through all its stages of growth on wet mud. The rise of the fronds to the surface of the water in the spring is brought about mainly by bubbles of air when their new growth commences. *L. polyrhiza* appears to be functionally unisexual, though structurally hermaphrodite.

Exotropism of the Root-system.†—Dr. F. Noll asserts that the direction of growth of the ultimate branches of the root is determined, not only by geotropism and heliotropism, but also by their tendency to grow in a direction radial to that of the mother-root, in other words, by exotropism. This is in fact the principal factor in bringing about the distribution of the finer roots through a large extent of soil, by which they are enabled to absorb the largest amount of nutritive materials. This tendency is independent of external influences, and was demonstrated by the author by artificially causing root-branches to grow in a different direction, and then removing the obstruction, when they at once again began to grow in a direction radial to the mother-root. This law has also a strong influence on the place of origin of new roots, which is always on the convex side when the mother-root is curved.

Influence of Worms on the Growth of Rhizomes.‡—Herr P. E. Müller describes the mode of growth of those plants which are provided with rhizomes, especially in beech-forests, and the way in which this is influenced by the action of worms. This takes place chiefly by the loosening of the soil, and the consequent increased power of the roots to strike downwards. Aerial stolons with normal leaves thus become replaced by underground rhizomes.

Assimilation of Nitrates by Plants.§—M. Demoussy finds that nitrates are absorbed by seeds from the soil in proportion to the amount of nitrogenous substances which they contain. Thus small seeds, like those of clover and colza, absorb but a small quantity of nitrates, while larger seeds, like those of maize, absorb larger quantities, which are found in the seedling. The nitrates thus absorbed appear to be employed directly in the formation of the albuminoids necessary for the life of the plant.

Absorption of Free Nitrogen by Plants.‖—Further experiments on this subject lead Herren F. Nobbe and L. Hiltner to the conclusion that

* Journ. Linn. Soc. (Bot.), xxx. (1894) pp. 323–30.

† SB. Niederrhein. Gesell. Nat. u. Heilkunde Bonn, 1894, pp. 34–6.

‡ Overs. K. Dansk. Vidensk. Selsk. Forhandl., 1894, pp. 49–147 (20 figs.) and pp. xii.–xxxvii. (French *resumé*).

§ Comptes Rendus, cxix. (1894) pp. 868–71. Cf. this Journal, 1894, p. 469.

‖ Landwirthsch. Versuchsstat., xlv. (1894) pp. 155–9. See Bot. Centralbl, 1894, Beih., p. 467. Cf. this Journal, 1894, p. 479.

Elæagnus, *Alnus*, and *Podocarpus* resemble Leguminosæ in their power of assimilating the free nitrogen of the air by means of root-nodules. Negative results were obtained from a series of experiments on mustard, buckwheat, and oat.

(3) Irritability.

Photeolic Movements and Structure of Pulvini.*—Mr. F. De F. Heald proposes the term *photeolic* for the movements in vegetable organs due to the varying intensity of the light. The organ (pulvinus) the curvatures of which set in motion other passive organs, is called the *motor* (in contrast to the motile) organ. This organ is termed the primary, secondary, or tertiary, according as it is at the base of the primary petiole, or of the petioles of the primary or secondary pinnæ. A depression which often occurs in the centre of the stele of the motor organ is termed the *hilum of the stele*.

With one exception among the plants observed (*Abutilon Avicennæ*), simple leaves never have pulvini. In the case of compound leaves, if a primary pulvinus is present, there are always also secondary pulvini, The pulvinus is never provided with stomates, and has but very few intercellular spaces; these, when present, are very small. This gives the pulvinus a darker colour than the ordinary tissue. The cells contain either chlorophyll or xanthophyll. The epiderm is well developed, and is usually covered with trichomes. The completely developed organ is always traversed by a stele which is entire, and completely surrounded by a layer of non-lignified bast-fibres. It always shows, even in the diurnal position, well-marked transverse folds, which become changed when the curvature of the organ increases or diminishes.

Traumatropic Curvature of Roots.†—Prof. V. M. Spalding has investigated, in the case of the root of seedlings, secondary roots, and aerial roots (*Anthurium*), the phenomena termed by Pfeffer *traumatropism*, i.e. results which follow the infliction of wounds on the tip of growing roots. If a radicle is branded just below the apex, the tip begins, in the course of an hour or more, to bend away, so that in a few hours the lower part of the radicle is strongly convex on the injured side. In the course of a day or two the tip may have described an entire circle. This traumatropic curvature is independent of a quite distinct mechanical curvature which takes place at the spot where the injury is inflicted, and which is concave on the injured side; it follows only when the injury is close to the apex. The experiments made show that the tissue lying just beneath the root-cap is sensitive, and that the wound gives it a stimulus to which, after induction, the root responds by bending. No traumatropic curvature takes place even when extensive injury is inflicted which does not involve the growing point. The biological significance of the phenomenon appears to be that it removes the wounded portion of the root from the source of injury while repair is going on.

Fall of the Corolla of Verbascum.‡—Sig. U. Martelli explains as a phenomenon of irritability the fact that in all species of *Verbascum* examined, the corolla of mature flowers becomes detached and falls

* Bot. Gazette, xix. (1894) pp. 477–91 (1 pl.).
† Ann. Bot., viii. (1894) pp. 423–51.
‡ Journ. Linn. Soc. (Bot.), xxx. (1894) pp. 316–22 (3 figs.).

shortly after the stem has been sharply struck. This irritability is transmitted by the vascular bundles in an ascending line until it reaches the flowers. Here it acts first of all on the calyx, the lamina of the sepal rising, with a more or less rapid movement, till it leans against the corolla and compresses it, pushing it continually forward, until it falls off from its own weight. This detachment is facilitated by the existence of a separating zone of very small cells intermediate between the large ovoid or oblong cells of which the lamina of the corolla is composed and the large rounded cells of the receptacle. A similar structure occurs in the leaves.

(4) Chemical Changes (including Respiration and Fermentation).

Diastatic Ferments in Plants.—From a series of experiments on a number of species (*Canna*, maize, *Platanus*, date, *Phaseolus*, *Begonia*, &c.) Dr. J. Grüss * comes to the conclusion that there exists in seedlings a soluble diastase which is capable of diffusion through the cell-wall in the same way as sugar. It appears to pass, with maltose, out of the cotyledons into the stem. The removal of the cotyledons diminishes the amount of diastase in the stem. The quantity of diastase present was ascertained by its action on starch; the iodine-test being used to determine the extent to which the latter had been destroyed. In woody plants the chief seats of formation of diastase are the cambium and the pith.

The same author † has observed the action of natural diastase on the endosperm of the date, and applies the term *allöolysis* to the mode in which it takes place, the penetration of the diastase into the substance acted upon being accompanied by a simultaneous change in the latter. The action on the reserve-cellulose is very slow, and ends in its transformation into soluble products, probably mannose. It is by this action of diastase that the absorption of the reserve-cellulose is effected in the germinating date.

Influence of Oxygen on Alcoholic Fermentation.‡—Dr. E. Giltay and Herr J. H. Aberson have carried on a series of experiments for the purpose of testing the correctness of Pasteur's view that yeast assumes its fermenting properties only when there is no free access of oxygen. The general result at which they arrived is that, in the presence of a gas containing a larger proportion of oxygen than that in atmospheric air, the amount of sugar which yeasts split up into alcohol and carbon dioxide is greatly increased.

γ. General.

Bastin's Laboratory Exercises in Botany.§—This bulky volume is the first attempt, as far as we are aware, to combine a macroscopic and a microscopic text-book of botany. It is divided into two parts,—"Organography" and "Vegetable Histology"; both relating to Flowering Plants only, the whole range of Cryptogamy being left almost untouched. The first part comprises the subjects of an ordinary handbook of Morpho-

* Jahrb. f. wiss. Bot. (Pringsheim), xxvi. (1894) pp. 379–437 (2 pls.); Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 2–13 (1 pl.).

† Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 60–71 (2 pls.).

‡ Jahrb. f. wiss. Bot. (Pringsheim), xxvi. (1894) pp. 544–86.

§ Philadelphia, 1895, 8vo, 540 pp., 87 pls. and 7 figs.

logical Botany. The second part commences with an Introduction on the Microscope, its structure, the use of staining reagents, &c., and proceeds to a description of the minute structure of the tissues and other parts of plants. It is well and clearly written, and the illustrations are very well chosen.

B. CRYPTOGAMIA.

Cryptogamia Vascularia.

Botryopterideæ.*—M. R. Renault establishes the new family BOTRYOPTERIDEÆ, intermediate between Filices and Hydropterideæ, for the fossil genera *Clepsydropsis* Ung., *Zygopteris* Cord., *Grammatopteris* g. n., and *Botryopteris* Ren. They appear to have been aquatic plants in which the parenchyme of the frond is nearly or entirely suppressed. The branches of the rachis are alternate in a horizontal or vertical plane; the fructification is situated at the apex of the ultimate branches. When floating on the water the frond sometimes possesses a lamina provided with stomates on its upper, and absorbing hairs on its under surface. The sporanges are large, pear-shaped, oblong, circular or polyhedral, are provided with an annulus, and contain two kinds of spore. They may be regarded as sporocarps with free megaspores and microspores. The Botryopterideæ are allied to the Filices by the structure and mode of branching of the stem, and by the presence of an annulus, but differ from them in the existence of two kinds of spore. In this respect they resemble the Hydropterideæ, as also in the mode of grouping of the stalked sporanges, and in their habit.

Apospory in Ferns.—Prof. F. O. Bower † records two examples of the production of gemmæ in *Trichomanes Kaulfussii* (growing in dark shady situations) similar to those already observed in *T. alatum*. They occurred in great quantities, and the leaves which bear them appear to be destitute of sporanges. They originate from single marginal or superficial cells, and bear lateral rhizoids of a dark-brown colour. At their apices the prothalloid growths bear short branches or sterigmas, on each of which is a gemma which germinates directly. The whole structure is regarded by the author as of a gametophytic nature.

Mr. C. T. Drewry ‡ describes a new example of apospory in the case of a variety of *Scolopendrium vulgare*. In young plants raised from the aposporous prothallia of *Lastrea pseudo-mas* var. *cristata*, he finds all intermediate stages between the oophore and the sporophore.

Elaters of Polypodium imbricatum.§—Herr G. Karsten describes the peculiar structure of the spores in this fern, each of which is provided with a band composed of two very long and slender threads of cellulose closely interwoven with one another, the surface of this band being again covered with very fine hairs or projections. The whole band is strongly hygroscopic, and presents a remarkable analogy to the elaters of *Marchantia* or of *Equisetum*, as it performs the same function in the

* Bull. Soc. d'Hist. Nat. d'Autun, iv. (2 pls.). See Bot. Centralbl., 1894, Beih., p. 451.

† Ann. Bot., viii. (1894) pp. 465-8 (3 figs.). Cf. this Journal, 1888, p. 617.

‡ Journ. Linn. Soc. (Bot.). xxx. (1894) pp. 281-4 (1 pl.).

§ Flora, lxxix. (1894) Ergänzungsbd., pp. 87-91 (1 pl.).

distribution of the spores. The hygroscopic band is formed, as in *Equisetum*, out of a third thin membrane, the epispore, exterior to the endospore and exospore. The mode of attachment of this band to the spore appears to vary.

Stem of Calamites.*—Mr. T. Hick describes the primary structure of the stem of *Calamites*, previous to the commencement of secondary thickening. An especial character is the remarkable features of the tissue which makes up the inner zone of the cortex. It consists of large elongated cellular elements, standing in vertical rows, with no sign of thickening or sculpturing on their walls.

Muscineæ.

Annulus of Mosses.†—Herr H. Dihm describes in detail the structure of the annulus of the capsule in a large number of genera of Bryaceæ. He regards the annulus as an invariable constituent of the capsule, though in some cases present in only a rudimentary form. Its purpose is to bring about a separation between the wall of the capsule and the opercule. This is usually effected by one or more layers of cells which are filled with mucilage swelling up by absorption of moisture when the capsule is ripe, and thus causing the two parts to become detached from one another. In other cases the separating layer consists of small thick-walled cells of great mechanical tenacity. As a general rule the structure of the annulus is remarkably uniform within the same genus. In the Tetraphideæ the cells of the opercule contain so large an amount of mucilage, that this organ itself swells and rolls up so as to bring about the opening of the capsule.

Chromatophores of Asterophyllum sylvaticum.‡—Mr. A. C. Stokes has studied the structure of the chlorophyll-bodies in this moss, where they are easily observed in consequence of the transparency of the leaves. The number of these structures in each cell is very small. The author was unable to detect in them any appearance of fibrillæ. They are pitted or spongy, the pits being comparable to those in the shell of a diatom; from the boundaries of the pits proceed green bars or trabecules, forming a reticulate structure. Each chlorophyll-body is probably at all times surrounded by a membrane, which can be made out especially when it is undergoing the process of bipartition, and it is furthermore imbedded in a coating of the cell-protoplasm. The cytoplasm consists of fine threads springing from the nucleus, which connect the chlorophyll-bodies with one another, and are in continuous quivering movement. A similar structure of the chlorophyll-bodies was observed in some other plants.

Notothylas.§—Mr. D. M. Mottier has followed out the life-history of this genus of Hepaticæ, especially of the American species *N. orbicularis*. He finds the capsule to possess a columel varying in size with that of the capsule. It originates, as in *Anthoceros*, primarily in the young sporogone with the archespore and independently of it; it is, therefore,

* Mem. Manchester Lit. and Phil. Soc., 1893, 4, pp. 158-70 (1 pl.).
† Flora, lxxix. (1894) Ergänzungsbd., pp. 286-349 (3 pls.).
‡ Bull. Torrey Bot. Club, xxi. (1894) pp. 396-406 (8 figs.).
§ Ann. Bot., viii. (1894) pp. 391-402 (2 pls.).

not a secondary differentiation within the spore-chamber. The archegone resembles more closely that of the eusporangiate ferns than does that of *Anthoceros*. The antherid arises from a hypodermal cell, a process which occurs nowhere else among Bryophytes. Its development, however, agrees altogether with that of *Anthoceros*.

Fossil Liverwort.*—Under the name *Preissites Wardii* g. et sp. n., Mr. F. H. Knowlton describes a fossil from the Lower Yellowstone, in Montana, representing a genus of Frondose Hepaticæ, evidently nearly related both to *Preissia* and to *Marchantia*.

Characeæ.

New Characeæ.—In the most recently published part of his Characeæ of America,† Dr. T. F. Allen gives a monograph of the division Glœocarpæ of the section Monarthrodactylæ of *Nitella*, including four new species, *N. obtusa*, *montana*, *Blankinshipii*, and *missouriensis*.

In another paper ‡ he describes three other new species of *Nitella* belonging to the same section, *N. mexicana*, *californica*, and *occidentalis*, and erects Braun's species of *Chara*, *C. gymnopus*, into a section GYMNOPODÆ, including two new species, *C. carmensis* and *cubensis*, and establishes also another new species of this genus, *C. depauperata*.

Algæ.

Anatomy of Florideæ.§—Herr E. Bruns makes the following observations on the structure of some Mediterranean Florideæ.

In *Bonnemaisonia asparagoides* every branch contains a large number of strongly refringent particles which are an intense blue in reflected light. These bodies are not contained in the cells, but in the enveloping gelatinous layer, at the points of junction of two or three epidermal cells. Their chemical nature was not ascertained. Sieve-tubes and sieve-plates occur in both the principal and secondary branches. Similar refringent particles were also found in *Antithamnion cruciatum* and in other species of the genus, within the gelatinous sheath. Their function is obscure; but they are not, as was supposed by Nägeli, abortive mother-cells of tetraspores. In *Vidalia volubilis* there are no sieve-tubes, but the ordinary cells of the thallus are connected with one another by sieve-plates. Crystalloids were found in many species; they were coloured red from rhodospermin.

Biology of Florideæ.‖—Dr. M. Golenkin notes the remarkable fact that *Bonnemaisonia asparagoides*, in drying, excretes free iodine. The iodine appears to be contained in the vacuoles of special cells.

The author further describes the germination of the carpospores in this species, which often commences while still in the cystocarp. When ripe they are filled with Florideæ-starch, which substance was found in great abundance in all the Florideæ of the Bay of Naples, while in the

* Bull. Torrey Bot. Club, xxi. (1894) pp. 458–60 (1 pl.).
† 'The Characeæ of America,' 1894, pt. ii. fasc. 1 (14 pls.).
‡ Bull. Torrey Bot. Club, xxi. (1894) pp. 162–7 (2 pls.).
§ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 178–86 (1 pl.)
‖ Bull. Soc. Imp. Nat. Moscou, 1894, pp. 257–68 (3 figs.) (German).

vegetative condition, though it disappears at the period of fructification. In some species the grains have the form of flat disks.

The spherical refringent bodies found by several authors in the cells of *Laurencia*, *Plocamium*, *Sphærococcus*, and other Florideæ, were investigated by Golenkin, and found to exhibit all the characters of elaioplasts, which is also the case with the large yellow spherical bodies in *Dictyota*. Structures of a similar appearance in *Sebdenia Monardiana* presented, however, quite different reactions.

Phycoerythrin.*—Prof. H. Molisch finds *Nitophyllum punctatum* a favourable object for obtaining crystals of the red colouring matter of the Florideæ, known as phycoerythrin or rhodospermin; and, these terms being identical, he proposes the abolition of the latter. The crystals do not occur in the living plant, but are only postmortal. They can readily be obtained by placing the plant in a 10 per cent. solution of sodium chloride, the addition of a few drops of carbon bisulphide greatly facilitating the process. The crystals belong to the hexagonal prismatic system; their size varies greatly, as also their degree of solubility in fresh water. They are slowly soluble in glycerin, insoluble in alcohol, ether, benzol, carbon bisulphide, olive oil, and turpentine oil. A striking peculiarity is their strong swelling-properties on addition of potash-lye, soda-lye, or ammonia. They take up iodine, and some other pigments, such as fuchsin. These and other chemical reactions show that the so-called crystals of phycoerythrin are in reality crystalloids of an albuminoid character. The substance can be obtained also as an amorphous precipitate. Other species of Florideæ yield similar results.

Peculiar Form of Chantransia.†—In a culture of *Batrachospermum irregulare*, M. J. Huber found the *Chantransia* generation assume a peculiar form, which had the property of multiplying by means of buds.

Systematic Position of the Bangiaceæ.‡—The late Prof. F. Schmitz criticized on several points Johnson's views on this subject; but agreed in the general conclusion that, under whatever name, the Bangiaceæ must be treated as a distinct class from the Florideæ or "Eu-Florideæ."

Systematic Position of Thorea.§—Reverting to this subject, the late Prof. F. Schmitz somewhat modified his view that *Thorea* can be classed with the Phæophyceæ. He, however, held that its divergence from the Florideæ is so strong that, until sexual organs of reproduction have been detected, it must be placed in a class by itself, intermediate between the Florideæ, Phæophyceæ, and Chlorophyceæ. The mode of apical growth is altogether different from that of the Mesogloiaceæ (*Castagnea* and *Myriocladia*), where the apical hair is an assimilating organ.

Seaweeds of Heligoland.‖—In an exhaustive account of the flora of the shores of Heligoland, Dr. P. Kuckuck describes several new species

* Bot. Ztg., lii. (1894) 1te Abtheil., 177–89 (1 pl.).

† Bull. Herb. Boiss., ii. (1894) pp. 164–6 (1 pl.). See Bot. Centralbl., lx. (1894) p. 177.

‡ La Nuova Notarisia, v. (1894) pp. 714–7. Cf. this Journal, 1894, p. 599.

§ La Nuova Notarisia, v. (1894) pp. 705–14. Cf. this Journal, 1892, p. 293.

‖ 'Wissensch. Meeresunters. herausgegeben v. d. Kommission z. wissensch. Unters. d. Deutschen Meere in Kiel u.s.w.,' i. pp. 223–65 (29 figs.).

and three new genera of marine algæ, two of the latter belonging to the Phæosporeæ, and one to the Chlorophyceæ.

Sphaceloderma. Thallus crustaceous, with marginal growth, sometimes stratified, black-brown, only a few mm. in diameter, and a few layers of cells in thickness, destitute of vertical branches; unilocular sporanges globular, springing directly from the superficial cells, projecting above the thallus, and united into sori; plurilocular sporanges unknown; chromatophores forming numerous roundish plates in each cell; hairs unknown. *Sphaceloderma* scarcely differs from *Lithoderma*, but exhibits the reaction of *Sphacelaria* with eau-de-javelle.

Serapion. Thallus crustaceous, with marginal growth, dark brown, only a few mm. in diameter, with erect branched confluent filaments springing from the originally uniseriate basal plate; unilocular sporanges pear-shaped, springing directly from the superficial cells, projecting above the thallus and united into sori; plurilocular sporanges unknown; chromatophore forming a disc-like plate in each cell; hairs unknown. The position of *Serapion* among the Phæosporeæ is uncertain.

Prasinocladus. Unicellular; united by branched gelatinous stalks into tufted colonies, forming a green slimy scum; cells ovoid, 13–20 μ long, 7–11 μ broad, with an at first rod-shaped, afterwards mantle-shaped chromatophore, and pyrenoid-like body, which divides obliquely; non-sexual swarmspores with four cilia pointing backwards, and red eye-spot. The systematic position of this genus among the Chlorophyceæ is uncertain.

Pogotrichum and Litosiphon.*—Recurring to the relationship between these two genera of Phæosporeæ, Prof. T. Johnson gives further details of the structure of the two species of *Litosiphon*, comparing them with the two species of *Pogotrichum*.

Mougeotiopsis, a new Genus of Conjugatæ.†—Under the name *Mougeotiopsis calospora* g. et sp. n., Herr E. Palla describes the type of a new genus of Conjugatæ, nearly allied to *Mougeotia*, and differing from *Debarya* only in the invariable absence of pyrenoids. Each cell contains only a single chloroplast, with jagged outline; the mode of conjugation is scalariform. The author further records the occurrence of karyoids in *Penium*, *Micrasterias*, *Hyalotheca*, and *Desmidium*. He proposes the classification of the genera of Conjugatæ into three families, viz.:—(1) Spirogyraceæ (*Spirogyra*), chloroplasts one or more, parietal; (2) Mougeotiaceæ (*Gonatonema*, *Mougeotia*, *Debarya*, *Mougeotiopsis*), chloroplast solitary, axile, discoid; (3) Zygnemaceæ (*Zygnema*, *Zygogonium*), chloroplasts two, axile, more or less stellate.

Valoniaceæ.‡—In an account of a collection of East Indian Algæ, chiefly from Formosa and the Moluccas, Herr F. Heydrich establishes a new genus of Valoniaceæ, *Rhipidiphyllum*, founded on *Anadyomene reticulata*, and distinguished from that genus by the absence of intermediate cells, apical growth, and the presence of tenacles. The genus *Spongocladia* he places among Valoniaceæ, rather than, as proposed

* Ann. Bot., viii. (1894) pp. 457–64 (1 pl.). Cf. this Journal, 1894, p. 717.
† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 228–36 (1 pl.).
‡ Hedwigia, xxxiii. (1894) pp. 267–304 (2 pls.).

by Murray and Boodle,* near to *Cladophora*. The author doubts whether there is any true symbiosis between this alga and the mussel-shell to which it is attached.

Division of the Nucleus in Valonia.†—According to Mr. D. G. Fairchild, the nuclei in the bladder of *Valonia utricularis* have two modes of division, an amitotic and a mitotic; and these two modes are essentially distinct, although no difference can be detected, before division, between the nuclei which divide in one way, and those which divide in the other.

Fluorescent Bodies in Derbesia.‡—In *Derbesia Lamourouxii*, which grows in dense masses illuminated only from above, Dr. N. Golenkin finds peculiar fluorescent bodies which disappear when the alga is grown so as to receive light from all sides. They appear to have for their function the dispersion of the light.

Euglenopsis.§—In salt marshes in Massachusetts, Mr. B. M. Davis finds an alga-like organism to which he gives the name *Euglenopsis subsalsa* g. et sp. n. The following is given as the diagnosis of the genus:—Plant filamentous, branching above; filaments formed of compartments, those below empty, the terminal containing green cells; cells with a nucleus, a peripheric band-shaped grass-green chromatophore, and a red pigment-spot; reproduction by four-ciliate zoospores, otherwise agreeing with the cells in structure; sexual reproduction unknown. The plant is about 0·25 mm. high, and is composed of moniliform filaments, the lower cells of which are empty, while the upper contain a large chromatophore, and their contents escape as large 4-ciliate zoospores, resembling the megazoospores of algæ. A pigment-spot is present even in the resting condition. Even the very young plant contains empty as well as green cells. Though to a certain extent intermediate between plants and animals, the author regards *Euglenopsis* as most nearly allied to the Tetrasporeæ among Algæ, and especially to *Chlorangium*.

Spirophyta and Fucoides.‖—Herr T. Fuchs argues that the structures known as *Spirophyta*, *Taonurus*, and *Zoophycus*, and generally regarded as the impressions of fossil Algæ, cannot represent any vegetable structure; and suggests that those known as *Fucoides* or *Chondrites* are worm-casts which have been filled up with some hairy substance.

Fungi.

Composition of the Cell-wall of Fungi.¶—M. L. Mangin repeats his objection to the use of the term "fungus-cellulose" for the substance of the cell-wall of fungi, and especially controverts the statements of Winterstein.** He finds that with some fungi (Agaricineæ and Polyporeæ) the membrane consists of hemi-cellulose accompanied by another substance capable of powerfully absorbing basic pigments; while in

* Cf. this Journal, 1888, p. 1002.
† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 331-8 (1 pl.).
‡ Bull. Soc. Imp. Nat. Moscou, 1894, pp. 268-70 (German).
§ Ann. Bot., viii. (1894) pp. 377-91 (1 pl.).
‖ SB. K. Akad. Wiss. Wien, cii. (1893) pp. 552-70 (1 pl. and 4 figs.).
¶ Bull. Soc. Bot. France, xli. (1894) pp. 375-84. Cf. this Journal, 1894, p. 233.
** Cf. this Journal, 1894, p. 234.

other species of the same groups it is composed of callose in company with the same substance.

Monstrosities in Fungi.*—Dr. P. Voglino describes a number of cases of monstrosity among the Hymenomycetes, and proposes to classify those which occur in Fungi under four heads, viz.:—(1) *Prosphitiasis*, or Adhesion; (2) *Eutochia*, or Prolification, which again may be superior (*Epieutochia*), inferior (*Hypoeutochia*), or internal (*Entoeutochia*); (3) Hypertrophy; and (4) Atrophy.

Cilia of the Zoospores of the Phycomycetes.†—Dr. W. Rothert has investigated the fate of the cilia of the zoospores in the Saprolegniaceæ and Peronosporeæ. The zoospores of *Saprolegnia* are diplanetic. In the first swarming-period they have two cilia of equal length inserted at the apex; after swarming for a short time they come to rest, and become invested in a thin membrane; the contents then escape through a small opening, and the new zoospore has two cilia of unequal length inserted laterally; after a second and longer period of swarming, the zoospore finally comes to rest, forms a new membrane, and puts out a germinating tube. The zoospores of the Peronosporeæ (including *Pythium*) are monoplanetic, corresponding to the second swarming stage of those of *Saprolegnia*.

In the first swarming period of the zoospores of *Saprolegnia* the cilia are invariably absorbed into the body of the spore. Usually this takes place gradually and regularly; but sometimes a knot (*Oese*) is formed, which is afterwards drawn in. In the second stage of *Saprolegnia*, and in the zoospores of the Peronosporeæ, the cilia are never absorbed into the body of the spore, but remain outside as a residue, and are finally thrown off. Before this takes place, the cilium always bends itself in a variety of ways, so that the upper and basal parts coalesce, leaving a kind of knot, which may be sessile upon the membrane of the spore, or may have a stalk composed of the coalescent portions of the cilia. The residue of the cilia may remain attached to the spore after germination has commenced.

Swarmspores of Rhizophidium.‡—Prof. G. F. Atkinson described the peculiar apparently "intelligent" amœboid movements by which the swarmspores of *Rhizophidium globosum*, parasitic on *Spirogyra*, find their way to the ostiole in order to escape from the zoosporange.

Spores of Cerebella.§—By causing the spores of *Cerebella Paspali* to germinate in a nutrient solution, Prof. G. F. Atkinson has obtained a branched mycele resembling that of the Pyrenomycetes or Hyphomycetes, but no sporids. He considers that this throws considerable doubt on the correctness of the location of *Cerebella* among the Ustilagineæ.

Parasitic Fungi.—Herr P. Vuillemin ‖ describes the two species of *Puccinia* parasitic on *Thesium*, *P. Desvauxii* and *Thesii*; the former

* Atti R. Accad. Sci. Torino, xxx. (1894) pp. 97–108 (1 pl.).
† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 268–82 (1 pl.).
‡ Bot. Gazette, xix. (1894) pp. 503–4.
§ Bull. Torrey Bot. Club, xxi. (1894) pp. 127–8 (1 pl.).
‖ Bull. Soc. Mycol. France, 1894, p. 107. See Bot. Centralbl., 1894, Beih, p. 4?5.

belonging to the *Auteupuccinieæ*, and intermediate between *Puccinia* and *Diorchidium*, the latter to the *Hemipuccinieæ*.

Prof. L. H. Pammel * describes the injury inflicted on the sunflower by *Sclerotinia Libertiana* (*Peziza sclerotioides*). An exhaustive bibliography is appended of the root-diseases caused by fungi.

The parasite of the beet previously described by M. L. Trabut under the name *Entyloma leproideum* is now made by him † the type of a new genus, which he calls *Œdomyces*.

Herr H. O. Juel describes ‡ the following new species:—*Ustilago seminum* on seeds of *Arabis petræa; Tilletia Sesleriæ* on *Sesleria cœrulea; Polystigma obscurum* on living leaves of *Astragalus alpinus; Puccinia nemoralis*, the æcidia on *Melampyrum pratense*, the teleutospores on *Molinia cœrulea*. He also establishes a new genus of Phacidiaceæ, *Pseudorhytisma*, founded on *Xyloma Bistortæ* DC.

Herr R. Aderhold § identifies *Fusicladium dendriticum* as the conidial form of *Venturia chlorospora* f. *Mali*, which occurs on both the apple and pear. The relationship of these to *F. pyrinum* and to *V. ditricha* f. *Pyri* still remains doubtful.

Association of Parasitic Fungi.‖—The stem and leaves of *Anemone ranunculoides* are, according to M. P. Vuillemin, subject to the attacks of two different parasitic fungi, *Æcidium punctatum* and *Plasmopara pygmæa*. The former of these has but little, if any, injurious effect on the nutritive organs of the host; it produces a hypertrophy of the tissues; but it partially or entirely prevents the formation of the sexual organs.¶ The latter parasite causes partial or complete decay of all the aerial organs; if flowers are formed, the number of perianth-segments is reduced, and a differentiation of calyx and corolla established; the flower approximates more closely in structure to that of other genera of Ranunculaceæ. When these two parasites simultaneously attack the same host-plant, the influence of one appears to neutralize that of the other, and normal fertile flowers are not unfrequently produced.

Similar phenomena are presented in the effects of *Puccinia Desvauxii* and *Tuberculina persicina* on *Thesium humifusum*.

Fungus-parasites of the Vine.—M. A. Prunet ** has found a new species of Chytridiaceæ, to which he gives the name *Cladochytrium viticolum*, very widely distributed in all parts of diseased vines, especially in the cells of the pith. This parasite he believes to be the cause of the most diverse diseases of cultivated vines, including the "gommose bacilaire," "gelivine," "anthracnose ponctuée," "roncet," "brunissure," and "mal nero." He proposes to abolish all these terms, and to unite the various diseases due to *Cladochytrium viticolum* under the common term *chytridiosis*. Its effects are very similar to those of the phylloxera.

* Trans. Acad. Sci. St. Louis, vi. (1894) pp. 19–232 (2 pls.).

† Rev. Gén. de Bot. (Bonnier), vi. (1894) pp. 409–10 (1 pl.). Cf. this Journal, 1894, p. 601.

‡ Öfvers. K. Vetensk.-Akad. Förhandl. Stockholm, liv. (1894) pp. 491–508 (3 figs.) (German).

§ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 338–42.

‖ Bull. Soc. Bot. France, xli. (1894) pp. 442–6.

¶ Cf. this Journal, 1890, p. 744.

** Comptes Rendus, cxix. (1894) pp. 221–5, 1233–6.

M. P. Viala * confirms the detection of peritheces on *Uncinula spiralis*, which identifies this American parasite of the vine with the European oidium *Erysiphe Tuckeri*. Both are subject to the attacks of the parasite *Cicinnobolus Cesatii*.

MM. P. Viala and L. Ravaz † have also found the peritheces of the fungus which produces the white rot of the vine, *Coniothyrium Diplodiella*, hitherto known to be reproduced only by pycnids. They propose, on the strength of this observation, to erect it into a distinct genus *Charrinia*.

Specialization in the Parasitism of the Rusts of Grain.‡—Herr J. Eriksson calls attention to the existence of distinct biological forms in the various species of Uredineæ parasitic on our corn-crops, which can grow only on particular species of grass. Thus *Puccinia graminis* has the following distinct specialized forms:—(1) f. *Secalis* on *Secale cereale*, *Hordeum pratense*, *Triticum repens*, and *Elymus arenarius;* (2) f. *Avenæ*, on *Avena sativa* and *elatior*, *Milium effusum*, *Alopecurus pratensis*, and *Dactylis glomerata;* (3) f. *Airæ*, on *Aira cæspitosa;* (4) f. *Agrostidis* on *Agrostis canina* and *stolonifera;* (5) f. *Poæ* on *Poa compressa* and *pratensis;* and a sixth not sharply defined f. *Tritici* on *Triticum vulgare*—six forms on fifteen different species of grass. In the same way *Puccinia Phlei pratensis* has only one form on two species of grass; *P. glumarum* five forms on five species; *P. dispersa* four forms on five species; and *P. coronata* six forms on eight species.

Protoplasmic Connection in Lichens.§—M. G. Poirault finds the connection of the cells by filaments of protoplasm to be a common phenomenon in lichens. A favourable species for demonstrating the phenomenon is *Usnea barbata*, where it can be observed without any preliminary fixing process, and even in dried material. It occurs here in the cells of the medullary layer of the thallus, even between those which are at some distance from one another; the cell-walls are usually perforated by several protoplasmic filaments, while in the multiseptate paraphyses of the apotheces there is usually only one. Between the gonids and the surrounding hyphæ no such communication has been observed.

Podetium of Cladonia.‖—Prof. J. Reinke discusses the morphological value of the podetium of *Cladonia*, and combats the view of Krabbe ¶ that it belongs altogether to the fertile portion or apothece. He maintains, on the other hand, that both the podetium and the thallus-scales belong to the vegetative portion of the lichen, or thallus, only the terminal portion which bears the asci or pycnids being an essential part of the fructification. The main arguments in favour of this view are derived from the assimilating properties of the podetium, and from the fact that in some species it alone represents the assimilating organs, the thallus-scales being entirely wanting.

Action of Antiseptics on Yeast.**—Mr. H. H. Mann, from his experiments on *Saccharomyces cerevisiæ* with carbolic acid, sulphate of

* Comptes Rendus, cxix. (1894) pp. 411-3. † Tom. cit., pp. 443-4.
‡ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 292-331.
§ Comptes Rendus, cxviii. (1894) pp. 1362-3.
‖ Jahrb. f. wiss. Bot. (Pringsheim), xxvi. (1894) pp. 495-523 (7 figs.).
¶ Cf. this Journal, 1892, p. 81.
** Ann. Inst. Pasteur, viii. (1894) pp. 785-95.

copper, salts of iron, lead, and mercury, concludes that certain metallic salts are endowed with antiseptic properties, but that the quantity of the antiseptic necessary to kill the yeast with certainty increases with the quantity of the yeast. With phenol the like result was not always observed.

With the salts of copper, lead, iron, and mercury, the antiseptic effect is due to the fixation of the metal by the yeast; the quantity fixed varies for each metal, with the time of action, the strength of the solution, and the condition of the yeast.

This fixation is due, in part at least, to the formation of an insoluble phosphate, the metal becoming intimately fixed in the cell-wall; besides this certain organic substances of the cell may also be precipitated.

Monilia candida.*—Herren B. Fischer and C. Brebeck publish an exhaustive account of this fungus and its allies. They propose to abolish the generic names *Mycoderma* and *Monilia*, and to establish a new genus *Endoblastoderma*, characterized by a remarkable process of endogenous cell-formation, which they describe as follows:—Within the cell is formed a strongly refringent corpuscle which, in its growth, approaches the cell-wall, and finally escapes from the cell. This process may be repeated several times in the mother-cell, the daughter-cells retaining a similar kind of connection with it to that which exists in budding, and multiplying either by a similar process of endogenous cell-formation or by budding.

The new genus *Endoblastoderma* includes species without mycele which cannot cause alcoholic fermentation, and fermenting species with mycele. The former comprise *E. amycoides*, which has numerous forms, one of which is *Mycoderma cerevisiæ*, and *E. liquefaciens*, a marine species. The latter comprise *E. glucomyces*, which has numerous forms, *E. pulverulentum* (*M. cerevisiæ* var. *pulverulentum*) and *E. candidum* (*Monilia candida*). *Saccharomyces albicans* Reess the authors retain under Reess's genus.

A new marine organism is described under the name *Blastoderma salmonicolor*. It produces a salmon-coloured pellicle on the water, and is distinguished from *Endoblastoderma* by the absence of the endogenous cell-formation.

Fructification of the Gastromycetes.†—Herr L. Rabinowitsch traces the development of the fructification of several species of Gastromycetes—*Lycoperdon depressum*, *Scleroderma Bovista*, and others—especially in reference to the occurrence of a boundary line between the fertile and sterile portion of the glebe in one section of *Lycoperdon*, and the formation of the spores in *Scleroderma*. The author concludes that the genera *Areolaria*, *Phlyctospora*, and *Pompholyx* must be reunited to *Scleroderma*; while the development of *Sphærobolus* corresponds more to that of *Geaster*.

Structure and Development of Anthurus.‡—Under the name *Anthurus borealis*, Mr. E. A. Burt describes a new species of this genus of

* 'Zur Morph., Biol., u. System. d. Kahmpilze,' Jena, 1894, 52 pp. and 2 pls. See Bot. Centralbl., lx. (1894) p. 299.

† Flora, lxxix. (1894) Ergänzungsbd., pp. 385–418 (2 pls. and 1 fig.). Cf. this Journal, 1893, p. 367.

‡ Mem. Boston Soc. Nat. Hist., iii. (1894) pp. 487–505 (2 pls.).

Fungi belonging to the Phalloideæ. The whole of the tissues are derived, by internal differentiation, from the medullary and cortical tissues of the medullary strand. The medullary portion gives rise to the column of gelatinous tissue in the main cavity of the stipe, to the more persistent forms of this tissue which constitute the diaphragm and the zone, to the entire mass of the glebe, and to the gelatinous and outer layers of the peridium. The cortical layer gives rise to the outer wall of the peridium, to the cortical plates, and to the cortical sheath of loose tissue outside the stipe. The receptacle is formed by the joint action of the cortical and medullary tissues.

Mycetozoa.

New Myxomycetes.*—Under the names *Kleistobolus pusillus* and *Didymium oculatum*, Herr C. Lippert describes two new species of Myxomycetes, both found on dead pine-wood. *Kleistobolus* forms a new genus with solitary spherical sessile sporanges, the opercule circular with toothed margin, a double peridium, and rudimentary capillitium consisting only of a few short tubes.

Lister's Mycetozoa.†—Mr. A. Lister publishes a descriptive catalogue of the species of Mycetozoa in the herbarium of the British Museum, with briefer descriptions of all other known species, forming therefore a monograph of the group. The work commences with an account of the general structure and modes of reproduction of the Mycetozoa, the process of karyokinesis in the nuclei being especially dwelt on. The group is divided into two sub-classes, the Exosporeæ and the Endosporeæ, the former comprising one order, the Ceratiomyxaceæ, the latter twelve, viz. the Physaraceæ, Didymiaceæ, Stemonitaceæ, Amaurochætaceæ, Heterodermaceæ, Liceaceæ, Tubulinaceæ, Reticulariaceæ, Trichiaceæ, Arcyriaceæ, Margaritaceæ, and Lycogalaceæ. To each order is prefixed a key to the genera, and to each genus a key to the species. The illustrations, which are entirely from nature, are a very valuable feature of the work.

Germination of Myxomycetes.—In *Labyrinthula Cienkowskii*, parasitic on *Vaucheria terrestris*, Prof. W. Zopf‡ finds that the cysts are always invested with a double membrane. On germination, these cysts produce, not swarm-spores, but amœbæ, the protoplasm putting out one or two pseudopodes, which pierce the membrane of the cyst. The amœbæ not unfrequently remain for a considerable time within the cyst before escaping, carrying it with them in their movements.

Mr. A. J. M'Clatchie§ states that the spores of some Myxomycetes, especially *Reticularia umbrina*, germinate very rapidly in ordinary drinking or in distilled water, in some cases within an hour.

* Verhandl. K. K. Zool.-Bot. Gesell. Wien, xliv. (1894) pp. 70–4 (2 pls.).
† Monograph of the Mycetozoa. London, 8vo, 1894, 224 pp., 78 pls. and 51 figs.
‡ Beitr. z. Phys. u. Morph. niederer Organismen (Zopf), Heft 4 (1894) pp. 60–2 (2 figs.).
§ Bot. Gazette, xix. (1894) pp. 245–6.

Protophyta.

α. Schizophyceæ.

New Genera of Protococcoideæ.*—Prof. R. Chodat gives details of the structure and life-history of the following species of Protococcoideæ:—*Palmella miniata*, *Chlamydomonas intermedius* sp. n., *Gonium pectorale*, *G. sociale*, *Pandorina morum*, *Palmellococcus miniatus* g. et sp. n., *Dactylococcus infusionum*, *Scenedesmus quadricauda*, *Raphidium Braunii*, *Chlorosphæra muralis* sp. n., *Pleurastrum insigne* g. et sp. n., *Pleurococcus vulgaris*. The following are the diagnoses of the new genera:—

Palmellococcus. Cellulæ globosæ, plerumque singulæ, bipartitione contentus intra membranam matricalem v. quadripartitione cellulas membrana firma donatas, atque zoogonidiis agilibus nudis ciliis destitutis (?) intra cellulas proprias ortis sese propagantes. Species aerophilæ.

Pleurastrum. Unicellular algæ reproduced by tetrads of cells within the primitive membrane, the membrane sculptured when mature; forming complex tetrads which can be resolved into the glœocyst stage and produce biciliated zoospores.

The author regards *Palmella* as nearly allied to *Tetraspora*. Through *Chlamydomonas* the Volvocineæ are allied to the Protococcoideæ, and especially to the Tetrasporaceæ and Chlorosphæraceæ. It is doubtful whether *Pleurococcus superbus* is an autonomous species; it wants the red eye-spot of *Chlamydomonas*, and is probably a stage of the development of *Gonium sociale*. *Chlamydomonas* and *Sphærella* are the simplest members of the Volvocineæ, the Phacoteæ forming a second line of development. *Scenedesmus* and *Dactylococcus* are stages in the cycle of development of the same organism.

Another new genus of Protococcaceæ, *Golenkinia*, is described by the same author,† forming a *flos aquæ* on a duck-pond near Geneva. It consists of rounded cells, 10–15 μ in diam., from the wall of which proceed filiform prolongations equalling or exceeding the diameter of the cell. In the course of development these prolongations disappear, and the cell-wall becomes gelatinous, the alga assuming then a *Glœocystis* condition. It next divides into two or four, and produces a corresponding number of four-ciliated zoospores. It may also, when in the *Glœocystis* state, be propagated by spores, which have a feeble amœboid motion, or by the escape of a portion of the cell-contents, clothed with a membrane, which, after remaining for a considerable time in this condition, gives birth to zoospores. The genus appears to be allied to *Trochiscia*.

Naviculoid Diatoms.‡—Prof. P. T. Cleve publishes the first part of a Synopsis of the Naviculoid Diatoms, with an analytical key of the sub-groups and genera, and of the species in each genus. The variations within the group are described in the habit of life and growth, the size, the form of the frustule, the zone, the outline of the valves, the central nodule, the median line, the areas, the longitudinal lines, the structure of the valve, and the cell-contents. The various genera, species, and varieties are then described in detail. The author considers the first

* Bull. Herb. Boissier, ii. (1894) pp. 585–616 (8 pls.).

† Journ. de Bot. (Morot), viii. (1894) pp. 305–8 (1 pl.).

‡ SB. K. Svensk. Vetensk.-Akad. Handl., xxvi. (1894) 194 pp., 5 pls. and numerous figs. (English).

well-authenticated appearance of diatoms to be in the Trias. While many species are cosmopolitan, others are known only within limited areas.

Pearls of Diatoms.*—Prof. J. Brun claims to have settled the question that the pearls of diatoms are cavities and not protuberances, in the following way. If a particle of a transparent body immersed in a liquid is first exactly focused under the Microscope, and the tube then raised, the object will appear to have a bright centre if its index of refraction is higher than that of the liquid, a dark centre if the index is lower. If the tube is lowered the results are the opposite. If a diatom with large areas, such as a *Coscinodiscus*, is immersed in styrax or monobromide of naphthalin, and examined in this way, the pentagonal siliceous network is shown to have a lower index of refraction than the styrax, while the interior of the pentagon has not, showing that it must be a cavity, with the same index as that of the surrounding medium. If immersed in water, the inverse phenomenon is observed.

Structure of Cyanophyceæ.†—Herr H. Zukal has made a fresh study of several points connected with the structure and life-history of the Cyanophyceæ.

In a large species of *Oscillatoria* he has detected, by sufficient magnification (1500–2000), in the peripheral portion of the protoplast, a distinctly fibrillar structure, although distinct grains were not differentiated. He concludes, therefore, that the Cyanophyceæ may, in certain cases, possess a highly organized chromatophore, although in others it is reduced simply to a coloured homogeneous parietal layer of protoplasm.

With regard to the grains of cyanophycin, their position and distribution vary greatly even in different cells of the same individual. Their chief distinguishing characteristics are their solubility in dilute hydrochloric acid, and the intense blue colour imparted to them by hæmatoxylin. Their function in the economy of the cell is doubtful; but their main purpose appears to be the formation of pigment.

The "red granules" (*Schleimkugeln*) are not distinct in their origin from the grains of cyanophycin, since the author has been able, in one instance, to follow out the formation of the latter from the former.

The central portion of ordinary vegetative cells, when mature, consists mainly of cytoplasm, with which glucose may occasionally be associated. It is not usually distinguished by a high refringency. It is readily fixed by absolute alcohol, and is then strongly erythrophilous. The author regards it as a soluble modification of the substance of the red granules, into which it is readily transformed.

Although, under certain circumstances, a peculiar contraction of the entire protoplasmic contents of the cell takes place, there is not, in the Cyanophyceæ, any structure to which the term nucleole can properly be applied.

In *Cylindrospermum stagnale* Herr Zukal has observed a remarkable process which he regards as a kind of conjugation. The cells contained

* Le Diatomiste. ii. (1894) pp. 139–40.

† Oesterr. Bot. Zeitschr., xliv. (1894) pp. 266–7, 281–6, 338–43, 387–91; Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 256–66 (1 pl.). Cf. this Journal, 1894, p. 383.

a watery, almost colourless fluid, in which were from two to five large refringent colourless granules, scarcely stained by hæmatoxylin. These assumed after a time a swarming motion, and finally escaped through an opening in the cell-wall. Their movement then became more energetic, and they were seen to have a contractile membrane of protoplasm, but no cilia, and were enveloped in a very thin gelatinous layer. They were spherical or ellipsoidal, with a diameter of from 1 to $3 \cdot 5\ \mu$. When they came to rest they became clothed with a firm membrane. These "zoospores" then became united into diplozoospores, each pair consisting of a larger and a smaller one, and began to assume a blue-green tint. Each of the two cells now increased to a diameter of 5–6 μ, and repeatedly divided so that a small colony was formed, enclosed in mucilage, and precisely resembling a colony of *Glœocapsa* or *Aphanocapsa*, the separate cells still having a slight swarming motion. The metamorphosis of this colony into the *Cylindrospermum* condition was not observed. The author has also seen a similar formation of "zoospores" in *Gomphosphæria aporina*, *Glœotrichia pisum*, and a species of *Oscillatoria*.

A new species of *Lyngbya*, *L. Bornetii*, is described, in which the chromatophore has a reticulate framework.

Lyngbya Borziana.*—Sig. L. Macchiati has come to the conclusion that the organism described by him under this name is a stage in the cycle of development of *Phormidium Retzii*. This latter is transformed into the *Lyngbya*-form when growing in still or very slowly running water. The branching species of *Phormidium*, *P. Retzii* and *penicillatum* are grouped by the author into a sub-genus *Dendro-phormidium* or *Kladodo-phormidium*.

β. Schizomycetes.

Third Report of the Royal Society Water Research Committee.†—The third report of Profs. P. F. Frankland and H. Marshall Ward commences with an account of Prof. Ward's further experiments on the action of light on *Bacillus anthracis* and on the bacteria of the Thames. He strongly urges that an attempt should be made to thoroughly investigate the bacteriology of the Thames. One point of great interest in this elaborate report is the discovery of very distinct evidence that the bacteria in summer water are many of them enfeebled forms. In some cases those obtained in August, which turned out to be identical with forms found in the winter, at first grew so feebly that their characters on the plates led one to put them down as distinct species or varieties. The matter is very complex; but in one or two cases at any rate, there is no question that exposure to light does so affect the germination and growth of the bacteria that the resulting colonies depart widely from the normal in many of their characters.

The second part of the paper treats of the behaviour of the typhoid-bacillus and of *B. coli communis*; in this research Prof. Frankland was assisted by Mr. Appleyard. A large number of experiments have been made. In one series the vitality of one and the same culture of the typhoid bacillus was observed in one and the same sample of Thames water (A) in its natural unsterilized state; (B) sterilized by steam;

* Bull. Soc. Bot. Ital., 1894, pp. 296-9. Cf. this Journal, 1890, p. 651.
† Proc. Roy. Soc., lvi. (1894) pp. 315–556.

(C) sterilized by filtration through porous porcelain. In other series Loch Katrine water was used instead of Thames water. Other experiments were made with potable water highly charged with vegetable matter. It was found that typhoid bacilli from ordinary agar-agar and gelatin cultures, on being introduced into steam-sterilized potable water in such numbers as not to materially alter the composition of the latter, undergo no multiplication. This result was uniformly obtained with all the waters used. By first submitting the typhoid bacilli to prolonged culture in more and more aqueous media, and then introducing them into steam-sterilized Thames water, slight but distinct multiplication of these bacilli was observed, although the introduced typhoid bacilli did not multiply in steam-sterilized potable water; the bacilli were found to be possessed of very considerable longevity (from 13 to 76 days). The experiments distinctly show that in these steam-sterilized potable waters the summer temperature of 19° is more prejudicial than a winter temperature 6 to 8° to the duration of life of the typhoid bacillus. In most cases it was found that the duration of life of the typhoid bacillus was greater, and often much greater, in the steam-sterilized than in the corresponding waters unsterilized. A comparative experiment of great interest was made with Thames, Loch Katrine and deep-well water. The duration of life was found to be shortest in the Thames water (9 to 13 days), longest in the deep-well water (33 to 39 days) and intermediate in the Loch Katrine water (19 to 33 days). This result has a very great practical importance as indicating the greater danger of typhoid bacilli gaining access to deep-well than to surface water, and it is pointed out that this danger is in actual practice further enhanced by the fact that well-water is almost invariably consumed without storage, whilst surface waters are often stored for days or weeks, and in some cases for many months. The greater bactericidal power of unsterilized than of steam-sterilized surface waters does not appear to be due to a competition between water bacteria and typhoid bacilli, but rather to the elaboration of products of these aquatic bacteria, which are inimical and prejudicial to the welfare of the typhoid bacilli. The *Bacillus coli communis* taken from ordinary agar-agar cultures and introduced into steam-sterilized Thames water undergoes considerable multiplication, when under precisely similar conditions the typhoid bacillus does not multiply. Introduced into unsterilized water the *B. coli communis* exists in the living state for a much longer period than the typhoid bacillus.

Action of Light on Bacteria.*—Prof. H. Marshall Ward describes further applications of his method of obtaining photographic records of the action of the various rays of light on bacteria. He finds that insolation not only kills large numbers of the bacteria in river-water, but in some cases shows its effects in diminishing the liquefying or zymotic action of certain forms, and even in altering their mode of growth.

Microbe of the Tubercles of Leguminosæ.†—In reference to the question whether the microbes of all tubercle-producing Leguminosæ

* Proc. Cambridge Phil. Soc., viii. (1894) pp. 128–9. Cf. this Journal, 1894, p. 241.

† Landwirthsch. Versuchsstat., xlv. (1894) p. 1–28. See Bot. Centralbl., 1894, Beih., p. 466. Cf. this Journal, 1894, p. 479.

are identical, Herren F. Nobbe, L. Hiltner, and E. Schmid have come to the conclusion that they are all (including those of the Mimoseæ) forms of *Bacillus radicicola*, but that this microbe is so greatly influenced by the plant in the root of which it lives, that its progeny can thrive only in that host, or in another very nearly related to it, though it may live in others. Thus *Pisum sativum* could be infected only by bacteria from *Pisum* or *Vicia; Robinia Pseud-acacia* only by bacteria from *Robinia* or *Caragana*. Of the forms found in the tubercles of the Vicieæ one appears to be confined to that family, while another attacks *Robinia* only among the Galegeæ.

Leucocytes in Diphtheria.*—The principal results of the clinical and experimental observations of M. G. Gabritschewsky on diphtheria may be summed up as follows:—The general leucocytosis in diphtheria (i. e. the number of white corpuscles in the blood) possesses a special character which distinguishes it from the leucocytoses observed in the majority of other infectious diseases. There is a local as well as a general leucocytosis. In cases going to recover, or in immunized animals, the initial rise of the general leucocytosis is soon followed by a progressive diminution in the number of white corpuscles in the general circulation. A progressive leucocytosis, therefore, augurs a bad prognosis. In immunized animals the local leucocytosis is more marked than in the non-immunized, and the corpuscles appear about an hour after infection. In the first case, however, phagocytosis is well marked, and the bacilli have disappeared. In the second the bacilli predominate, and the leucocytes are dead. Hence the cure of a local diphtheritic lesion is tantamount to a successful phagocytosis. The author also deals with the diphtheritic toxin which impedes the phagocytic action of the leucocytes by its necrotic power, and suggests the probability that phagocytes are not only capable of seizing and assimilating solid bodies, but of imbibing and absorbing liquid substances, and of rendering them harmless to the organism. For this action the term *pinocytosis* is suggested.

The favourable results obtained from the use of therapeutic serum are supposed to be brought about by the serum rendering the cells of the organism less sensitive to the necrotic action of the diphtheritic virus.

Action of Anthrax on Hippocampus.†—MM. Sabrazès and Colombot find that anthrax is very virulent to *Hippocampus*, all the animals dying in a few days. The injections were made at the root of the tail, beneath the skin, and intraperitoneally. The temperature of the water in which the fish were kept varied from 18°–26°. Cultivations from the infected *Hippocampi* showed that the anthrax increased in virulence by passage through the animals.

Phagocytosis was a well-marked phenomenon, the leucocytes being from 12–10 μ in diameter. The nucleus (6–3 μ) is single, oval, compact, and granular. The nucleus stained well with methylen-blue, while the cytoplasm, which is more or less vacuolated, was only slightly tinged.

Long Continuance of Diphtheria Bacilli in Nasal Secretion.‡—Dr. R. Abel records a case in which diphtheria bacilli could be demon-

* Ann. Inst. Pasteur, viii. (1894) pp. 673–95 (1 pl).
† Tom. cit., pp. 696–705.
‡ Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 571–2.

strated in the nasal secretion 65 days after the pharyngeal membrane had disappeared. Experiments on animals proved that these bacteria were still quite virulent. The patient was a girl 12 years old, who had a slight attack of pharyngeal diphtheria. Nine days after the membrane on the fauces had vanished the nasal mucosa became affected, and, as before stated, diphtheritic bacilli were demonstrable for more than nine weeks. Hence it follows that a bacteriological examination of the nasal and pharyngeal secretions, &c. should always be made before a patient is pronounced fit to associate with healthy persons.

Bacillus orthobutylicus.*—*Bacillus orthobutylicus* was isolated by M. L. Grimbert from seeds of Leguminosæ which were macerated and cultivated in tartrate of lime. It is a strictly anaerobic organism, from 3–6 μ long and 1·5 μ broad. When young it is extremely mobile, and then often resembles a bell-clapper; as it gets older it gets straighter. As a rule it contains 2 or 3 spores, which appear when the movements cease. The spores can resist a temperature of 80° for 10 minutes, but are destroyed at 85°. *B. orthobutylicus* ferments glycerin, mannite, glucose, lævulose, saccharose, maltose, lactose, galactose, arabinose, starch, potato, dextrin, inulin. The products of its fermentation are butylic alcohol and some isobutylic alcohol, butyric acid, acetic acid, and occasionally formic acid. The gases given off are carbonic acid and hydrogen. With regard to its action, the following points are noticeable. It ferments saccharose, maltose, and lactose without inverting them. It changes starch into maltose and dextrine, though the latter is transformed into maltose as it is produced; thus its presence is not revealed during the course of fermentation. The dextrin is converted into maltose by means of a special ferment. Inulin is attacked directly without being transformed into lævulose.

From *B. butyricus* Pasteur, and from *B. amylobacter* van Tieghem, it is distinguished by not fermenting lactate of lime and not affecting cellulose. It is not coloured blue by iodine at any period of its development. From *B. butylicus* Fitz. it is differentiated by being able to ferment lactose and starch, and not inverting saccharose. And from *B. amylozyme* Perdrix, it is clearly separated by its power of making butylic alcohol with certain hydrates of carbon.

The organism was cultivated in a fluid very much like Pasteur's medium, and the details are given at considerable length and are very exhaustive.

Comparison between Bacterium coli commune and Diplobacillus pneumoniæ Friedländer.†—Herr J. Ury gives the following characters of these two bacteria, which have certain resemblances and certain distinct differences.

Diplobacillus pneumoniæ. Short rodlets of variable length, always possessing a capsule. Motionless. Stainable with the ordinary anilin dyes, decolorized by Gram's method. In gelatin forms a "nail" or grows over the surface. Copious gas development. Forms as crystals in gelatin. On agar forms a yellowish-white film and some gas. Potato

* Ann. Inst. Pasteur, vii. (1893) pp. 353–402 (1 fig.).

† Inaug.-Diss., Strasburg, 1894, 8vo, pp. 47. See Centralbl. f. Bakteriol. u, Parasitenk., xvi. (1894) pp. 579–81.

cultures are white or yellowish-grey. In grape-sugar bouillon sometimes fermentation, sometimes not. Sometimes will coagulate milk, at other times not. Is pathogenic to mice, rabbits, and guinea-pigs.

Bacterium coli commune is less thick, rarely forms a capsule, usually mobile but sometimes not. Behaves in same way as far as growth on gelatin and agar are concerned, but on potato the cultures are brown tending to green. Nearly always ferments grape-sugar bouillon. Almost always coagulates milk. Pathogenic action on animals the same as *D. pneumoniæ.*

The author also refers to the distinctions between *B. coli* and *B. typhosus*, and points out that when the former coagulates milk and ferments grape sugar it is easily differentiated from *B. typhosus.* But there is a variety of *B. coli* which does neither, and therefore it would be difficult to distinguish between this variety and the bacillus of Eberth.

Microbic Origin of Chorea.*—Dr. C. L. Dana records a case of chorea in a man 34 years of age, in the cerebral cortex of whom degenerative changes were observed post mortem. An organism very similar to *Micrococcus lanceolatus* was detected in the deeper layers of the pia and the superficial layers of the cortex. The author suggests that the phenomena of chorea are sometimes to be attributed to a micro-organism.

Interesting Example of Mixed Culture.†—Herren A. Burri and A. Stutzer record an interesting and important example of what may be termed symbiosis; for they have observed that two different species of bacteria, when inoculated simultaneously, as a mixed cultivation, on a medium of definite composition, excite a lively fermentation, which neither of them alone is able to effect. The medium is formed by nitric acid or its salts, and the bacteria are *Bac. coli commune* and another bacterium not previously described. Both organisms were isolated from horse-dung. The gas produced was free nitrogen.

Anthrax in Man.‡—Dr. A. Lewin records nine cases of anthrax in man. Two of these occurred as malignant pustules on the face, the patients recovering after operation, while in the remaining seven opportunity was afforded of examining the internal organs. Examination of sections of various parts and viscera showed that the distribution of the organism was very variable. As a rule, the bacilli were found free, though a certain number were observed enclosed in cells. The material was hardened in alcohol, and the sections stained on the slide with Kühne's carbol-methylen blue, the excess of stain being removed by water and alcohol. This procedure was found to be superior to other methods, not excepting Gram's.

Bacteriological Diagnosis of Acne.§—From examination of comedones, Dr. Hodara has discovered three kinds of microbes of pretty regular appearance. These are a coccus, a flask-shaped bacillus, and a

* Amer. Journ. Med. Sci., cvii. (1894) p. 31. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 868.

† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 814–7.

‡ Tom. cit., pp. 681–7, 731–7.

§ Monatshefte f. Prakt. Dermatol., xviii. (1894) No. 1. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 666–7.

small bacillus. The small bacilli are best shown by Nuna's methylen-blue stain. They are on the average about 0·7 μ long and 0·3 μ broad. These exist in very large numbers in the central part of the comedo. The flask-shaped bacilli (Malassez's spores) were first found by Malassez in *Pityriasis capitis* and also by Unna in *Eczema sebosa*. They exist as saprophytes on the surface of the comedones. In shape they are very variable, sometimes being rodlets, sometimes cocci, sometimes flask-shaped, and sometimes hollow spheres. The rodlets vary in length from 0·5–1·5 μ, in breadth from 0·2–0·6 μ. The flask-shaped are 2–3·5 μ long and 1–2 μ broad. The hollow spheres are from 1–2·5 μ in diameter. The cocci are almost invariably mixed up with the flask-shaped forms in the superficial layers of the comedones. Their diameters are from 0·3–0·5 μ.

The author believes that the bacilli are the cause of acne; they were always present and always in the centre of the comedo, and absent in pseudo-acne.

Anaerobiosis of Cholera Vibrios.*—By inoculating hens' eggs with cholera, Herren Hueppe and Fajans have shown that there is a continuous decrease in the amount of oxygen, ending in its total disappearance. From these experiments it was also deduced that microbes will live and retain their virulence longer in egg than in any other medium. And, notwithstanding that eventually complete anaerobiosis is attained, the cholera vibrios still grow. This gives a practical demonstration of the anaerobiosis of cholera bacteria, and supports Koch's original contention that the cholera microbe is a potential anaerobe.

Dissemination of Bacterium coli commune.†—Dr. T. Henke describes how he found a bacillus having, on examination, all the characters of *Bacterium coli commune*. The organism was isolated from the dressings of an empyema, and when some of the discharge was injected into the peritoneal sac of a guinea-pig the animal died of suppurative inflammation. The original and the cultivated microbes exhibited the same morphological characters, and the latter organism was found to be mobile, was decolorized by Gram, was possessed of flagella, produced acid (Petruschky's gelatin), coagulated milk quickly at body temperature, gave characteristic appearances on oblique agar and on potato, and also developed gas, especially on saccharated media. These and some other characteristics are quoted to show that the organism was undoubtedly *B. coli commune*, and the occurrence is cited to show the universal distribution of this pathogenic organism. A very similar case has been reported by Gaertner, who concluded that the animals had died owing to accidental perforation of the gut during inoculation. In Henke's case this source can be excluded.

Differentiation of Bacillus typhi abdominalis from Bacillus coli communis.‡—Dr. A. P. Matthews points out that, of all the methods in use for diagnosing between *B. coli communis* and *B. typhosus*, that of Wurtz is by far the most useful. Wurtz's medium consists of litmus-

* Arch. f. Hygiene, xx. No. 4. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 216–7. † Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 481–4.

‡ Technol. Quarterly, vi. 1893, No. 3. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1894) pp. 214–5.

lactose-gelatin or litmus-lactose-agar, and the fermentation of the lactose is indicated by a red staining of the medium. Now, according to the author, the typhoid bacillus, so far from even diminishing the alkalinity, actually increases it, so that the colonies stand out on a still deeper blue, while those of *B. coli* turn it red. In investigating any suspected water the author adds 1 ccm. of the water to the litmus-lactose-agar, and then makes plates in the usual way. After incubation for 14 hours at 37·5°, all the blue colonies which have any resemblance to typhoid are transferred for further examination to milk, gelatin, bouillon, nitrate, and saccharine solutions. As many saprophytic water bacteria do not grow at 37·5°, agar plates are recommended, although the appearance of typhoid colonies is less characteristic than those on gelatin plates.

Bacillus bovis morbificans.*—*Bacillus bovis morbificans* was isolated by Herr F. Basenau from the muscle of a cow which had died of blood-poisoning after calving. The organism is a short rodlet of about the same size as the typhoid bacillus, and is endowed with considerable mobility and power of growth. It is a facultative anaerobe. It does not form spores, and is killed in one minute at a temperature of 70°. It does not peptonize gelatin or invert cane sugar. In Loeffler's bouillon to which 1 per cent. of grape sugar has been added, there is a slight development of gas at 39°. It does not form acid in any demonstrable quantity in bouillon, nor does it coagulate milk. No toxines could be demonstrated on the cultures, though it is fatal to animals. From the sum of its characters the author concludes that it is an organism hitherto undescribed, some of its special peculiarities being that it grows not only on the surface of meat, but also within the flesh, and mere contact is sufficient to infect.

Occurrence of Bacillus diphtheriæ outside the Body.†—Drs. J. H. Wright and H. C. Emerson record some experiments undertaken to ascertain if the diphtheria bacillus could be detected in the dust on the floors of the diphtheria wards in Boston City Hospital, and also on the dresses and the hair of the nurses. Out of four cultures from sweepings, broom, &c., one was successful (the broom). Out of four cultures from the dust scraped from the nurses' shoes, three were positive. One successful result was obtained out of four cultures from the nurses' hair. Other cultures from the nurses' clothes and finger-nails, from the patient's clothes and bedclothes, and from the air of the ward, were negative. The authors infer from their success that the Klebs-Loeffler bacillus must have been present in pretty large numbers, though their inoculation experiments showed that the virulence of the organisms was low.

The meat blood serum and bouillon mixture was set with dry heat, and thrice steam-sterilized at 100° C. If colonies developed and a microscopical examination demonstrated the presence of the Klebs-Loeffler bacillus, pure cultivations were made, and guinea-pigs inoculated therewith. For inoculating, cultures in 1 per cent. sugar-bouillon were used.

* Arch. f. Hygiene, xx. No. 3. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 521-2.

† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 412-4.

New Pathogenic Anaerobic Bacillus.*—Dr. R. Kerry describes a microbe which he obtained from the dried flesh of an ox stated to have died of symptomatic anthrax, and which was lethal to guinea-pigs, rats, and rabbits in 7–48 hours with symptoms of Rauschbrand. Microscopical examination showed that the bacilli were from 4–6 μ long, pretty thick, and occurring singly, in pairs, or in short threads. Spores which are characteristic of the involution forms of symptomatic anthrax were absent. Young agar cultivations showed long thick flagella, which on further cultivation lost in length and thickness. The bacillus grew best at incubation temperature, and never developed below 26°. From the bacillus of symptomatic anthrax it is distinguished by being pathogenic to rabbits and mice, and from that of malignant œdema by not growing below 26°. Its shape also differs, for it never grows into long filaments, or developes spores. When cultivated on bouillon and milk there are decided differences. Bouillon remains quite clear, and though milk is coagulated, it is in large, not in small lumps. The virulence of this microbe diminishes with continued cultivation, but can be protracted by the addition of lactic acid and sugar.

Avian Diphtheria of Tunis.†—Dr. A. Loir and M. E. Ducloux describe a disease sometimes called diphtheria, sometimes fowl-cholera, and sometimes variola, which prevents the rearing of fowls on a large scale in Tunis. It is caused by a bacillus quite different from that of the human diphtheria. It is easily cultivable in all the usual media, and kills turkeys, fowls, pigeons, ducks, sparrows, rabbits, and other animals. Guinea-pigs and cattle are unaffected by it. Fowls which have passed through one attack after inoculation are subsequently immune. If the bacillus be heated up to 55°, its virulence is so far diminished that it then acts as a true vaccine. The authors record a case in which this organism caused a false membrane on the fauces accompanied by the symptoms of true diphtheria.

Biological Variations of Pneumobacillus liquefaciens bovis.‡—M. S. Arloing finds that *Pneumobacillus liquefaciens bovis* exhibits two well-marked variations, the one liquefying, the other non-liquefying. It would seem that there is a tendency for this organism to lose its liquefactive power with lapse of time, though change of medium may occasionally restore the property. In the liquefying colonies most of the individuals are elongated and distinctly bacillary, and are surrounded by numerous long flagella. In the non-liquefying they are for the most part short, stumpy, and with rounded ends. There is less resemblance to bacilli than to cocci. This form is also well supplied with flagella. When injected subcutaneously it was found that both forms produced an effect which differed only in intensity. Inoculations directly into the lung gave the same result.

Abel's Manual of Bacteriology.§—The third edition of Dr. R. Abel's 'Manual of Bacteriology,' chiefly intended for students and practitioners,

* Oesterr. Zeitschr. f. wiss. Veterinärkunde, v. (1894) 2/3. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 372-3.
† Ann. Inst. Pasteur, viii. (1894) pp. 599–607.
‡ Comptes Rendus, cxix. (1894) pp. 208–10.
§ Würzburg, 1894, 8vo, 56 pp. See Centralbl. f. Bakteriol. u. Parasitenk., xvii. (1895) pp. 39–40.

deals with the technical details of bacteriological procedure in a concise though thorough manner, the author's aim being to attain his object in a direct and simple way.

To enteric fever and cholera, on account of their importance, more than the usual space is given. The work is divided up into 9 sections:—(1) the Microscope; (2) sterilization and disinfection; (3) nutrient media; (4) cultivation; (5) staining; (6) special cultivation and staining methods; (7) examination of water, air, and soil; (8) inoculation of animals; (9) methods for preserving preparations and cultures.

Atlas of Photomicrographs of Microparasites.*—Drs. G. Itzerott and F. Niemann have brought out a most excellent atlas of photographs of microparasites, chiefly bacteria. Altogether there are 126 photographs, for the most part from cover-glass preparations of pure cultivations, and these are consistently given of the same magnification throughout—a point of great importance. The remainder are photographs of yeasts, moulds, pleomorphic bacteria, and protozoa.

The letterpress consists of two parts, the first dealing with the apparatus and methods necessary for photomicrography, and the second with the morphology and biology of bacteria. Then follows a detailed description of each species photographed. These descriptions, though necessarily short and concise, afford considerable information, e. g. the history, methods of cultivation and preparation, the size, shape, and appearance, results of experiments on animals and so forth are given.

Bunge, R.—**Zur Kenntnis der geisseltragenden Bakterien.** (On Flagellate Bacteria.) *Fortschr. d. Med.*, 1894, pp. 653–70.

Cassedebat, P.-A.—**De l'action de l'eau de mer sur les microbes.** (On the Action of Sea-water on Microbes.) *Rev. d. Hygiène et de la Police Sanitaire*, XVI. p. 104.

Crookshank, E. M.—**Abstract of a Lecture on Microbes and the Spread of Disease.** *Journ. State Med.*, II. (1894) pp. 198–202.

Dietl, P.—**New Californian Uredineæ. II.** *Erythea*, 1894, p. 127.

Duclaux, E.—**Moyens d'examen des eaux potables.** (Methods for Examining Potable Waters.) *Journ. d'Hygiène*, 1894, pp. 429–31.

Gabritschewski, G.—**Bacterium coli commune.** *Med. Obozren*, 1894, pp. 1087–1102 [Russian].

Haase, C.—**Zur Morphologie der Milzbrandbacillen.** (The Morphology of the Bacilli of Anthrax.) *Deutsche Zeitschr. f. Tiermed.*, XX. (1894) pp. 429–30.

Hellin, D.—**Das Verhalten der Cholerabacillen in aëroben und anaëroben Kulturen.** (The Relation of Cholera-bacilli in Aerobic and Anaerobic Cultures.) *Arch. f. Hygiene*, XXI. (1894) pp. 308–16.

Iolin, Severin—**Einige Untersuchungen über die Leistungsfähigkeit der Kieselguhrfilter.** (Some investigations on the use of Filters with Infusorial Earth.) *Zeitschr. f. Hygiene u. Infektionskrank.*, XVII. p. 517.

Issaeff & Ivanoff—**Untersuchungen über die Immunisirung der Meerschweinchen gegen den Vibrio Ivanoff.** (Researches on the Immunization of the Guinea-pig against Ivanoff's Vibrio.) *Zeitschr. f. Hygiene u. Infektionskrank.*, XVII. p. 117.

Jean, F.—**L'analyse bactériologique des eaux potables.** (The Bacteriological Analysis of Potable Waters.) *Journ. d'Hygiène*, 1894, pp. 417–8.

Kruse, W.—**Kritische und experimentelle Beiträge zur hygienischen Beurtheilung des Wassers.** (Critical and Experimental Contributions to the Hygiene of Water.) *Zeitschr. f. Hygiene u. Infektionskrank.*, XVII. p. 117.

* Leipzig, 1895, 115 pp., 21 photo. pls.

LASER, H.—**Bericht über die Resultate der bakteriologischen Untersuchung des Wassers der Königsberger städtischen Leitung im Jahre 1893.** (Report on the Results of the Bacteriological Examination of the Water of the Urban Supply of Königsberg in 1893.) *Centralbl. Allg. Gesundheitspfl.*, 1894, pp. 401–17.

LEONI, O.—**Sur les agents spécifiques et pathogènes du vaccin.** (On the Specific and Pathogenic Agents of Vaccinating Material.) *Rev. d'Hygiène et de Police Sanitaire*, XVI. p. 692.

PFUHL—**Ueber das Vorkommen des *Vibrio Metschnikovi* (Gamaleia) in einem öffentlichen Wasserlauf.** (On the presence of *V. Metschnikovi* in a Public Water-course.) *Zeitschr. f. Hygiene u. Infektionskrank.*, XVII. p. 234.

RODET, A.—**De la variabilité dans les microbes au point de vue morphologique et physiologique (application à la pathologie générale et à l'hygiène.** (On the Variability of Microbes from the Morphological and Physiological Points of View (application to General Pathology and to Hygiene.) Paris, 1894, large 8vo.

ROSS, J. M.—**A Brief Note on the Methods of dealing with Outbreaks of Infection at Dairies.** *Journ. of State Med.*, II. (1894) pp. 94–100.

THOMPSON, W. G.—**Notes on the Observation of Malarial Organisms in connection with Enteric Fever.** *Trans. Ass. Amer. Physic.*, 1894, pp. 110–27.

VOGES, O.—**Weitere Mittheilungen über die intraperitoneale Infection der Meerschweinchen mit Cholerabakterien.** (Further communications on the Intraperitoneal Infection of the Guinea-pig with Cholera-bacteria.) *Zeitschr. f. Hygiene u. Infektionskrank.*, XVII. p. 474.

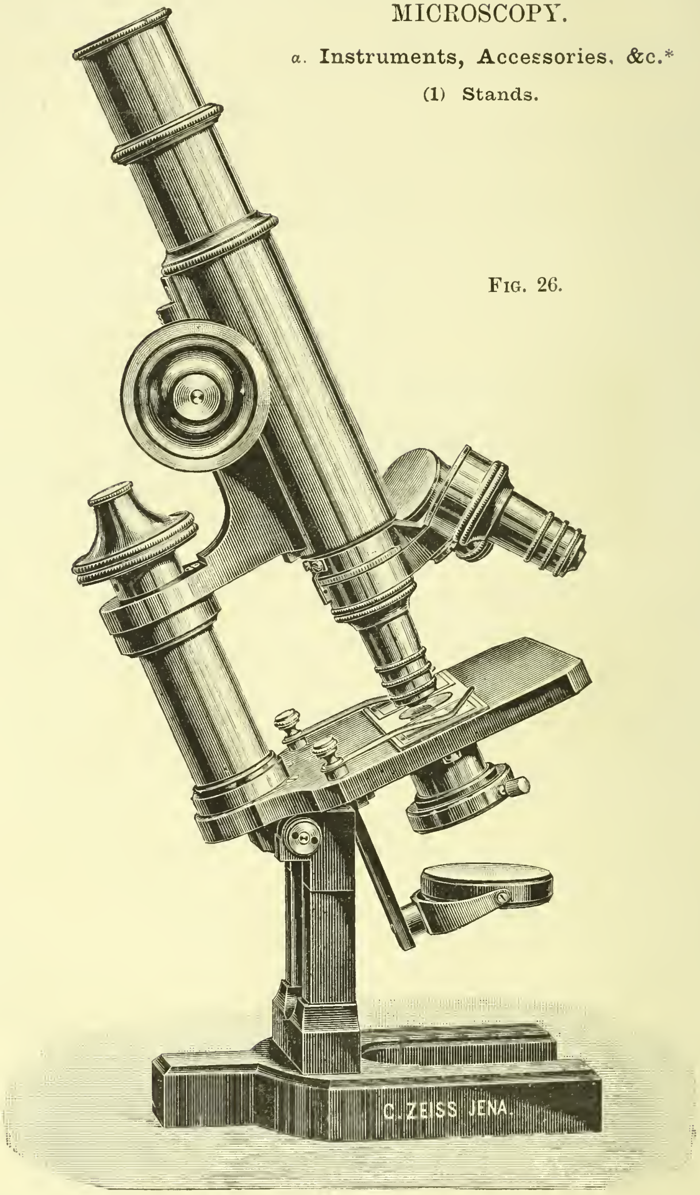
WOLF, KURT—**Ueber Desinfection mit Sapokresol.** (On Disinfection by Sapocresol.) *Arch. f. Hygiene*, XX. p. 214.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Fig. 26.



* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

Zeiss Stand VIa.—Messrs. Zeiss have designed a stand which they consider particularly suitable as a small laboratory and travelling Microscope.

The stand (fig. 26) is on the lines of their usual Microscopes. With respect to size and equipment it stands just midway between stands IV. and VI. The upper body of the instrument is inclinable as a whole and may be tilted into a horizontal position. The solid metal stage has a surface of 80 × 80 mm. ($3\frac{1}{8} \times 3\frac{1}{8}$ in.). It is therefore large enough for the convenient manipulation of the usual forms of object-slides. Below the stage, in the axis of the Microscope, is fixed a sleeve into which any of the following interchangeable appliances may

Fig. 27.

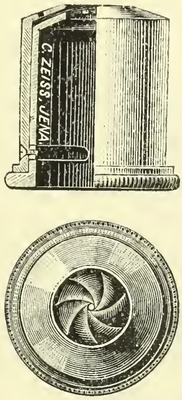
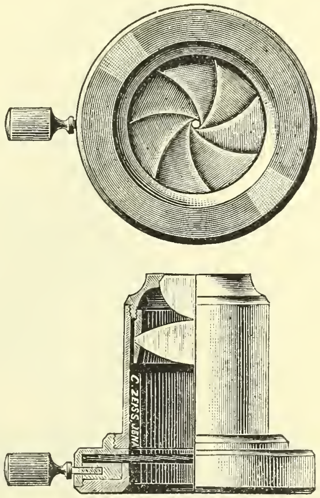


Fig. 28.



be inserted, viz.—the ordinary cylinder diaphragm (with three stops of different apertures); or the new form of iris cylinder diaphragm (fig. 27); or the illuminator No. 19 (fig. 28), of numerical aperture 1·0, with iris diaphragm centrally fixed in the lower focal plane of the condenser. The illuminator suffices for bacteriological work with so-called "full illumination."

For central illumination, the aperture of 1·0 will be found sufficient for all purposes, but the condenser is not adapted for observation with oblique illumination.

The light is reflected to the condenser by means of a plane and concave mirror of 36 mm. ($1\frac{3}{8}$ in. diam.), attached to an arm which is movable in all directions.

The prism which forms the guiding element for the micrometer-movement or fine-adjustment, rises from the top of the stage. This micrometer-movement is, Messrs. Zeiss state, well adapted for work with the highest powers.

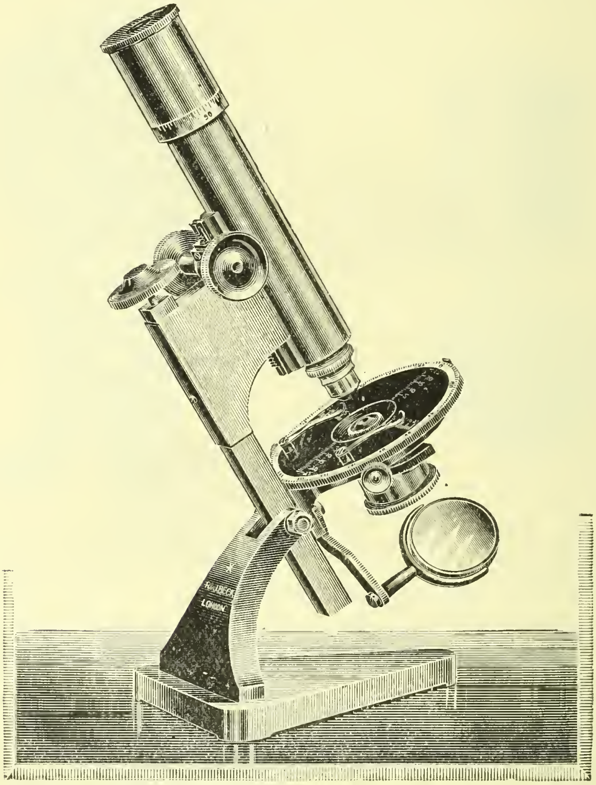
The tube is not graduated, and when extended to its full length, has the exact length of 160 mm. for which all their objectives have been adjusted. When a revolver is used, which is a useful adjunct to this stand, the tube should be shortened 15 mm., which is the depth of the collar of the revolver. The correct position of the tube when a revolver is used may be seen by a mark cut into the draw-tube.

Messrs. R. & J. Beck's New Student's Petrological Microscope.—Figs. 29 and 30 illustrate two forms of a cheap Petrological Microscope recently made by Messrs. Beck.

The only difference in the construction of these two instruments is that one has a rack-and-pinion, and the other a sliding coarse-adjustment.

The principal feature in the construction of a small model Microscope

Fig. 29.

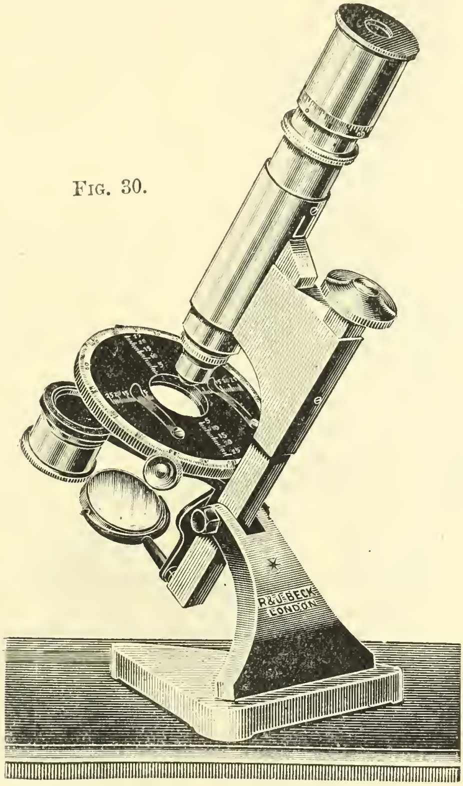


is the fine-adjustment, which in these instruments, the makers affirm, is exceedingly simple, yet perfectly efficient.

In the present instrument the stage is supplied with a centering adjustment, revolves concentrically with the optic axis, and has a graduated scale of degrees on the circumference, with finders in horizontal and vertical directions.

The polarizer is fitted to an arm in the substage which swings in and out, and has a revolving fitting with spring catches to hold it at the points when the prisms are crossed; an achromatic system of lenses is supplied to fit in over the polarizer, and is easily adjusted in the sleeve for axial illumination.

Fig. 30.



The analyser is fitted over the eye-piece, which is supplied with cross wires and is in a rotating fitting similar to that of the polarizer; being provided with spring detents, it revolves freely over the eye-piece, and has a graduated scale of degrees on its circumference.

Messrs. R. & J. Beck's Large Model Petrological Microscope.—This instrument has been specially designed for advanced petrological work (fig. 31).

It has a rack-and-pinion coarse-adjustment and micrometer screw fine-adjustment. The draw-tube carries a slide containing a Bertrand lens, which can be pushed in and out, and is provided with a rack-and-pinion adjustment for focusing it, when examining the rings and brushes of crystals.

The centering arrangement is supplied to the nose-piece, or may be added to the stage instead if desired.

The revolving stage has a graduated scale of degrees on its circumference and has finders on its surface in horizontal and vertical directions.

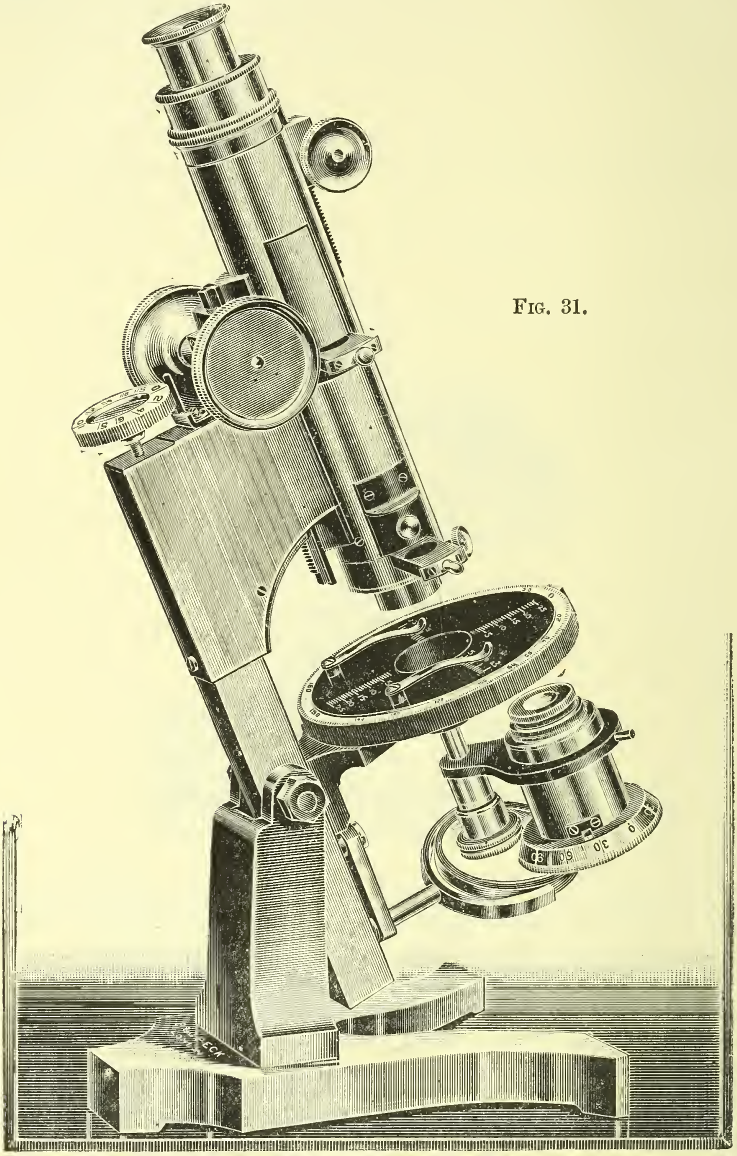


Fig. 31.

The substage is arranged to swing in and out from the central position for polarized or transmitted light, and carries a condenser over the polarizer for axial illumination; the substage focusing adjustment is by a spiral screw actuated by the small milled head, which in the figure is shown immediately over the mirror.

The polarizing prism is in a revolving fitting which is divided on its circumference; it has a catch to hold prism at points of extinction.

The analyser is mounted in a sliding box, and is fitted in the tube of the instrument; beneath the analyser is a Klein's quartz plate, also mounted in a sliding fitting, and either can be immediately removed from the axis of the instrument.

The double mirror is arranged on an arm to swing in and out.

New Microscope for Observations at High Temperatures.* — Mr. Von Wyronboff has had constructed by Nachet a polarization Microscope for the examination of objects at temperatures up to 600°. It is claimed to be simpler and more serviceable for the object in view than the Lehmann instrument, chiefly owing to the long focus given to the objective. The object lies on a perforated ring-shaped sheet of copper which is heated by two Bunsen burners and is attached to a special insulating support to prevent any heat being conducted to the body of the Microscope. As the object therefore cannot be moved, the whole Microscope is made to revolve in a horizontal semicircle and can be also moved horizontally by two guides.

From the description of this wonderful instrument we learn that the "motions provide for the measurement of inclinations due to extinction," and that "the instrument does not exactly measure temperatures, but some thermometric substance."

(3) Illuminating and other Apparatus.

Substage Apochromatic Condenser with Collar Correction.—At the Society's meeting on March 20th last, Mr. E. M. Nelson read the following note:—"The apparatus before you this evening can hardly be called novel, for it was suggested by me some ten years ago; I believe, however, that this is the first actually constructed. The reason why my first suggestion was not carried out was owing to its being stated on all sides that the game was not worth the candle; but practical results now obtained disprove this statement.

The mechanical arrangement is very simple: the correction collar is similar to that of an ordinary objective, it has a steeper spiral slot, and only half a revolution of movement; a long arm is fixed to the collar so that it may conveniently be reached by the finger (fig. 32). Mr. Powell has constructed it so that it will turn easily and smoothly at the slightest touch. This is an important point; for if the movement were as stiff as the collars on some objectives it would be impossible to move the collar without throwing the condenser out of centre. It is needless to state that the collar moves only the back lens of the combination, leaving the mount rigid.

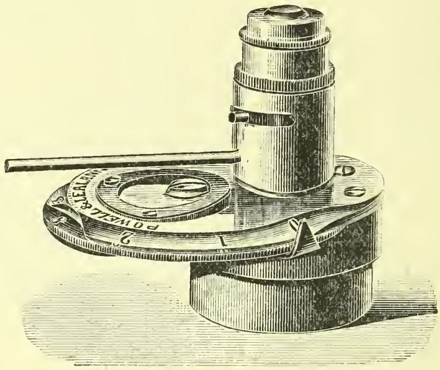
The object of the correctional movement is primarily to increase the maximum aplanatic aperture of the condenser; this is effected by separating the lenses. If the back of a wide-angled objective be examined, when an object is illuminated by the full aperture of the

* Amer. Micr. Journ., xv. (1894) pp. 352–3.

condenser, the edge of the flame being in focus, it will be noticed that the illuminated portion of the back lens will be oval and pointed instead of circular. Also that when the condenser is racked up, although the exterior shape of the illuminated portion will become more circular, two dark patches will appear on either side of the centre, showing the operation of the spherical aberration of the condenser. If under these circumstances the lenses are separated by means of the collar adjustment, the black spots will be closed up, and a circular and evenly illuminated disc of illumination of a larger size will be secured.

Here we have a distinct gain, in consequence of which we ought to be able to see more than we have hitherto done. There is an object in my cabinet that has engaged my attention for nearly a quarter of a century, viz. the well-known diatom *Navicula major*. If its "principal view" be examined two vertical stripes will be seen running down the centre of the hoop (fig. 33*a*). In the early days of my microscopical

Fig. 32.

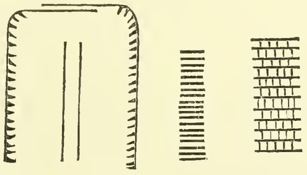


work I happened to be looking at this diatom on a dark ground, using a Gillett's condenser with a circular stop, when I was struck by the blue sheen given out by these two stripes; knowing that this predicated unresolved structure, I attacked it with a new water-immersion 1/8, a lens which Messrs. Powell and Lealand had recently brought out. The illumination was obtained by the same Gillett's condenser with a moon-shaped stop, and the stripes were resolved into striæ without difficulty; subsequently these striæ were counted, and found to be 60,000 per inch (fig. 33*b*), and also they were resolved by an ordinary 1/4 in. of N.A. ·74.

Now, as it is highly probable that there are no such things as striæ on any of the Diatomaceæ, the structure under discussion probably consists of rows of very minute perforations, and as it has been my endeavour to resolve these perforations, every new improvement in microscopical technique has been tried on this diatom, but hitherto without success. At last, however, the condenser with the collar correction has achieved the feat by means of its enlarged aplanatic solid cone (fig. 33*c*). This is a very good diatom to work on, because there are no edges and raphæ by which false ghosts can be made; it is specially a direct solid cone test, and an oblique azimuthal beam is not of much assistance. This diatom is numbered in Moller's 400 "Typen-Platte" 3.3.11; the hoops are also common in "Sozodont," and the striation will be found pretty constant at 60,000.

In the second place, this correctional collar has another office. It is admitted that an iris diaphragm is exceedingly useful for the purpose of regulating the size of the illuminating cone, but there is this objection to its employment, viz. that it is quite impossible to record the size of the hole or to reproduce a similar sized hole on a subsequent occasion with sufficient accuracy for microscopical purposes. A wheel of diaphragms, or a series of graduated diaphragm discs to drop into a holder, are on this account recommended for critical work, because the diaphragm can always be recorded, and the identical illuminating cone precisely reproduced at any subsequent time.

Fig. 33.

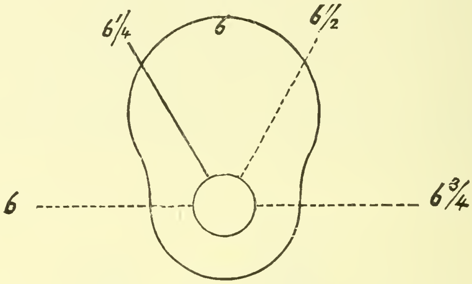


a *b* *c*

The disadvantage with this plan is the loss of the power of delicate graduation between any two contiguous sizes of diaphragms, a want which the iris supplies. Now the correctional collar meets this deficiency by making the wheel of diaphragms as adjustable as the iris, in addition to securing an advantage which the iris does not possess, viz. that the size of the illuminating cone can be recorded, and with facility exactly reproduced at any time. For we know that by separating lenses the power of a combination is reduced, and conversely, by closing lenses it is increased, and also that with powers of equal apertures the size of the back lens must be larger with the lower power. Now, if we by means of the correctional collar separate the lenses, we shall reduce the power of the combination, and if the back lens, i. e. the diaphragm aperture, remains the same, the aperture of the combination will be lowered.

Hence we have a very simple means of graduating the apertures between any two contiguous diaphragms; if, for example, we place the lever to the left, so that the lenses may be separated as far as possible, and use a No. 6 diaphragm, and if on examining the object it is thought that the illuminating cone is not large enough, and if when No. 7 is turned on it is found too much, we can go back to No. 6, and by turning the lever 60° towards the right, closing the lenses and increasing the power a little, we shall obtain an aperture somewhere between the No. 6 and 7 diaphragms (fig. 34). This position of the lever may be called $6\frac{1}{4}$; if this is an insufficient cone we can turn the lever through another 60°, which will further close the lenses and increase both the power and the aperture. The position of the lever may now be called $6\frac{1}{2}$; if that is still not enough we may turn the lever a third 60°, which will bring it home to the right hand, its full movement being a half circle; the position may be called $6\frac{3}{4}$. The next step is to turn the lever back to the left, and turn on the No. 7 diaphragm, and so on until the full aperture of the condenser is employed, when the lever must be placed to the left

Fig. 34.

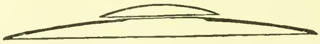


hand to correct the aberration for the extreme aperture. Thus we can by means of the correction collar graduate the aperture with the same facility as with an iris, and we can record any particular aperture with a degree of accuracy foreign to the iris.

It should be mentioned that it is, of course, necessary to refocus the condenser after moving the collar, just as with an objective."

New Magnifying Lens with Combined Illuminator.—At the Society's meeting on March 20th last, Mr. E. M. Nelson read the following note:—"This magnifying lens or loup is the outcome of a paper I read before this Society on lens mirrors the year before last.* It consists of a lens mirror with the silver removed in the centre, and another lens placed above it (fig. 35). The focus of the lens mirror is the same as that of the combined lenses, so that the light reflected by the lens mirror is focused on the object when the object itself is in focus.

Fig. 35.



This is the first Messrs. Watson have made from my design; it is not achromatic, but the curves have been calculated for minimum aberration for the system. The aberration is half that of an equi-convex lens of the same power, viz. 8. The curve of the lens-mirror being fixed, it is not possible with this simple form to reduce the aberration lower. The result is very good and the definition is clear and bright. It is in fact the combination of a loup and a lieberkuhn. The lens mirror not only gives more light, but is cheaper than a speculum, it also forms one of the lenses of the combination.

* This Journal, 1894, p. 254.

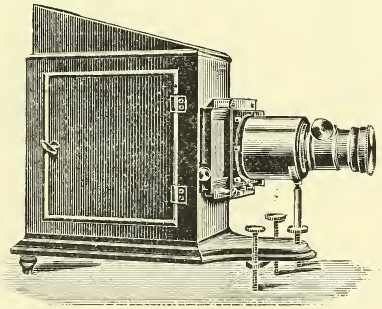
Now as most unmounted objects are seen by reflected light, for it is only prepared objects that are suitable for examination by transmitted light, a lens of this kind is of great service in the field. An object examined by this lens when held up towards a bright part of the sky is strongly illuminated and looks altogether a different thing. For dissecting purposes it is a convenient combined lens and illuminator, and is much easier to manage than other methods now in vogue, such for example as that of Mr. Cheshire which was exhibited here some years ago.*

The lace-work on the egg of a house-fly can be seen. The object under it this evening is the egg of the parasite of the Ground Hornbill."

Sources of Light for the Projection Lamp.†—Herr J. Lützen describes some of the latest projection instruments made in Germany, and gives an account of the various methods of illumination which have been made use of in such instruments. In fig. 36 is shown the $10\frac{1}{2}$ cm. scioptikon for school work made by Meckel in Berlin. This apparatus is made of the best steel and contains no soldering.

The different methods of illumination can be divided into three groups. Electricity in the form of the arc-light is the most perfect, but on many grounds can seldom be used. Then we have the illumination with oxygen, and lastly without the use of oxygen. Of these two kinds the burners in which a stream of oxygen is used give a light which is nearest to the electric. Illumination without a stream of oxygen, as

Fig. 36.



petroleum light, Auer's incandescent light, or magnesium light, is not to be recommended. The petroleum light is not bright and has a yellow colour; the gas incandescent light does not give sharply defined images, and is not very intense; while the magnesium light burns unsteadily and forms a deposit on the lenses. If these disadvantages, however, could be obviated, this last light would be preferable to any other.

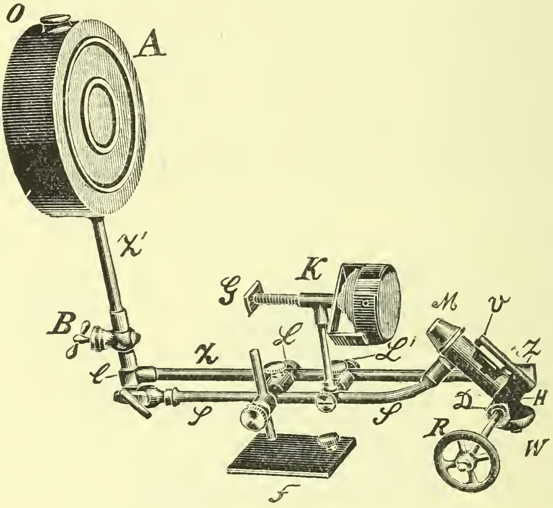
The introduction of the oxygen-burner has had a revolutionary influence in methods of projection. A peculiarity of these burners is that they produce a source of light approximating to the point form, and give a clear quiet white light. When properly constructed they are

* Carpenter on the Microscope, 9th edition, p. 344, fig. 289.
† Central.-Ztg. f. Optik u. Mechanik, xvi. (1895) pp. 14–6.

without danger and easy to use. The earlier form of burner in which the gases were allowed to mix before burning gave rise to many explosions. In the safety burners, the gases only come together at the moment of burning. They give a little less light than the first, but the loss is more than compensated for by the absolute freedom from danger.

All oxygen burners make use of the Drummond principle, which consists in raising the temperature of burning gas by the introduction of a stream of oxygen, so that a piece of incombustible material placed in the flame is raised to incandescence. The brightness of the light so produced is dependent on the heat of the flame and the emissive power of the incandescent body. As the latter, lime, zirconia, and metallic iridium have been used. Iridium possesses many properties which

Fig. 37.



should recommend it for such a purpose. It does not oxidise at the highest temperatures, fuses with much more difficulty than platinum, and has a good emissive power. Zirconia is less to be commended owing to its high price and to the fact that it becomes useless after a few hours' burning. Lime as dense as possible and free from sand is in most general use.

As gas for the source of heat, coal gas, hydrogen or the vapour of some volatile inflammable liquid can be employed. Coal gas is usually most convenient. For places without coal gas, petroleum is the usual source of light for projection purposes, but is quite inadequate for demonstrations before large audiences.

The spirit-blowpipe burner, in which the light was obtained by the introduction of a stream of oxygen into a spirit flame, is not to be recommended owing to its dangerous nature. The most perfect burning material is of course hydrogen, which can be easily transported in a compressed state in steel cylinders. In the Meckel oxy-hydrogen safety burner the light is produced by a plate of lime which emits 500 candles. The use of hydrogen is somewhat expensive and, unless every precaution is taken that it is quite pure, may be attended with danger. As a substitute for hydrogen where coal gas is not to be obtained, the benzine blowpipe burner shown in fig. 37 may be used. The vessel A contains pure benzine which is conducted along the tube L to the heating chamber H. The latter is heated by a small amount of spirit burning in the dish W, so that the benzine is volatilised. The vapour is ignited at the mouth of the blowpipe M. A small amount of vapour passes back through the tube V, and keeps the chamber H hot. Oxygen is introduced by the tube R, and the flame is made to impinge upon the lime K. The small wheel R and the stop-cock B serve to regulate the flow of benzine. This burner gives a light of 200 candles, and is strongly recommended by the author as quite free from danger and convenient in use. Pictures 3 m. in diam. can be obtained with it, which are clearly visible to an audience of 800 people.

Wolff's Hygienic Lamp-shade.*—Herr J. Rodenstock recommends the Wolff lamp-shade to all who are compelled to work by artificial light. There does not appear to be any very notable peculiarity in its construction. As seen in the figure it serves to protect the head of the observer from the light and heat of the lamp, while it reflects a strong light upon the work-table. At the same time, since the shade only covers part of the lamp, the room is not darkened.

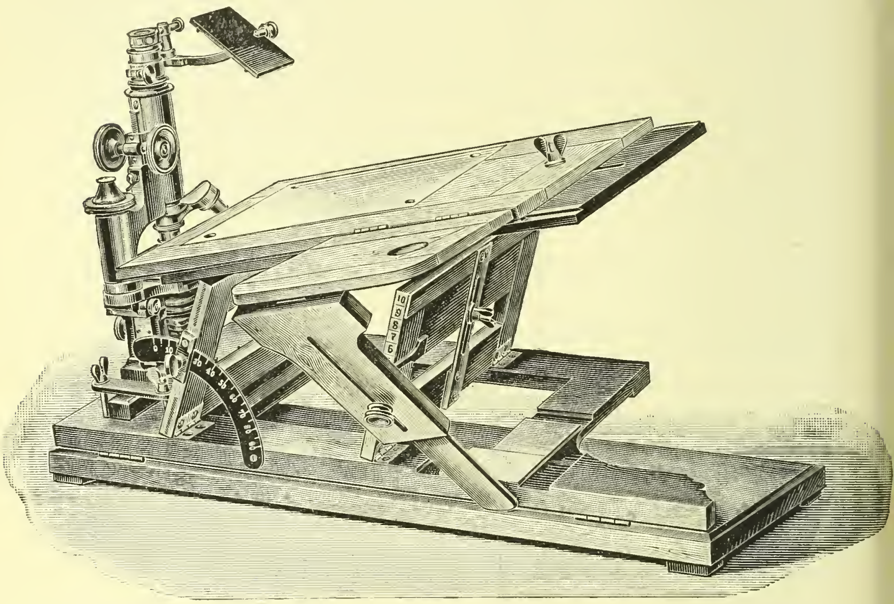
Marking Apparatus for Indicating the Position of Objects or Parts of Objects in Microscopical Preparations.†—Prof. S. H. Gage makes use as object-finder of a modified form of the apparatus devised by Dr. May of Philadelphia, and later by Winckel of Göttingen. By means of this apparatus a circular scratch could be made with a diamond point on the cover-glass. The disadvantage of this method is that the line is so fine that is difficult to find, and in the case of homogeneous-immersion objectives is obliterated by the liquid. The author has therefore modified the apparatus by replacing the diamond point by a small brush with which a circular mark can be made on the cover-glass. Its mode of attachment to the Microscope must be given in the author's own words:—"This brush was attached to a piece that could be made eccentric, then this to another, rotating on a central axis, which was screwed into a piece with Society screw, which in turn could be attached to the nose-piece."

Sawing Rock-sections.‡—For this purpose the Geological Survey in Washington uses a band-saw, which consists of an endless steel wire 1/8 inch thick, running at a high rate of speed over two fly-wheels.

* Central-Ztg. f. Optik u. Mechanik, xvi. (1895) pp. 25–6.
† Amer. Micr. Journ., xv. (1894) pp. 337–9. ‡ Tom. cit., p. 350.

Bernhard's Drawing Desk.—A description of this apparatus (fig. 38) appeared in the last number of this Journal, p. 106.

Fig. 38.



"Loup."—Mr. E. M. Nelson writes, "The word 'loup' has of late years been so much used to express in English a simple Microscope, a magnifying lens of higher power than a reading glass, &c., &c., that I think a note should be inserted about it among new scientific terms when the next list is issued.

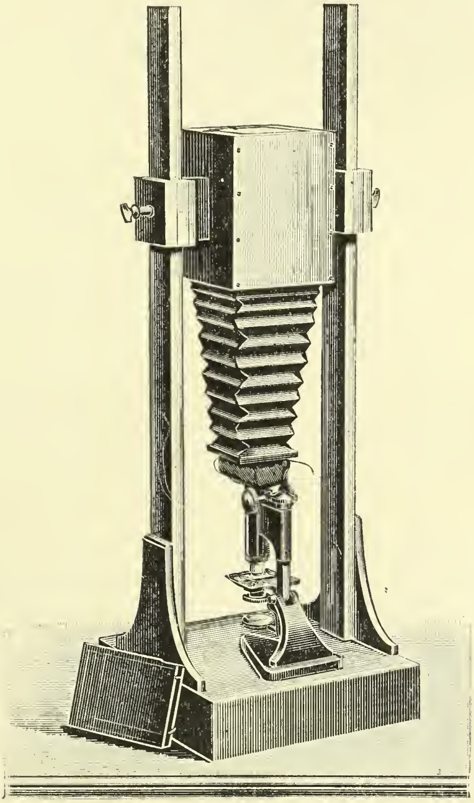
It is of course manufactured from the French *loupe* or German *Loupen.* There is no single word in English that exactly expresses the meaning. A loup is a simple Microscope, either achromatic or chromatic, varying in power from 5 to 25 diameters."

(4) Photomicrography.

Messrs. R. and J. Beck's Vertical Photomicrographic Camera.—This simple form of photomicrographic camera is intended for use with the Microscope in a vertical position, and for several kinds of work it is exceedingly convenient.

The Microscope is easily adjusted and does not require any special attachment to the fine-adjustment. The camera is raised or lowered by releasing the screws which attach the body of the camera to the two uprights. The apparatus is exceedingly rigid, the base being heavily weighted. Each is furnished with one double plate-holder and a fine ground-glass focusing screen.

Fig. 39.



Itzerott, G., & F. Niemann—**Mikrophotographischer Atlas der Bakterienkunde.** (Microphotographic Atlas of Bacteriology.)

Leipzig, 1894, 8vo, xii. and 115 pp., 126 microphotographic figs. in 21 plates.

(5) Microscopical Optics and Manipulation.

The Birefractometer or Eye-piece Comparer.*—M. J. Amann describes the instrument which he uses for determining the double refraction of crystalline bodies which exhibit this property.

The birefractometer or eye-piece comparer consists principally of a wedge of selenite or of quartz carrying a micrometer division, at each division of which the thickness has been very exactly determined. This wedge can be inserted beneath the ocular lens of the Huyghens eye-piece, just as a micrometer, in such a way that its longitudinal axis makes with the principal sections of the nicols an angle of $\pm$ 45°.

* Zeitschr. f. wiss. Mikr., xi. (1895) pp. 440–54.

The author explains carefully the method of calibrating the wedge, and gives the usual demonstration, according to Fresnel's theory, of the formulæ relating to the nature and intensity of the interference tints produced in doubly refracting bodies in parallel polarized light. For the ordinary conditions of work with the nicols crossed and the principal section of the wedge orientated at ± 45° to the plane of primitive polarization the intensity J of the ray from the analyser is given by

$$J = \sin^2 \pi \frac{(N_o - N_e) D}{\lambda},$$

where N_o and N_e are the indices of refraction of the doubly refracting body corresponding to the ordinary and extraordinary rays, D the thickness of the wedge at the given point, and λ the wave-length of the light.

The intensity of the coloration will be a maximum when

$$(N_o - N_e) D = (2k + 1) \frac{\lambda}{2},$$

where k is any whole number.

The tints given by the wedge between crossed nicols thus correspond to those of Newton's rings, since the rings which have the maximum intensity are those for which the relation holds:

$$2e = (2k + 1) \frac{\lambda}{2},$$

where e is the thickness of the layer of air.

Now, in the case of the wedge the difference of path θ of the ordinary and extraordinary rays is given by

$$\theta = \frac{(N_o - N_e) D}{\lambda}.$$

If, therefore, the wedge is examined in homogeneous polarized light of wave-length λ, it will present bright parts corresponding to thicknesses such that the difference of path θ is equal to an uneven number of half wave-lengths, and dark parts where the thickness is such that the difference of path is equal to an even number of half wave-lengths, i. e. to a whole number of wave-lengths.

This gives a first means of calibrating the wedge, viz. by determining what is the difference of path of the two interfering rays and, therefore, the thickness for each point of the wedge.

In the case of the selenite, according to the determinations of Descloiseaux and Ångström, in sodium light ($\lambda = 0 \cdot 589\ \mu$),

for the axis of elasticity c : $n_g = 1 \cdot 5297$;
for the axis of elasticity a : $n_p = 1 \cdot 5206$;
whence $n_g - n_p = 0 \cdot 0091$.

We have, therefore, for the first dark band

$$0 \cdot 0091\ D_1 = 0 \cdot 589\ \mu ;$$

for the second,

$$0 \cdot 0091\ D_2 = 1 \cdot 178\ \mu,$$

and so on.

In order to dispense with the use of homogeneous light, the author prefers to the above method one, no less exact, depending on the observation of the bands of Müller, which appear in the spectrum when the interference colours presented by doubly refracting plates in polarized light are analysed by the spectroscope. In this method, the wedge of selenite is placed, as before, between the crossed nicols with its axes orientated at 45° to the principal sections of the nicols. Above the analyser, which is directly above the objective, is placed a direct-vision spectroscope provided with a special apparatus for determining the wave-length in the different parts of the spectrum. The lateral displacement of the wedge in the azimuth 45° is effected by a micrometer screw, and can be measured to 0·05 mm. nearly. In these conditions the dark bands in the spectrum are observed and their position accurately determined by means of the scale of the micro-spectroscope. The position and number of these bands varies with the nature and thickness of the double-refracting plate.

With daylight instead of homogeneous light the interference colour is composed of all the colours for which the difference of path θ of the two interfering rays is equal to

$$\theta = (2k + 1)\frac{\lambda}{2},$$

while in this tint there are wanting all the colours for which

$$\theta = 2k\frac{\lambda}{2}.$$

The parts of the spectrum corresponding to these absent colours are therefore dark, and form the bands of Müller.

Denoting by δ the constant difference $N_e - N_o$, we have then for the first dark band corresponding to the wave-length λ

$$\delta D_1 = \lambda,$$

which gives the thickness of the wedge at the point considered, and similarly for the second, third . . . . bands.

Having determined the thickness of the wedge at each point of the micrometer division, the tints of the Newton rings which correspond to these thicknesses are given by

$$2e = D(N_o - N_e),$$

i. e. for the selenite $2e = 0·0091\,D$, where e is the thickness of the layer of air corresponding to the ring considered.

The exact determination of the position of the bands of Müller in the spectrum offers some difficulty owing to their considerable width when thin layers are observed. For this reason 6 to 10 observations must be made and the mean taken. The bands are so much narrower, the thicker the section. This leads to a slight modification of the method of calibration described. This modification consists in superposing the wedge on a doubly refracting plate of the same nature as that of the wedge and of such a thickness that it takes the white colour between crossed nicols and gives a certain number (4 to 6) of the bands of Müller throughout the length of the spectrum.

The exact position of these bands is determined once for all, and the displacements which they undergo when the wedge is superposed, first so as to augment the effect of the plate, and secondly so as to subtract from it.

The difference of path of the system will be in the first case

$$\Theta = \theta + \theta',$$

in the second,

$$\Theta = \theta - \theta',$$

θ' being the constant difference produced by the plate, θ the variable one caused by the wedge. But we have

$$\theta' = D' \delta,$$

where D' is the known thickness of the plate, and

$$\theta = D \delta.$$

Therefore,

$$D = \frac{\Theta \mp \theta'}{\delta}.$$

The author's determinations of the thickness at different points of the ordinary wedges offered for sale showed how very irregular was their form.

The method of using the birefractometer is very simple and convenient. The crystal section under examination is orientated so as to give the maximum brightness between crossed nicols, and the birefractometer is then slid in beneath the analyser until the doubly refracting body is obscured as completely as possible. When this happens, the difference of path produced by the crystal is exactly compensated by that caused by the wedge. The division on the latter at which the compensation takes place is then noted, and thus from the table giving the constants which accompanies each instrument, the exact value of the interference tint exhibited by the crystal, in the thickness of the layer of air of the Newton's rings corresponding to this tint, can be determined.

β. Technique.*

(1) Collecting Objects, including Culture Processes.

Ilosvay's Reagent as a Test for Cholera Bacilli and other Bacteria.† — Dr. M. Lunkewicz finds that Ilosvay's reagent is an extremely sensitive test for the nitrous acid produced by cholera bacilli and some other organisms. The reagent is composed of two fluids kept apart and mixed in equal volumes when required for use :—I. Naphthylamin 0·1 ; aq. destill. 20·0 ; acid. acetic. dil. 150·0. II. Acid. sulphanilici 0·5 ; acid. acetic. dil. 150·0. The naphthylamin is boiled with water, and, after standing, the supernatant clear fluid is decanted off, and then the acetic acid added.

To bouillon or pepton cultures about one-fifth of their bulk of the

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 945-9.

reagent is added. In a few seconds a red colour appears. The hue varies somewhat with the nutritive medium. The reagent may be used for solid as well as for liquid media, though the results with agar are less effective and much slower in developing than with gelatin.

For using this test two points must be borne in mind:—(1) that some commercial peptons will often give a reaction, because they contain nitrous acid (the "peptonum siccum ex albumine" is free from this objection); (2) fluid gelatin will also give the reaction. Hence the cultures should be laid in ice before applying the reagent, which also should be cold. In this way confusion between the colour from the organisms and that of the medium is avoided.

The reagent was tried with more than 30 bacteria, *Vibrio choleræ asiaticæ* giving the most characteristic reaction. With *V. Metchnikovi* the reaction was weaker, and with other vibrios of Finkler-Prior, Müller, Deneke there was none at all. The author states that *Bacterium coli commune* gives the reaction, but adds in a note that sometimes there was failure. There was no reaction with *B. typhi abdominalis* and many others.

In conclusion, the author points out that this nitrous acid reaction is superior to the indol reaction in that it can be obtained in a shorter time, that it can be used for pepton and gelatin cultures, that the colour developed is more intense, and that it can distinguish between cholera bacilli on the one hand and the Finkler-Prior and Müller's bacteria on the other.

Hens' Eggs as a Cultivation Medium for the Cholera Vibrio.*—Drs. R. Abel and A. Dräer have investigated the suitability of hens' eggs for growing the cholera vibrio. The material worked with was obtained from cholera fæces, from intestinal cholera corpses, and from old cultivations. From each source four eggs were inoculated and incubated at 37°. On the 8th, 14th, 18th and 21st days one egg from each of these stocks was examined especially for H_2S, and for alterations of colour and consistence. Microscopical preparations were made, and also cultures in pepton water and bouillon, on gelatin plates, on agar, and also on agar by the pyrogallic acid method.

Direct egg to egg inoculation was also tried in order to ascertain if any micro-organisms had been overlooked owing to their small numbers. The authors concluded that the hen's egg is a very unsuitable cultivation medium; that the cholera vibrio is present as a pure cultivation, both when the yolk is of golden-yellow colour and when it is greenish black. The explanation of these facts seems to be due on the one hand to the impurities which naturally exist in the egg, and on the other to differences in the derivation of the vibrio, some having considerable power of blackening the yolk, others very little, and again, the number of organisms introduced appears to have a certain influence. It was further found that the cholera vibrios developed H_2S in some eggs, and in others not.

Plaster and Brick Blocks for growing Yeast.†—M. J. C. Nielsen contests the statement made by Wichmann ‡ relative to the blocks for

* Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 85–7.
† C.R. Travaux Laboratoire de Carlsberg, iii. (1894) p. 179.
‡ See this Journal, 1894, p. 127.

growing yeast. The latter recommended that these cubical blocks should be made of firebrick instead of plaster of Paris. The author agrees with Klöcker, who found that spore formation, like all other physiological functions, was subject to oscillations, determined partly by the condition of the cells themselves, but also by slight variations in the experiments. Now these oscillations are less marked with plaster blocks than with those made of clay, and hence the plaster blocks are superior.

Vitreous Humour as a Nutrient Medium.*—Dr. Herrnheiser has tested the value of vitreous humour as a nutrient medium, and it seems to answer very well. About 10 ccm. of vitreous is obtained from each eye (bullock) by incising the sclerotic. The fluid obtained is at once steam sterilized for half an hour, then filtered and afterwards sterilized again. The fluid, after these procedures, is somewhat milky from coagulation of the albumen. Besides using the fluid thus obtained, the author also employed modifications, rendered advisable for experimental purposes, owing to the richness in saline substances and to the poverty in proteid, by diluting with water and by adding 1 per cent. pepton solution. Comparative experiments with these three varieties of vitreous medium and also control cultivations with bouillon and sugar bouillon showed that the undiluted non-peptonized vitreous was the most effective medium for most bacteria.

Production of Sporeless Anthrax.†—MM. H. Surmont and E. Arnould have re-tried the methods for obtaining sporeless anthrax, and they infer from their experiments that it is very difficult to transform certain races of anthrax into sporeless ones. The best method for attaining a positive result is that of Roux, and if the results be not immediate it becomes easy to succeed by previously heating the cultures up to 42°, sowing them again every five days. The methods tried were four in number.

(1) Roux's method, where carbolic acid is added to the bouillon. The bouillon was alkaline veal broth, to which carbolic acid in the proportion of 1–10,000 to 20–10,000 was added. After sterilization the tubes were inoculated with the blood of a guinea-pig dead of anthrax. The presence or absence of spores was determined by placing bouillon cultures in water heated to 65° for 15 minutes.

(2) Method of Chamberland and Roux; this consists in adding bichromate of potash to the medium 1, 2, and 3 per 4000.

(3) Addition of hydrochloric and rosolic acids to the medium or Behring's method. Neither of these reagents was successful.

(4) Application of heat or the method of Phisalix. Pasteur's flasks containing bouillon inoculated with anthrax were incubated at 42°, and resown every five days.

New Method of Preparing Culture-media.‡—Dr. Lorrain Smith describes a method for preparing media suitable for the cultivation of bacteria. The principle of the method consists in the addition of a

* Prager Med. Wochenschr., 1894, Nos. 22, 24. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 980–1.
† Ann. Inst. Pasteur, viii. (1894) pp. 817–32.
‡ Proc. Cambridge Phil. Soc., viii. (1894) p. 217.

small percentage of alkali to fluids which contain proteids, such as white of egg and the serum of blood. The fluid is then heated to the boiling point or over it in the autoclave. By this means it is converted into a clear transparent jelly. It is then a medium suitable for the growth of a large variety of germs.

Preparation and Properties of Tetanus Antitoxin.*—Dr. R. T. Hewlett prepares tetanus antitoxin by cultivating the bacillus in yeast flasks in an atmosphere of hydrogen, the medium used being grape-sugar bouillon. After incubating at 37° for three to four weeks the cultures to which carbolic acid is added in the proportion of 0·5 per cent., are filtered through a Chamberland bougie. One-hundredth of a ccm. of the toxin thus obtained will kill a guinea-pig weighing 300–400 grm.

The toxin is next weakened by adding an equal volume of Gram's iodine solution, and this mixture is injected subcutaneously into a horse, starting with ·5 ccm. and going up 22 ccm. After this intravascular injections were made; these ranged from 4–70 ccm. and were continued for about 5 weeks, when a period of a month without injections was allowed to elapse. At the end of this time the antitoxic power of the serum was found to be about 50,000. After this the treatment was rapidly pushed until the antitoxic power was equal to 1,000,000.

The antitoxic serum was obtained by bleeding from the jugular vein into sterilized vessels, and after 24 hours pipetting off the clear serum used for injection. To obtain the substance dry, it must be evaporated in vacuo over sulphuric acid. According to the author the experimental effects of the antitoxin smack of the marvellous; thus 0·0005 ccm. will protect a 400–500 grm. guinea-pig from 0·01 ccm. of the toxin, and a mixture of the two in the proportion of 50 to 1 is quite inert.

Alkali Albuminates in the Preparation of Cultivation Media.†—Dr. G. Deycke ‡ prepares agar for isolating diphtheria bacilli in the following way:—1 per cent. alkali albuminate, 1 per cent. pepton, 1/2 per cent. salt, 2 per cent. agar, and 5 per cent. glycerin are mixed with the adequate quantity of distilled water. This mixture is first neutralized with pure hydrochloric acid and next alkalinized with 1 per cent. of a soda solution consisting of 1 part soda and 2 parts water. After standing for several hours at room temperature, the mixture is boiled in a sterilizer for 3/4–1 hour. The hot agar is then filtered through a thin layer of cotton-wool into test-tubes, and then steam-sterilized for 1/2 hour, after which it is allowed to set in oblique position. Prepared in this way the agar is a little cloudy, but the procedure has the advantage of rapidity.

For cultivating cholera bacilli a nutrient gelatin is made thus:—$2\frac{1}{2}$ per cent. alkali albuminate, 1 per cent. pepton, 1 per cent. salt, and 10 per cent. gelatin are mixed with the proper proportion of distilled water and then neutralized with 2 per cent. of the before-mentioned soda solution. After this it is boiled for $1\frac{1}{2}$–2 hours in a steamer, and finally filtered in a hot-water funnel through blotting paper into test-tubes, which are boiled for 10 minutes on three consecutive days.

* Brit. Med. Journ., March 2, 1895, pp. 464–5.
† Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 241–5.
‡ See also this Journal, 1894, p. 750.

Even better than the preceding is a mixture of gelatin and agar, for it combines the advantages of both, and can be incubated at 37° without liquefaction:—2 per cent. agar, 5 per cent. gelatin, $2\frac{1}{2}$ alkali albuminate, 1 per cent. salt, and 1 per cent. pepton, with the necessary quantity of water, are gently heated until the constituents are dissolved. After neutralizing with 2 per cent. of the soda solution the mixture is boiled for two hours in a steam sterilizer, and then filtered through a thin layer of cotton-wool into capsules.

Antiseptic and Disinfecting Properties of Formic Aldehyde.*—M. H. Pottevin who has made experiments as to the antiseptic property of formol, finds that the number of germs sown in a medium to which formol has been added has a definite influence on the result, i.e. the prevention of growth, and also the time required for killing the germs. The action of the disinfectant is aided by moisture and elevation of temperature. Formic aldehyde has also a direct action on diastase, the activity of which is diminished or suppressed. Injected into animals formol exhibits irritant properties as shown by the necrosis of the tissues, but its toxicity is relatively small. As the vapours given off by saturated solutions and by the powder of trioxymethylen are noxious, disinfection with formic aldehyde requires great caution.

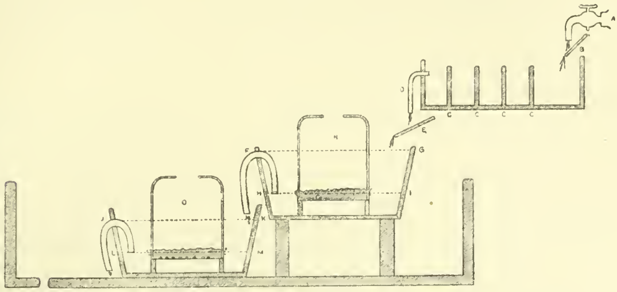
Dr. P. Miquel discusses the disinfectant properties of formic aldehyde from the practical aspect. By mixing an aqueous solution of commercial formic aldehyde (probably a paraldehyde or a mixture of formic aldehydes in different conditions of polymerism) of a density of 1·07 to 1·08 with calcium chloride, so that the resulting liquid has a density of 1·20, a fluid is obtained with which linen cloths can be soaked; when hung up these cloths give off the vapour of formic aldehyde very copiously, and if placed in a confined space serve to disinfect very actively. For loose articles such as books, bedding, &c., this method acts well, but for the disinfection of rooms and large spaces it is not applicable.

Apparatus for the Care and Hatching of Fresh-water Fish Eggs.†—Mr. A. T. Holbrook describes an arrangement which for laboratory and experimental use has been found to answer all ordinary requirements. In addition to the apparatus, nothing is needed except a steady supply of tolerably clean cold water, a cool clean room and a sink or water escape. The water enters at the faucet A (fig. 40) and splashes on the board B; it is thus aerated and falls into a box containing a number of filtering partitions. This box is water-tight and provided with a set of four flannel filters of different grades of fineness. All use of metal in the apparatus is avoided, except where necessary, and then it is covered with paraffin or other harmless substance. The water leaves the filter-box by means of a tube near the top, from which it falls on to another board E, being thus further aerated as it falls into a rather large dish or trough; placed in this trough is a bell-jar N, with a considerable opening at the top, and with a piece of fine netting stretched and held in place across the bottom of the jar by a rubber band. At the further end of the trough is placed a siphon F. When

* Ann. Inst. Pasteur, viii. (1894) pp. 796–810; Ann. de Micrographie, vi. (1894) pp. 588–95. † Bull. Mus. Comp. Zool., xxv. (1894) pp. 93 and 4.

the apparatus is in running order the eggs are placed in the bell-jar and spread upon the cloth in a single layer. The short end of the siphon is placed in the trough in such a position that when the water is siphoned off, the eggs will not be left out of water. The apparatus so works that

FIG. 40.



the water alternately rises and falls, washing the eggs constantly in a gentle way, but not heaping them together, nor disturbing them to any considerable extent. The water that is siphoned from the first trough falls into another smaller trough, supplied with jar and eggs, and placed far enough below the first trough to prevent interference with the siphoning.

RODET, A.—Sur la stérilisation du lait. (On the Sterilization of Milk.) *Rev. d'Hygiène et de Police Sanitaire*, XVI. p. 1025.

(2) Preparing Objects.

Preparation of Fish Embryos.*—Mr. A. T. Holbrook points out that Henneguy's method of treating eggs with Müller's fluid has the objection that the yolk is dissolved out in such a manner as to be subsequently precipitated around the eggs, which are thus left imbedded in the precipitated mass. This difficulty may be overcome by cutting the egg-membrane in such a way as to catch an air-bubble within the egg-shell, and thus to float the egg in the fluid. The author reports that his best results were secured with material killed in picro-sulphuric acid. The embryos were left for three hours in the fluid, and then removed and dehydrated by passing them slowly through successively stronger grades of alcohol. In staining, the eggs were passed through weaker grades of alcohol and then stained for 24 hours in Czokor's cochineal. Mr. Holbrook found it best to cut his eggs without attempting to remove the membrane or any of the hardened yolk. Great difficulty was experienced in making sections, as parts of the yolk break up and fall out of the section, often carrying the embryo with them, while the firm membrane is apt to resist the knife, and fold or break the embryo. It was found to be a good plan to have a generous amount of imbedding substance about the object and to cause the knife to strike the embryo before the yolk, as there is thus less danger that the embryo will be turned or pushed by the resisting yolk.

* Bull. Mus. Comp. Zool., xxv. (1894) pp. 82 and 3.

Examining Blood of Vertebrata for Endoglobular Parasites.* — M. A. Labbé finds that methylen-blue is the most useful reagent for examining fresh specimens of parasitic Protozoa, and gives the following formula:—Methylen-blue, 1; H_2O, 100; NaCl, 0·75. A drop of this fluid is placed on the slide near the cover-glass, under which it is drawn by suction with a piece of blotting-paper. Acetic carmine and 1 per cent. methyl-green are also favourably spoken of. The best fixatives are sublimate, osmic acid, a mixture of equal parts of ether and absolute alcohol, picric acid and Flemming's fluid.

The procedure adopted by the author is first to pass the cover-glass through the flame and wash in distilled water for 5 minutes. When dry, immerse in acetic acid, 1 drop; H_2O, 20 ccm.; after this it is treated for 24 hours with saturated aqueous solution of picric acid, 30; H_2O, 30; glacial acetic acid, 1. It is next washed in absolute alcohol.

The staining methods recommended are—(1) Malachowsky's. Saturated aqueous sol. methylen-blue, 24; 5 per cent. sol. borax, 16; H_2O, 40. With this the preparations are treated for 24 hours and then washed. (2) Czenzinski's. (*a*) Saturated aqueous solution methylen-blue, 2; H_2O, 4. (*b*) 1 per cent. solution of eosin in 60° spirit. Mix 1 part of (*b*) with 2 of (*a*), and stain for 24 hours. (3) Mannaberg's. Saturated aqueous solution methylen-blue, 40; 2 per cent. eosin in C_2H_6O at 60°, 80; H_2O, 40. (4) Hæmatoxylin. (*a*) Hæmatoxylin solution, 10; C_2H_6O, 100. (*b*) 1/2 per cent. solution ammonia-alum; 1 part of (*a*) and 2 of (*b*). Stain for 24 hours. Then differentiate in nitric acid alcohol, followed by ammonia-alcohol. Wash in 80 per cent. spirit. Balsam.

Besides the preceding numerous hints are scattered throughout the author's exhaustive paper.

For removing the pigments from *Gymnosporidia* the author used the following:—Glycerin, 100; alcohol 70 per cent., 100; a few drops of HCl.

Preparation and Care of Insect Collections.†—Mr. C. Dury has prepared an essay on the best methods of killing, pinning, mounting, and taking care of material as well as on the proper methods for collecting it. It will probably be found useful by those whose experiences are not sufficient to enable them to do this for themselves.

Karyokinesis of Spirogyra.‡—Dr. J. W. Moll fixed the filaments in Flemming's mixture for four days. Fragments were placed in a 6 per cent. solution of celloidin (dissolved in equal parts of ether and 90 per cent. alcohol). The addition of a minute quantity of gentian-violet made the recognition of the objects easier. After a few minutes they were placed on a slide with a drop of celloidin, and the slide placed in 95 or 96 per cent. alcohol. The hardened layer of celloidin was cut into square centimetres; the squares were lifted off the slide and placed in 96 per cent. for $1\frac{1}{2}$ hours. The alcohol was replaced with oil of marjoram; this requires to be done carefully. Then the objects were transferred through solutions of paraffin and oil of marjoram (15, 30,

* Arch. Zool. Exp. et Gén., ii. (1894) pp. 55–258 (10 plates).

† Journ. Cincinnati Soc. Nat. Hist., xvii. (1894) pp. 173–80.

‡ Arch. Néer. Sci. Nat., xxviii. (1894) pp. 312–57 (2 pls.). Cf. this Journal, 1893, p. 752.

45, 60, 75, and 90 per cent.); and finally cut. We have said enough to show that Dr. Moll goes in for somewhat elaborate technique, but he has much more to say on this subject.

Cell-structure.*—Herr G. Schloter, in studying the cells of the Salamander (skin and liver), used corrosive sublimate as fixative, and stained with Böhmer's hæmatoxylin + indulin + eosin + safranin, or with Böhmer's hæmatoxylin + aurantia, or with Ehrlich's stains.

(3) Cutting, including Imbedding and Microtomes.

Anise Oil in Histological Technique.†—Dr. V. A. Moore has obtained very satisfactory results from a modification of Kühne's ‡ method of imbedding in anise oil. The pieces to be sectioned should be from 2–4 mm. thick. These are placed in a test-tube, on the bottom of which is some cotton-wool and which contains absolute alcohol. The tubes are heated in a water-bath to about 40° for half-an-hour or so, by which time the tissue is sufficiently hardened. The blocks are then mopped with blotting paper, and having been covered with anise oil sectioned on a freezing microtome. In this way specimens can be examined in less than an hour after removal from the body, a point of considerable importance very often.

By previously staining the tissue *en masse* much time is saved if several or many sections from the same block are intended to be kept. This is rendered possible by the fact that anise oil and Canada balsam are miscible; consequently, the sections can be transferred directly from the knife to the mounting medium, provided the block has been thoroughly impregnated with the oil.

(4) Staining and Injecting.

Staining Attraction-spheres and Centrosomes.§—Mr. J. H. Schaffner recommends the following two processes for observing the attraction spheres and centrosomes in vegetable cells:—(1) Fix the objects for 1 or 2 days in a solution of 15 parts 1 per cent. platinum chloride, 1 part acetic acid, 2–4 parts 2 per cent. osmic acid, 80 parts water. Now wash the objects in flowing water, harden gradually in alcohol, and after that place them from 12 to 18 hours in pyroligneous acid. Next place them in a solution of 1 part 20 per cent. hæmatoxylin and 99 parts 70 per cent. alcohol. Keep in the dark, and leave from 12 to 18 hours, and after that in the dark for some time in 70 per cent. alcohol. Imbed and section. After the sections are fastened to the slide, cover them with a solution of potassium permanganate of a light rose colour, and leave until they have an ochre colour. Then wash in a solution of 1 part hydric oxalate, 1 part potassic sulphate, and 1000–2000 parts water. After this stain the sections from 3–5 minutes in a saturated alcoholic solution of safranin; clear, and mount in Canada balsam. The centrosomes are stained very black by the safranin; while the attraction-spheres remain quite colourless or are only very slightly stained. (2) Place the sections for 30–35 minutes in a 1 per cent. aqueous solu-

* Arch. f. Mikr. Anat., xliv. (1894) pp. 249–59 (1 pl.).
† Amer. Mon. Micr. Journ., xv. (1894) pp. 373–6.
‡ See this Journal, 1892, p. 706.
§ Bot. Gazette, xix. (1894) pp. 451–3.

tion of ferrous sulphate, then wash, place for the same length of time in a 5 per cent. aqueous solution of tannin, wash again, again cover with the iron solution, and leave for a minute or two, or until they change to a rather dark colour. After washing off the iron, stain with anilin-safranin (1 part 1 per cent. alcoholic solution of safranin and 2 parts water) from 30 minutes to 1 hour, and then 15 minutes or more in an aqueous solution of picro-nigrosin long enough to take a dark bluish-green colour. Then raise through the grades of alcohol, and mount in Canada balsam. The centrosomes are by this process stained very dark; —and the attraction-spheres are well defined, often showing the radiate structure.

Flagella-Staining.*— Dr. R. Bunge has improved his method of staining flagella in the following manner.† After filtering a requisite quantity of the mordant, which should be a few days old, into a test-tube, peroxide of hydrogen is added, drop by drop, until the mordant becomes of a red-brown hue. It is then shaken up and filtered over the prepared cover-glass, on which it is allowed to act for about 1 minute. The cover-glass is then mopped up, dried, and stained, preferably with carbol-gentian. The flagella seem swollen and are so deeply stained that this can never be overlooked. Besides staining the flagella the capsules are also simultaneously coloured by this method.

Lithium Bichromate as a new Reagent for Hardening Adult Brains.‡—Mr. O. S. Strong reports on the use of this reagent in the application of Golgi's method. As is well known, the principal defects of this method are the uncertainty of good results, inequality of the impregnation, and the expense in the use of so much osmic acid. It occurred to Mr. Strong that the defects could be remedied to some extent by enhancing the penetration of the silver nitrate. This was attained by mixing the silver nitrate solution with solutions of sodium or zinc sulphate. In certain cases this modification gave very good results, but further experience is necessary to determine its exact value. Lithium bichromate, however, promises to prove valuable in certain lines of work. The long Golgi's method dispenses with the osmic acid, and therefore with the expense, but the period of time is so long that it would be an advantage to be able to shorten it. This time may be reduced from the 20 or 30 days now required to 1 to 3 days, by simply using lithium bichromate instead of potassium bichromate. The tissue should be cut into small pieces, and put into a liberal supply of a 2 to 3 per cent. solution of lithium bichromate. In the course of 1 to 2 days pieces should be placed in the silver nitrate solution at intervals. A piece found to be impregnated may be washed with strong alcohol for about half-an-hour, stuck on a microtome block, and cut in 95 per cent. alcohol into sections of suitable thickness. After being washed in 95 per cent. alcohol, these may be cleared in Ol. origanum cretici, rinsed in xylol and mounted in dammar-balsam without a cover-slip. For the human brain and for that of the hen, it has been found that this method

* Fortschr. d. Med., xii. (1894) No. 24. See Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 102–3.
† See this Journal, 1894, p. 640; 1895, p. 129.
‡ Trans. New York Acad. Sci., xiii. (1894) pp. 237–9.

gives good results, but it appears to be inferior to the ordinary rapid method for embryonic material.

JOHNE—**Zur Färbung der Milzbrandbacillen.** (Staining Bacilli of Anthrax.)
Dtsche. Tierärztl. Wochenschr., 1894, No. 35, pp. 289–92.
Dtsche. Zeitschr. f. Tiermed., 1894, XX. Nos. 5/6, pp. 426–9.

(5) Mounting, including Slides, Preservative Fluids, &c.

Wiese's Preserving Fluid.*—Dr. A. B. Meyer reports on his experience with Wiese's fluid (6 gr. sodium hyposulphite in 5000 gr. water, 75 gr. ammonium chloride in 250 gr. of water, mixed with 4–6 litres of spirit). It certainly allows the colours of fishes, reptiles, &c., to remain, but unfortunately it does not prevent decomposition, as Meyer recently experienced with some tropical fishes thus preserved. The much desired fluid is still to seek.

Formalin as a Preserving Medium for Vegetable Tissues.†—Prof. O. Penzig recommends the use of formalin or formol—a solution of 40 parts formaldehyd in 100 of water—for the preservation of vegetable substances. A mixture of this solution in water to the extent of 2–2·5 per cent. has powerful antiseptic properties. The colours of chlorophyll and anthocyan are, to a certain extent, also preserved.

Herr E. Bruns ‡ speaks favourably of the same substance as a liquid for the preservation of green, red, and brown seaweeds, using a 1 per cent. solution of formalin in sea water. The colour of the algæ is perfectly preserved, if protected from light.

Dr. L. Linsbauer § also recommends formol as a preservative of the delicate parts of plants, either in the form of vapour, or as a 2·5 per cent. solution in water. It prevents shrinking in the objects immersed; some colours of flowers are well preserved.

(6) Miscellaneous.

Detection of Phosphorus in Vegetable Tissues.‖—Dr. G. Pollacci recommends the following method. The phosphorus is first brought into the state of ammonium phospho-molybdate by the application of a mixture of ammonium molybdate and nitric acid. The addition of stannous chloride $SnCl_2$ then produces a strong coloration, varying from dark blue to grey, according to the amount of phosphorus contained in the preparation.

Slide-holder.¶—Dr. L. Heim describes a stand which he finds useful for heating slides when being stained. The stand consists of a base, an upright, and a tray. The tray is connected with the upright by means of a horizontal piece which is fixed for vertical and also horizontal movement by two joints. The slide-holder is nothing more than the stand used by chemists for heating liquids over a flame.

* Zool. Anzeig., xvii. (1894) pp. 446–7.
† Malpighia, viii. (1894) pp. 331–6.
‡ Ber. Deutsch. Bot. Gesell., xii. (1894) p. 185.
§ SB. K. K. Zool.-Bot. Gesell. Wien, 1894, pp. 23–6.
‖ Malpighia, viii. (1894) p. 363.
¶ Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) p. 84 (1 fig.).

PROCEEDINGS OF THE SOCIETY.

Meeting of 20th February, 1895, at 20 Hanover Square, W.
The President (A. D. Michael, Esq., F.L.S.) in the Chair.

The Minutes of the meeting of 16th January last were read and confirmed, and were signed by the President.

The Secretary announced that the Trustees of the British Museum had presented the Society with a very valuable work—a monograph of the Mycetozoa which had been prepared by Mr. Lister. Mr. A. W. Bennett, who had seen this book, would no doubt say a few words about it.

Mr. Bennett said that this very admirable production had been eagerly looked for for some time past by students of these lower classes of life, which might be said to possess a peculiar interest from the position they occupy, apparently on the border line between animal and vegetable life. This work would no doubt be one also of special interest to the Fellows of that Society, inasmuch as the author was the son of one and the brother of another gentleman who had in past years been so intimately associated with them—he referred to Mr. J. J. Lister and Sir Joseph Lister. The work in question professed to be a description of all the Mycetozoa in the British Museum—but in addition to this it gave an account of many species not in that collection, and formed, therefore, a complete monograph of these organisms, illustrated by collotype reproductions of a number of very beautiful water-colour drawings by Miss Lister. Another point in which this work would be of interest to many would be the fact that it went on the line of rather reducing than of increasing the number of species, and that it did not describe a single new genus, but on the contrary, had altogether suppressed a large number of species, described by other writers as separate, but which, in reality, were but slight varieties of those already known.

The work before them was a very beautiful and remarkable addition to those which had hitherto treated of the subject.

The President said that the remarks made by Mr. Bennett were not the first speech he had already heard in commendation of Mr. Lister's work during the short period which had elapsed since it was published. A vote of thanks to the donors was then put from the chair, and unanimously carried.

Mr. E. B. Green exhibited and described a large number of drawings of parasitic growths on root-hairs, drawn to a uniform scale of $\times$ 100.

Prof. F. Jeffrey Bell thought that before they went into any general discussion upon the question raised by Mr. Green it would be well if they could get some definite decision on one point of some importance, and that was as to the presence of chlorophyll in these root-hairs. The statement in itself was a somewhat startling one, and it did not seem to be supported at present by any direct proof, so that unless they knew without the possibility of doubt that it really was chlorophyll, he thought it would be almost a waste of time to discuss it.

Mr. Bennett said that whilst he remained sceptical—as stated on a former occasion—as to the correctness of some of the conclusions at which Mr. Green seemed to have arrived, he still thought that the comparative study of root-hairs was a good one, and that it might lead to important results. He hoped, therefore, that Mr. Green would continue to pursue his observations and study of the subject. The existence of chlorophyll in the subterranean organs of plants was not absolutely unknown, but its presence in the root-hairs would be a very extraordinary circumstance, and they should want some very good explanation given before they were able to accept it. He quite agreed with what Prof. Bell had said, and when they remembered the tricks which were played by colour in viewing this class of objects with high powers, he thought they would do well not to come to any hasty conclusions.

Mr. Green said he had never found this colour in the root-hairs themselves, but only in the parasitic growths on the hairs. He did not know that what he found was chlorophyll, but he had thought it must be so on account of its colour.

The President said Mr. Green had undoubtedly taken an immense amount of trouble in the preparation of these very interesting drawings, and they were greatly indebted to him for bring them down to the meeting, but, as Prof. Bell had remarked, it was essential to determine if what had been spoken of as chlorophyll really was so, and this could, of course, be done by chemical analysis or by means of the spectroscope. It would also be interesting to know what evidence there was that these growths were parasites at all, for he had not heard anything conclusive yet as to this—they might be or they might not be, so far as they were at present informed. The subject was certainly an interesting one, and if Mr. Green pursued it with some closer examination of some of the points mentioned it might turn out to be of considerable value.

Mr. Bennett said he entirely concurred in the views expressed—that they should have some absolute proof presented to them before they accepted the interpretation given.

Prof. Bell said they had received a letter from Dr. Stolterforth calling attention to a misprint in the December number of the Journal at p. 762 in his communication "On the genus *Corethron*," the word Atlantic having been substituted for Antarctic.

Prof. Bell gave an interesting description of some very remarkable Corals lately received at the British Museum of Natural History from Mr. W. Saville Kent, of which a series of excellent photographs were shown upon the screen. He said that the specimens were in themselves scarcely to be regarded as proper subjects to bring before a Microscopical Society, but they were of great interest to students of natural history because they demonstrated in an absolutely irrefragable manner that variations of a most remarkable character were to be found in one and the same mass. Some of the specimens at the Museum were of enormous size as compared with anything of the kind hitherto received, the largest weighing as much as 1500 lb. These large masses must be taken to be formed by a single species, and yet they exhibited almost every variety of form and size in the calicles, totally distinct forms being sometimes found within a few inches of each other.

Mr. H. Bernard said he had not much to add to the interesting facts which had been mentioned by Prof. Bell, but he thought when they considered the remarkable differences in size and form of the calicles in different portions of the same mass, it would be understood at once that attempts to classify these Corals from an examination of fragments were simply impossible, for, as they had seen, one mass might give rise to a tall cylindrical group with calicles projecting like branches, and at the same time other portions might spread out or exhibit the nodules which had been pointed out on some of the photographs. Possibly the larger growth might indicate that, from aspect or position, that portion got more food than the other and became consequently more vigorous. In a large Brain Coral at the Museum it would be seen that one half had large calicles and the other had small ones, and that here and there small streaks of the large were found running over into the small. Unfortunately they did not know enough of the natural history of Corals to form a true opinion of these matters, and they did not know how or where to get the requisite series of observations to enable them to obtain that knowledge. All the Turbinarians began with the formation of a small cup; some of these persisted as cups, whilst others grew up into all kinds of forms, so that there really seemed to be no method in the growth. At present they could not get at the laws which regulated these forms; possibly here was something which had responded to its surroundings, and these were really the chief cause. If this was so they might have to modify some of their ideas on heredity, because it seemed as if they had here an alteration produced by an immediate response to surrounding conditions.

The President said the subject which had been brought before them by Prof. Bell was undoubtedly one of considerable interest and importance, and the slides which had been exhibited to them that evening had been a remarkable object lesson upon the undesirability, especially in the case of low organisms, of naming things as new species without knowing something about their life-history. The ordinary method of division into genera and species was a very useful method of cataloguing but it did not exist in nature, and it therefore required the greatest judgment to determine where to separate into a genus or a species; but usually if they found that a stop or a break occurred, they saw in it a reason for a new species; or if a wider break in the continuity was noticed then it was called a new genus. The subject was full of difficulty, and required the exercise of great judgment, and that kind of intuition which enabled one man to be right more often than another; but all would no doubt agree that it was most undesirable that people should rush to make new species upon incomplete data. It was only when an opportunity occurred such as had been placed before them that evening, that they could quite realize the danger of the practice. Some years ago Entomologists made no less than about thirty-two distinct species of Button Tortrices; but at last some one procured a pair, male and female, a large quantity of eggs were deposited and hatched; from these eggs, all laid by the same insect, he reared specimens of all the thirty-two so-called species. That was an opportunity. Prof. Bell had introduced them to another that evening, and their thanks were heartily due to him for bringing this very interesting subject before them.

The thanks of the meeting were cordially voted to Prof. Bell for his communication.

The following Instruments, Objects, &c., were exhibited:—

Prof. F. J. Bell:—Lantern Slides of Corals illustrating his paper.

Mr. E. B. Green:—Drawings of Parasitic Root-hairs.

Mr. E. E. Hill:—Surface of a Coin under a 1/4 in., illuminated with Beck's Patent Illuminator.

Mr. C. Rousselet:—Mounted Rotifers (*Synchæta pectinata*).

Mr. G. Western:—*Floscularia Hoodi.*

Mr. Wright:—Microscope by Dollond.

New Fellows.—The following were elected *Ordinary* Fellows:—Messrs. G. Otis Mitchell and Fridrich Cohen.

MEETING OF 20TH MARCH 1895, AT 20 HANOVER SQUARE, W.
THE PRESIDENT (A. D. MICHAEL, ESQ., F.L.S.) IN THE CHAIR.

The Minutes of the Meeting of 20th February last were read and confirmed, and were signed by the President.

Prof. F. Jeffrey Bell said that their list of donations that evening consisted of two negatives and three stereoscopic photomicrographs of the gizzard of the house cricket, presented by the Hon. A. A. Adee of Washington, which were accompanied by the following explanation from Messrs. Watson:—

"The photograph is taken by means of an accurately adjusted tilting stage. The angle of this tilt must be varied to suit the angular aperture of the objective. The angle subtended by normal 10-in. vision is exaggerated fourfold by an objective of 60° angular aperture. The subject herewith was tilted only about $3\frac{3}{4}$°.

Mr. Adee says in his letter, 'I should be much gratified if you would cause a good print and the paired negatives to be presented to the Royal Microscopical Society at their next convenient meeting, in order that the discussion initiated by Dr. Borden's announcement and its results in his hands may be continued.'"

The President said that he was sure it would be the pleasure of the meeting to pass a vote of thanks to Mr. Adee for this donation. The prints from these negatives had been prepared by Messrs. Watson, and would be handed round for inspection. The subject—the gizzard of a cricket—was well known to most of those present, and although he was himself unable to appreciate any stereoscopic effect, the photographs were nevertheless extremely good.

A vote of thanks for this donation was unanimously carried.

Mr. E. M. Nelson exhibited and described an apochromatic condenser fitted with a correction collar worked by a lever; he also exhibited a new magnifying lens illuminator, or lens mirror, in which the upper surface of a plano-convex lens was silvered, excepting a circular aperture in the centre, above which was placed another lens arranged so that the foci of the loup and the lens mirror were identical, and thus the advantages of a loup and a lieberkuhn were combined.

Dr. W. H. Dallinger said that Mr. Nelson had done so much in making and suggesting improvements in matters of detail to assist them in carrying out the higher microscopical work, that any fresh communication from him was sure to be received with attention and interest. Unfortunately he had himself not yet had an opportunity of discussing the subject before them with him, nor of seeing the arrangement until that moment, but he anticipated the pleasure of doing so, and from what they had heard he thought that the improvement in the condenser was likely to prove of great value. He was of course not able to say more about it, for the reason mentioned, but he felt he could not sit still and allow the matter to pass without a note of thanks to Mr. Nelson for his communication.

Mr. R. Smith said he should like to mention that Mr. Nelson was not quite correct as to the impossibility of registering the aperture of the iris diaphragm, for he had one made a short time ago which worked admirably and enabled him to register the aperture quite accurately, so that at any future time he could set it to precisely the same condition if desired.

Mr. T. Charters White thought the addition of the lever to the correction collar would get over a great difficulty if it could be applied to objectives, as the stiffness with which these collars generally worked, made them very inconvenient to manipulate.

The President said that this arrangement was likely to be specially useful to those who required fine definition; whether in practice it would be found too loose or not, he could not say, but the apparatus itself was a very ingenious application of a well-known principle to the improvement of the condenser, and was sure to be of great service. As regarded the iris diaphragm, he did not quite see why they could not register the aperture if it was desirable to do so.

The thanks of the Society were voted to Mr. Nelson for his communication.

Mr. E. E. Hill said he had brought for exhibition a very small Microscope made by Nachet, which fitted in a small brass case, and would, he thought, be found even smaller than the portable Microscope by Zentmayer, described by Mr. Nelson in the last number of the Journal.

The President said this was certainly a remarkable instance of extreme portability, and for those who wanted to carry a very small instrument about with them, as for instance a traveller or explorer, who was obliged to reduce his outfit to what could be carried on a horse's back, so small a Microscope would be very useful. He did not think however that it need be quite so heavy as this one was; there was no need to have the case made of such thick brass, and the reduction in weight by using thinner metal, or aluminium, would be rather an improvement.

Mr. T. C. White said he had been asked to say a few words as to his exhibit, some artificial crystals of hippuric acid. The natural crystals were acicular and not of any particular interest as microscopic objects, but if a saturated solution was made in boiling absolute alcohol, and a drop of this was placed upon a glass slide, it would spread out in a film, but the crystals would remain locked up until the slide was moistened or breathed upon. When this was done, however, a large number of circular crystals were started, and by varying the conditions under which the crystallization was carried on a number of very pretty patterns could be obtained. Objects of this class he knew would be said to belong to what Dr. Bowerbank used to call his "Goodness gracious" cabinet, but if any one wanted a particularly pretty polariscope slide, it could be obtained in this way.

Mr. F. J. Reid's note on the action of menthol vapours on *Staphylococcus pyogenes aureus* was read by Prof. Bell.

Dr. R. G. Hebb said this communication was extremely interesting as showing the remarkable antiseptic action of menthol; but at the same time the facts were well known, being recorded in most works treating on the subject.

Mr. W. H. Brown read a paper on "Early Patents connected with the Microscope." The Microscope of George Lindsay, from the Society's collection, was exhibited in illustration.

Mr. Nelson said that this paper showed a great deal of patience on the part of Mr. Brown, to whom their thanks were certainly due, for anything more tedious than searching through musty old records and extracting useful information from them, he did not know. Many of these things for which patents had been obtained were of very little value, and some of them were absurd, and the specifications so unintelligible, that it was doubtful if the authors themselves understood what was meant. Blair's method of making hollow lenses and putting fluid inside them was worth some attention, and he thought it very possible that they might hear more of this in the future. So far as advance in optical construction was concerned, the telescope was miles behind the Microscope, for even the last monster at Greenwich was made with two lenses as usual, and only two rays were combined, and the great Lick telescope had a large chromatic error, all of which could be removed by Blair's method. It looked very much as if the limit had been reached as to the size of refracting telescopes, but a paper by Sir Howard Grubb pointed out how superior a reflector was to a refractor, and if the amount of money expended upon these huge telescopes had been spent on properly mounting reflectors, he thought the results would have been much more advantageous.

Mr. C. Beck said he had been much interested in Mr. Brown's paper, but thought they should not laugh too much at some of these old Microscopes, because any one who knew what the Patent Office was would be aware that ideas which were quite as absurd were being patented every day. As an instance of this he might say that some time ago he was asked to give his opinion upon a Microscope which some one had invented and which was said to possess the power of showing chemical molecules. He went as requested, and found that the Microscope had not at present done this, but it was about to do so; it was a home-made instrument, and had been devised by a gentleman who had made the discovery that by drawing out the draw-tube an increase of magnifying power could be obtained; and who was of opinion that with an unlimited length of tube an unlimited power could be got; and that by using an electric light and a 1/2 in. objective, he would by going to the top of the house and looking down through an eye-piece, be able to obtain enormous magnifying power! Dr. Blair's fluid object-glasses he thought had been admitted to be a means of correcting the secondary spectrum, but the difficulty in connection with them was in keeping the fluid at a uniform temperature, and also in keeping them from leaking.

The President said the Society was much indebted to Mr. Brown for his paper, which had involved a considerable amount of research and supplied a great deal of useful information.

The thanks of the meeting were voted to Mr. Brown for his paper.

The following Instruments, Objects, &c., were exhibited:—

The Society:—Lindsay's Patent Microscope, 1742.—The Hon. A. A. Adee's Photomicrographs.

Mr. T. D. Ersser:—Winged Ant in Baltic Amber, Tertiary.

Mr. E. E. Hill:—Nachet's Portable Microscope.

Mr. E. M. Nelson:—A Condenser with Collar Correction.—Lens Mirror Loup.

Mr. T. C. White:—Crystals of Hippuric Acid.

Mr. Wright:—A Microscope by Dollond.

New Fellows.—The following were elected *Ordinary* Fellows:—Messrs. J. E. Barnard, Arnold G. Maddox, and Dr. John Tatham.

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

JUNE 1895.

TRANSACTIONS OF THE SOCIETY.

VI.—*Patents connected with the Microscope.*—1666–1800.

By W. H. Brown, Assistant Secretary R.M.S.

(*Read 20th March*, 1895.)

Plates IV. and V.

I have great pleasure in drawing the attention of the Society to the following few facts relating to the early history of the Microscope, which, as far as I can trace, appear to have hitherto been overlooked in all the treatises which have yet appeared relating to that instrument.

When examining the Society's collection of instruments with Mr. T. D. Aldous, F.R.M.S., preparatory to making an inventory of the same, our attention was directed to the patent Microscope made by George Lindsay. It was then suggested by one of us that probably further information might be obtained if the specifications of the early patents were examined. With this object in view, I have been to the Library of the Patent Office and have gone through the reprints of the specifications relating to the patents from the earliest, dated 1617, down to the year 1800. During this period nearly 2500 patents were issued, the specifications of which I have carefully examined.

I would first call attention to Patent No. 71,* dated 24th June, 1634, granted by Charles I. to Arnold Rotsipen for "manie engines and instruments . . . To Forme and to Polishe all Manner of Opticall Sections, whether Concave, Convex, or Mixed, Elliptique, Parabolique, Hiperbolique, or Sphericall, of Iron, of Steele, or of anie other mixed Metalls, Harde or Softe, much better and in shorter Tyme then can be done by Hand, or by anie knowne Meanes hitherto vsed." The specification then gives a list of other instruments invented by Rotsipen, but which have no connection with optical instruments. Whatever this patent may refer to, it is evident that it is too vague to be identified with the Microscope. My object in including it here

* Reprinted and published by the Patent Office in 1857.

was the hope that some Fellow of the Society might be able to give some information as to the nature of these "Opticall Sections."

Smethwick.

The first specification in which the word Microscope is mentioned is one granted to Francis Smethwick by Charles II. for a method for grinding plano-convex lenses. The number of the patent is 149,* and is dated 14th May, 1666. It is for "A New and Pfect Way to Grind Opticke Glasses in Figures that are not Sphericall, which will add much to the Vse of Pspective Glasses by Sea and by Land, as well as for the Heavens, because his are all Open and soe shew the Obiect clearer as admitting more Sight, whereas the Sphericall which are hitherto made must be covered for the most part; and will alsoe, in Reading or Magnifying Glasses, now cōmonly called Microscopes, shewe all Thinge in more Distinct, and in Truer Proporcons; in Burning Glasses will Fire more strongly, and discover in the Darke at much greater Distaunce." Mr. Smethwick, who was one of the original Fellows of the Royal Society, brought his invention before that body, and in the 'Philosophical Transactions,' No. 33, issued Monday, March 16, 1667/8 (vol. iii. 1669, pp. 631-2) occurs the following:—"*An Account of the Invention of Grinding* Optick *and* Burning-*Glasses of a Figure* not-Sphericall, *produced before the* R. Society: The Ingenious and Industrious *Francis Smethwick* Esquire, Fellow of the *R. Society*, having for divers years painfully search't after the way of Grinding Glasses *not-Sphericall*, affirms, that at length he hath now found it: for the proof of which, he lately, (viz. *February* 27, 1667/8,) produced before the said Society *certain Specimina* of that Invention, which were a *Telescope*, a *Reading*, and two *Burning-Glasses*.

"The *Telescope* was about *four* foot long, furnisht with *four* Glasses, whereof the three *Ocular* ones, Plano-convexe, were of this newly-invented *not-Sphericall* Figure, and the *fourth* a *Sphericall* Object-glass. This being compared with a *Common*, yet very good *Telescope* . . . was found . . . to *exceed* the other in goodnesse, by taking in a greater angle, and representing the Objects more exactly in their respective proportions, and enduring a greater Aperture, free from colors.

"The *Reading* Glasse, of the same Figure, being compared with a common *Sphericall*-Glasse, did far excell it, by magnifying the Letters, to which it was applyed, up to the very edges, and by shewing them *distinctly* from one brim thorough the Center to the other; which the *Sphericall*-Glasse came farr short of. And this effect the new figur'd Glasse perform'd only on one of its sides, and not on the other, as being of a different figure from Sphericall-Glasses, which performe their effect near equally on both sides."

* Reprinted in 1857.

Lindsay (pl. IV.).

The next specification referring to the Microscope is No. 588,* dated the 17th February and the 1st and 4th June, 1743. It refers to a portable Microscope made by George Lindsay. I am pleased to say that the Society possesses two examples of this Microscope. One of these instruments is a very complete specimen; the other wants many of the principal parts. One of Lindsay's Microscopes was exhibited at the International Exhibition held in London in 1876. The instrument was first noticed by later writers in 1878,† and attention was again directed to it by the late Mr. John Mayall, in his Cantor Lectures,‡ but it does not appear from either of these notices that the patent was ever examined. The figures in the German publication were probably taken from the instrument and not from the specification, as stated in the Journal.§ The title of the specification reads:—"Whereas His Majesty, by His Letters Patent . . . dated the seventeenth day of February, in the sixteenth year of His reign, did grant unto me, George Lindsay . . . the sole use and benefitt of making and vending 'A Generall Portable Microscope, of a Structure intirely New and Different from any now in Use, which, with Parts for Transparent and Opake Bodies, Conveniences for Living Creatures, and a Stand and Reflecting Speculum, are contained in a Case not exceeding Six Cubick Inches, and is so contrived as the Instant it is taken out to be Ready for Use, without the Trouble of Screwing and Unscrewing any Part, and Measures by a Scale the Focall Distance of each Lens, thereby giveing the Reall and Apparent Magnitudes of Objects, having also Reflecting Mirrors for Illuminating Dark Bodies, and is applicable to all the Purposes which the Nature of Microscopes admitts.'"

In the Library of the British Museum there are two copies of a rather scarce pamphlet by Lindsay, entitled, 'An Explanation of the Mechanism and Uses of a general portable Microscope, first invented and made in the year 1728; and Publish'd by His Majesty's Royal Letters Patent, February 17, 1742. By George Lindsay, Watchmaker in the Strand, London." The date 1742 is evidently wrong, as the specification gives the date 1743; while in both the letter of patent and the specification the sixteenth year of the reign of George II. is given, which is also 1743. I may here state that both the Society's instruments bear the date 1742; one of them is numbered 22, the other does not appear to have been numbered. As Lindsay's Microscope is so rare, I venture to quote the description of it from his pamphlet; the illustrations are taken from the dia-

* Reprinted 1856.

† Bericht über die wissenschaftlichen Apparate auf der Londoner Internat. Ausstellung im Jahre 1876 (Achenbach und Falk), 1878, part i. pp. 52–3 (2 figs.). See Journ. R.M.S., 1883, p. 708 (2 figs.).

‡ The Microscope, Journ. Soc. Arts, xxxiv. (1886) p. 1048, fig. 52.

§ 1887, pp. 293–4 (1 fig.).

grammatic figures given in the specification alluded to, but I have added additional letters to bring it into accord with the description.

"Fig. 1 represents the Instrument in a perspective view ready for Use. A, I call the Head of the Instrument, which has a Cup to receive the Eye; to this Head is firmly fix'd a Plate, on which the Object Part B is mov'd backwards or forwards by the Leaver C, which turns out and folds in with the rest. D is the Handle to turn up or down occasionally. E is a Plane *Speculum* or Looking-glass, with a split Shank that fits into a Socket at the End of the sliding Bar F. G G are Sliders, in which the Glasses are set between the Plates confin'd with two small Screws; each of these Sliders has a little Spring to make it move in the Groove with a moderate Stiffness, that any Glass you would use, may stay before the Aperture I. K K K are three Pieces, which form a Stand for the Microscope, by fixing them together, turning out the Foot to a Triangle, and putting the End L (which is likewise a Turn-screw) into the Socket at the End of the Handle at M. N is a jointed Bar, with a Spring-Tube fitted to receive the Needle O, which has a Point at one End, and a small Tongs at the other, to hold or stick any minute Objects. P is a Case containing 6 Sliders for Objects, one of which has round Plates with Holes between the Talks, and is intended to keep any minute living Creature, as a Mite, Flea, &c. Q is a Pair of Plyers to take up any small Bodies, and the other End is for taking out the Rings that confine the Talks in the Ivory Sliders. R is a Box with Talks or Ising-Glass and Rings, to supply any that may be dropp'd or lost. S is a Plate having some Line wound on one End to tie a Fish, Frog, &c. on, to view the circulation of the Blood."

The following instructions are then given for viewing objects:—

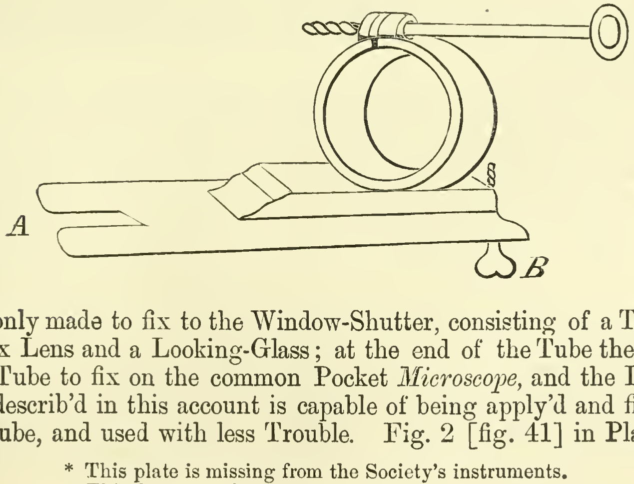
"Transparent Objects are generally confined between two Talks in Ivory Sliders, such as are in the Case P. One of these being put into the Object Part B, the round Hole in the Brass Plate *a*, is a Guide to place the Object you would view before the Aperture I. Then having observed the Number of the Glass that is before the Aperture, and appears at the Top of the Head A, if you move the Object-Part of the Leaver C, till the Index *b* comes on the Line under the same Figure on the Scale *c*, which is on the Side of the Instrument, the Object will then be in a Point of Vision, and by the minutest Touch at either End of the Leaver C, the Object will be adjusted immediately to the Eye of any Person that is viewing it. If you think proper to make the Object bigger, put down the Brass Slider G, till the next Figure comes even with the Top of the Instrument, and move the Object-Part nearer, till the Index is at the next Division on the Scale under that Figure, and so on."

Among the six slides is one made of ebony, "this has single Glasses in it" and is to be used for the examination of fluids. For viewing the circulation in the tail of a fish or in the foot of a frog, "there is a Plate S, having on the End some small Line. This Plate is to be join'd as represented in *Fig.* 3, to another which draws out of the Slider-Case P. The Body of the Fish, Frog, &c. is to be laid on the Plate S, and gently tied down, the Tail or Foot being extended over one of the Holes in the other, and may be confined from moving, by a little Plate* with two holes in it, represented underneath, that puts on at the end. The Creature thus fixed, put the Plate with the Holes into its Place in the Slider-Case, and open the Object-Part, by loosening the little Nut *d*, then bring the Place you would view before the Aperture, and holding the Object-Part together, fix it fast by tightening the Nut *d*, examine it with the fourth or fifth Magnifier, and you will see the Blood Globules rolling through the Veins and Arteries with a prodigious Rapidity . . .

"Of viewing Opake Bodies. These, if they are whole Insects, may be taken in the Tongs O, and the instrument is immediately made fit to receive them, by drawing of [*f*] the Brass Plate of the Object-Part, and turning down the other, which being confined by placing the little Nut *d*, as represented in *Fig.* 2. There will be a Cavity at *e* fitted to receive the Tail of the Jointed Bar N, in the Spring Tube of which you are to put the Needle O, and present your Object before tbe Aperture. If it be pretty large, the first Magnifier is proper. This is set in one of the Silver Mirrors V, and goes into the Groove as the Sliders G G . . . If you find it necessary to magnify more, you must use the other Mirror T, which has a Mark on it at *f*, to show the Way it is fitted to go on the Outside of the Groove before mentioned . . . the 2nd, 3rd, and 4th Glasses are to be used with it."

After describing the box, Lindsay gives the following instructions how to use his instrument as a solar Microscope. He says, "The Use of it depends on the Sunshine, and there is an *Apparatus* which is

Fig. 41.



commonly made to fix to the Window-Shutter, consisting of a Tube, a Convex Lens and a Looking-Glass; at the end of the Tube there is a small Tube to fix on the common Pocket *Microscope*, and the Instrument describ'd in this account is capable of being apply'd and fix'd to this Tube, and used with less Trouble. Fig. 2 [fig. 41] in Plate 2†

* This plate is missing from the Society's instruments.
† This figure is taken from the pamphlet.

is a Piece to fix to my Instrument, in order to slip it on to this Tube; it consists of a Hoop of Brass, with a Screw to make it embrace the Tube; this Hoop is fasten'd on a Plate, in which is a Slit or Notch at A, the Nut of the Instrument *d* is to be loosen'd till the Plate will go underneath it; then put the Screw B through the Socket F, at the End of the Sliding Bar represented in Plate I, Fig. 1, and fix it fast, the Instrument is then ready to slip on to the *Apparatus* abovemention'd, and by drawing the Head of the Instrument backwards or forwards you may adjust it immediately to any of the Magnifiers. . . . The properest Glasses to be used for this Purpose are the 2d and 3d."

Ribright (pl. V.).

The next patent to which I would direct attention does not appear to have ever received notice from any of the later writers on the Microscope. It is for a combined portable Microscope and Telescope; the specification is No. 640,* bearing the dates of the 7th February and 30th May, 1749. The patent was granted to "Thomas Ribright, of the Parish of Saint Lawrence Mildred, London, Optician," for "An entirely New Method of Making Small Perspective Glasses, with Mathematical and other Instruments and Twees in one and the same Case, both with and without Miscrocopes or Magnifying Glasses therein, in a very Portable, Neat, and Ornamental Manner, which, by reason of their Size, would be very Convenient and Usefull to His said Majestie's [George II.] Subjects, and in Making of which Glasses a considerable Number of Opticians and other Handicraft Workmen would necessarily be Employed." I would notice in passing that the spelling of the word miscrocope is evidently only a clerical error. As this Microscope has never received any attention, I subjoin the following explanation of the instrument from the specification together with the figures referring to the same, as being worthy of the notice of the Society:—

"The outside case, and the severall parts thereof, and the instruments or twees therein contained, are to be made of gold, silver, brass, steel, or any other metal, or the whole or part of the outside case may be made or covered with shagreen, fish skin, or leather, with rims and hinges of gold, silver, or other metal, or may be sett or inlaid with pearl, jewels, or any sort of precious or curious stones. The Figure A, *a*, is the perspective glass as it is to be seen thro', having both the sliders out or sett open. 1 is an eye glass, and 2 is an object glass. *b*, *b*, are the heads in which the said glasses are sett or fixed. C is the joynt or shutting of the case, which may be drawn out at pleasure to adjust it to the sight. The Figure Q is the same case with the object end open in its proper position when used for a miscrocope. The Figure B, B, represents the body of the said case without the top, which draws off at the said joynt or shutting C, showing the

* Reprinted in 1856.

spaces wherein the instruments hereafter described or mentioned are to be contained or placed, in the center whereof is the aperture of the eye stop, marked *e*, and in the bottom or lower end thereof is the said object glass. E is the neck of the said case which the said top D slides upon. The Figure D represents the top drawn off at the joint C aforesaid, wherein at the upper end thereof the said eye-glass is fixed. The instruments to be placed round the aperture of the eye stop aforesaid are, F, a penknife; G, a six inch rule; H, a pair of compasses or dividers; I, a pair of scissors; K, a pen and pencil; L, a bodkin and ear picker; M, a pair of knippers with a file; all or any of which said instruments, marked F, G, H, I, K, L, M, may be changed or omitted, and mathematical or other instruments for twees* are to be placed in their stead at pleasure. N is the slider of the microscope, with three magnifiers fixed therein, marked *f*, *g*, *h*. O is an instrument to fix objects upon to be viewed thro' the microscope, being a pair of forceps at one end thereof, and a fork at the other end thereof. P is the stem whereby it is to be set or fixed in any of the four holes marked *p*, in the microscope Q. In using the said Invention for a microscope, the object end of the said case is a lid, to be opened with a hinge after the manner of a snuffbox lid, as in the said Figure Q. On the inner side of the said lidd is fixed a silver concave speculum, for reflecting light upon opake objects held in the forceps, or stuck on the fork of the said instrument O, when fixed by the said stem in any of the aforesaid holes *p*. *r*, *r*, is an oblong hole or slit in the case under the said hinge, and in the said hole or slit is a small button that slides therein, and being thrust upwards towards the said hinge, carries up the head S, T_1, T_2. The Figure S screws off from T_2 at *s*, the said T_2 being only the reverse side of T_1. The aforesaid head *b*, in which the object glass is fixed as aforesaid, is screwed off from the outside of the said lidd, and the said peice S is to be screwed into the place of the said head so to be screwed off. Into the slitt or groove 3, 3, in the said piece S, is to be thrust the said slider N, containing the said three magnifiers, thro' either of which said magnifiers is to be viewed any object held by the said forceps, or stuck on the said fork, when placed by the said stem in either of the said four holes *p*, the magnifier *g* being greater than the magnifier *f*, and lesser than the magnifier *n*. The four spaces marked *x* in the said case or Figure Q, are four little boxes or repositories for small objects, that the user of the said Invention may chuse to preserve."

Storer.

There was a lapse of thirty-five years before any further patent referring to the Microscope appeared. In 1778 William Storer, Professor of Optics to George III., was granted a patent† for "An

* Twees[e] (Old English), a surgeon's box of instruments.—*Webster*.

† Specification No. 1183, dated March 4th and June 29th, 1778. Reprinted in 1856.

Optical Instrument, called an Accurate Delineator, which, amongst its many Perfections, intirely obviates the Defects of the Camera Obscura, as it may not only be used without the Assistance of the Sun in the Day Time, but also equally of Use by Candle Light, for drawing the Human Face, inside of Rooms, Buildings, Perspectives, Landscapes, Foilage and Fibres of Trees and Flowers, it exactly representing the Same, large or small, with the true Outlines, Lights, Shades, and Colours." Storer describes his invention as follows:—"The accurate delineator may be made of various forms, and the effects above mentioned arise from a new-invented application of lenses, mirrors, speculums, prisms, or mediums of lenses of glass, or any composition containing reflecting or refracting powers. The rays from the object are at first received on or conveyed to a mirror or speculum placed at a proper angle in the inside of a tube or box by one or more convex lens or medium of lenses before the mirror or speculum. In cases where the object is conveyed thro' a lens or medium of lenses on the mirror or speculum, one or more convex lenses or medium of lenses must be applied to correct and illuminate the rays, and to receive from the mirror or speculum the rays from the objects conveyed thereon through the first-mentioned lens or medium of lenses; but in cases where the rays from the objects are received in the first place on the mirror or speculum, a convex lens or medium of lenses must be placed fixed or moveable next after the mirror or speculum, to collect the rays from the mirror or speculum; and at a proper distance from the first lens or medium of lenses must be applied one or more convex lens or medium of lenses, to correct and illuminate the rays from the first lens or medium of lenses, by which means all rays that are spherically refracted through the first medium will be made parallel, and consequently all objects are accurately represented and all parts thereof equally illuminated on the lens or medium lenses so receiving and correcting the rays of the objects received from the mirror or speculum, or first lens or medium of lenses, and gives the most lively and exact representation of the objects, either by the light of the sun, moon, or any other light. In all cases the size of the aperture or medium through which the rays first pass must govern the size and powers of the correcting lens or medium, both contrary to the principles of the camera obscura. A prism, mirror, or speculum placed at a proper angle to reflect the image on the first lens or medium of lenses, mirror, or speculum, the objects will be represented in their true shape, figure, and form; and a collecting or correcting lens or lenses, or medium of lenses to collect or correct the rays from the images presented by a reflecting microscope, magick lanthorn, camera obscura, and other instrument of the like nature, instantly forms the accurate delineator, the principals of the accurate delineator being not so much in the form or figure of the instrument, as to collect and correct and illuminate the faint and imperfect rays from the objects received thro' these instruments."

In 1780 Storer obtained another patent * for his "new Invention and discoverys of 'Certain Properties in Light and in Optical Glasses, and by means of a New and Peculiar Application Invented certain Telescopes, Microscopes, Opera Glasses, and other Optical Instruments, which are thereby rendered More Accurate, More Distinct, and More Luminous; and, in particular, whereby a Refracting Telescope of Fifteen Inches Long has all the Powers of a Two-Foot Reflector, with the Additional Advantages of a Larger Field, More Light and Distinctness of Vision, and may be easier adapted to the Size of the Object and State of the Atmosphere, and by which said Invention one and the same Portable Refracting Telescope may be made to Answer the Purpose, and have all the Powers of Telescopes of various Lengths and Sizes now in Use, and which New-invented Telescopes are admirably adapted to the Purposes of Navigation and of Terestial and Astronomical Observations.'"

I have read Prof. Storer's specification many times, but must confess that I am unable to grasp his meaning. I may also remark that this and the succeeding specification were referred to Mr. E. M. Nelson, who, when returning them, wrote to say that he could make nothing of them. However, I submit the following quotations, so that the Fellows of the Society may have some idea as to the gist of Prof. Storer's remarks. He says, "having discovered that the eye, when form'd proper for distinct vision, is in every respect in effect the same as a plain mirrour . . . therefore the eye is properly a dilating catadioptrick refractor. But the eye is to be greatly assisted by means of spherical, or glasses with unequal forms . . . in order to form the image in a true dilating or pantagraphycal parelelism, to be inlarged or diminished at pleasure . . . without distortion or losing the light by such changes with the same glasses and by which glasses rays of light shall be reflected and varied so often and untill the dilating paralelism formed by them be agreeable to the paralelism form'd by the eye that are to receive them; for in the same manner as the eye forms and acts as a plain mirrour, so rays of light under every change, by the means of the aforesaid Invention, shall likewise form an image from an object in a perfect true paralelism, and which said image meeting the paralelism of the eye, the image then becomes in a centric, dilating or pantagraphical paralelism, to be diminished or enlarged ad infinitum, even to an angle of one third of the hemisphere, which human eye is capable of receiving, and in such angle no light ought to be lost. But magnifying powers, field of, and distinctness is preserved far superior to the most powerfull telescope, or the best optical instruments of the various kinds ever yet known, or that can be made on any other principle, by which means microscopes . . . are made to have superior powers with more light and greater distinctness, as instead of the object glass of microscopes . . . being

* Specification No. 1252, dated April 10th and Aug. 10th, 1780. Reprinted in 1856.

so small as scarce to admit any light, or not sufficient light for a great magnifying power or opake objects. Now, by my Invention, as aforesaid, the object glasses of microscopes will admit being as large, and the same as for telescopes as microscopes, composed as aforesaid, performs properly as telescopes, and visa versa, as no refractions whatever can disturb or distort an image once formed by my Invention of a true centric dilating pantagraphycal paralelism. . . . For want of such knowledge of the properties and applications before mentioned . . . all optical instruments have hitherto been very deficient. . . . For when a magnifying power was carried beyond a certain degree, as allowed by all opticians, notwithstanding the latest improvement of acromatic object glasses, they wanted light, field of view, and distinctness, which mathematicians know is contrary to their own demonstrations of the law of optics, and which no one has ever been able to account for."

At the end of his specification Storer gives the following explanations of the various technical terms he has used :—" Note, paralelism is probably a new technical term in optics . . . newly discovered by me, and don't appear to be understood by mathematicians or opticians. By an optical paralelism, I mean an invisible image, formed by points of rays of light, from two or more reflections, and which points shall meet, unite, but not pass other, but take a new direction in angles equal to each other, as the ray of incidents with the ray of reflection. By a dilating or pantagraphical paralelism is meant two paralelisms so meeting as the points from each unite. B[y] a centric dilating pantagraphycal paralelism I mean three paralelisms so united and formed as to reciprocally assist each other under every change required of them, in which state the minutest points of the rays producing the image may be caused to accede to or recede from each other in a dilating form, ad infinitum, without disturbing the image or wanting light, a phænomenon in optics never before known, though upon which the distinctness of vision, great magnifying powers, a large field of view, and sufficiency of light, entirely depends."

The following is an account of another patent* by Storer, and is probably a continuation of the preceding specification. It is for a " New and Peculiar Method of Preparing and Making of Optick Glasses, which I call'd by the Name Syllepsis Glasses, and also the Application thereof to Optick Instruments in general, particularly Tellescopes, Microscopes, Reading Glasses, Opera Glasses, and Spectacles, whereby Distinct Vision is more readily procured and the Sight greatly Relieved, and by which said Preparation Optick Glasses are rendered more Perfect, and may be applied with greater certainty."

In describing his patent Prof. Storer says, " all vision-making rays are transmitted through a syllepsis glass or optick glass in a straight line with the incident ray ; and as there are a sufficient supply of these

* Specification No. 1407, dated December 12th, 1783, and April 10th, 1784. Reprinted in 1856.

direct rays proceeding from any object in any direction agreeing with the laws of perspective that are transmitted through from any point of an object in a direct line with the incident ray, which direct rays alone are proper for distinct vision, proves that all rays of light that are refracted are not only become distorted, prismatick, and are enemies to but likewise useless for distinct vision, being repugnant to that truth. To obviate the defects of optical instruments which refracted light occasions, I have the extream edges of the two surfaces of my syllepsis glasses truly paralel to each other, which when truly centered I cut off the prism from the glass, leaving only such part of the centre of the glass as may be proper for a sufficient quantity of those rays of light to be transmitted through as will be on direct lines with the incident rays, according to the distance of the object or the image of the object and the magnifying power required, preserving the laws of perspective (videlicet) a straight line with the incident ray, and this strictly to be observed by light transmitted through every or any optick glass according to the instrument used to or the effect desired of it; I shut out all refracted light that I possibly can, considering it imperfect and improper for distinct vision."

"A syllepsis glass is one optick glass, and which fully answers the end and effect of but is far superior to the late improved accromatic object glass, exhibiting by its external shape or form such as when one convex and one concave or two convex's and one concave are placed close together, which is in effect and form but one syllepsis glass with the prism cut off."

On examining the Catalogue of the Library of the British Museum I found that Storer published a work entitled:—

"Storer's *Syllabus*, to a course of *Optical Experiments*, on the *Syllepsis Optica*, or the new optical principles of the *Royal Delineator analysed*." (4to, London, 1782.)

Storer appears to have had a committee to examine his invention, and made the experiments before them which he records in his book. I regret I have not been able to find out what conclusions the committee arrived at.

On page 18 he says:—

"The *following* is a copy of a description of the *Royal Patent Delineator*, wrote by that *high* and justly distinguished *noble* character, *as judge and patron of the Arts*, the Honourable Horace Walpole, and from *whom* I had the honour to receive it, to present to Sir Joshua Reynolds to correct, *who* was pleased to return it me, saying, it appeared to *him* to want no alteration.

'*THE DELINEATOR*, an Instrument that *obviates the defects* of the Camera Obscura, as it does *not* require the Sun to shine on the objects represented, as it represents the objects erect, and neither inverted nor transversed; as it is equally fit to be used *by candle light* as by day light; as it delineates . . . *with the nicest precision*. . . . *The idea* first occurred *to the inventor*, William Storer, of *Saham*

Toney, near *Swaffham*, in Norfolk, about the beginning of the year 1776. . . .

The instrument would not be offered to the public, if it had not the sanction of Sir Joshua Reynolds, Mr. West,* and other eminent professors,'" etc.

On page 52 Storer writes, "To make myself better understood, I have divided the combined powers and effects of the Royal *accurate* Delineator, by a *Syllepsis* or *Model*, by way of Analysis of that instrument, in the twelve following parts, viz. :—

First.
The Principia Optica.

Second.
The Optica Magica.

Third.
Iphiauxetic Microscope, for *pelluci[d]* objects.

Fourth.
Iphiauxetic Microscope, for *opake* objects.

Fifth.
The *Holomicroscope.*

Sixth.
A Solar Microscope.

Seventh.
The *Reconnoiterer.*

Eighth.
A Newtonian Scale.

Ninth.
A Night Telescope.

Tenth.
A Capital Portable Telescope.

[Eleventh.]
A Catadioptric Parallelism.

Twelfth.
Royal *accurate* Delineator, both simple, *as now made*, and compound, *as at first made.*"

Only Storer's experiments with parts 3–6 concern the Microscope, these were :—

"Third, Experiments on the *Iphiauxetic Microscope,* with extra-

* Benjamin West, the painter.

ordinary magnifying powers . . . for viewing minute *pellucid* objects.

Fourth, Experiments on the *Iphiauxetic Microscope*, with equal magnifying powers . . . for viewing minute *opake* objects.

Fifth, Experiments on the *Holomicroscope* . . . for viewing small objects entire. . . . It magnifies to a very great degree; and exhibits AT ONE VIEW, the entire figures of small insects, *&c. parts only of which*, and upon a much smaller scale, can be viewed by any instrument at present known.

Sixth, Experiments on a *solar Microscope* . . . particularly useful to SURGEONS and BOTANISTS, for viewing parts of *human* and other animals, *plants*, *insects*, &c. preferable for those purposes, in a surprising degree, to any known instrument whatsoever."

The major portion of Storer's work is given up to a controversy which he appears to have had with Dollond about Telescopes.

He also states that he was about to publish a work giving his new discoveries and improvements in Optics, but I have not as yet been able to find any clue to it and therefore cannot say whether it was ever published. From Prof. Storer's account his apparatus must have been a truly wonderful invention, and it is a matter of regret that his name and work should have apparently sunk into oblivion. I trust that some day an example of his instrument may be found, when the various claims which he makes can be verified.

MARTIN.

I would now call your attention to a patent* granted in 1782 to Joshua Lover Martin, son of the celebrated Benjamin Martin, for his "Newly-invented Art of Drawing Tubes, Plated or otherwise covered with Silver or Gold, on Copper or other Metal, for the Purpose and Construction of Telescopes, Perspectives, Opera Glasses, and various Optical, Mathematical, and Philosophical Instruments, to which they are adapted."

Martin's description of his patent is as follows:—"The copper or metals to be plated is first covered with silver or gold, and afterwards formed into tubes and soldered. They are then applied to the draw bench, and, being first put on a triblet or mandril, are drawn through the holes of different sizes according to the required thickness of the tubes. . . . And to prevent the surface of the plated metal tubes, in the necessary action of sliding, from being scratched or otherwise defaced . . . the collars or springs thro' which the plated tubes are made to slide is lined with cloth, velvet, or other soft substance."

BLAIR.

The two following specifications are extremely interesting, as representing examples of the endeavours that were made about the end of the

* No. 1316, dated 14th Jan., 28th March, and 4th April, 1782. Reprinted in 1856.

last century to moderate the excessive amount of colour which lenses then exhibited. I refer to two patents granted to Dr. Robert Blair, Surgeon in the Royal Navy and afterwards Regius Professor of Astronomy in the University of Edinburgh. The first patent * is for "A Method to Improve the Refracting Tellescope and other Optical Instruments," Blair's method being to fill the spaces between the lenses with fluid. He says, "The present improvement consists in removing the impediments arising from the imperfection of flint glass to the construction of refracting telescopes with large apertures and high magnifying powers, in correcting the errors arising from a difference of refrangibility of the rays of light and those from the spherical figures of glasses more perfectly, and transmitting more light where the apertures are equal, than can be done in the common achromatic telescope, by rejecting the imperfect kind of glass called white flint glass from the compound object glass, and in using in lieu of it a dispersive fluid. And in general the improvement consists in refracting the rays of light without dispersion of colour in dioptrical instruments, whether composed of lenses or prisms, where refraction without colour is wanted by a combination of crown glass, or any other kind of glass except flint-glass, with a fluid of different dispersive power from that of the glass with which it is combined, and that either by opposite refractions as at present practised with different kinds of glass, or by a single refraction in the manner above explained. By accurate experiments most metallic solutions were found to possess this dispersive power; or solution of corrosive sublimate mercury, either alone in spirit of wine, or in water with the addition of crude sal ammoniacum, disperses in a very considerable degree, but is greatly inferior in this respect to a chemical preparation called the caustic or butter of antimony,† which, in its strongest state, dispersives three times more than crown glass. Some essential oils were also found to possess this property in a sufficient degree to be useful for optical purposes. Those who are conversant in optics will not be at a loss in adapting the curvature of the lenses to the dispersive power of the fluid whose properties they have examined, so as to produce a colourless refraction, and will also perceive that, from having a choice of so great a variety of mediums of different refractive and dispersive powers, the errors of homogeneal rays arising from the spherical figure of the lenses may be more accurately corrected than when two kinds of glass of nearly the same density are made use of; this subject having been treated of long since by opticians of the greatest eminence. And it is well known that an accurate union of rays of all sorts, by the object glasses of telescopes and microscopes, is the chief thing requisite to bring these instruments to the greatest degree of perfection of which they are capable."

Blair continued his researches, and in 1791 took out a second

* No. 1473, dated 26th April, 21st and 24th May, 1785. Reprinted in 1856.
† Chloride of antimony.

patent * for improvements in the same subject. It is described as "A Method of Improving the Refracting Telescope and other Dioptrical Instruments." Blair finds that the defects of object-glasses were owing to the fact that "flint glass refracts the green light considerably less than crown glass, in proportion to the whole refraction of red and violet light, so that when the divergency of the red and violet light, caused by the refraction of the two mediums, is equal, the divergency of the red and green light is always greater in the crown glass than in the flint glass, and the divergency of the violet and green light is always less in the crown glass than in the flint glass. Those who are conversant in optical studies will perceive from this, that it is impossible to unite all the rays by any combination of these two mediums; for the correction of colour is most perfect when the red and violet light is united, and when this is effected the green light will always be refracted more than this united red and violet light."

After several experiments, Blair found that "The marine and nitrous acids, which are dispersive fluids of considerable strength, instead of refracting the green light less than crown glass in proportion to the whole refraction of the red and violet light, were found to refract the green light more. . . . I therefore mixed these two kinds of dispersive mediums, and thus obtained a medium which disperses the rays much more than crown glass, and yet causes all of them to diverge accurately in the same proportion in which they are made to diverge by the refraction of crown glass, which is the desideratum required to move entirely the aberration from the unequal refrangibility of light."

After cautioning opticians against using the medium in question without the necessary permission, Blair says, "To dioptrical instruments constructed upon this principle I apply the term aplanatic, which denotes the absence of aberration, in order to distinguish them from those which have with impropriety been stiled achromatic. The dispersive medium which I have found to answer best is a solution of antimony or mercury in the marine acid, but a variety of others may be used for the same purpose, and it is possible to remove the colour by a combination of two essential oils with glass, but in a more complex and less effectual way, than by using one dispersive medium, as above stated. It is well known that besides the aberration from unequal refrangibility, it is necessary to correct also the aberration from the spherical figures of lenses, but this has no connection with the Invention above specified. The colour may be entirely removed by using only one concave lens, formed of a dispersive medium; combined with one or with two convex lenses formed of an indispersive medium; and if the dispersive medium be more dense than the indispersive medium, the spherical aberration may be also corrected without any addition; but if the dispersive medium made use of be

* No. 1800, dated 4th, 27th and 29th April, 1791. Reprinted in 1856.

of less density than the indispersive medium, an additional lens becomes necessary to remove the spherical aberration. The cavity which in this case is formed between this additional lens and the former may either remain empty or may be filled with spirits of wine or any transparent indispersive fluid, merely to prevent the loss of light which would otherwise arise from reflexion."

In 1791 Blair read before the Royal Society of Edinburgh a paper * entitled, "Experiments *and* Observations *on the* Unequal Refrangibility *of* Light." In this paper he gives a most elaborate account of his method for combining various dispersive fluids with crown glass lenses.

Both Sir John Herschell † and Sir David Brewster held very favourable opinions of Blair's invention. Herschell remarks that "Could solid media of such properties be discovered, the telescope would become a new instrument;" and Brewster,‡ speaking of Blair, says that he produced "fluid object glasses in which the *aberration of colour was completely corrected.* The telescopes which he made on this principle were so extraordinary, that Professor Robison § assures us that one of them, FIFTEEN inches in focal length, *equalled in all respects, if it did not surpass, the best of Dollond's* FORTY-TWO inches long."

Blair entrusted the manufacture of his instruments to George Adams the younger, who, however, was not very successful with them. An equally unsuccessful attempt to sell them was made in 1827 by Archibald Blair, son of the inventor, who was an optician in Edinburgh. A biographical notice ‖ of Blair states that he died at Westlock, in Berwickshire, on December 22nd, 1828. I am indebted to Miss A. M. Clerke, the writer of the biographical notice, for much information concerning Blair.

DIXON.

In 1785, Hugh Dixon, a chemist of Clerkenwell, obtained a patent ¶ for "Certain considerable Improvements in the Construction of Telescopes, Microscopes, Spectacles, and all other Instruments of Vision, either by Reflection alone or compounded of Refraction and Reflection, whereby the Field of View is greatly extended, and the Objects rendered much more Distinct than at present."

* Trans. Roy. Soc. Edin., iii. (1794) pp. 3–76 (3 pls.). An abstract of Blair's paper, under the title of "The Principles and Application of a New Method of constructing Achromatic Telescopes," appeared in Nicholson's Journ. Nat. Phil. Chem. and Arts, London, i. (1797) pp. 1–13; and as the "Beschreibung einer neuen Art von achromatischen Fernröhren oder der sogenannten aplanatischen Telescope, und Entwickelung der Gründe, worauf sie beruhen," in Gilbert's Annalen der Physik, Halle, vi. (1800) pp. 129–148, pl. 3.

† Encyc. Metropolitana, iv. (1845) art. "Light," pp. 427–9.

‡ Encyc. Britannica, 8th ed., xvi. (1859) art. "Optics," pp. 584–6.

§ Professor of Natural Philosophy at the University of Edinburgh.

‖ Dict. National Biog., v. (1886) pp. 166–7.

¶ Specification No. 1515, dated Dec. 14th, 1785, and Jan. 13th, 1786. Reprinted in 1856.

After describing in detail the methods by which he proposes to improve telescopes, Dixon then describes the improvements he suggests for the solar Microscope:—" A small concave mirror, diameter and focus at pleasure, a small hole through the middle, widest at the back part; in the hole, but near the polished surface, a concave glass, to cause the accumulated light to fall on the object with either a small degree converging or paralel or diverging manner; the objects being small, and on a small circular piece of black body, supported by a narrow bit of metal or flatted wire, very little of the light will be obstructed which should help to form the image. The object screwed until between the center of cavity and principal focus of the concave speculum, the picture would be formed at a distance according, and behind the real object. But to extend the magnifying power (or diverging of the image), and if the room is short, to answer the purpose of a longer room, add a large diameter speculum, form convex, and radius rather long; adjust the object's distance, and receive the picture on a white concave surface on one side, or beyond the object place or around it. A plane mirror may be used instead of convex for throwing the image to side of room, &c., or one person may view the image from a concave mirror of large diameter. It is needless mentioning the use of a concave glass instead of the convex or plain mirror while vision is desirable by reflection."

In the same specification Dixon also describes certain improvements that he has made in " Visuals and Spectacles."

ADAMS.

In 1797, Dudley Adams, son of George Adams, took out a patent * for his invention of " Certain Spectacles upon an entire New Principle." The framework of these spectacles consisted of a jointed and folded metal band, which encircled the head above the eyes. The lenses were held in a ring which hung from the band by a short rod, and they could thus be moved nearer to or farther from each other to suit different persons' sight.

In 1800 Adams obtained another patent † for " A Mode of Rendering Telescopes, Perspective, Prospect, and other Optical Glasses, more Portable than has hitherto been Executed." This patent applies more strictly to telescopes; by his method Adams was able to make telescopes with more joints than had previously been made, without rendering them less steady.

* Specification No. 2155, dated Jan. 23rd and Feb. 11th, 1797. Reprinted in 1856.

† Specification No. 2407, dated May 30th and June 21st, 1800. Reprinted in 1856.

VII.—*On the Form and Proportions of the Brain in the Oribatidæ and in some other Acarina.*

By A. D. Michael, President R.M.S, F.L.S., &c.
With a Note by E. M. Nelson, F.R.M.S.

(*Read* 17*th April*, 1895.)

Plate VI.

When, some twelve years ago, I read a paper before this Society on the Anatomy of the Oribatidæ * there was one portion of the internal anatomy which was scarcely dealt with at all, namely, the brain and nervous system. That paper, however, together with the chapters on anatomy in my subsequently published 'British Oribatidæ,' † still practically contains all that is known respecting the internal anatomy of these creatures. At that time section-cutting had not attained the

EXPLANATION OF PLATE VI.

A, supra-œsophageal ganglion of the brain. B, sub-œsophageal ganglion of the brain. C, compressor muscles of pharynx cut across. *cl*, cortical layer of brain. *cm*, constrictor muscles of œsophagus. D, distensor muscles of pharynx. F, fibrous layer of brain. M, maxillary lip. N, neurilemma. *Nph*, pharyngeal nerve. *nu*, nuclei. *ph*, pharynx. *œ*, œsophagus. *rph*, roof of pharynx. *t*, tracheæ. V, ventriculus (lumen of). W, wall of ventriculus.

All the figures are of adult specimens, and all the sections are drawn from specimens hardened with picro-sulphuric acid or Flemming's fluid, and stained with hæmatoxylin or picro-carmine.

Fig. 1.—Brain of *Leiosoma palmacinctum* (Oribatidæ), × 240. Sagittal median section, showing the very wide œsophagus passing through the brain and dividing it (in this section) into two halves.
„ 2.—The same species; sagittal section of brain not median, but taken at the side of the œsophagus, × 240; showing the fusion of the supra-œsophageal and the sub-œsophageal ganglia into one mass.
„ 3.—Brain of *Cepheus latus* (Oribatidæ), × 175. Sagittal median section.
„ 4.—Brain of same species, transverse section about the centre of the brain, × 175.
„ 5.—Brain of *Gamasus terribilis* ♂. Sagittal median section, × 120.
„ 6.—Brain of *Sejus togatus* (Gamasidæ), × 175. Sagittal median section.
„ 7.—Brain of *Trombidium* (sp.) probably *holosericeum*, × 175. Sagittal median section.
„ 8.—Brain of *Trombidium fuliginosum* Herm., seen from above, × 110.
„ 9.—Brain of *Tetranychus lintearius* (Dufour), × 300. Sagittal median section.
„ 10.—Brain of *Thyas petrophilus* (Hydrachnidæ), × 120. Sagittal median section.
„ 11.—Brain of *Cheyletus flabellifer*, × 250. Sagittal median section.
„ 12.—Brain of *Glyciphagus platygaster* ♀ (Tyroglyphidæ), × 175. Sagittal median section.
„ 13.—Brain of the same species and sex, × 175. Transverse section about the centre.
„ 14.—Brain of the same species ♂, × 175. Transverse section about the centre.

* This Journal, 1883, pp. 1–25. † London (Ray Society), 1884, 1888.

degree of excellence which it has now arrived at; and these minute Acari, which are possessed of a chitinous exo-skeleton, almost as hard and as brittle as glass (a peculiarity noticed long ago by v. Siebold *), had baffled my attempts to get any sections of them which were at all satisfactory or reliable; and it is by sections that most can be learned respecting the brain and nerves of such extremely small animals. I allowed the matter to rest, hoping that improvements in apparatus and technique might some day enable me to do what I had not succeeded in doing at that time. The difficulty still exists, the chitin is so hard and brittle that instead of being properly cut, it either takes a notch out of the edge of the razor, or else breaks into numerous pieces at the first touch of the edge, and some of these pieces being carried before the razor, are apt to tear and destroy the soft internal organs which we wish to see; nor have I found softening agents of any service; if eau de Labarraque or eau de Javelle be employed I have found that the internal organs are destroyed before the chitin is softened. In spite of these difficulties I have by the skilful assistance of Mr. M. J. Michael of Davos, and with the aid of modern improved microtomes, been able to obtain some sections which at all events show what the brain is really like a great deal better than can be done otherwise; and as there are not, as far as I know, any existing records on the subject, except the very imperfect information which will be found in my own works above referred to, I think it may be worth while to notice the brain, although I am not able at present to follow it up, as should be done, by a description of the nerves which proceed from it. The reason of this inability is somewhat strange; it is simply that I have not, as yet, succeeded in seeing these nerves in any way fit for reliable investigation. It is curious, that even the larger nerves, such as those innervating the legs—which are easily seen, and are even conspicuous, in many Acarina far more sluggish than the Oribatidæ, which, although rather slow in their rate of progress, are not really sluggish animals—are difficult, or impossible to see in the Oribatidæ; even when one does get a good series of sections, or a good dissection, of the brain. Thus, in the crawling Water-Mite *Thyas*, which will be referred to later on, not only are the nerves to the legs large and easily traceable, but I have been able to distinguish and follow the very much smaller nerves to the mandibles, dorso-ventral muscles, and many other quite fine nerves, besides the more substantial ones to the palpi and eyes; yet *Thyas* is a creature living under stones in the water, or in chinks of the rock, and moving but little, while most of the Oribatidæ are fairly active creatures. The nerves of the latter must be very delicate to escape observation, they ought at all events to be seen where they start from the brain if they were not of extreme tenuity.

* 'The Anatomy of the Invertebrata,' English translation, Boston, 1854, p. 368, note 1.

The so-called brain, or great nervous ganglion, of an Acarus is doubtless derived from a supra-œsophageal ganglion united by broad commissures to a sub-œsophageal ganglion; but, as in many other Arachnida, the fusion of the parts has been so complete, and the commissures have become so broad and short, that the original formation is lost, and the whole appears to be one ganglionic mass, which is penetrated by the œsophagus; still, in the Acarina, the traces of the original distinction between the supra- and sub-œsophageal ganglia are plainly seen in some families, while they are completely lost in others; this produces a considerable variety in the form of the brain, although all are upon the same principle. I propose shortly to refer to these differences in this paper, and also to endeavour to indicate something of the comparative size of the great nervous centre in selected specimens of a few of the great families.

The brain of the Oribatidæ is constructed upon the same principle as the brains of other Acarina which have been described; but the first difference which strikes the observer is the very much greater proportionate size of the opening through which the œsophagus passes as compared with that in the brain of other families; this will be readily seen on comparing fig. 1 of the brain of *Leiosoma palmacinctum* (Oribatidæ) with, for instance, fig. 5, which is that of *Gamasus terribilis* (Gamasidæ). The reason for this is obvious; the Oribatidæ are vegetable feeders and devour a considerable quantity of solid food; the Gamasidæ, and most of the families in which the brain has been described, are predatory creatures, living entirely by sucking the blood of their victims, and never swallow anything except liquid; it is evident therefore that the Oribatidæ would require a much larger œsophageal passage than the Gamasidæ or the Trombidiidæ. The only other family yet investigated in which the opening in the brain for the passage of the œsophagus is anything approaching the size that we find in the Oribatidæ is that of the Tyroglyphidæ (see fig. 12, *Glyciphagus platygaster*), and these again are vegetable feeders and eat solid food, their food being mostly consumed in a dry state; still, the opening even in the Tyroglyphidæ is not so large as in the Oribatidæ. Of course in this, and all similar remarks in this paper, when I speak of the characters of the brain in a family it must be understood to mean in such species of that family as have hitherto been examined, including those dealt with in this paper.

The next character which will be observed, and it is a very strongly marked feature in the two species which I have good sections of, is that while in most of the known families the greatest measurement of the brain is in an antero-posterior direction (see figs. 5, 6, 7, &c.), in the Oribatidæ this is far the smallest of the three dimensions, while the depth considerably exceeds both the length and the width; this produces a sort of shield-shaped brain on edge in the body. This form does not follow that of the body of the creature; it is true that *Leiosoma palmacinctum* (figs. 1, 2) is a round-bodied creature, but the form is practically the same in *Cepheus latus* which is not by any means round-bodied. Some of the Hydrachnidæ are very round and short-bodied, much more so than any of the Oribatidæ, and yet the antero-posterior measurement of the brain, although short, is considerably larger in proportion than that of the Oribatidæ. I am not able to give the details of one of these forms of Hydrachnidæ in my table as I do not possess good serial sections of one; but Schaubs* in his description of *Hydrodroma dispar* gives the long axis as ·174 mm., the width as ·116 mm., and the thickness as ·1 mm.; his long axis practically corresponds with the depth, and his thickness with the length; he states his whole creature to be about 2 mm. long by about 1·5 wide, so that the brain is very small, but Schaub does not give the depth of the whole creature.

A third point to be noticed is that the cortical layer of small, rounded, deeply-staining cells, which usually constitutes the exterior of the brain in Acarina, is thick in the Oribatidæ, whereas in the Hydrachnidæ it is scarcely traceable, and that the fibrous layer exhibits a much more homogeneous and less fibrillar character than in the Hydrachnidæ, Gamasidæ, and many other families; this may probably be correlated with the slighter development of the nerves in the Oribatidæ. Again, it may be noticed that the oesophagus of the Oribatidæ, in its passage through the brain, is not accompanied by tracheæ, as it is in *Trombidium*, &c. This is doubtless due to the small number of the unbranched tracheæ of the former as compared with the abundant supply of fine tracheæ found in the latter.

I will now shortly glance at the relative form and comparative size of the brain in a few of the different families; and the first observation that occurs is that the form of the brain seems to follow the family far more than it follows the shape of the individual species, just as before remarked in the Oribatidæ. Thus the Trombidiidæ and the Hydrachnidæ are closely allied families, and on reference to figs. 7, 8, 10, it will be seen that the brains are all more or less of an approach to a globular form, notwithstanding that the creatures are very different in shape, *Thyas*, fig. 10, being flattened dorso-ventrally as compared with such a *Trombidium* as *fuliginosum*, fig. 8. *Cheyletus*, fig. 11, is also generally considered to be an allied form, but there are very considerable anatomical differences, and here the brain shows a tendency to lose its sub-globular form and approach a little to that found in *Gamasus*. *Tetranychus*, fig. 9, also is classified as an allied form, but it is a vegetable feeder, and there certainly is an approach to the form of the brain in other vegetable feeders, as will be seen by comparing it with the Tyroglyphidæ (fig. 12), which lead up to the extreme form found in the Oribatidæ.

* "Über die Anatomie von *Hydrodroma* (C. L. Koch), ein Beitrag zur Kenntniss der Hydrachniden," Sitzungsb. d. k. Akad. d. Wiss. Wien, March 1888, Bd. xcvii. Abth. i. pp. 98–151.

The shape of the brain in the Gamasidæ, with its great extension in an antero-posterior direction along the œsophagus, is very characteristic, fig. 5; *Gamasus terribilis* is very like that given by Winkler in his pl. iii. fig. 9, for another species of *Gamasus*, and the extent to which the sub-œsophageal ganglion is developed backward as compared with the supra-œsophageal is a well-marked feature; this is not found in the brain of *Sejus togatus*, but this is a very aberrant species—and the main character of the *Gamasus* brain, viz. its extension along the œsophagus, is well maintained.

Finally, it may be interesting to compare the size of the brain in the different families of Acarina. I have given at the end of this paper a table showing the relative size of the brain to the whole creature in selected species from some of the principal families and sub-families, and I have given in the plate drawings of median sagittal sections of the brain in all these species. I have purposely, in most cases, selected species where the brains have not previously been figured, as adding more to the general stock of information than if I had copied such few figures as exist by other authors. I was of course confined to those species of which I happen to possess good serial sections. The linear measurements have all been carefully made by me from such sections, and may, I think, be relied on as fairly correct. In every instance the measurements of the brain and the whole creature have been made from the same individual.

The calculations of volume can only be considered as approximations. I am indebted for them entirely to the kindness of Mr. E. M. Nelson, who has carefully prepared them from my measurements and drawings; the last three columns of the table are entirely Mr. Nelson's work, not mine. Of course, to obtain absolute correctness as to the volume of such irregularly shaped microscopic bodies as the brains of Acarina, and the Acarina themselves, it would be necessary to follow Mr. E. T. Newton's plan of drawing each one of the series of sections greatly enlarged to scale upon sheets of material of proportionate thickness, and then cutting out the various drawings and joining them so as to obtain a model of substantial size; if this model be made in material heavier than water the model could first be weighed in air and then in distilled water at a known temperature; the difference between the two weights would give the weight of water displaced; from which its bulk could be calculated; or a mould could be prepared from the model and filled with sand, which could be measured. This is the exact method, but it would be immensely laborious where there are a considerable number of figures, such as those included in the table; moreover, although the brain, which is a solid organ, would probably give a correct model by this process, the whole creature undergoes shrinkage and expansion under the action of the reagents necessary to prepare it for section-cutting, and its form gets more or less altered, so that the model of the whole creature would only be an approximation after all, probably not more exact than what Mr. Nelson has prepared from the measurements and drawings. I think it probable that if an actually correct model of the whole creature, with all its indentations, could be obtained, the brain would bear a slightly larger proportion to the bulk of the animal than that given in the table.

The species selected are not any of them very active. I wished to avoid the difference which might possibly arise from the larger nerve-supply required by a very active creature, and to compare members of the different families as far as possible unaffected by this cause of divergence. Thus, while some Gamasidæ, e. g. *Hæmogamasus hirsutus,* are extremely active, *Gamasus terribilis* is not, although the two species are found together under precisely similar circumstances; and though many Trombidiidæ, e.g. *Erythræus*, and some Hydrachnidæ, are extremely active, yet *Trombidium* and *Thyas* are not; again some Trombidiidæ are very active, but *Glyciphagus platygaster* is not.

It will be seen from the table, which doubtless is a sufficiently close approximation for practical purposes, that the ratio of the brain to the body is lowest in the Tyroglyphidæ, ·19 per cent.; this is interesting because they are atracheate creatures, and have always been considered the lowest organisms of any family in the table. On the other hand, the Gamasidæ show far the largest proportion of brain of any of the great families; the ratio of volume of brain to body in *G. terribilis* being 1·61 per cent. Megnin, many years ago, when the size of the brain was quite unknown, asserted that the Gamasidæ were the most highly organised of any of the Acarina; certainly the size of the brain in such a species as *G. terribilis* is very remarkable: it will be seen from the table that the brain is over a fifth of the length, over a fourth of the width, and over a half of the depth of the entire creature; it is however of irregular form, which somewhat diminishes its volume.

The small size of the brain in *Trombidium* and the Hydrachnidæ is not so easily accounted for; here it will be seen it only amounts to about a tenth of the length, a seventh to a fifth of the breadth, and a fifth to a third of the depth, while the volume is not much more than in the Tyroglyphidæ; yet these are rather highly organised creatures, with well-developed eyes, which are absent in the other families quoted. The much larger proportionate size of the brain in *Tetranychus,* which has generally been supposed to be closely allied to the Trombidiidæ, is also difficult to explain. The brain in the Oribatidæ is small when compared with the Gamasidæ, but is considerably larger in proportion than that of the Trombidiidæ and Hydrachnidæ.

It may be worth mentioning the usual ratio of the brain to the body in the human race. In a series of 278 cases weighed by Sims, Glendinning, Tiedemann, and Reid, the maximum weight of the brain in the adult male was 65 oz. and the minimum 34 oz. In

Name of Creature.		Nature of Dimension.	Brain.	Whole Creature.	Proportion of Linear Measurement of Brain to that of Whole Creature.	Approximate Volume: Of Brain.	Approximate Volume: Of Whole Creature.	Approximate Proportion of Volume of Brain to that of Whole Creature.
					per cent.			per cent.
pheus latus	Oribatidæ.	length	·09	1·10	8·18			
"		breadth	·10	·77	13·00	·0008511	·2627	$\frac{1}{308 \cdot 6}$ = ·32
"		depth	·21	·55	38·18			
iosoma palmacinctum ..		length	·06	·92	6·52			
" " ..		breadth	·11	·65	16·92	·0005979	·1693	$\frac{1}{283 \cdot 3}$ = ·35
" " ..		depth	·19	·52	36·65			
yciphagus platygaster ♀ .. (Tyroglyphidæ)		length	·12	·75	16·00			
" "		breadth	·09	·65	13·85	·0001772	·9115	$\frac{1}{514 \cdot 4}$ = ·19
" "		depth	·03	·30	10·00			
ımasus terribilis ♂ ..	Gamasidæ.	length	·35	1·65	21·21̇			
" " ..		breadth	·26	1·00	26·00	·001	·6175	$\frac{1}{61 \cdot 75}$ = 1·61
" " ..		depth	·31	·57	54·39			
ıus togatus		length	·16	·90	17·77̇			
" "		breadth	·12	·40	30·00	·0006484	·065	$\frac{1}{100 \cdot 25}$ = 1
" "		depth	·09	·22	40·91			
ombidium sp.? .. .. .. (probably *holosericium*)		length	·25	2·40	10·42			
"		breadth	·15	·82	18·29	·002488	1·2495	$\frac{1}{502 \cdot 2}$ = ·2
"		depth	·18	·85	21·18			
ıyas petrophilus .. .. .. (Hydrachnidæ)		length	·11	1·10	10·00			
" "		breadth	·10	·67	14·93	·0004605	·18915	$\frac{1}{410 \cdot 7}$ = ·24
" "		depth	·12	·40	30·00			
eyletus flabellifer		length	·07	·52	13·46			
" "		breadth	·07	·28	25·00	·00008776	·01689	$\frac{1}{192 \cdot 4}$ = ·52
" "		depth	·05	·17	29·41			
tranychus lintearius ♀ ..		length	·10	·42	23·81			
" "		breadth	·07	·22	31·81	·0001362	·009125	$\frac{1}{67}$ = 1·5
" "		depth	·05	·15	33·33̇			

All the measurements in this table are in decimals of a millimetre.

a series of 191 cases the maximum weight of the brain in the adult female was 56 oz. and the minimum 31 oz. The mean weight, according to Bischoff, of the adult male brain is 1358 grm. and that of the adult female 1220 grm. In children at birth the average weight according to Boyd is, male 11·65 oz. and female 10 oz., and the proportion of brain to body at birth according to Tiedeman is 1 to 5·85 in the male and 1 to 6·5 in the female; but in the adult the proportion is very much less; in persons dying after prolonged illness probably about 1 to 35; the normal ratio, however, in adult healthy persons is probably about 1 to 45 = $2 \cdot 2\dot{2}$ per cent.

The brain of the Acarina is too small an object to be weighed, but the proportionate weight of the brain to the body would doubtless be larger than the proportionate bulk, because the brain is a solid organ, whereas the body contains large cavities; it would seem therefore that as the human brain averages about 2·22 per cent. of the weight of the body, and the brain of *Gamasus terribilis* measures about 1·61 of the bulk, the brain of that creature, which may be considered a fair specimen of its family, cannot be very far short of the proportion of the human brain.

Note on the Mode of Calculating the Volumes.

By E. M. Nelson, F.R.M.S.

It would seem that the best course to pursue in arriving at the volumes of these irregularly shaped bodies would be to divide them up into more or less regularly shaped portions. Thus, for example, if we take *Cepheus latus* and cut off the rostrum, i.e. the pointed end, we shall have two fairly regular figures to deal with. The volume of the larger portion may be assumed to lie between the volume of an inscribed prolate spheroid and a circumscribed elliptical cylinder. If, therefore, the mean of the volumes of these two figures be taken the result cannot be far from the truth. With regard to the conical end (rostrum), its volume will be larger than a right cone of the same height because of its blunted end, it might therefore be taken as a half instead of as a third of its circumscribing cylinder. Assuming that the length of the conical end is one-sixth that of the whole body, the formula will be as follows:—

Let l be the length, b the breadth, d the depth, and V the volume, then

$$e = \frac{5\,l}{6}; \quad f = \frac{b + d}{2}; \quad g = b\,.\,d\,.\,e\,.\,\frac{\pi}{4}; \quad h = e\,.\,f^2\,.\,\frac{\pi}{6};$$

$$k = \left(\frac{d}{2}\right)^2 \cdot \frac{l}{12} \cdot \frac{\pi}{4}; \quad m = \frac{g + h}{2}; \quad \mathrm{V} = k + m.$$

g is the volume of the elliptical cylinder, h that of the prolate spheroid, and k that of the conical end, m being the mean between g and h.

An enlarged model was made of the following dimensions in inches, $l = 2 \cdot 2$, $b = 1 \cdot 5$, and $d = 1 \cdot 1$, this was found to displace $2 \cdot 02$ cub. in. of water. Its volume when computed by the above formula came out as $2 \cdot 04$ cub. in., an agreement sufficiently near for the purposes in question.

VIII.—*Some Details of the First Nuclear Division in the Pollen-Mother-Cells of Lilium Martagon L.*

By Ethel Sargant.

Communicated by D. H. Scott, Ph.D., F.R.S., F.R.M.S.

(*Read* 15*th May*, 1895.)

Two observers have recently called attention to the manner in which the segments of a single chromosome separate from each other during the first division of the nucleus in certain pollen-mother-cells.* The agreement of these independent researches is very striking. Having some preparations of the stages in question from anthers of *Lilium Martagon*, as well as a stock of good material, I have made some observations on the subject, and since my results differ somewhat from those just mentioned, it seems desirable to publish a short account of them.

All the details which follow refer to anthers of *Lilium Martagon* fixed last summer in Hermann's solution, chromic acid, or absolute alcohol. After proper hardening, they were preserved in a mixture of alcohol, glycerin, and water. Most of the observations have been made on microtome sections of 5–15 μ in thickness, but these have been compared with hand sections from alcohol material. The sections were stained in various ways: on the whole, for Hermann or chromic material I prefer Henneguy's safranin or Flemming's orange method,† and for thick sections of alcohol material a mixture of methyl-green and acid fuchsin.

When the nuclear plate is first formed, each chromosome has been for some time completely divided by a longitudinal fission.‡ The segments lie side by side, and the fission is seen as a dark line, except at one end, where the segments have begun to separate (fig. 42). This is the end nearer the axis of the spindle, and it is attached to a sheaf of spindle fibres *sp*.

The chromosome itself is straight, and its segments are therefore straight too, except for the bend where they have begun to separate, and for any irregular curves where they do not adhere closely (fig. 42).

In the typical diaster stage the segments are completely separated, and are arranged in two groups on the way to the poles, but they are

* J. B. Farmer, "Ueber Kerntheilung in *Lilium*-Antheren besonders in Bezug auf die Centrosomen-Frage," Flora, 1895, Heft i. [Pollen-mother-cells of *Lilium Martagon, candidum, speciosum, tigrinum*.] W. L. Belajeff, "Zur Kenntniss der Karyokinese bei den Pflanzen," Flora, Ergänzungsband, 1894. [Pollen-mother-cells of species of *Larix, Lilium*, and *Fritillaria*.]

† For details of these processes see Bolles Lee, 'Microtomist's Vade-Mecum, 3rd English edition, pp. 70 and 160. Before using Flemming's method I usually leave the sections for 10–15 minutes in a 1 per cent solution of permanganate of potash, afterwards clearing with clove oil.

‡ L. Guignard, 'Nouvelles Études sur la Fécondation,' p. 175.

no longer even approximately straight. Each is V-shaped, with the angle turned towards the pole which it approaches (fig. 43). Thus in the interval between the formation of the nuclear plate and the complete separation of each chromosome into two segments, the shape of

Fig. 42.

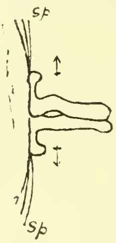
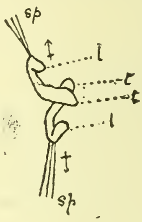


Fig. 43.

Fig. 44.



each segment has changed from the half of an approximately straight rod to an acute-angled V. A complete study of the stages intermediate between these extremes is necessary to determine how this change occurs. The view hitherto accepted is that as the free end, or *limb* (*l*) of the segment lengthens at the expense of the other end or *trunk* (*t*), it bends outwards with reference to the whole spindle (fig. 44).* Such intermediate forms as those figured in fig. 44 support this theory.

The view advanced by Professor Farmer and Mr. Belajeff independently of each other differs widely from this. They have come to the conclusion that a second longitudinal fission exists in the chromosome besides that along which the actual separation takes place. The relative positions of these two fissions are shown in fig. 45. A is a diagram of a chromosome seen in profile, B a diagram of

Fig. 45.

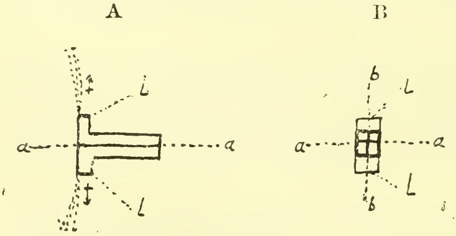
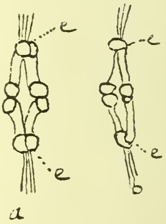


Fig. 46.



the same chromosome seen end-on. The fission shown in A along the line *a*, *a*, is that along which the separation of the segments actually takes place. The second fission along *b*, *b*, is visible in B. It is

* Strasburger, 'Controversen der indirecten Kerntheilung,' p. 31. L. Guignard, op. cit., p. 176.

incomplete, that is, it does not extend from end to end of the chromosome. The ends *l*, *l*, remain undivided. If we imagine the limb of each segment following the course of the spindle fibres as indicated by the arrows in fig. 45, A, and at the same time the fission along *b*, *b*, opening out, it is clear that each segment becomes V-shaped by a partial fission, and without any elaborate curving. Such figures as the chromosomes drawn in fig. 46, *a* and *b*, are readily and simply explained by this hypothesis. I am convinced, however, that the forms assumed by the chromosomes in earlier stages are inconsistent with it.

I cannot hope here to do more than give a short account of my own view, and indicate the nature of the evidence which supports it.

Fig. 47.

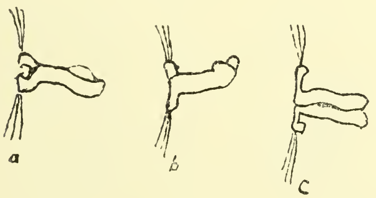
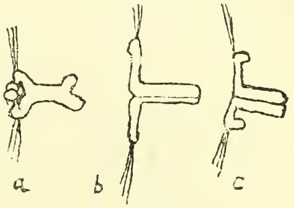


Fig. 48.



The large number of spindle figures examined may conveniently be divided into three classes, distinguished by the shape of their chromosomes.

1. The limb of each chromosome occupies less than a quarter of its whole length.

2. The limb is between a quarter and half the whole length of the chromosome.

3. The length of the limb is more than half the whole length of the chromosome.

1. This class includes three types (fig. 47): chromosomes with limbs which curve inwards with reference to the whole spindle figure (*a*), chromosomes with straight limbs (*b*), and with outcurving limbs (*c*). In 100 chromosomes at this stage I counted 53 with incurved limbs, 33 with straight limbs, and 14 with outcurved limbs.

2. The three types reappear in this class (fig. 48), but their comparative frequency is rather different. In 100 chromosomes the limbs of 52 were incurved, 30 outcurved, and 18 straight. That is, while the proportion of chromosomes with incurved limbs to the whole is about the same as in the earlier stage, the outcurved limbs have increased in number at the expense of the straight ones. This is easily understood when we consider that in the case of the chromosome with incurved limb the surface in contact with the spindle fibres was originally the outer surface of the chromosome (fig. 47 *a*), while those with straight and outcurved limbs adhere by the surface formed by

the fission. It would therefore be difficult to conceive an incurving limb straightening, or a straight limb curving inwards, but it is easy to imagine a straight limb curving outwards.

The chromosomes with incurved limbs commonly have their free ends pressed together at this stage (fig. 48 *a*), but examples with the ends barely touching, or quite free, are numerous.

3. The difficulty of interpreting the forms of chromosomes in these later stages arises from the fact that as the limb *l* in such a figure as fig. 49 increases in length at the expense of the trunk *t* they soon become of about equal length and are hardly to be distinguished from each other (fig. 50). This is emphasised by the tendency of the figure to become pinched up as if it were hinged at *e e*, so that limb and trunk lie close together and almost parallel (fig. 50). The front view of a

Fig. 49.

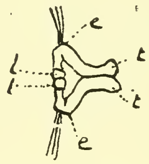


Fig. 50.

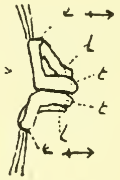
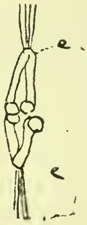


Fig. 51.



chromosome in this stage resembles fig. 51. When, as often happens, the elbows *e e* curve outwards or inwards (see arrows in fig. 50) the appearance of the chromosome in front is that of fig. 46*a*, in three-quarters view that of 46*b*.

The uniformity of shape of the chromosomes in the spindle just before the diaster stage begins, is very remarkable. The great majority of chromosomes are of the shapes figured in figs. 46 and 51, and the whole figure certainly recalls the "tonnen-form" in Flemming's drawings of heterotype division. I have suggested in figs. 47 *a*, 48 *a*, 49, and 50 how a chromosome with incurved limb may assume the appearance of fig. 51 (front view). A similar series is easily constructed for chromosomes with outcurving limbs (cf. fig. 44). Most straight limbed chromosomes curve outwards in later stages, but a few continue straight after separation and never assume the V-shape at all. The discussion of other irregularities must be postponed.

It will be seen that the explanation just given of the assumption of the V-shape by the segments of chromosomes as they separate differs only in detail from that hitherto accepted. I believe that the appearances shown in fig. 46 are the result of the bending of the segments and are independent of any partial fission. There is no doubt, however, that the process is more complicated than was formerly thought.

It is dangerous to speculate on what takes place during life from observation of a number of stages in artificially fixed material. If however, the separation of the chromatic segments really takes place as I have described, we cannot conceive them as drawn apart by the contraction of the spindle fibres. Each segment must move along the set of fibres with which it is in contact, using them to some extent as a support. This view is supported by the odd curvatures of the chromosomes, which if not due to the action of fixing agents, certainly suggest a wriggling motion suddenly arrested.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.

*Including Original Communications from Fellows and Others.**

ZOOLOGY.

VERTEBRATA:—Embryology, Histology, and General.

a. Embryology.†

Ancestry of Vertebrates.‡—Prof. W. N. Parker calls attention to Mr. Willey's recent work § on *Amphioxus*, in which it appears that an excellent description is given of the habits, anatomy, and development of *Amphioxus*, while a special section is devoted to the Ascidians. Mr. Bateson's division of the Hemichorda is accepted, and the forms which constitute the group are described and compared, while an account is given of the development of *Tornaria* and of the larvæ of Echinoderms. The general conclusion to which Mr. Willey arrives is that "for the present we may conclude that the proximate ancestor of the Vertebrates was a free-swimming animal intermediate in organisation between an Ascidian tadpole and *Amphioxus*, possessing the dorsal mouth, hypophysis, and restricted notochord of the former, and the myotomes, cœlomic epithelium, and straight alimentary canal of the latter. The ultimate or primordial ancestor of the Vertebrates would, on the contrary, be a wormlike animal whose organisation was approximately on a level with that of the bilateral ancestors of the Echinoderms."

Succession of Teeth in Man.‖—Herr W. Dietlein has taken an average of 7500 individuals as to the time of the appearance of the permanent teeth. His table is as follows:—

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, &c., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development and Reproduction, and allied subjects.

‡ Nature, li. (1895) pp. 433 and 4.

§ 'The Ancestry of the Vertebrates,' London and New York, 1894.

‖ Anat. Anzeig., x. (1895) pp. 354–7.

	Upper jaw.		Lower jaw.	
I 1	7 yr.,	10 m.	7 yr.,	4 m.
I 2	8 ,,	9 ,,	8 ,,	3 ,,
C	11 ,,	9 ,,	10 ,,	9 ,,
Pm 1	10 ,,	2 ,,	10 ,,	10 ,,
Pm 2	11 ,,	3 ,,	12 ,,	4 ,,
M 1	7 ,,	5 ,,	7 ,,	
M 2	12 ,,	10 ,,	12 ,,	4 ,,
M 3	24 ,,		24 ,,	

He makes three interesting generalisations :—

(1) In higher-class schools the children showed a more rapid acquisition of the second set than in the Volkschulen. This is probably due to the difference of nutrition.

(2) The canine of girls appears about three-quarters of a year sooner than that of boys (as among anthropoids), and the same is true of the second molar. It well known that girls have for a time a more rapid rate of growth than boys.

(3) Townsfolk show in about 3 per cent. of cases a loss of the lateral upper incisor, but in country-folk the percentage is only ·5 per cent. The absence depends greatly on the form of the gum ; among the townsfolk of Freiburg the dolichocephalic or leptoprosopic type prevails, in the country the brachycephalic or chamæprosopic type. The former is associated with a high narrow gum, the latter with a flat broadly arched gum (Kollmann).

Development of Auditory Ossicles.*—Dr. M. Zondek has investigated this difficult problem in embryos of rabbit, ox, and man. He agrees with the majority that malleus and incus are derived from the first arch ; he finds that the stapes arises in continuity with the hyoid arch, but the lamina stapedialis in connection with the labyrinth wall. Before malleus and incus become cartilaginous they form a continuous mass of cells, but with the chondrification a joint is formed. The author has some interesting notes on the various histological stages through which the arches and their derivatives pass.

Menstruation of Semnopithecus Entellus.†—Mr. W. Heape gives an account of the menstruation of this monkey, describing fully the histology of the uterus in its different stages. These stages are eight in number, and belong to four different periods. The first period is that of rest, and contains the first or resting stage. In the second period, which is that of growth, two stages are recognised; in one there is a growth of stroma and an increase of the vessels. In the third period, or that of degeneration, there is a breaking down of vessels, the formation of lacunæ, the rupture of lacunæ, and the formation of the menstrual clot. In the fourth period, or that of recuperation, there is a single recuperation stage. Mr. Heape thinks that the existence of these periods, although they cannot be quite sharply defined, is nevertheless very marked and real, and they indicate that a substantial periodic growth of the mucosa has arisen by degenerative changes, when a fertilised ovum is not present.

* Arch. f. Mikr. Anat., xliv. (1895) pp. 499-509 (4 figs.).
† Phil. Trans., clxxxv. B. (1894) pp. 411-71 (7 pls.).

Corpus Luteum of Mouse.*—Dr. J. Sobotta finds that the corpus luteum of the mouse, the history of which he has traced, consists of enlarged epithelial cells within a connective-tissue framework. It is an organised structure, somewhat carcinoma-like, somewhat liver-like. It arises wholly from a hypertrophy of the epithelial cells of the Graafian follicle, without any process of proliferation. The only cells which multiply are the connective-tissue theca-cells, but neither they nor wandering cells have any direct share in forming the corpus luteum. Its development is very rapid; in three days it is fully formed.

Double Monsters.†—Professor O. Schultze has been studying the effect of fastening the eggs of *Rana fusca* to glass slides, fertilising them, and then fixing them between slides so that they cannot revolve when turned upside down. It appears that a considerable number of the eggs exposed to the disturbing effects of gravitation develope into double monsters of various characters. Some develope two heads and two sets of gills on each. The formation of these double individuals is in some way due to the rearrangement of the substance of the cell when inverted and acted upon by gravity, so that the heavier part is drawn down and the lighter rises; this results in a modification of the egg substance which acts like a partial division of the egg, and allows each of the two cells to develope somewhat as if isolated. As to the general question of the formation of double monsters in nature, the author thinks that the cause is to be found in some abnormal state of the ovarian egg. Double individuals may be regarded as coming from imperfectly divided ovarian cells; a complete division of the germ material produces separate individuals, a very slight division, double monsters; between these extremes are identical twins.

Development of Tarsus of Pelobates fuscus.‡—Herr M. Chomiakoff finds that the astragalus and the calcaneum have from the first their adult form and relative length. There is no trace of fusion out of several parts, nor of a distinct intermedium. The prehallux arises as a single rudiment, from which are differentiated first a basal and then a terminal segment. The basal segment is not a centrale (Howes and Ridewood), still less are the two parts cuneiforms (Dugès). In the rudiment of the prehallux cartilage appears later than in the digits, and the structure must be regarded as secondary, and not as a sixth toe. As to the other parts of the tarsus, the earliest element is that which Gegenbaur and Hoffmann regard as the tarsal of the first digit. This is probably the centrale. The distal tarsals arise as a common rudiment, from which are differentiated first that (probably a fusion of two) which is opposite the second and third digit, and then that opposite the hallux. This last tarsal divides into two parts, so that there are *four* distal tarsals in the adult.

Development of Amia, Lepidosteus, and Necturus.§—Dr. F. Fülleborn has a report on the results of his visit to North America to observe the development of these lower Vertebrates. He gives some

* Anat. Anzeig., x. (1895) pp. 482-90 (7 figs.).
† Arch. f. Entwicklungsmechanik, i. (1894). See Amer. Natural., xxix. (1895) pp. 287-8.
‡ Bull. Soc. Imp. Moscou, 1894, pp. 351-6 (1 pl.).
§ SB. Akad. Wiss. Berlin, 1894, pp. 1057-70.

details of the development of *Amia*, and states that a larva 3 cm. long had on the whole the appearance of an adult *Amia* in miniature. He found that in *Lepidosteus* the first ganoid scale appeared in forms 10 cm. long. The author appears to have made a good collection of materials for a complete monograph.

Gills of Ceratodus Embryos.*—Dr. R. Semon reasserts his observation that there is no hint of external (or larval) gills in *Ceratodus*-embryos, since Herr P. Clemens has interpreted one of his figures so as to suggest the presence of these organs.

Spermatogenesis of Selachians.†—M. A. Sabatier continues his remarks on this subject.‡ He finds that in all cases there is a formation of primitive nests of germs under the form of a plasmodium, and due to the amitotic multiplication of the nuclei of the connective germinal tissue. Secondary nests are formed by the amitotic multiplication of the nuclei of the membrana-propria of the testicular cavity. These germs are situated in a common mass of protoplasm, which may become the caducous protoplasm. The germ nuclei acquire a proper protoplasm, and so become proto-spermatoblasts. A head is formed for the spermatozoon at the expense of a portion of the nuclein of the cell, while the rest forms a cephalic hood. Mitotic division is twice repeated for these cellular elements, and in this way we arrive at the trito-spermatoblasts. Radiated or caudal filaments are formed at the expense of the cytoplasm, and there is some resemblance to the spermatozoa of Locustidæ, on which the author remarks.

Cephalic Neural Crest of Selachii.§—Sig. A. Coggi describes in *Torpedo* and *Pristiurus*, in the region of the fore-brain, a portion of the neural crest, which he calls the anterior ganglionic ridge; its elements arise from the cerebral wall and from the ectoderm, as in the other parts of the ganglionic ridge; but its rôle appears to be that of passive mesenchyme, for it is not associated with the origin of nerves. The character of passive adaptability is elsewhere illustrated in other parts of the ganglionic ridge. The first division of the neural crest is due to hypertrophy of epidermic cells in the auditory region; thus a pre-auditory and a post-auditory region are distinguished. A further division is associated with the appearance of the trigeminal and facial in the pre-auditory region. Thereafter the trigeminal group is divided in its ventral portion, "the ganglionic lamina," into two parts, belonging anteriorly to the ciliary, posteriorly to the trigeminal proper, and so on. In these partitions the ganglionic lamina is passive, and subject to the influences exerted on it by epidermis, cerebral wall, somites, and gut. Of importance also are its relations with a transitory superficial sense-organ, one of Kupffer's "placodes," which is divided into an anterior portion in relation with the ciliary and a posterior portion in relation with the trigeminal proper.

Development of Egg in Flat-fishes and Pipe-fishes.‖—Mr. J. T. Cunningham has been directing his attention to a history of a definite

* Anat. Anzeig., x. (1894) pp. 332–3.
† Comptes Rendus, cxx. (1895) pp. 205–8. ‡ See *ante*, p. 156.
§ Atti R. Accad. Lincei (Rend.), iv. (1895) pp. 265–9.
‖ Journn. Mar. Biol. Assoc., iii. (1895) pp. 258–70 (3 figs.).

body in the yolk known as vitelline nucleus, but quite distinct from the proper nucleus of the egg. In the fresh state it is almost impossible to perceive any trace of this body, but after treatment with dilute acetic acid the structure can be easily seen. Examined with a high power it is found to consist of a spherical collection of minute granules. It does not appear to be present in the youngest ova, but becomes visible when they have reached a certain definite size. It makes its appearance in the form of a few granules close to the wall of the germinal vesicle, and as the egg becomes larger it is gradually more and more separated from the latter, while increasing in size and opacity. A history is given of the ovum in a flat-fish from the time of its first origin in the germinal epithelium to the stage in which it is almost ready for extrusion. This history is probably almost exactly similar in all fishes which produce pelagic eggs and have an annual spawning season. The ova of the pipe-fish have been examined, and they have been found to have as many as four vitelline nuclei.

Pronephros of Salmonidæ.*—Dr. J. Sobotta finds that the pronephros of the trout arises from a diverticulum of the body-cavity in the region of the fifth and sixth segments. It lies at first laterally and dorsally, but subsequently takes up a wholly dorsal position above the gut. It appears after the enclosure of the yolk is completed, later than the pronephric duct, and is slowly but wholly shut off from the body-cavity. At the time of the first heart-beat it is divided into (1) a median part —the future chamber; and (2) a lateral part, in direct continuity with the pronephric duct—the secreting canal portion. The latter comes to be connected with the chamber by a simple funnel-like opening. From cells lying between the chambers of the two sides, a blood-vessel is formed; this invaginates the walls of both, and forms the glomerulus. Meantime the anterior part of the duct, which is at first straight, is bent upon itself in a loop, and this looped part enters into an important connection with the anterior ends of the cardinal veins, projecting into them. A series of single vasa afferentia arise from the aorta, but there is no special renal artery. This primitive state of affairs represents for a considerable time the whole excretory system.

β. Histology.

Cytotropism.†—Prof. W. Roux reports the results of his recent experiments on frogs' eggs. These eggs were teazed apart and observed under precautions necessary to prevent currents and jars in the liquids. It was found that movements may take place which result in the union of some of these isolated cells. These movements are gliding or creeping in form. In many cases, especially when salt solution is used, the cells throw out pseudopodia, which may anastomose with pseudopodia of other cells. "In detail these movements are found to be of limited extent, but yet capable of resolution into considerable complexity." Only cells having diameters of from 20 to 60 μ show the phenomena, and then only when not more than their own diameter apart. Many cells may

* Anat. Anzeig., x. (1894) pp. 333–6 (2 figs.).
† Arch. f. Entwicklungsmechanik, i. (1894). See Amer. Natural., xxix. (1895) pp. 385–7.

eventually come together and form a firm aggregate out of a scattered collection of isolated cells. Beside the change of position there is a marked change of form; a cell may even divide while moving towards another cell. The author thinks that these movements are the result of chemical action, and it would appear to be clear that they are not simply physical, but results of life in the cells. They may be compared with those of sperm cells towards ova, and of conjugating Infusoria towards one another, and they may be all classed as cases of cytotropism.

Zonula and Ora Serrata.*—Dr. W. Schoen finds that there is no ora serrata in the eyes of young children, for the line of transition to the retina is straight and without teeth. The macroscopic teeth, regarded as normal, are functional modifications acquired during life. The term ora serrata may be retained, but it primarily represents 600–800 microscopic processes, the origins of the zonula fibres; the forty or so large teeth are secondary. A second deeper group of zonula fibres arises from the epithelial cells of the pars ciliaris. These zonula fibres are continuations of the membrana fenestrata and of the radial supporting fibres of the retina. The retina is continued not only in the ciliary epithelium, but in the whole system of supporting fibres which extends to the angle of the ciliary body and is attached to the capsule of the lens.

Endings of Secretory Nerves.†—Professor C. Arnstein has investigated these in the pancreas, the salivary glands, and in the Harderian gland of rabbit, cat, and the like. He has also instigated Herr Dmitrewsky to do the same for the mammary glands, Herr Ostroumow for the skin-glands, Herr Timofeew for the prostate.

In tubular or acinous glands alike, the nerves form a web on the membrana propria, and from this web circumcellular threads pass to the glandular cells. But they form no plexus nor network, but end in a definite terminal structure, often like a bunch of grapes or like a tendril with varicosities. The structure arises by budding and by secondary connections of varicose threads. Various forms may be seen on one cell.

Intercellular Bridges of Smooth Muscle.‡—Herr H. Boheman finds that the smooth muscle-cells in the alimentary canal of cat, dog, pig, and rabbit are connected by intercellular bridges. These are not, as Barfurth described, low ridges in the longitudinal direction of the cells, but consist of fine strands, which extend either for a short distance from one cell to its nearest neighbours, or for a long distance uniting more distant cells. The muscle-cells, like the epithelial cells of the rete Malpighii, are surrounded by fluid-containing spaces, which are in direct connection with the lymph courses in the musculature. No cementing substance between the cells was demonstrable.

Centrosome and Attraction-Sphere in the Resting Cell.§—Dr. B. Rawitz finds that the resting cell of the Salamander's testis is a bilaterally symmetrical element, with a regulating central "organ," namely the

* Anat. Anzeig., x. (1895) pp. 360–4 (5 figs.).
† Tom. cit., pp. 410–9 (12 figs.).
‡ Tom. cit., pp. 305–15 (6 figs.).
§ Arch. f. Mikr. Anat., xliv. (1895) pp. 555–79 (1 pl.).

attraction sphere and its centrosome. In the centre the cytomitome and the linin-framework of the nucleus are united.

Mechanism of Cell-Division.*—Dr. L. Drüner has studied this in the testes of the Salamander, which have served so many investigators as suitable objects. Unable to accept Flemming's conclusion that the divergence of the poles is due to a centrifugal shortening of the polar rays, Drüner inquires afresh into the forces by which the central corpuscles are separated, and are kept in position at the time of the strongest tension of the mantle-fibres. Apart from the polar rays, there are two other sets of fibres proceeding from the poles, namely—the fibres of the central spindle (central fibres) which run continuously from pole to pole, and the fibres of the spindle-mantle (mantle fibres) which are attached to the halves of the chromosomes. The mantle-fibres alone are contractile. The central spindle-fibres exhibit elasticity, for they are bent by polar pressure and they straighten when released from this. They keep the poles apart against the action of the contractile mantle-fibres. The polar fibres have no contractility, but by their growth they displace the pole towards the cell-membrane. In fact, the author speaks of both central spindle and polar rays as *Stützorgane.* Of much interest is the chapter entitled "An attempt towards a comparative morphology of cell-division."

Nuclear Structure and Division.†—Dr. O. Van der Stricht describes irregularly contoured and lobed nuclei in some of the epithelial cells of larval Salamanders. The peculiarity of shape appears to be associated with the last stage of mitosis, during the final reconstruction of daughter-nuclei. Other cases of nuclear polymorphism are also discussed.

Wandering Cells of the Frog.‡—Dr. A. A. Kanthack and Mr. W. B. Hardy find that the three different kinds of wandering cells, the eosinophile cell, the hyaline or non-granular cell, and the basophile rose-reacting cell, proliferate while free in the body fluids. The different kinds of cells multiply independently, so that the numbers of any one kind of cell may vary without a corresponding variation in the numbers of the other cells. The three kinds are differently affected by different substances introduced into the plasma. For example, solid substances of indifferent nature affect only hyaline cells, which ingest the particles. Anthrax and filamentous bacilli, when first introduced, attract only the eosinophile cells, which kill or maim them by means of a substance derived from their stored eosinophile granules. After the bacilli have been thus acted on they can become the prey of the hyaline cells. Vermilion and yeast cells attract both hyaline and eosinophile cells. The rose-reacting cells are increased in number and size by alteration in the chemical composition of the plasma. It is pointed out that the eosinophile cells are highly specialised bodies endowed with the power of movement and with glandular powers directed to the production of a bactericidal or at least antitoxic substance. With regard to the morphology of these cells the authors point out that the sporadic mesoblast of the frog contains elements precisely similar to those that

* Jenaische Zeitschr. f. Naturwiss., xxix. (1894) pp. 271–344 (5 pls.).
† Bull. Acad. Belg., xxix. (1895) pp. 38–58 (1 pl.).
‡ Phil. Trans., clxxxv. B. (1894) pp. 279–318 (1 pl.).

compose the similar tissue of such a very different animal as the crayfish. This resemblance suggests to them that the three cell-elements of the frog have arisen by the differentiation of a primitive homogeneous sporadic mesoblast. With regard to the physiology of the cells, the extra-cellular nature of the eosinophile cells is pointed out. This cell is in short a unicellular gland which preserves intact the initial step of the primitive process, contact with its prey. The hyaline cell also effects contact with its prey, but the extra-cellular discharge is insignificant or absent.

Morphology of the Cell.*—Herr G. Schlater was by a misprint in the original spoken of as Schloter.

γ. General.

General Physiology.†—Prof. Michael Foster has a review of Verworn's ‡ work on general physiology, to some points in which we have already called attention.§ Prof. Foster thinks that the author exaggerates the value of the point of view of cellular physiology. He thinks that, important as is the idea of the cell viewed as a morphological unit, it is of much less importance when dealt with as a physiological unit. The reviewer is of opinion that the author is quite wrong in taunting physiologists with the methods of inquiry which they have adopted during the last half century. He urges that the application of exact physical methods to the study of muscles, so far from having brought us to a point beyond which we cannot go, seems just now to be opening up the way to fruitful conceptions of the intimate nature of muscular contraction. As to blaming physiologists for their comparative neglect of the lowest invertebrate forms, experience and reflection have shown Dr. Foster that, after all, the physiological world is wise in spending its strength on the study of the higher animals. He thinks that the contraction of a striated muscle is easier to grasp and understand than the amœboid movements of the lowest forms. At the same time the reviewer concludes that this contribution to general physiology is a volume to be welcomed by all.

Outlines of Zoology.‖—Mr. J. Arthur Thomson has produced a second edition of his text-book, the figures in which are a decided improvement on those in the first. He states in his preface that he has endeavoured to take advantage of the suggestions of kindly critics. The book is intended to serve as a manual to the student of zoology, for use in the lecture-room, museum and laboratory, and as an accompaniment to several well known works cited in the Appendix. Mr. Thomson appears to be fortunate in having the assistance of numerous authorities on subjects which they have made especially their own.

Vertical Distribution of Pelagic Life.¶—Prof. A. Agassiz, while on a visit to the Bahamas, thought that he could not select a better spot

* Arch. f. Mikr. Anat., xliv. (1894) pp. 249–58 (1 pl.).
† Nature, li. (1895) pp. 529–30.
‡ 'Allgemeine Physiologie. Ein Grundriss der Lehre vom Leben,' Jena, 1895.
§ See *ante*, p. 40.
‖ 'Outlines of Zoology,' Edinburgh and London, 1895, 820 pp., 266 figs. in text.
¶ Bull. Mus. Comp. Zool., xxvi. (1894) 203 pp. (47 pls.).

for finally settling the vertical distribution of pelagic life than off Havanna, which is in deep water, close to the track of the Gulf Stream, which is remarkable for the mass of pelagic life which it carries along its course; he towed in 100, 150, 250, and 300 fathoms, and for an equal time on the surface, at or near the same locality. At no depth did he obtain with the Tanner net any species which were not also at some time found at the surface. Even at 100 fathoms the amount of animal life was much less than in the belt from the surface to that depth. At 150 fathoms there was still less, and at 250 and 300 fathoms the closed part of the Tanner net contained nothing. This, Prof. Agassiz points out, is in accordance with the observations of the Plankton expedition so far as they have been published. He adds that many observations which formed the basis of statements proving the indefinite extension in depth of the pelagic fauna and flora, are of little value, owing to the imperfect working of the apparatus used. In a towing for 20 minutes, at a depth from 100 to 110 fathoms, only one Copepod was brought up from that depth, while in the open part of the net he obtained several specimens of *Eucope*, many pails of *Diphyes*, numerous Copepods, *Alciope*, Schizopods, larvæ of Brachyurans, Macrurans, *Doliolum*, *Appendicularia*, Gastropod larvæ, and *Collozoum*. A second tow at 300 fathoms resulted in the closed part of the net containing nothing, and an examination of the contents of the open part of the net, which remained open from 300 fathoms to the surface, showed that it contained nothing that had not been obtained from the shallower depths between the surface and 100 fathoms. Other observations resulted in very similar kinds of collections.

Theory of Descent and Heredity.*—Prof. C. Emery directs attention to Fabre's thesis that instincts do not vary as such (though they may be modified by intelligence), that they are distinct and fixed for each species, and that they show evidence of gradual evolution from simpler instincts. It may be noticed that this is just what used to be said of structural characters, and is mainly an *argumentum ad ignorantiam.* But Emery's solution is that the instincts, to whose evolution we have no clue, are cases of "saltatory evolution"—abrupt variations.

The author then discusses budding. In sessile organisms, such as Hydroids, liable to have parts bitten off, it was probably at first a process of regeneration, adaptive in origin. He dissents from Weismann's view, that budding is traceable to a sort of parthenogenesis or sporulation of special cells, one for each bud. Such a case as *Cœnurus* he regards as due to the hereditary fixing of a teratological multiplicity, comparable to poly-embryony, and finds in it another instance of saltatory evolution. Emery does not seem to attach any primary importance to the conspicuously vegetative condition of most animals which bud.

Darwinism and Experiment.†—Herr G. Wolff has some criticisms on the theory of natural selection. He believes Darwinism is breaking up: "Es mehren sich die Anzeichen, dass die Episode des Darwinismus überwunden werden wird." Episode, forsooth! The theory does not explain *origins*, the chances of a fit variation arising are small except in the case of gradual progressive change, and so on, as has been said before.

* Biol. Centralbl., xiv. (1894) pp. 721–7. † Tom. cit., pp. 609–20.

Wolff's main point is that all vital phenomena are adaptive; useful adaptation is the very essence of an organism; to try to explain adaptation is to try to explain life.

Herr Wolff made the following experiment. He removed the lens from the larva and adult of *Triton tæniatus.* In a few months it was perfectly regenerated by the *iris.* The inner epithelial layer of the iris lost its pigment, proliferated at the margin of the pupil, and formed a lens-sac, and eventually a perfect normal lens.

Inheritance of Acquired Characters.*—Prof. A. S. Packard discusses this subject under several heads. He commences with the physical basis of heredity, and appears to incline to the theory of Hertwig. He next treats of the heredity of characters acquired during the lifetime of the individual, in which he expresses his admiration for the observations of Herbert Spencer on this subject. He concludes that "we feel justified from the facts now known in holding the view that characters acquired in the lifetime of an individual, as the result of functional activity in certain regions of the body, or in certain organs, may under favourable conditions be more or less completely transmitted; or at least the tendency to such transmission, if latent in one generation, may appear in a succeeding one; and in the earlier geological ages this principle may have been much more active than at present. The hypothesis seems to be a good working one to account for phenomena which cannot be otherwise explained, and should not in consequence of adverse, though often very able and candid, criticism be set aside."

Inheritance at corresponding periods of life is next treated, and what the author thinks to be signal examples of the inheritance of characters at corresponding periods of life are cited. The fourth section of the essay deals with homochronous heredity in insects with a hypermetamorphosis. The examples cited are thought by the author to be evidently the result of adaptation in response to a series of stimuli whose nature is in part appreciable, but in part unknown. In treating of the inheritance of acquired characters by Lepidoptera Prof. Packard is dealing with a subject which he has made more particularly his own, and he concludes with a plea in favour of the adequacy of Neolamarckism.

Subterranean Fauna of North America.†—Prof. A. S. Packard discusses the origin of the subterranean fauna of North America, in the course of which he complains of some of the more eminent writers on this subject, such as Professors Weismann and Ray Lankester, who have not themselves had practical experience in collecting and studying cave animals and their surroundings, and who have not carefully read the recent literature on the subject; they seem to be overmastered by speculative views, and prefer to make an extremely vague, unscientific, and *a priori* speculation rather than adopt an opinion based on the inductive method. Mr. Herbert Spencer, however, has with rare good sense and penetration recognised the probability of the active agency of the principle of transmission of acquired characters in the origin of cave life. The author compares with subterranean fauna the experience gained by

* Proc. Amer. Acad., xxix. (1894) pp. 331–70.
† Amer. Nat., xxviii. (1894) pp. 727–52 (1 pl.).

those who have had to do with deaf-mute asylums in the United States, and he concludes that after a few generations the society of troglodytes, vertebrate and invertebrate, might be compared to a newly established asylum of deaf-mutes, or an asylum for the blind if they interbred in the same proportions. Judging by what we know of the sudden production of deaf-mutes in human societies, only two or three generations might suffice to make the congenitally blind preponderate in numbers.

Distribution of Assimilated Iron Compounds in Animal and Vegetable Cells.*—Prof. A. B. Macallum has a preliminary notice on the distribution of assimilated iron compounds other than hæmoglobin and hæmatins in animal and vegetable cells. He finds that iron, firmly combined, is a constant constituent of animal and vegetable chromatin. Another substance, less rich in iron, is found in nucleoli. The chromophilous substance in ferment-forming cells contains iron, and the cytoplasm of protozoan organisms, which also probably secretes ferments, yields evidence of the presence of a firmly combined iron compound. A firm compound of iron is present in the chromophilous substance of the cytoplasm of Fungi. Of the non-nucleated organisms, Bacteria, owing to their minuteness, have, with one exception, given little evidence of the presence of an organic iron compound; but in the Cyanophyceæ the chromophilous portions of the central substance contain iron.

Nests of Pelagic Fishes.†—Prof. C. Möbius describes a fish's nest from the Mid-Atlantic. It consisted of a sack, woven of fine silk-like threads, and bearing over a million eggs. The sack had a diameter of 40 cm. at its mouth, a depth of 50 cm., and two holes at the lower end. The threads seem to consist of an insoluble albuminoid akin to the fibroïn of silk or to byssus. Möbius calls attention to previous notes on the " nests " of pelagic fishes by J. T. Cunningham, L. Agassiz, and A. Agassiz, and describes what appeared to be the nest of a species of *Antennarius*.

Tunicata.

Budding in Tunicata.‡—Mr. W. Garstang has prepared an interesting essay on this subject, on which, as our readers are aware, numerous papers have lately been written. He finds the conclusion to be inevitable that all the types of budding in Tunicata are ultimately referable to an ancestral process of embryonic longitudinal fission, as Balfour and Uljanin have already suggested. He thinks we may also conclude that budding has probably not arisen more than once within the group of Tunicata, since the various types of asexual reproduction found within it form a single phylogenetic series, and are connected with one another by numerous gradations; the differentiate type of budding is probably in many respects more primitive than the undifferentiate. Yet there have been modifications in both directions since budding first arose, leading in some cases to a secondary simplification of the organisation of the bud, and in others to a slightly increased complexity.

* Proc. Roy. Soc. Lond., lvii. (1895) pp. 261–2.
† SB. K. Akad. Berlin, 1894, pp. 1203–10 (3 figs.).
‡ Science Progress. ii. (1895) pp. 43–67.

Development of the Nervous System and Vibratile Organ in Larvæ of Compound Ascidians.*—M. A. Pizon has studied a number of compound Ascidians, especially *Fragarium* and *Amaroucium*. He finds in these that the vibratile organ is a portion of the primitive endoderm vesicle, as it is in the buds of all compound Ascidians. This organ is formed independently of the vesicle and nerve-tube. Its connection with the vesicle is accidental and temporary, and Hjort's error in believing that the vibratile organ was a remnant of the nerve-tube was due to his not having studied sufficiently young stages. As to the definite ganglion of a fixed oozoite it is a product of the larval nervous system, as the author has already observed in the Botryllidæ and as Hjort has seen in *Distaplia*.

Mollusca.

α. Cephalopoda.

Habits and Reproduction of Rossia macrosoma.†—M. E. G. Racovitza gives an interesting description of the habits of this cuttle-fish. It buries itself, like *Sepiola*, in the sandy bottom; feeds on small crustaceans and fishes; and seems to have a short life—probably a year. In spring, the males and females are small, with slightly developed gonads; in August and September they are mature. The copulatory region in the female and the hectocotylus-gland of the male develope greatly. Copulation probably occurs as in *Sepiola*; the spermatophores, directed by the penis into the funnel, reach the mantle-cavity of the female probably along a special groove. Along this groove they pass to the receptive region, where they are glued by the secretion of the hectocotylus-gland. There they burst, introducing the end of the spermatophore-tube under the skin, and form a second series of sperm-reservoirs.

The two arms of the male inserted in the mantle-cavity of the female during copulation, hinder her from breathing; hence her resistance and the straying of spermatophores.

After copulation and the disruption of the spermatophores the membrane of the sperm-sac bursts, the spermatozoa are scattered, and fertilise the ova just as these pass from the oviduct. The almost spherical eggs are laid singly, each within a resistant yellowish shell. They are often grouped on shells and the like. The hectocotylus-gland is an invagination of the epidermis of the grooves which separate the rows of suckers. The supporting cells are got rid of at sexual maturity and the epithelium becomes wholly glandular.

So-called "White Body" of Cephalopods.‡—Herr V. Faussek discusses this strange tissue or organ which lies between the eyeball and the optic ganglion of Cephalopods, within the common ectodermic sheath. Its structure in the adult suggests that it is an area for the formation of blood-cells; the development shows that it arises from the ectoderm in close connection with the nervous system. It is difficult to bring these two facts together. Schäffer indeed speaks of the ectodermic

* Comptes Rendus, cxx. (1895) pp. 462–4.
† Arch. Zool. Expér., ii. (1894) pp. 491–539 (3 pls., 6 figs.).
‡ Mem. Acad. Imp. St. Pétersbourg, xli. (1893, received 1895) pp. 1–28 (1 pl.).

origin of the blood-cells in Lepidoptera and Diptera, and this may be the case here. But it seems to Faussek more likely that the "white body" is a "substitution-organ" whose original ectoderm is replaced by mesoderm, as in the thymus of Vertebrates.

γ. Gastropoda.

Anatomy of Mollusca.*—Dr. L. Plate continues his account of the Mollusca he found on the coast of Chile. *Crepidula adolphei* is extraordinarily common in the Bay of Talchuano, where it exists in two varieties. If we take adult examples of these two forms, we should certainly regard them as representatives of two distinct species, but the young forms and half-grown animals present so many intermediate stages that it is quite impossible to separate them. We appear to have to do here with two varieties which have adapted themselves to different modes of life. The one which is most exposed to light develops a quantity of pigment. The details do not allow of an abstract.

The renal organ of *Chiton granosus* is also described.

In his eleventh note an account is given of *Chilina dombeyana*.† As most of the species of this genus are remarkably small, Dr. Plate was lucky in finding the above-named species, which is about half the size of the common pond snail of Germany. He finds that its respiratory cleft is not contractile; the mantle cavity has no special vascular network which functions exclusively as a lung. All the venous blood that passes into the mantle goes through a network formed by the renal walls, so that the kidney is also a respiratory organ. The radula is rudimentary; the stomach consists of several portions; the heart lies far forward, near the left anterior angle of the mantle cavity. The division into the vas deferens and oviduct occurs some distance from the hermaphrodite duct. For some distance both efferent ducts are united to form a spermoviduct. The penis is dentated, and there are calcareous secretions in the vagina. All the ganglia are very well developed. The commissures are very long. The kidney opens directly, without a ureter, into the mantle cavity.

Myology of some Pulmonate Mollusca.‡—Mr. W. E. Collinge has a note on the myology of some pulmonate Mollusca, considered as a distinctive feature in the discrimination of genera, &c. At the outset of his investigations he finds, what nearly all workers in other groups have noticed, that the muscles which do not supply either sense or other important organs are subject to great variation in form, size, and position. His investigations further resolve themselves into a comparatively simple series of observations on three muscles:—(1) the buccal retractor; (2) the tentacular retractor; (3) the genital retractor. He has examined these in *Arion*, *Limax*, and *Helix aspersa*, and summarises his results as follows:—No variation whatever was found in the form, number, or position of the buccal retractor muscles. The tentacular retractor muscles are quite as constant, very slight variations only being found in the labial branches. Innumerable variations were found in the genital retractor muscles of the three genera mentioned, as well as of *Testacella*

* SB. Akad. Wiss. Berlin, 1894, pp. 1071–83. † Tom. cit., pp. 1267–76.
‡ Proc. Malacol. Soc., i. (1894) pp. 52–4.

and *Limnæa*. No great specific value can be attached to the myology in these genera, and the generic value of these muscles is probably much less than that of the nervous, generative, or digestive systems in the pulmonate Mollusca generally.

Colpodaspis pusilla.*—Mr. W. Garstang gives an account of this rare mollusc, a single example of which has lately been found at Plymouth. He adds to and somewhat modifies the original description of Sars, and comes to the conclusion that the Plymouth specimen presents features which indicate a slight advance on the organisation of those described and figured by Sars. It is, that is to say, 3·125 mm. long as compared with 2·5 mm. The tentacles, the pallial siphon and the admedian denticles are more differentiated, while there is perhaps some increased extension of the free margin of the shell. Sars was in some doubt as to whether *Colpodaspis* was really an Opisthobranchiate at all, but on this point Mr. Garstang has no doubt. He thinks that we may regard this genus as a very primitive type of a Tectibranchiate mollusc belonging indeed to the Cephalaspidea, but retaining in an unspecialised condition an unusual number of those primitive characters which the common ancestors of the Cephalaspidea and Notaspidea alike possessed. It supplies, he says, an indubitable connecting-link between these too great subdivisions of the Tectibranchiata, but it belongs to the group Cephalaspidea in spite of the inappropriateness of the name, owing to its acquisition of pleuropodial expansions and a posterior pallial appendage—two associated features which are especially characteristic of that group.

Opisthobranchs of the "Albatross" Expedition.†—Dr. R. Bergh gives a systematic account of the Opisthobranchs dredged by the "Albatross." He describes the following new species:—*Æolidia herculea*, *Himatella trophina*, *Tritonia diomedea*, *T. exsulans*, *Geitodoris immunda*, *Garganiella immaculata*, *Thordisa* (?) *dubia*, *Chromodoris Agassizii*, *Tridachia diomedea*, *Doridium purpureum*, *D. diomedeum*, *D. ocelligerum*, *Navarchus ænigmaticus*.

Hedylidæ, a new Family of Nudibranchs.‡—Dr. R. Bergh describes *Hedyle Weberi* g. et sp. n., from the Indian Ocean, type of a new family of cladohepatic Nudibranchs. It appears at present very divergent. Thus there are no dorsal appendages; the body is elongated, rather narrow, somewhat flattened, and for more than its posterior half separate from the foot; there are no mandibles; the foot is elongated and rather narrow, the tail particularly long.

Habits of Limpets.§—Prof. J. R. Ainsworth Davis has a note on the homing and other habits of Limpets. It has been suggested that the great length of the radula of these Molluscs is to be correlated with the large amount of wear and tear entailed by the constant scraping of barnacles, &c. This view appears to be confirmed by *Helcion*, of which *Laminaria* constitute the chief, if not the only food, and in which the radula is relatively somewhat shorter. The scraping sound heard on rocks during warm weather is not entirely due to feeding Limpets;

* Proc. Zool. Soc. London, 1894 (1895) pp. 664–9 (1 pl.).
† Bull. Mus. Comp. Zool. Harvard, xxv. (1894) pp. 125–233 (12 pls.).
‡ Verh. K. K. Zool.-Bot. Gesellsch. Wien, xlv. (1895) pp. 4–20 (1 pl.).
§ Nature, li. (1895) pp. 511–2.

Purpura lapillus is also busy at work, sawing out the *Balani* from their shells. The author thinks that the mantle tentacles, of which as many as a hundred may be present on a Limpet, help in the locality sense. For the homing habit these tentacles appear to be of two kinds, some longer and some shorter. The fact that *Helcion pellucidum* also possesses the homing faculty appears to be new to general knowledge. The object of homing seems to be protection from the assaults of the incoming or outgoing tide. There is no danger when the objects are completely covered or uncovered. The force with which Limpets adhere is illustrated by the fact that five small Limpets at Aberystwyth were quite uninjured by the terrible gale and high sea of December 21 and 22 last. The much thinner shell of *Helcion* is explained by the sheltered position of its home. The author is inclined to adopt the suggestion of Prof. Michael Foster, that the adhesive power of the Limpet is due to the adhesion being like that between two smooth glass surfaces brought very close together. The muscular foot is, so to speak, rolled out on the rock, with which it is thus brought into close contact.

δ. Lamellibranchiata.

Mode of Fixation of Lamellibranchs by their Byssus.* — M. L. Boutan has made experiments with *Arca tetragona*, where the byssus is compact and is of enormous size in proportion to the whole mass of the animal. His experiments show that adult *Arcæ* are compelled, if their attachment is broken, to refix themselves by first getting rid of all the old byssus and by secreting a new one, whereas young *Arcæ* can fix themselves by the aid of the old organ. These apparently contradictory facts are explained by a study of the structure of the byssus. The byssus secreted between the glandular lamellæ is formed in *Arca* by a series of lamellæ fitted into one another. The matter secreted in the fluid state is injected between the lamellæ, and protected by the foot against the action of water. When the secreted matter can make its way out it can re-establish the attachment of the byssus, as is the case with the young forms. When, on the other hand, the byssus has become compact in its upper part this injection is impossible. Further observations are promised.

Bryozoa.

Embryonic Fission in Lichenopora.†—Mr. S. F. Harmer reminds the student that he has already shown that the primary embryo of *Crisia* gives rise to numerous larvæ by a constantly repeated process of embryonic fission, and he has suggested that this method of development will be found to be characteristic of cyclostomatous Polyzoa in general. The observations he has recently been able to make on *L. verrucaria* from the coast of Norway, have enabled him to prove the occurrence of embryonic fission in a second genus of Cyclostoma, although the details are remarkably different from those of *Crisia*. The author gives a brief preliminary account of his observations, and concludes that the following results may be deduced from them. The ovicell is not altogether

* Comptes Rendus, cxx. (1895) pp. 208–10.
† Proc. Roy. Soc. London, lvii. (1895) pp. 188–92.

external to the zooecia, as might be inferred from some of the older descriptions of this structure. Its cavity is morphologically identical with the body-cavity of the zooecia, and the ovicell results from the breaking down of numerous septa, which at first separate from one another a set of tubes formed at the growing edge of the colony. The development of the ovicell and that of the embryo normally commence at almost the beginning of the life of the colony. The numerous young larvæ found in the ovicell are descendants of the single primary embryo, which is normally produced in one of the two zooecia first budded off from the primary zooecium. It is thought that the process cannot be interpreted as a form of alternation of generations. A large number, if not the great majority, of the secondary embryos are formed by the direct fission of pre-existing embryos, and are not budded off from a compact mass of cells as in *Crisia*. Further research must decide whether the resemblances between the development of the Cyclostoma and the Phylactolæma are nothing more than mere analogies.

Revision of Jurassic Bryozoa.*—Dr. J. W. Gregory points out that the diagnosis of species of Cyclostomatous Bryozoa is a difficult and unsatisfactory task. While the Cheilostoma offer nine useful characters, only the least trustworthy of these are available in typical Cyclostoma, and at first sight it seems almost impossible to diagnose species, as even the genera appear to vary to a hopeless extent. While some authors have founded numerous species on insignificant and individual variations, others have thought that the sub-class affords an illustration of the theory of the persistence of type, and have therefore abandoned the effort to separate species of different ages. They have so lumped together the forms of different geological horizons that, if their example be followed, the study of the group becomes valueless. Dr. Gregory has attempted to find a mean between these extremes, and concludes that it is possible by examining a good series of specimens to see fairly constant differences. For example, if we take a Jurassic specimen in which the zoarium contains, say two hundred zooecia, and compare it with one of a closely allied recent species with as many zooecia, it is not improbable that one zooecium in each may be found to be identical. But this does not seem sufficient reason for ignoring the constant differences between the majority of the zooecia in each. To draw up a diagnosis which will accurately describe each zooecium in a colony, and shall at the same time be sufficiently definite to characterise the species, is impossible. However, if we take the normal adult zooecia and compare equivalent ones in different species, there seems sufficient reason for supporting the practical validity of species in this group. The author gives a revision of the genus *Stomatopora*, in which he recognises five species. In discussing the relations of these species he proposes the use of a formula by means of which they can be easily compared with forms of other ages. The result of his comparative formula is to show a gradual increase in the degree of development of the distinguishing characters.

Nephridium of Phylactolæmatous Polyzoa.†—Mr. A. Oka gives a general and critical account of these organs. He comes to the conclusion

* Ann. and Mag. Nat. Hist., xv. (1895) pp. 223–8.
† Zool. Mag., vii. (1895) pp. 21–37 (1 pl.).

that they agree with the organs described by Joliet in the following points:—(1) They are both composed of two short ciliated tubes opening at one end into the body-cavity and at the other to the exterior. (2) They are both situated between the mouth and the anus in the vicinity of the nervous ganglion. (3) They are both destitute of a glandular portion, so that they cannot be looked upon as an excretory organ *per se;* they can only serve as a passage for substances contained in the perigastric fluid. In this consideration it seems highly probable that in both forms the excretory function is carried on in the same manner, that is the leucocytes which absorb excretory products are thrown out by the action of the ciliated tubes. With regard to the relationship of the two main divisions of the Bryozoa, Mr. Oka points out that the Ectoproctous and Entoproctous forms agree in the following points:—They are all provided with a single nervous ganglion, and have a special organ for the exportation of leucocytes laden with excretory products. They are all small sedentary animals, generally united into colonies, with ciliated tentacles, and a U-shaped digestive canal. While thus maintaining the genetic affinity of Ectoprocta and Entoprocta, the author does not undervalue the points of agreement between the former and other forms of animals, such as *Phoronis.*

Arthropoda.

Myrmecophilous and Termitophilous Arthropods.* — Herr E. Wasmann has published a bibliography and catalogue. The list includes 1177 species of myrmecophilous and 105 species of termitophilous insects. These are mostly Coleoptera (993 + 87). To these have to be added 64 Arachnids and 9 Crustaceans. The book also contains a critical sifting of the information which is available in regard to these associations.

Herr E. Wasmann,† in calling attention to his book, lays emphasis on the numerous correlations between structure and habit. Certain tufts of yellow or reddish-yellow hairs on myrmecophilous Coleoptera are certain indications that their hosts lick these for the sake of an ethereal oil; Aleocharinæ, who are fed from the mouths of their hosts, have broad tongues and rudimentary labial palps; the Clavigeridæ, who also depend on their hosts, have rudimentary palps; the Staphylinidæ who accompany the almost blind Eciton-ants of Brazil resemble these, not in colour, which would be unprofitable, but in sculpturing, hairs, shape, and size.

α. Insecta.

Convergence and Pœcilogony in Insects.‡—Prof. A. Giard calls attention to the difficulty of distinguishing between animals which in the adult stage are very like one another, while in the course of their development they appear to belong to quite different forms. It is necessary to distinguish insects of the same or of different genera which become like one another in the adult stage by convergence, and secondly

* E. Wasmann, 'Kritisches Verzeichnis der myrmekophilen und termitophilen Arthropoden,' Berlin, 1894, 8vo. † Zool. Anzeig., xviii. pp. 111–4.

‡ Ann. Soc. Entomol. France, lxiii. (1894) pp. 128–35. See Zool. Centralbl., ii. (1895) p. 81.

insect larvæ of the same species which under the influence of different factors are formed differently to one another, while the imagines exhibit the same form. The latter case is an example of what the author has already called pœcilogony. It is often difficult to determine with which phenomenon one has to do. Anatomy and embryology will enable us to distinguish the converging species of different genera. When such species belong to the same genus we find that in one locality there is no fruitful sexual intermixture between them; on the other hand a fruitful crossing is evidence of pœcilogony. An interesting example of pœcilogony is exhibited by a coprophagous fly, *Musca corvina*, which, according to Portchinsky, lays, in the north of Russia, 24 eggs, the development of which breaks up into two sharply distinct periods. In the south, on the other hand, the same fly lays only one egg and the development is much simplified.

Specific Stability.*—Mr. F. Galton has made some suggestions to the Entomological Society which appear to be of considerable importance. He asks for information on—(1) Instances of such strongly marked peculiarities, whether in form, in colour, or in habit, as have occasionally appeared in a single or in a few individuals among a brood. (2) Instances in which any one of the above peculiarities has appeared in the broods of different parents. (3) Instances in which any of these peculiarly characterised individuals have transmitted their peculiarities to one or more generations; especial mention should be made whether the peculiarity was in any case transmitted in all its original intensity, and numerical data that showed the frequency of its transmission would be particularly acceptable—(*a*) in an undiluted form; (*b*) in one that was more or less diluted; and (*c*) of its non-transmission in any perceptible degree. The author appends a list of his various memoirs which bear on this subject.

Classification of Lepidoptera.†—Mr. V. L. Kellogg draws attention to the new provisional classification of the Lepidoptera which has been proposed by Prof. Comstock, and adds a few notes of observations which seem to be confirmatory of the most conspicuous feature of this new classification. The author calls attention to an essay by himself on the taxonomic value of the scales in Lepidoptera.‡ He thinks that the structure of the thorax in the Jugatæ, though not distinctly available as a recognition character, has considerable phylogenetic significance, and he is of opinion that a careful study of the thorax of the Lepidoptera must certainly be rewarded by suggestive results.

From a wide point of view there is, in the development of any considerable group of organisms, as for example, the class Insecta, a general tendency of specialisation along some pretty definite main line, or more or less nearly parallel lines. We may cite in the Insecta the development of the flight function accompanied, in the Lepidoptera, by the specialisation of the front wings and a reduction of the hind wings as well as by a specialisation of the thorax. Subordinate to any general tendency such as the development of the flight function, there will

* Trans. Ent. Soc. Lond., 1895, pp. 155 and 6; Nature, li. (1895) pp. 570 and 1.
† Amer. Natural., xxix. (1895) pp. 248–57 (1 pl.).
‡ Kansas Univ. Quarterly, iii. (1894) pp. 45–89.

appear characters indicating dichotomous divisions of lines of descent, the methods of advance along the line of general tendency developing in two branches of the group. An example of this is afforded by the Odonata and the Diptera; in one group the specialisation of fore and hind wings has followed the same lines, in the other the specialisation has resulted in the loss of the hind wings. In both instances a fine development of the flight function has been reached.

Geographical Distribution of Butterflies.*—Mr. H. J. Elwes took this subject for his annual address to the Entomological Society of London. While pointing out that comparatively little has been done by entomologists to show how far the natural divisions of the earth's surface, which have been established for other classes, are applicable to Insects, he also points out how little there has yet been done for this group. In the first place, we have not as large a knowledge of the Insect fauna of many most important areas of which the mammals, birds, and plants are well known; and in the next place, the condition of the classification of the Lepidoptera puts serious obstacles in the way of any generalisations. He tells us that, though one may be able to give the general features of the butterfly fauna in many sub-regions, one cannot be sure how far their relative degree of specialisation may not have to be modified by future discoveries, and better systems of classification based on larger materials for study.

Metamorphosis of Lepidoptera.†—M. J. Gonin has made a study of *Pieris brassicæ*. Each appendage of the imago arises by evagination of the hypodermis, previously invaginated. The tracheæ are not the cause either of the duplication or of the extension of the walls of the wing.

The bud of the wing develops from the earliest larval stage, the other organs from the last moult. The antennæ, jaws, labial palps, and legs of the caterpillar correspond merely to the extremity of the homologous organs in the adult. The bud of the leg corresponds to femur and tibia in the adult.

Beside each rudiment a portion of the envelope of the imaginal germ persists, another part becomes useless; the former is regenerated, the latter is detached as débris. The hypodermic wall of the thorax is partially replaced by imaginal epithelium, that of the head almost wholly.

There is no adherence to twelve imaginal discs in the thorax of Lepidoptera; the dorsal discs of the first segment are wanting; the ventral discs are each represented by several distinct folds. Imaginal fold is suggested as a term more appropriate than imaginal disc. These folds form new organs, increase existing organs, alter the size and form of thorax and head, and sustain the larval hypodermis on the surface of the imaginal bud.

The rudiments of the wings do not participate in the larval moults; their surface has no cuticle until near the end of the last stage; capillary tracheoles are formed for all the appendages during the third larval stage; the permanent tracheæ appear at the time of the last

* Trans. Entomol. Soc. Lond., 1894–5, pp. lvi.–lxxxiv.
† Bull. Soc. Vaudoise Sci. Nat, xxx. (1894) pp. 89–139 (5 pls., 1 fig.).

moult, but they only function in the chrysalis, where they give rise to a second system of tracheoles. The appendages of thorax and head assume their adult position as the chrysalis stage is reached.

Larvæ of British Butterflies and Moths.*—Mr. J. T. Porritt has edited the sixth volume of the late William Buckler's accounts of the larvæ of British butterflies and moths. The volume before us deals with the third and concluding portion of the Noctuæ. He appears to have kept the work up to the high standard to which it was brought by the editing of the late Mr. Stainton.

Morphology of the Skeleton of Myrmicides.†—M. C. Janet uses the term morphology in the rare sense of a pure description of anatomical details, and his account of the skeletal anatomy of *Myrmica rubra* is confined to a statement of facts, without any generalisations whatever.

A Marine Fly.‡—M. R. Chevrel describes a species of *Clunio* which he observed a dozen years ago on the rocks uncovered at the lowest tides on the coast of Calvados. The larva is submarine, the apterous female lives on the algæ and rocks, the male flies about on the surface. Both sexes have a very short aerial life. Haliday has recorded *Clunio marinus* from British coasts, and Schiner *Cl. adriaticus* from Trieste; for the present species the author proposes the name *Cl. syzygialis*, but awaits more details as to the others. Meantime, he describes the male, female, and larva. M. Gadeau de Kerville has found the apterous females in abundance at Grandcamp (Calvados), and H. Carpenter § has recently published an article on *Cl. marinus*.

Vascular Ampullæ in Head of Orthoptera. ||—M. Pawlowa describes a contractile vascular sac at the base of each antenna in the cockroach. The cavity has a valvular communication with the blood-space below and in front of the brain, and muscle-fibres effect systole and diastole. Each sac is beyond doubt an independently active part of the circulatory system. The histology and innervation are described. Similar organs occur in *Locusta*, *Pachytilus*, *Meconema*, and other Orthoptera; and Selvatico has described similar organs in *Bombyx mori* and some other Lepidoptera.

Thysanura from the Cave of Central France.¶—M. R. Moniez describes three new species of Thysanura from the Grotto of Dargilan. *Campodea dargilani* appears to be the third of a series of forms adapted progressively for a life in darkness. That is, the characters of *C. staphylinus*, which lives in the open air, are more accentuated in *C. coopii*, a cave form, and are carried to an extreme in *C. dargilani*. *Sira cavernarum* is white, and entirely blind. *Lipura cirrigera* has tufts of cirri at the base of the second joint of the antennæ which, though present in other Lipuræ, are in them so rudimentary as to have hitherto escaped observation.

* Vol. vi. London, printed for the Ray Society, vi. and 141 pp., 19 colrd. pls.
† Mém. Soc. Acad. Oise, xv. (1894) pp. 591–611 (5 figs.).
‡ Arch. Zool. Expér., ii. (1894) pp. 583–98.
§ Entom. Monthly Mag., No. 362, 1894.
|| Zool. Anzeig., xviii. (1895) pp. 7–13 (1 fig.).
¶ Revue Biol. du Nord, Dec. 1893. See Amer. Natural., xxviii. (1894) pp. 811-2.

β. Myriopoda.

Poison-glands of Scolopendra.*—M. O. Duboscq distinguishes the three pairs of so-called salivary glands, which have no connection with the œsophagus, from the poison-gland which is entirely within the poison-claw, between the external insertions of its adductor muscles. Numerous glandular tubes radiating around a chitinous excretory canal are compressed by a network of striped muscle-fibres. The gland arises as an invagination of the skin; the glandular tubes are modified hypodermic glands.

The limpid homogeneous venom, of acid reaction, seems not to act except on Arthropods and Vertebrates, and at most very slightly on Fishes and Reptiles. On Arthropods it acts with variable virulence on the nervous system; on man and higher Vertebrates its effect is local.

δ. Arachnida.

Phylogeny of Arachnida.†—Herr J. Wagner begins with a discussion of the systematic position of Acarina. In *Ixodes*, the Malpighian tubules have an endodermic origin, and are only secondarily connected with the rectum. Moreover, in no larval stage of *Ixodes* is there any trace of tracheæ.

Wagner holds fast to the idea that the ancestral form had no tracheæ opening in the cephalothorax. He believes that gill-books, like those of *Limulus*, gave origin to lung-sacs, and these to Arachnid tracheæ. The cephalothoracic tracheæ of certain Arachnids (e. g. Solifugæ) are regarded as not directly homologous with the tracheæ of other Tracheata. They are derivatives of skin-glands.

The Arachnids split into two groups. In the one the tracheæ developed greatly, the lung-sacs (modified gills) remained only in part, or disappeared wholly; in the other the skin-glands modified into tracheæ degenerated, and the lung-sacs increased.

Wagner thinks it likely that the so-called Malpighian tubules of all Arachnids are endodermic; they are only analogous with those of Insects and Myriopods.

The anatomy of the hypothetical Protarachnon is described at length. The ancestor of the Arachnoidea was a *Peripatus*-like terrestrial animal. From the primitive Crustacea the Crustacea and Trilobites developed; Protarachnon and the Gigantostraca represent a side-twig of the latter.

Origin and Evolution of Web-spinning in Spiders.‡—Mr. R. I. Pocock calls attention to Dr. McCook's chapter on the genesis of snares, in which he thinks that the author succeeds in leaving his readers completely in doubt as to whether or no he intends one or all of his attempts at tracing the genesis of snares to represent what has actually occurred in the course of nature. Mr. Pocock points out that silk threads are fabricated by two allied groups of animals. In one of these, the Book-Scorpions or Chelifers, the presence of silk-glands has long been known; in the other, the Phrynidæ, their existence is now for the first time, it is believed, pointed out. One of the chief points of interest in this dis-

* Arch. Zool. Exper., ii. (1894) pp. 575–82 (5 figs.).
† Jenaische Zeitschr. f. Naturwiss., xxix. (1894) pp. 123–56.
‡ Nature, li. (1895) pp. 417–20.

covery lies in the circumstance that of existing animals the Phrynidæ appear to be most nearly allied to the immediate ancestor of the Spiders, and we may conclude, therefore, that originally the silk in spiders was utilised for the purpose of making a case for the eggs. The simplest stage now to be observed is probably to be found among the females of the Drassidæ, some of whom spin a temporary retreat for themselves and their young at the breeding season. Others utilise the retreat as a permanent dwelling-place. If we conclude that a simple tube was the primitive form of nest, we may see that the evolution of web-spinning has been carried out along two main lines. Along one there is a gradual elaboration of the tube until it ends in the complex trap-door nest. Along the other the tubular nest either disappears or remains simple, while it is superposed by a new structure, the net for ensnaring prey. In the latter part of his essay Mr. Pocock discusses the use of radiating threads, and concludes that in constructing the net of radiating and concentric threads the *Epeira* economises both time and silk, and renders her snare as strong and as serviceable, and yet as delicate and invisible as possible.

ε. Crustacea.

Post-œsophageal Nerve-cord of Crustacea.*—Mr. W. B. Hardy has a memoir on some histological features and physiological properties of this portion of the nerve-cord. With regard to the post-œsophageal nerve-cord in *Branchipus*, he points out that the central nervous system, taken as a whole, consists of two cords of nerve tissue, which run the length of the body and are connected anterior to the mouth by the brain, in the region of the mouth by the circumoral ganglion, and posterior to the mouth by the transverse commissures which connect the various ganglionic enlargements. Each nerve-cord consists of a mass of fine nerve-fibres invested more or less completely by nerve-cells. The ganglionic regions differ from the inter-ganglionic chiefly in the development of a very fine plexus on the ventral aspect of the cords. The ganglionic regions are also characterised by the large number of nerve-cells, but the inter-ganglionic and ganglionic regions are not sharply defined from one another. A description is given of the connections of the nerve-cells, and of the distribution of the elements in a typical ganglion. In the crayfish three pairs of nerves are found to arise from each of the first five abdominal ganglia. The anterior pair, which rise directly from the ganglion, contain a large number of fine or afferent fibres, and comparatively few large or efferent fibres; these supply the appendages with motor and sensory fibres, and also the skin of the sternum and pleura. The posterior ventral nerves contain relatively more large fibres; these supply the dorsally placed extensor muscles and the dorsal skin. In the third segment, or segment next following, the posterior dorsal nerves are purely motor, and innervate the flexor muscles. The author also discusses the general relations and structure of the second abdominal ganglion, as well as the arrangement of its nervous elements. The internal connections of the anterior and the posterior pairs of nerves are described, as well as those of the posterior

* Phil. Trans., clxxxv. B. (1894) pp. 83–117 (4 pls.).

dorsal nerves. With regard to the motor system of nerves, it is pointed out that in *Astacus* the unit of the motor system consists of three parts :—(1) A single nerve-cell, which, from its histological characters and relations to the blood stream, appears to be a highly metabolic structure. This cell is removed by a considerable length of nerve from the direct track of the nerve's impulses. (2) A single nerve process from this cell branches in a characteristic fashion, and consists of a number of elements suspended in a plasma. (3) The branches of this process, and therefore of the single nerve-cell. These are very numerous, are distributed to the plexus of the ganglion, and to a very large mass of muscle fibres. The longitudinal commissures of the ventral cord appear to be connected directly with the plexus of the ganglion, and again with it by a T-shaped junction, and thirdly with cells whose processes merge in the plexus of the ganglion. In conclusion, the author points out that the nerve fibrils which pass to the fine plexus, enter it in well-defined bundles, which go to histologically distinct regions. This structural feature may be correlated with the fact that each nerve contains different grades of fibres, which supply either different muscles or regions of the sensory surface supplied by the nerve as a whole, which differ in the fact that stimulation of the one region or the other does not produce quite identical disturbances in the central nervous system.

Flying Crustacea.*—Herr Al. Mrásek notes, under this somewhat sensational title, that Captain Hendorff has recorded two cases of Crustacea leaping out of the water.† One was a Pontellid (*Pontella securifer* Brady), which several times sprang almost a foot out of the vessel. The other referred to some Schizopod. The leaps are probably either playful or attempts to escape.

Springing or Flying? ‡—Dr. A. Ostroumoff thinks the "flying" of *Pontellina mediterranea* Cls. is indubitable, but he does not mean that the Crustacean can actively change its original direction of movement. In the same way the dolphin only springs or leaps, but *Pteromys volans* "flies." In English, the word "fly" is usually restricted by zoologists to cases in which there are active locomotor organs which beat the air, as in flying insects, flying birds, and bats.

Embryonic Development of a Dicranodromia.§—M. E. Caustier has had the opportunity of investigating some of the *Dromiæ* collected during the deep sea dredgings of the *Blake* and the *Talisman*. *Dicranodromia ovata* was found to carry large eggs 2 mm. in diameter. These eggs were found to possess all the cephalic and thoracic appendages, while the distinctly segmented abdomen was already provided with plœopods. Although the embryo had thus already reached the Mysis stage, half of the yolk still remained to be digested at the stage which the author was able to study. The development of the appendages shows very well the extent of the affinities of this creature with the Anomura and the Macrura. These characters the author details. Particular attention is directed to the fifth pair of thoracic limbs; these are folded on the back and directed forwards so that they

* Zool. Anzeig., xviii. (1895) pp. 5–6. † See this Journal, 1894, p. 681.
‡ Zool. Anzeig., xviii. (1895) p. 122.
§ Comptes Rendus, cxx. (1895) pp. 573–5.

recall the modified limbs of adult *Dromiæ*. The *Dromiæ* have been divided into two groups; those which have two pairs of modified limbs and those which have only one. *Dicranodromia* in the adult condition belongs to the former of these two groups, but in the embryonic stage it exhibits the more primitive type, in which only one pair of limbs was modified.

Segmentation of Ovum in Terrestrial Isopods.*—Prof. J. Playfair McMurrich has come to very different conclusions from those to which Roule was led by his investigation of *Porcellio scaber*. The author, who has followed step by step the segmentation of several Isopods, is able to state with certainty that in none of these forms does a telolecithal segmentation occur, but in all it is of the same type as the typically centrolecithal *Porcellio* and *Armadillidium*. Immediately after fertilization the nucleus occupies practically the centre of the egg, where it lies imbedded in a mass of protoplasm, from which delicate processes radiate off into the yolk. Enclosing the yolk is a delicate layer of protoplasm entirely destitute of nuclei, and probably, to judge from what occurs in the egg of *Jaera*, united with the central nucleated mass by a reticulum of protoplasm, the yolk being distributed in the meshes of this reticulum. The full details as to segmentation and certain interesting phenomena which accompany it will be given in a paper which is promised us. The author confines himself at present to pointing out that the segmentation of *Porcellio* and *Armadillidium* is identical with that of *Asellus*. These statements are at utter variance with the observations recorded by Roule, but, as the author observes, they may be readily verified by the use of proper methods. He suggests that Roule has mistaken a stage at which the nuclei had already reached the surface for the stage immediately succeeding fertilisation. This failure to perceive the true significance of the structures in question is thought to be due to the imperfect methods which the French naturalist adopted.

Pelagic Crustacea in Green Lake, Wisconsin.†—Mr. C. D. Marsh reports that Green Lake is the deepest body of water in the State of Wisconsin, having a maximum depth of about 60 metres. It has, therefore, not only the littoral and pelagic faunæ of shallower bodies of water, but also the true abyssal fauna which is characteristic of the deeper lakes. In these deeper waters there are found 15 species of Crustacea. Of these 12 may be considered as belonging peculiarly to the deep water fauna. Most of them can be captured in very large numbers at night by means of the skimming net. The author expected to find the three regions characteristic of the deep sea—the pelagic, the intermediate, and the abyssal. He was rather disappointed therefore when he found material in his dredge from all depths. The species found in greatest numbers is *Diaptomus minutus*. More than one-half of the individuals of this species are found within 10 metres of the surface, and from that point to the bottom the numbers steadily decrease. *Daphnella* is more exclusively pelagic, and *Epischura* is still more distinctly pelagic, 81 per cent. being found in the first 10 metres, and 3·3 per cent. in the last 10. *Pontoporeia* and *Mysis* live at the bottom, and

* Zool. Anzeig., xviii. (1895) pp. 109-11.
† Amer. Natural., xxviii. (1894) pp. 807-9.

belong to the true abyssal fauna. The author found it difficult to fix any exact limit as to the diurnal migrations of the pelagic species. As a result of his collections he was led to doubt the value of Plankton determinations, at least so far as Crustacea are concerned. Zacharias in his last report has reached the same conclusions, not only in regard to the Crustacea, but also to other pelagic organisms. Plankton determinations, in order to have much value, must, the author thinks, be almost infinite in number.

Phyllopod Crustacea of Japan.*—Mr. C. Ishikawa gives an account of the new species *Limnadia nipponica.* It differs from all the known species of *Limnadia* and *Eulimnadia* in having four lines of growth on the shell. All the specimens examined by the author are, however, still young, and it is probable that the number of the lines of growth will increase. *E. brauerina* was first discovered in small ponds formed by rain water. These pools were formed after a heavy rain at the end of July, and the first trace of the animals was observed a week afterwards. These were already quite mature, the females carrying numerous eggs laid under the shell. Associated with this species were many aquatic beetles, bugs, and mosquito larvæ; and the water of the pool remained perfectly clear during the month. The continued dry weather of August dried up the pools at the end of the month, so that they existed only for about four weeks, during which time only one gamogenetic generation was found. Of *E. packardiana* the female only has been observed, although sixty specimens have been under investigation. It cannot be doubted that the present colony is a parthenogenetic one, and as this species is closely allied to the preceding its different mode of reproduction is of great interest.

Synopsis of British Cladocera.†—Mr. T. V. Hodgson has prepared a synopsis of these Crustacea, which ought to be particularly useful as it is now nearly thirty years since one was attempted. The classification of G. O. Sars has been adopted, and the object of the author has been to produce a list giving just sufficient information to lead to the identification of a species, and one in accordance with the system of nomenclature now in use.

Ilyocryptus agilis.‡—Mr. D. J. Scourfield found this rare mud-inhabiting water-flea in the well-known Victoria Regia tank in the Botanic Gardens, Regent's Park. This locality of course is no proof of the species being British, but the author has little doubt that it will turn out to be so. The female only has as yet been observed. Mr. Scourfield adds some few notes on the other described species of *Ilyocryptus*, with the object of indicating the relation of *Ilyocryptus agilis* to its allies.

Mouth-parts of Cypris-Stage of Balanus.§—Mr. T. T. Groom has carefully examined the Cypris-stage of *Balanus perforatus* and *B. balanoides*, as well as some stages of an undetermined species of

* Zool. Mag., vii. (1895) pp. 13–21 (1 pl.).
† Journ. Birm. Nat. Hist. and Phil. Soc., i. (1895) pp. 101–2.
‡ Journ. Quek. Micr. Club, v. (1894) pp. 429–32 (1 pl.).
§ Quart. Journ. Micr. Soc., xxxvii. (1895) pp. 269–76 (1 pl.).

Balanus. He thinks that it is tolerably certain that the antennæ of the Nauplius become definitely lost with the moult which results in the production of the Cypris-stage. The biramous mandibles in the Nauplius become reduced at the same time to the small mandibles, the ramus of which is probably preserved in the form of a small palp. The first pair of maxillæ arise behind the mandibles, and at a later date, as a small pair of foliaceous appendages. The second pair of maxillæ arise still later, just in front of the first pair of thoracic legs. In the fate of the mandibles of the Nauplius and in the constitution of the head of the adult, the Cirripedia may be seen to conform to what is recognised as typical among other Crustacea.

Structure and Appendages of Trinucleus. * — Mr. C. E. Beecher has a note on some new facts regarding the structure and appendages of this ancient Trilobite. With regard to the so-called eye-line, which occurs in many early Trilobite genera, he points out that at least four-fifths of the Cambrian forms preserve this feature, which was almost entirely eliminated before Devonian time. It is evidently a larval character in Trilobites, as shown from its geological history and the ontogeny of *Trinucleus*. It is surmised from the direction of the optic nerve in *Limulus*, and its relation to the surface features of the cephalothorax, that the eye-line probably represents the course of that nerve, and that it is of much less morphological importance than the different types of visual organs. Three specimens have now been observed, which show the nature of the appendages of *Trinucleus*. Their characters appear to indicate an animal of burrowing habit, which probably lived in the soft mud on the sea bottom, much after the fashion of the modern *Limulus*. In addition to its limuloid form, the absence of eyes seems to favour this assumption, as does the fact that many specimens have been found preserving the cast of the alimentary canal, for this is a proof that the animal gorged itself with mud like many other sea-bottom animals.

Annulata.

Function of Amœbocytes in Polychæta.†—M. E. G. Racovitza has studied *Leiocephalus leiopygos* by injecting directly into the general cavity sepia ink. In about a fortnight the rosy colour of the anterior segments of these worms became blackened, and sections showed that this coloration was due to the presence of granules of ink in the epidermis. These granules were for the most part contained in longitudinal cells, which were undoubtedly undergoing degeneration. The deposit of the black granules in the epidermis is clearly the result of the diapædesis of the amœbocytes. The transport of excretory granules of these cells has been already demonstrated in the most diverse groups, and numerous works confirm the beautiful theory of Eisig on the excretory origin of the coloured pigments of animals. The author concludes that amœbocytes do not merely serve to deposit excretory pigment in the epidermis, but that on occasion they will withdraw and digest reserve substances which have accumulated in the organism.

* Amer. Journ. Sci., xlix. (1895) pp. 307–11 (1 pl.).
† Comptes Rendus, cxx. (1895) pp. 464–7.

Structure of Vermiculus pilosus.*—Mr. E. S. Goodrich has made a further study of this interesting new Oligochæte, which it will be remembered he found on the sea shore near Weymouth. He finds that the following are its chief characters. It has four bundles to each segment of furcate setæ, generally three per bundle; a dense covering of hair-like processes; a vascular system, containing red blood, and composed of dorsal and ventral longitudinal vessels, communicating by means of lateral vessels, which branch into the body-wall. There are no hearts or commissural vessels, but the longitudinal and transverse dorsal vessels have an elaborate system of unicellular valves. The brain is deeply cleft in front, and there is a nerve-cord bearing muscular strands of considerable size. A compact nephridium has a peculiarly modified funnel. In the tenth segment there is a pair of testes, and in the eleventh a pair of ovaries. Two short sperm-ducts open into a median chamber, which opens to the exterior by a large median pore. The oviducts are rudimentary. These and other characters place this little worm in a very isolated position. The dense covering of sense-hairs, although, perhaps, of no great morphological importance, is quite unique among the Oligochæta. The late development of the spermiducal chamber is another character quite peculiar to this worm; it is difficult to conjecture what is the function of this chamber, but it is possible that it acts as a sucker during copulation, and the disposition of its muscles would favour this supposition. On the whole, it must be concluded that *Vermiculus* stands very much by itself; the shape of its setæ, and, above all, the situation of its gonads, place it in the family Tubificidæ, but its more intimate relationships remain obscure for the present.

Fertilisation in the Earthworm.†—Miss K. Foot gives a preliminary account of a detailed study of the eggs of *Allolobophora fœtida*. She reports that the "sperm" grows very rapidly just before the eggs are laid, so that one sperm may more than double its length within two hours. These sperms have a long head with a spine at its tip, the middle piece of some length, and a long tail. They are found free in the cocoons for some ten minutes after laying, and then penetrate the eggs. The egg gives off two polar bodies after the cocoon is deposited. Of these, the first divides into two; the three thus formed subsequently break up into spherical bodies that lie irregularly between the egg and its membrane.

Nemathelminthes.

Helminthological Notes.—Dr. M. Stossich ‡ discusses the genus *Ankylostomum*, whose species are parasitic in mammals, with the exception of one from the boa. He briefly describes *A. duodenale* Dubini in man and Anthropoids, *A. perniciosum* Linstow in the tiger, *A. tubæforme* in many species of *Felis*, *A. trigonocephalum* Rudolphi in many species of *Canis*, and *A. Boæ*.

He describes § *Solenophorus megalocephalus* from *Python molurus*, and notes a terminal bifurcation of the strobila.

* Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 253–67 (3 pls.).
† Journ. Morphol., ix. (1894). See Amer. Natural., xxix. (1895) pp. 62 and 3.
‡ Boll. Soc. Adriatico Sci. Nat., xvi. (1895) pp. 21–5.
§ Tom. cit., pp. 27–32 (2 pls.).

In another paper* he has notes on numerous forms, including *Dochmius Vallei* sp. n. from the intestine of *Vipera ammodytes*, the *Agamonema* stage of *Ascaris rubicundæ* from the lungs of *Python reticulatus*, *Tænia varanii* sp. n. from the intestine of *Varanus arenarius*, *Anthobothrium parvum* sp. n. from the intestine of *Zygæna malleus*, and many others.

Notes on Nematodes.†—Dr. von Linstow describes *Filaria* (*Dispharagus*) *anthuris* Rud. from Corvidæ and other birds. His description illustrates an almost unparalleled detail of measurement, e.g. of the thickness of cuticula, cutis I., and cutis II. in male and female. In fact, we think the patient author overdoes it. The absence of a lumen in the intestine, of male as well as of female, is striking.

He also describes the larva of *Ascaris Eperlani* from the dorsal musculature of *Osmerus eperlanus*, *Physaloptera Sonsinoi* sp. n. from *Agama mutabilis*, *Rhabditis Lumbriculi* sp. n. from *Lumbriculus variegatus*, and *Ascaris osculata* Rud. from the alimentary canal of seals and the like.

Platyhelminthes.

Lacustrine Species of Macrorhynchus.‡—Dr. G. du Plessis has found in Lake Geneva a Rhabdocœle exceedingly like *Macrorhynchus helgolandicus* Metschn., but differing in two essential points. The proboscis has a canal, a terminal pore, and basal unicellular glands; the two sinuous water-vascular trunks are united at the tail in a contractile pyriform vesicle.

The author has found in Lake Geneva five new worms of indubitably marine origin—the species above referred to, *Macrorhynchus lemanus* sp. n., *Emea lacustris*, *Monotus Morgiense*, and *Plagiostoma Lemani*.

Asexual Multiplication in Turbellarians.§—Herr Vogt gives a summary of observations made by himself and others. He has worked out an interesting series. In *Planaria alpina* he has observed that over-eating is followed by rupture; the separation of a part may occur without any stimulus but abundant nutrition. In *P. alpina*, *P. albissima*, and *Bipalium kewense*, constriction occurs without any preparatory process whatever. The plane of division is not fixed in *P. alpina* or *Bp. kewense*; it may be in front of or behind the mouth; in *P. albissima* it is always where the œsophagus enters the intestine. In none of these three cases is it a regularly occurring reproductive act. In *Polycelis cornuta*, the plane of division is in a definite zone, the division is a normal process of reproduction in all individuals, and the formation of the gullet has begun before the separation. In *Planaria subtentaculata*, the new head has begun before the tail portion is separated off. In *Planaria fissipara*, finally, the division is preceded by complex processes of absorption and regeneration, all the new organs being formed before the separation is effected. The general result is that the asexual reproduction is traceable to a simple regenerative process.

New Flukes in American Rabbits.‖—Dr. C. W. Stiles communicates to the Zoological Society of France a short notice of a new species

* Tom. cit., pp. 33–46 (3 pls.).
† Arch. f. Mikr. Anat., xliv. (1895) pp. 509–33 (2 pls.).
‡ Zool. Anzeig., xviii. (1895) pp. 25–7.
§ Biol. Centralbl., xiv. (1894) pp. 745–51, 771–7.
‖ Bull. Soc. Zool. France, xix. (1894) pp. 160–2 (1 fig.).

of *Distomum* of which he, with Mr. Hassall, has given an account in the 'Veterinary Magazine' of Philadelphia. *D. tricolor* has been found in *Lepus sylvaticus* and *L. americanus*. It is very common in Maryland, Colombia, and Virginia. It is intermediate in structure between the genera *Mesogonimus* and *Urogonimus*. Like Braun and other authors, the present writers have doubts as to the validity of these two genera. Self-copulation has been observed in this new species.

Distomum molle.*—The same authors report that the species which the late Prof. Leidy called *Monostomum molle* is a *Distomum*, most closely allied to *D. polyorchis* (Stossich). They give a short description of the species, and point out its resemblances to, and its differences from, Stossich's species. The characters are such as to justify the formation of a sub-genus (*Polyorchis*) and probably even of a genus.

Distomum gigas.†—Sig. E. Setti gives an account of an example of this species, which was observed in the fresh condition, when it measured 12 cm. long. In a transverse section the body was seen to be bounded by a cuticle and subcuticular layer, as well as by a basal membrane. The œsophagus is short, and the two intestinal trunks are unbranched. The excretory vesicle is small and receives two long primary trunks. The generative orifice is on the ventral surface, and lies midway between the two suckers. The uterus extends backwards to about 2 cm. from the end. The ova are 0·0335 mm. long and 0·030 mm. broad.

Early Stages in the Development of the Tæniæ of the Rabbit.‡—Dr. C. W. Stiles, in examining rabbits for the purpose of finding *Distomum tricolor*, found in the intestine several very small tape-worms. They varied from 0·624 mm. to 0·96 mm. in length, and had not yet commenced to form rings. While many specimens presented nothing remarkable, and had heads similar to those of ordinary unarmed Anoplocephalians, several presented characters which deserve a special description. The orifice of their suckers was provided with numerous and very small hooks of which there may have been as many as 150 or 200 to each sucker. The tip of the head was provided with a retracted rostrum, the equator of which was occupied by a row of small hooks. In several specimens the anterior portions of the head and neck were covered by a membrane. The small hooks and the membranous envelope were merely temporary structures which disappeared in a short time, and left the head with the characteristic appearance of the Anoplocephalinæ. A further account is promised.

Tetrarhynchi.§—Dr. Th. Pintner continues his investigation of these most highly differentiated Cestodes. He differs from Lang on three essential points. (1) The proboscis-muscles, arranged in interlocked layers, are cross-striped, and in the interior of the prismatic muscle-bands is a fibrillar plasma. The latter Lang regards as a nerve, and he describes the muscle-fibres as smooth. (2) Pintner described very peculiar large cells—formative epithelial cells—in a double row alongside

* Bull. Soc. Zool. France, xix. (1894) pp. 162–3 (1 fig.).
† At. Soc. Lig. Ann., vi. (1894) 19 pp. (1 pl.). See Zool. Centralbl., i. (1895) pp. 828 and 9.
‡ Bull. Soc. Zool. France, xix. (1894) pp. 163–5.
§ SB. Akad. Wiss. Wien, cii. (1893) pp. 605–50 (4 pls.).

of the nerve-strands; they have large nuclei and homogeneous or vacuolated plasma. Between them runs the nerve, and beside it two clear structureless pillars (giant fibres) with regular cross-branches connecting them. Lang calls the large cells ganglionic, and the clear strands water-vascular; but from both of these interpretations Pintner thoroughly dissents. (3) Lang described the gradual formation of a terminal excretory pore, which Pintner denies. There is an opening only in the original last joint, and no rudiment of it elsewhere.

Dr. Pintner gives a detailed description of *Tetrarhynchus Smaridum* from species of *Smaris* and *Mæna*.

Rotatoria.

Rotatoria of the Great Lakes.*—Mr. H. S. Jennings has prepared for the Michigan Fish Commission a list of the Rotatoria found in Lake St. Clair and some of the inland lakes of Michigan. Of the 122 Rotifers named in the list, six are described and figured for the first time. The most abundant pelagic species are *Polyarthra platyptera*, *Anurea cochlearis*, and *Asplanchna priodonta*, in this respect agreeing with the conditions found in European Lakes.

Foreign Rotifers.†—Mr. G. Western has a series of somewhat scattered notes on various Rotifers hitherto supposed to occur only in waters foreign to Britain. He brings forward cases of 12 species which certainly belong to the British list. He takes the opportunity of making some remarks as to the presence of antennæ or setæ, and points out that their apparent absence from some species was possibly due to the want of better objectives and more perfect methods of illumination, such as are at our disposal now, but which were not in the possession of the authors who originally described the species. The presence or absence of setæ is a very unreliable character; for example, there are species of Rotifers to be found which have them in some specimens and not in others. He concludes with stating some problems which he thinks are worthy of solution.

Distyla spinifera.‡—Mr. G. Western describes this form, which is apparently new. He first found it in some stuff taken on Putney Heath. At first sight it rather resembles *Metopidia oxysternon*. The species may be easily identified by the possession of two thorn-like spines on the postero-lateral angles of the edges of the ventral shield.

Cyrtonia tuba.§—Mr. C. F. Rousselet gives a more extended description and more correct figure of this interesting little Rotifer than was supplied by Ehrenberg, who originally described it. He finds that it cannot be allowed to remain in the genus *Notommata*, in which it was originally placed. It is clearly one of the Hydatinidæ, and a new genus must be formed for its reception. The author gives a definition of the generic and specific characters.

Macrotrachelous Callidinæ.‖—Mr. D. Bryce gives descriptions of ten species which he has not already noticed. The first five of them

* Amer. Natural, xxviii. (1894) pp. 809–10.
† Journ. Quek. Micr. Club, v. (1894) pp. 420–6.
‡ Tom. cit., pp. 427–8 (1 pl.). § Tom. cit., pp. 433–5 (1 pl.).
‖ Tom. cit., pp. 436–55 (2 pls.).

have not, the author believes, been hitherto recorded from the United Kingdom, and the other five are new. The latter are called *C. fusca, plena, habita, angusta*, and *eremita*.

Echinoderma.

Echinoderms of North-Eastern America.*—Prof. A. E. Verrill continues his account of the Echinoderms of North-Eastern America. The total number of species of Starfishes found in this region is 76, of which 7 are found at a depth of more than 2000 fathoms, while the largest number of species is found in the zone between 50 and 100 fathoms. In the family Pterasteridæ he makes a new genus, *Lophopteraster*, characterised by the possession of a very prominent solid crest on the centre of each jaw. *L. abyssorum* sp. n. was taken from 2021 fathoms. As may be supposed, additions are made to the genus *Asterias*.

Sexually produced Organisms without Maternal Characters.†—Dr. O. Seeliger has repeated the experiments of Boveri on bastard larvæ formed by the sperm of one and the eggs of another species of Echinoid. Boveri, it may be remembered, maintained that the male sperm nucleus could be shown to have transmitted paternal characters, while the egg protoplasm, deprived of its nucleus, gave none of the maternal characters to the offspring. Seeliger points out that many bastards from whole eggs resemble the father, and there is therefore no proof that the bastards from broken eggs were not also from nucleated pieces. As to the small size of the nucleus in the dwarf larvæ, Seeliger points out that there is a great deal of variation in the size of the nuclei in normal bastards; and again, bastards of the whole eggs vary much in size. The conclusion would appear to be that though the specialisation of non-nucleated egg fragments may not be impossible, it is probable that the dwarf larvæ obtained by Boveri were merely the results of specialisation of broken eggs or egg-fragments still retaining their nuclei.

Cœlentera.

Sense of Cœlentera.‡—Dr. W. A. Nagel has investigated the influence of mechanical and other stimuli on the senses of Cœlentera. *Beroe ovata* was found to be most sensitive in the centre of the polar area, where there appears to be a true specific sensory organ of the mechanical sense. The surfaces of the umbrella and the velum of *Carmarina hastata* were found to be quite insensitive to mechanical, chemical, or thermal stimuli. Chemical or mechanical irritation of a tentacle is succeeded by merely local shortening and thickening of the filaments, or by swimming movements of the whole umbrella. The lower surface of the umbrella is sensitive to quite slight mechanical stimuli, but not to chemical. Six species of Anemones were examined; in them the tentacles are the most important seat of sensibility, the rest of the covering of the body exhibiting only feeble sensibility. In some

* Amer. Journ. Sci., xlix. (1895) pp. 199–212.

† Arch. f. Entwicklungsmechanik, i. (1894). See Amer. Natural., xxix. (1894) pp. 286–7.

‡ Pflüger, Arch. Ges. Physiol., lvii. (1894) pp. 495–522. See Zool. Centralbl., ii. (1895) pp. 13–6.

species the edge of the sole is sensitive, but in many experiments it exhibited no sensibility at all. The neighbourhood of the mouth was likewise found to be insensitive. The tentacles are universal sense-organs, as they exhibit all possible activities of sense. None of the species examined appeared to be sensitive to sound, and most were also insensitive to light.

Alicia.*—Mr. J. E. Duerden has made an anatomical investigation of this genus of sea anemones, and comes to the conclusion that it is necessary to form for it a new family which may be defined as consisting of Hexactiniæ with a large flat contractile base, with simple cylindrical tentacles. The column provided with simple or complex hollow processes or vesicles over the greater part of its surface, arranged mostly in vertical rows. No cinclides. The sphincter muscle endodermal and diffuse, varying in the extent of its development. Perfect mesenteries few or numerous. No acontia. Owing to our ignorance of the anatomical condition of many of the sea anemones, he thinks it premature to discuss the position of his new family.

Variation of Tentaculocysts of Aurelia aurita.†—Mr. E. T. Browne, on the suggestion of Prof. Weldon, has examined a large number of specimens of the Ephyra and adult stage of *Aurelia aurita*, for the purpose of finding out the variation in the number of tentaculocysts; and, if the variation occurred among the Ephyræ, to see how far it affected the adults. Of 359 Ephyræ collected in 1893 no less than 81, or 22·6 per cent., are abnormal in possessing more or less than 8 tentaculocysts, and the range of variation extends from 6 to 13 tentaculocysts. The percentage of abnormal specimens presented by the 1156 Ephyræ collected in 1894 tells much the same tale. Of 383 adult *Aureliæ* collected in 1894, 87 specimens, or 22·8 per cent., have a variation in the number of tentaculocysts. The variation, on the whole, shows a tendency for an increase in the tentaculocysts. Whether this will change the present characteristic features of the species or not can only be found out by examining the Ephyræ and adults at long intervals of time, and comparing the results with previous records.

Development of Scyphomedusæ.‡—Miss Ida H. Hyde has investigated the early stages in the development of several Medusæ. In *Aurelia flavidula* the germ-layers are formed in two different ways: eggs from Eastport, Maine, give rise to the endoderm by a process of delamination, combined with inwandering of cells from various parts of the blastula wall; eggs from Annisquam formed invaginate gastrulas. In *Cyanea arctica* the gastrulation is a modified invagination in which some cells break loose from the pole that is invaginating; there is, however, no trace of the multipolar inwandering of cells described by McMurrich. In all the species examined the mouth is a new formation, and not a reopening of a gastrula mouth. The inrolled part of the ectoderm remains as the œsophagus. The first pair of gastric pouches arise as a pair of outgrowths from the endoderm, but the second pair comes from the ectoderm. It is thought that these observations

* Ann. and Mag. Nat. Hist., xv. (1895) pp. 213–8 (1 pl.).
† Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 245–51 (1 pl.).
‡ Amer. Natural., xxix. (1895) pp. 289–90.

strengthen Goette's views as to the relation of the Hydromedusæ and Anthozoa.

Coloured Cells in Ectoderm of Hydroids.* — Dr. R. Zoja stated some time since that he had observed diffusely and palely pigmented cells in the ectoderm of the buccal cone and pedal discs in *Hydra vulgaris*. He now finds that some ectoderm cells, resembling glandular elements, in *Sertularella polyzonias*, *S. gayi*, *Halecium tenellum*, and *Aglaophenia pluma*, have a greenish pigment in minute granules.

Porifera.

Development of Sponges.†—Mr. H. V. Wilson has made a study of the gemmule development of *Esperella fibrexilis* sp. n. and some allied forms. He finds that in *Esperella* gemmules appear in any part of the sponge mesoderm, and when present in large numbers cause degeneration in the sponge tissue. A number of mesoderm cells, well supplied with yolk, collect together, and the mass so formed rounds itself off into a gemmule, the follicle of which is formed by the outer cells. The gemmule grows, not only by a cell division, but by fusion with it of other small gemmules. When mature it breaks up into irregular masses of cells, which separate into the constituent individual cells. The outer cells become ectodermal. Those at the posterior pole flatten, and develop neither flagella nor pigment. The other ectoderm cells become columnar and develope both flagella and pigment. The inner mass of cells forms an intercellular network. In the swimming larvæ there is a bundle of long, straight spicules at the posterior end. Bow-shaped spicules and embryonic "shovels" are scattered through the parenchyma. The swimming larva attaches itself by the posterior pole, but obliquely, so that it lies on its side during attachment. The entire ectoderm grows flat, and afterwards spreads out round the sponge, as a membrane containing no mesoderm. The changes in the contour of the young sponge are due to the variations in the edge of a peripheral mesodermic zone, which consists of a network of cells. The canals and subdermal spaces arise as lacunæ or intercellular spåces in the parenchyma, which are attached independently of one another, and only subsequently become connected by the perforation of the intervening tissue. In their origin and mode of development there is no difference between the subdermal cavities, afferent canals, and efferent canals. Flagellated chambers arise independently of one another and of the canals, and only later acquire connection with the canal system. A chamber may be formed from a group of formative cells which arrange themselves in a hollow sphere, the intercellular space becoming the cavity of the chamber; or a chamber may be produced by the appearance of a central cavity in a solid mass of fine cells derived from the division of formative cells.

Development of Oscarella.‡ — Dr. R. V. Lendenfeld notes that although Heider doubted Sollas' observation that the blastula of

* Rend. R. Ist. Lombardo, xxvi. (1893) pp. 568–9.
† Journ. Morphol., ix. (1894) pp. 277–406 (12 pls.).
‡ Zool. Anzeig., xviii. (1895) pp. 17–9.

Oscarella was folded in a complex manner within the body of the parent, this is borne out by Sollas'. preparations, and by others which Lendenfeld and Böhmig have made. He has some other crows to pick with Heider, but they are less important.

Monograph of French Sponges.*—M. E. Topsent calls attention to the fact that, excepting Barrois, Delage, and a few others, French zoologists have not done their duty in regard to Sponges. From 1840–1870 almost nothing was done. Thus patriotism has abetted his monograph. The present part deals with the Tetractinellidæ. He describes the complicated skeleton, the highly differentiated and eminently contractile ectosome, the mesoderm with all its division of labour, and the canalicular system. Then he describes twenty-five French species, among which there is but one Lithistid—*Desmanthus incrustans* Tops.

Non-calcareous Sponges of Port Phillip Heads.†—Prof. A. Dendy has published the first part of a catalogue of the non-calcareous sponges collected by Mr. Bracebridge Wilson in the neighbourhood of Port Phillip Heads. It must not, however, be thought to pretend to completeness, as a very large number of small specimens as yet remain entirely unexamined. The extent of the collection may be imagined from the fact that the non-calcareous sponges are contained in upwards of 900 large Mason jars. Prof. Dendy has had the advantage of being able to study fragments of a very large number of the types of the late Mr. H. J. Carter's Australian Sponges. He finds that the collection contains a very large number of duplicates, there being in some cases two or three dozen jars of the same species. This is due to the fact that the species are very difficult to distinguish by external characters alone, owing to their variability in form and sometimes also in colour.

The present instalment contains only the families Homorrhaphidæ and Heterorrhaphidæ of the order Monaxonida. Although the author is aware that considerable modification will doubtless have to be made in the classification of the Monaxonida as proposed by Mr. Ridley and himself in their 'Challenger' report, he adheres for the present to the original scheme. As might be expected from the extent of the collection, the proportion of new species is large. In the present contribution, out of a total of 37 species 17 are described as new. There is only one new genus, and that receives the name of *Stylotrichophora* (*S. rubra* sp. n.); it is perhaps allied to Marshall's *Phoriospongia*.

Protozoa.

Some new Protozoa.‡—Prof. L. Maggi describes *Amœba heteropoda*, with different kinds of pseudopodia; *Amœba hyalina*, peculiarly hyaline; *Difflugia polycroma*, most diversely coloured; *Monas nephrodes*, a kidney-shaped Flagellate.

Geographical Distribution of Fresh-water Protozoa.§—Herr W. Schewiakoff observed a large number of Protozoa in a journey through a

* Arch. Zool. Expér., ii. (1894) pp. 259–400 (6 pls.).
† Proc. Roy. Soc. Victoria, 1895, pp. 232–60.
‡ Rend. R. Ist. Lombardo, xxvi. (1893) p. 354.
§ Mem. Acad. Imp. Sci. St. Petersburg, xli. No. 8 (1894) iv. and 201 pp. See Zool. Centralbl., i. pp. 813–5.

large part of the world. Among these is a new genus, which he calls *Maupasia paradoxa*, from the Sandwich Islands. The anterior fourth of the ovoid body is provided with long cilia, which apparently have no definite arrangement, while the rest of the body is covered with long plasmatic filaments, which are much stronger than the cilia, and resemble flagella. At the hinder end of the body there is a still longer flagellum. It seems to him clear that the simultaneous possession of cilia and flagella makes *Maupasia* a form intermediate between the Infusoria and the Mastigophora. This intermediate group may be called the Mastigotricha. Unfortunately, like other remarkable tropical intermediate forms, this type has not been seen again. In the second part of his work the author gives an account of the literature of the fresh-water Protozoa as yet observed in Europe. He comes to the conclusion that we cannot say that these Protozoa have a definite geographical distribution, for they seem to be ubiquitous. Of the forms known from Europe, a large percentage have already been found beyond its boundaries. It is likely that species which have been found outside Europe will in time be found also in it.

Food Vacuoles in Infusoria.*—Miss M. Greenwood discusses the constitution and mode of formation of food vacuoles in Infusoria, as illustrated by the history of the process of digestion in *Carchesium polypinum.* She finds that this Vorticellid offers in many ways a particularly good field for the study of some of the processes of protozoan digestion. Ingestion is often eager; digestion may be rapid; and the especially transparent cell-substance which characterises this animal allows of the observation of both. One striking feature after the administration of abundant nutriment is the presence of numerous spherical masses of food. These may number 100 in one polype of *Carchesium.* Continued watching shows that each spherical food-mass springs from one vacuole of ingestion. The vacuole discharged from the œsophagus internally, and made up of water and, as the case may be, amorphous matter, motile particles, or inert particles, passes towards the base of the animal. It pauses internally at the curve made by the nucleus in this region, and without further locomotion or, after slight rotary movement, the finely divided solids which it contains undergo a sudden and striking rearrangement. All the granules present are shifted centripetally, all individual movement is stilled, and a composite solid lying in clear fluid surroundings, represents the scattered particles of a moment ago. The food-masses thus welded journey through the substance of *Carchesium* in a fairly constant fashion, but for a variable time. Digestion may take place at any point throughout a relatively large part of the central substance of *Carchesium*, but the region from which insoluble matter is rejected is, like the place of ingestion, definite. A vacuole of ingestion passes into the protoplasm from the extreme internal point of the œsophagus. Effete matter is passed into the pharynx at the junction of its external and middle thirds from some spot in a ridge running transversely to the long axis of the polype in that region. Ingestion of matter by *Carchesium* is indiscriminate; when the

* Phil. Trans., clxxxv. B. (1894) pp. 355–83 (1 pl.).

particles concerned are sufficiently small, nutritious and innutritious substances exhibit alike the striking centripetal clustering. Intracellular sojourn of innutritious bodies is curtailed, however; the vacuoles in which they lie at first tend to disappear quickly, and there is but rarely that re-formation of fluid which is so nearly concerned in the solution of true food-stuffs.

Genesis, Organisation, and Metamorphosis of Infusorians.* — The posthumous work of Sig. Egisto Tortori, of which, as we understand, only 55 copies have been distributed, does not appear to call for serious scientific comment. It is not, at any rate, confined to Infusorians in the accepted systematic sense.

Ciliated Infusoria.†—Mr. H. Wallengren devotes the first of his studies on Ciliated Infusoria to the genus *Licnophora*. He finds that division is longitudinal; the peristome of the daughter animal is laid down on the left side outside the adoral zone of the mother as a finely ciliated area. From this area there is differentiated a right-handed spiral, consisting of membranellæ, which later on becomes the left-handed adoral zone of the daughter. From this it is clear that the left-handed zone of the fully adult animal is only a secondary development, and that therefore *Licnophora* is not an intermediate stage between the hypotrichous and peritrichous Infusoria, as Bütschli supposed. The author is of opinion that *Licnophora* is not allied to the hypotrichous Infusoria, but is a true, although perhaps specially differentiated, peritrichous Infusorian. Its closest affinities are perhaps with *Trichodina mitra*.

Camptonema nutans.‡—Under this name Dr. F. Schaudinn describes a new marine Rhizopod which he found at Bergen. Its structure is such that it is difficult to say with certainty what its proper systematic position is. The form of its pseudopodia allies it to the Heliozoa, and it appears on the whole to be most closely allied to *Sticholonches*. Its special interest lies in the mode of movement of the pseudopodia and in their connection with the nucleus. It is now, of course, well recognised that between the three modes of movement observed in the protoplasm of the Protozoa there is no fundamental difference. *Amœbæ* have been seen with flagella; Flagellates have been seen with cilia; and there are many other intermediate forms which have exhibited at the same moment two different kinds of locomotor differentiation. The movement of the pseudopodia of *Camptonema* appears to the author to be intermediate between the three generally recognised modes of movement. The pseudopodia exhibit phenomena of streaming, though not markedly. Secondly, they show twisting movements which may be regarded as a preparatory stage to the movement of flagella; and, again, another movement recalls that of a cilium. The connection of the pseudopodia with the nuclei is likewise a matter of great interest, for it leads to the

* 'Genesi, Organizzazione, e Metamorfosi degli Infusori,' Firenze, 1895, royal 8vo, 196 pp., 60 pls.
† Lunds Univ. Arsskrift, xxx. (1894) 48 pp., 1 pl. See Zool. Centralbl., ii. (1895) pp. 36 and 7.
‡ SB. Akad. Wiss. Berlin, 1894, pp. 1277–86 (1 pl).

suggestion that the nucleus plays a considerable part in the movement of the pseudopodia, acting perhaps as a regulating centre.

Natural System of Thalamophora.*—Dr. L. Rhumbler argues in favour of the following arrangement:—

VI. Orbitolitidæ. Later chambers around earlier, subdivided by supporting walls. Since Lias.

VIII. Nodosaridæ. Calcareous, finely perforate chambers, partly in a spiral. Since Carboniferous. In Lageninæ the individual chambers have separated.

X. Rotaliidæ. Spiral rows of calcareous perforate chambers, with a canal system in involute forms. Since Carboniferous.

IX. Endothyridæ. Sand-chambers in spiral rows; partly calcareous and perforate. Since Carboniferous.

V. Miliolinidæ. Bead-like imperforate chambers, mostly calcareous and coiled. Since Trias.

VII. Textulariidæ. Sand-chambers in rows, partly spiral and calcareous. Since Carboniferous.

IV. Nodosinellidæ. Straight sand-tubes with bead-like chambers. Since Carboniferous.

II. Ammodiscidæ. Imperforate tubes, becoming spiral for strength, partly calcareous. Since Carboniferous.

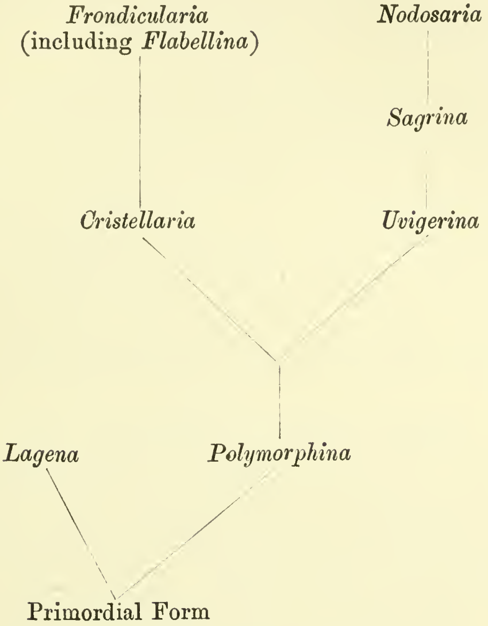
III. Spirillinidæ. Perforate, calcareous, spiral tubes, partly with pocket-like diverticula of the peripheral wall. *Archæodiscus* in Carboniferous.

I. Rhabdamminidæ. With imperforate sand-shells, originally more or less spherical, secondarily tubular. *Girvanella* in Silurian.

Foraminifera from Trinidad.†—Mr. R. J. Lechmere Guppy describes some Foraminifera from the Microzoic deposits of Trinidad. He thinks that the species of Foraminifera have positively as definite a form as most other species of organic beings. He urges that in the so-called higher animals we are not unfamiliar with the occurrence or persistence of what are known as embryonic characters, and just as these characters have thrown most valuable light upon the affinity and course of development of these animals, so they probably will do the same in the case of the Foraminifera. He makes some remarks on the initial stage of *Frondicularia*, which leads him to a view of the evolution of this

* Nachr. K. Gesellsch. Wiss. Göttingen, 1895, pp. 51–98.
† Proc. Zool. Soc. Lond., 1894 (1895) pp. 647–53 (1 pl.).

genus and of allied forms which may be summarised by the following table:—



Adherence of Amœba to solid bodies.*—M. F. Le Dantec has made experiments which enable him to confirm the statement of Bruno Hofer that *Amœba proteus* moves along the surface of solid bodies placed in water, and that this mode of crawling is indispensable if the animal is to feed itself. The author points out that he has shown elsewhere that the protoplasm of the *Amœba* has an outer layer which in contact with water is of high superficial tension. When an *Amœba* is completely extended, its lower face has become a plane parallel and very close to the plate that holds it. Adhesion is effected by molecular attraction. The adhesion is never very energetic.

Thermotaxis of Euglena.†—Dr. E. de Wildeman has made a number of experiments showing how *Euglena viridis* behaves in relation to heat. In the first place, he mixed the Protozoa in a tube with sand, in order to avoid convection currents, placed the tube horizontally in darkness near a source of heat, and found that all the *Euglenæ* accumulated towards the upper part and the warmer end. The same result was got when the Protozoa were kept in fluid. When capillary tubes were used, *in darkness*, the animalcules sought the warmer parts, which were however those with most oxygen. If the crowded end was cooled they shifted to the other. But when the tubes were placed at right angles to rays of the light, the organisms avoided the heat; if the tubes were placed in the same direction as the rays of light they sought the end

* Comptes Rendus, cxx. (1895) pp. 210–3.
† Bull. Soc. Belge Micr., ix. (1894) pp. 245–58.

nearest the light, and the application of heat did not drive them away. As Engelmann has found that sensitiveness to light is stronger with a partial pressure of oxygen greater than the normal, this must also be considered. The relations of thermotaxis and heliotaxis require further working out.

Filament-spores of the Microsporidia.*—By treating the spores of the pébrine parasite with strong nitric acid, M. P. Thélohan has found that, under the influence of this reagent, the spores swell up, acquiring double their original bulk, while at the same time they become extremely pale. Within the spore there is a highly refracting pyriform capsule, which occupies about two-thirds of the interior of the cavity. By the side of this are usually two or three collections of protoplasm coagulated by the acid. To a large number of spores is attached a filament, which attains a length three or four times the original length of the spore, 12–15 μ. By the extrusion of this filament the capsule diminishes in bulk, and becomes much less refractive. Thus the spore of the Microsporidia has quite the same structure as that of some of the Myxosporidia, e. g. Glugeidæ.

Nucleus and Nuclear Division in Benedenia.†—M. A. Labbé, finding examples of this genus which were more than 1 mm. long, was able to make serial sections, and so to study their structure and development. He finds that most of his predecessors are wrong. The nucleus of young specimens of *Benedenia* does not agree at all with the descriptions given by Schneider. Whether rounded or oval, it has a membrane, a very fine reticulum, and a large nucleus. As the Coccidium grows it passes through a certain number of stages which M. Labbé proposes to call premitotic. First of all the karyosome degenerates and undergoes fragmentation ; it becomes hollowed by a vacuole formed by other karyosomes, which in their turn break up and fill the nucleus with their débris. These karyosomes he calls primary karyosomes, and they can be stained by acid substances, which is an indication of their retrograde state. There next appear very small karyosomes varying from 1 to 6 μ. These secondary karyosomes are basophile. The nucleus in this stage is irregular in form. At the centre there are one or more primary karyosomes more or less degenerated, together with extremely delicate fibrils, and, lastly, closely applied against the membrane of the nucleus are the secondary karyosomes. These vary much in number and size. When a nuclear division is going to take place the nuclear membrane breaks, the nucleus becomes stellate in form, the primary karyosomes pass into the cytoplasm, or are partially dissolved in the enchylema. A curious phenomenon may now be observed: part of the nuclear elements emigrate to a point of the periphery where they form a stainable mass, which is not a nucleus, and which does not persist. Meantime, at the centre of the protoplasm there remains a rounded or ovoid mass which is very difficult to stain; it contains fine and numerous granules, and is surrounded by a solid zone of an amorphous, coloured enchylema. The author refrains from explaining the phenomena which he has observed, but promises us a more detailed account.

* C.R. Soc. Biol. de Paris, 1894, pp. 505–6. Cf. this Journal, 1894, p. 465.
† Comptes Rendus, cxx. (1895) pp. 381–3.

New American Species of Sarcosporidia.*—Dr. C. W. Stiles has sent to the Zoological Society of France a *résumé* of a paper communicated to the 'Veterinary Magazine' of Philadelphia. He draws attention to the very frequent occurrence of a very delicate species of *Miescheria* in the heart of an American domestic animal; to a Sarcosporidian from rabbits; to another intra-muscular Sarcosporidian found in the rats of Iowa; in some localities 75 per cent. were infested by it; to another intra-muscular Sarcosporidian found in chickens; and to a species of *Balbiania* found in *Sethopaga ruticilla*.

Coccidia.†—M. P. Thélohan finds that the plasma of Coccidia may exhibit various differentiations. It may contain (1) plastic granules—spherical, refractive, and constantly present reserve-products; (2) large refractive globules; (3) chromatoid granules, of minute size, superficial position, and strong affinity for hæmatoxylin; and (4) exceptional fatty globules.

He describes *Coccidium cristalloides* sp. n. from the intestinal walls of *Motella; C. variabile* sp. n. from the rectum, &c. of many Teleosteans, e. g. *Gobius bicolor; C. clupearum* sp. n. from herring, sardine, and anchovy; and a doubtful species from *Labrus festivus*.

Protozoan Parasite on Fishes.‡—The note of Dr. C. W. Stiles on the appearance of *Ichthyophthirius multifilis* on fishes preserved in the aquaria at the Universal Exposition of Chicago has been translated into French. This parasite, which has been observed by various authors in various places, was submitted by Dr. Stiles to a close investigation. He finds that this species was the cause of a considerable mortality among the fishes exhibited at Chicago. It appears to have been introduced by young cat-fish. It is believed to multiply by simple division, or by fission into a number of small ciliated tubes. But the two methods of reproduction are hardly distinct, as numerous gradations are to be seen between them. Reproduction does not only take place at night, as was supposed by Kerbert, it is also effected during the day. Encystation may be produced on the fish or after the parasite has quitted it. It is not easy to kill parasites while they are on the fish, for fluids tolerated by the fish do not penetrate the viscous material which surrounds the parasites. The most practical method for destroying the parasite consists in attacking it during its free stage, either before or after encystation or during the encysted stage. The last, according to the author's observations, lasts for about one day. The young cells which result from the division which goes on during encystation swim freely in the water, and then attack new hosts.

Parasites of Variola.§—Sig. G. P. Piana and Sig. B. Galli-Valerio describe various bodies which they have observed in purulent pocks when examined directly. (*a*) Spherical hyaline immobile corpuscles of 2–4 μ in diameter; (*b*) spherical bodies of 5–7 μ diameter with hyaline nucleus and finely granular protoplasm, and one or more refractory

* Bull. Soc. Zool. France, xix. (1894) p. 160.

† Arch. f. Zool. Expér., ii. (1894) pp. 541–73 (1 pl.).

‡ Bull. Soc. Centr. d'Agriculture de France, vi. (1894) pp. 165–7 (1 pl.).

§ La Riforma Med., 1894, No. 126. See Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) p. 260.

nucleoli; (*c*) ellipsoidal bodies having a length of 7·5 μ with two small nuclei; (*d*) amœboid mobile bodies, having a length of 7·5 μ, without any obvious nucleus and two or more refracting nucleoli; (*e*) spherical bodies of 8 μ diameter, with one or more pseudopodia and one or more large hyaline nuclei; (*f*) ovoid bodies of 3–5 μ diameter, pointed at one end, and provided with a distinct capsule, in which there appeared to be an opening at the pointed end.

The forms described under *a*, *b*, *c*, were mostly free, though some were observed in lymph cells, and in cells in the deeper layers of the epidermis. The *d* corpuscles were always free. The bodies described under *e* were partly free and partly wedged in between epidermic cells, and those under *f* were found in considerable numbers in the cells of the middle epidermic layer.

BOTANY.

A. GENERAL, including the Anatomy and Physiology of the Phanerogamia.

a. Anatomy.

(1) Cell-structure and Protoplasm.

Division of the Nucleus.*—M. C. Degagny has studied the phenomena attending the disappearance of the nuclear membrane in the process of division, especially in *Spirogyra* and in the embryo-sac of *Lilium*. This disappearance is common to all nuclei, whether animal or vegetable. The processes referred to take place with great rapidity; but the observations of the author indicate that they are not due to the directing spheres. At the moment when the rods are being formed, the nucleus contains a large quantity of granulations and of hyaline protoplasmic substances, among which are found a portion of the rods in the upper part of the nucleus; its lower portion, towards the funicular bundle, contains a denser nuclear fluid in which the other rods are to be found. The granular protoplasm then becomes uniformly disseminated through the nucleus, enveloping all the rods as well as the nucleole. The protoplasm next disappears, and is replaced by innumerable achromatic filaments, which pass in every direction through the nuclear cavity, now deprived of its membrane. The granular protoplasmic substances which have enveloped the nucleole and the rods have been transformed into achromatic filaments, this transformation taking place at the moment when the nuclear fluid which surrounds the rods has become denser. This process is then carried on to the membrane, causing at length its dissolution. A similar change has, in the meantime, also taken place in the filaments and in the nucleole. The nuclein can only act on a very dense medium. Generally speaking, the membrane is completely transformed, but the products of its dissolution no longer form achromatic filaments; the substances which compose it are less profoundly modified; they form granulations which are added to those of the neighbouring cytoplasm.

Nuclear Division in the Anthers of Lilium.†—Professor J. B. Farmer has pursued his investigation of this subject in three species of *Lilium*, *L. candidum*, *speciosum*, and *tigrinum*. As fixing solutions he recommends absolute alcohol, alcohol and acetic acid, alcohol and formic acid, and especially Hermann's solution. He does not accept the criticism of Humphrey ‡ that the results which he previously obtained are the result of pathological conditions.

When the end is approaching of the first division of the nucleus, the chromosomes are arranged regularly in relation to the polar field, but do not enter their period of rest until after the next division. The combining filaments give rise to the barrel-like structure, and the cell-

* Bull. Soc. Bot. France, xli. (1895) pp. 588–96.
† Flora, lxxx. (1895) pp. 56–67 (2 pls.). Cf. this Journal, 1894, p. 74.
‡ Cf. this Journal, 1894, p. 583.

plate is formed by the thickening of the filaments. The protoplasm on both sides of the cell-plate is comparatively light-coloured, but is denser and more deeply coloured near the nuclei. The second division of the nucleus does not partake of the special characters of the first mitosis; it differs from the ordinary mode of division of the vegetative nuclei only in the reduction of the number of chromosomes. The peculiarities of the first division are probably connected with the sudden change in the number of chromosomes.

Active Reserve-Albumin in Plants. — Herr O. Loew * justifies the term "active albumin" on the ground that there is very frequently found stored up in plants an albuminoid substance which is much less stable than ordinary albumen, and presents the greatest resemblance to the albumen of living protoplasm; it is used up in the growth of the plant. He gives a long list of species in which it has been observed, mentioning the part of the plant in which it occurs. Its reactions and the modes of its detection are also given in detail.

M. G. Daikuhara † confirms, in general terms, the results obtained by Loew and Bokorny.

Crystallisation of Cellulose.‡ — Mr. D. S. Johnson confirms to a certain extent the statement of Gilson, that crystal-like substances can be obtained from cellulose, both in flowering and flowerless plants; but maintains, from their optical properties, that they are not crystals in the true sense of the term.

(2) Other Cell-contents (including Secretions).

Different Forms of Chlorophyll.§—Pursuing his investigations on the occurrence of several chlorophylls in the same plant, M. A. Etard now describes two distinct forms of medicagophyll obtained from the lucerne, to which he gives the names medicagophyll α and medicagophyll β, and assigns to them the formulæ, $C_{28}H_{45}NO_4$ and $C_{42}H_{63}NO_{14}$ respectively.

Coniine in Sambucus nigra.||—Dr. G. De Sanctis demonstrates in the elder the presence of the alkaloid coniine, hitherto believed to be confined to the hemlock. The substance extracted resembled ordinary coniine in its chemical character and physiological effects.

Pectase and Pectic Fermentation.¶—MM. G. Bertrand and A. Mallèvre have studied the occurrence in plants of pectase, to which is due the coagulation of vegetable juices rich in pectin. They state that pectic fermentation cannot be produced by pectase alone, but only by the concurrent action of pectase and lime, though the calcium may be replaced by barium or strontium. The coagulum thus formed does not consist of pectic acid, but of the pectate of an alkaline earth. Pectase occurs in a state of solution in the juice of acid fruits and in the sap of the carrot.

* Flora, lxxx. (1895) pp. 68–89. Cf. this Journal, 1893, p. 59.
† Tom. cit., pp. 90–5.
‡ Bot. Gazette, xx. (1895) pp. 23–8. Cf. this Journal, 1894, p. 215.
§ Comptes Rendus, cxx. (1895) pp. 328–31. Cf. this Journal, 1894, p. 702.
|| Atti R. Accad. Lincei Roma (Rend.), ccxci. (1894) pp. 373–6.
¶ Journ. de Bot. (Morot), viii. (1894) pp. 390–6; ix. (1895) pp. 53–8.

Distribution of Aluminium in Plants.*—From a series of analyses made by MM. Berthelot and G. André of the tissues of a variety of plants, chiefly herbaceous, it appears that aluminium exists chiefly in the roots, in conjunction with phosphoric acid. The quantity which reaches the leaves is exceedingly small, in the case of the lime nearly infinitesimal. Aluminium phosphate may occur in solution in the presence of citric and tartaric acid.

(3) Structure of Tissues.

Schizo-lysigenous Receptacles for Secretions.†—Herr W. Sieck has investigated the mode of formation and structure of these receptacles, chiefly in the Rutaceæ. He finds that the oil-cavities arise from a specialised mother-cell or idioblast, from which a special tissue is developed which is subsequently resorbed. The central cells then part from one another, forming a schizogenous cavity. The cell-walls which face the canal present the character of mucilage-membranes. The secretion is formed in the cell-wall, and gradually collects in the side which faces the intercellular space, this portion bulging out so as to form a cap. The oil accumulates in this cap; the outer layer of the membrane bursts, and the oil passes into the canal; the inner layer also bursts, and the protoplasts are exposed. In the resin-canals of the Anacardiaceæ, the lysigenous enlargement of the receptacle is effected by the gelatinising of the intermediate cell-walls. Except under pathological conditions, no purely lysigenous secretion-receptacles occur in the Rutaceæ, Simarubaceæ, Anacardiaceæ, Gynometraceæ, Dipterocarpaceæ, or Hamamelideæ.

Laticiferous System of the Convolvulaceæ.‡—Dr. F. Czapek states that in all the genera of Convolvulaceæ, except *Dichondra*, the laticiferous tubes have septa which are not resorbed. The laticiferous cells originate in the embryo at the same time as the rudiments of the vascular bundles. Those of the hypocotyl and of the cotyledons form a connected system with which those of the epicotyl only subsequently come into connection. In the epicotyl their development coincides in time and place with that of the leaf-trace bundles. In *Dichondra* the laticiferous receptacles are unseptated, and differ from the adjoining cells only in their thicker walls. With regard to their physiological purpose, the laticiferous tubes of the Convolvulaceæ form a conducting system, the function of which appears to cease with the completion of the growth of the plant.

Deformations caused by Fungi.§—Mr. W. G. Smith describes the structure of the deformations in the shoot and leaf caused by species of *Exoascus*. In the shoot the chief change is in the parenchymatous cells, which increase in size and divide. There is less change in the vascular bundles; though there is a tendency to a weakening of the sclerenchymatous elements. The phloem-elements are richer in protoplasm. The tracheæ increase in number, but are less developed. The libriform

* Comptes Rendus, cxx. (1895) pp. 288–90.
† Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 197–242 (4 pls.). Cf. this Journal, *ante*, p. 190.
‡ SB. K. Akad. Wiss. Wien, ciii. (1894) pp. 87–121 (5 pls.).
§ Forstl. Naturw. Zeitschr., 1894, pp. 420, 432, 473 (1 pl. and 1 fig.). See Hedwigia, xxxiv. (1895), Rep., p. 20.

is much less developed, and has thinner walls. In the leaf, either the epidermal cells only increase in size, or the hypertrophy extends also to the other tissues.

Epitrophy of the Cortex.*— Prof. J. Wiesner states that the increased development of cortex on the upper surface of branches which are placed obliquely to the horizon is not an isolated phenomenon, but is a general characteristic of the Tiliaceæ and Anonaceæ in the tropics.

(4) Structure of Organs.

Metamorphosis of Organs.†—Herr A. Mann distinguishes between "ideal" metamorphosis, when, at any point of an organism, a different organ is formed instead of the normal one, and "real" metamorphosis, when the early stages of the typical and of the metamorphosed organ are the same, but one assumes during growth the form and function of the other. The cause of the latter is rather in the internal essence of the plant than in external factors. The phenomena of metamorphosis are illustrated by the case of the metamorphosis of shoots into tendrils (Ampelideæ, Passifloraceæ) and into spines (e. g. *Sideroxylon spinosum*); and of leaves into scales (e. g. *Vitis*), phyllodes (*Acacia*), spines (e. g. *Berberis sinensis*), and tendrils (e. g. *Pisum sativum*).

Adaptation of Plants to External Conditions.‡—Dr. K. O. E. Stenström discusses in great detail the specialities of structure characteristic of plants growing in various climatic conditions, and especially the occurrence of a xerophilous structure in certain hydrophilous plants. The special characters of alpine plants are stated to be:—An increase of the underground and a decrease of the aerial system; strengthening of the mechanical elements; a diminished surface and increased thickness of the leaves; a stronger development of the palisade-parenchyme and of the epiderm; gelatinisation of the inner wall of the epiderm; and a large storing up of tannin.

Flower of the Hemp.§—Sigg. G. Briosi and F. Tognini describe in great detail the male and female flowers of *Cannabis sativa*. The ovule they regard, from a morphological point of view, as neither strictly of an axile nor of a foliar character, but intermediate between the two. The male inflorescence is fundamentally a compound raceme, the secondary axes of which display a sympodial dichotomy.

Fossil Pollen.‖—M. B. Renault describes the remarkable structure of the pollen-grains in the male fructification of *Dolerophyllum*, a fossil genus from the upper Carboniferous. The intine is pluricellular, composed of from eight to ten cells. The extine is thick and coriaceous, and is furnished with two furrows near together on one side of the grain. The portion of the extine between these furrows seems to be lifted off in the form of an opercule, through which the intine appears to project in its entirety.

* Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 93–6. Cf. this Journal, 1893, p. 354.

† 'Was bedeutet Metamorphose in d. Bot.?' München, 1894, 40 pp. and 25 figs.

‡ Flora, lxxx. (1895) pp. 117–240 (2 figs.).

§ Atti Ist. Bot. R. Univ. Pavia, iii. (1894) 119 pp. and 19 pls. See Bot. Centralbl., lxi. (1895) p. 265.

‖ Comptes Rendus, cxix. (1894) pp. 1239–41.

Fruit of Conifers.*—A detailed examination of the structure of the cone in the different genera of Coniferæ leads M. M. Radais to the following general conclusions:—

As a general rule the structure of the strobile confirms the present delimitation of the genera in the Abietineæ, Taxodieæ, and Araucarieæ. *Keteleeria* should form a distinct genus of Abietineæ, and *Sciadopitys* should constitute a separate tribe of the same rank as the Abietineæ. *Cunninghamia* should be removed from the Araucarieæ, and placed in the Taxodieæ, to which it is allied through *Athrotaxis*.

In the Abietineæ the vascular bundles of the supporting bract and those of the seminiferous scale are completely distinct from the origin of these structures; and the same is the case with *Sciadopitys*. In the Taxodineæ there is no constancy on this point. A vascular transfusion-tissue, connected with the xylem-vessels, accompanies each bundle in the bracts and scales; but it is not surrounded by a special endoderm-sheath. Its cells are most frequently furnished with areolated punctations. The development of the vascular system which nourishes the seed differs in the different groups. In most cases the seminal bundle terminates at the chalaza; but in others it is continued into the integument. The secreting canals originate at the base of the bracts and scales. They ramify in the Abietineæ, but not in the Taxodineæ. The supporting function is performed by the xylem-portion of the vascular bundles, and by a specially differentiated sclerenchyme. In addition to the imbrication of the scales of the cone, there are other special contrivances for the protection of the seeds.

Organs of Leaves which absorb and excrete Water.†—Under the name *hydathode*, Prof. G. Haberlandt designates those organs, which are frequently found in the leaves of tropical and other plants, especially designed for the storing up or excretion of water. The hydathodes are always trichomic organs, and may consist of one or of several cells; their special structure offers a great variety, and is described in the case of several trees in Java, belonging especially to the Icacinaceæ, Menispermaceæ, and Moraceæ. When unicellular, the cell is usually more or less of a funnel shape, with a vesicular basal portion, contains abundance of protoplasm, and has a mucilaginous apex. The exudation of water is not simply a mechanical process, but is due to the vital activity of the organ. A very simple type of hydathode occurs in the leaves of grasses.

Hairs imitating Pollen.‡—Prof. O. Penzig describes a peculiar structure in the flowers of *Rondeletia strigosa*, from Guatemala, belonging to the Rubiaceæ. The inner face of the corolla is covered by a yellowish powder, which has all the appearance of pollen, and which apparently attracts the fertilising insects. This substance has, however, nothing to do with pollen, but consists of spherical or ellipsoidal cells resulting from the disintegration of the hairs with which the inside of the corolla was clothed.

* Ann. Sci. Nat. (Bot.), xix. (1894) pp. 165–368 (15 pls.).
† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 366–78 (1 pl.).
‡ Malpighia, viii. (1895) pp. 472–4 (2 figs.).

Development of the Gesneriaceæ.*—According to Dr. K. Fritsch, the tubers of *Sinningia* and *Corytholoma* originate from a hypocotyledonary tubercle; while the scaly subterranean stolons of *Achimenes* and *Kohleria* are found on the first year's plant, as axillary shoots of the cotyledons and of the first pair of foliage-leaves.

New Myrmecophilous Plant.†—Prof. O. Penzig describes an Abyssinian shrub, *Stereospermum dentatum*, belonging to the Bignoniaceæ, in which there is a peculiar contrivance for the housing of ants. The insects are attracted by extra-floral nectaries on the under side of the leaves, and they form themselves a home in the following way. A false dichotomy is produced by the destruction of an axillary bud. The internode between the branching is then hollowed out by the removal of the pith, and an aperture to the formicarium is provided by an opening in the woody cone which still remains in the place of the original axillary bud.

β. Physiology.

(2) Nutrition and Growth (including Germination, and Movements of Fluids).

Amount of Light which is favourable to the Growth of Plants.‡—Prof. J. Wiesner has studied the amount of light which is effective in promoting the growth of plants, and has come to the following conclusions:—Plants (like *Lemna*) which receive an unlimited amount of light do not produce a maximum of organic substances. In by far the greater number of plants the amount of light absorbed is diminished by the form and position of the organs. In trees this amount is reduced, in the peripheral portion of the foliage to $\frac{1}{2}$ or $\frac{1}{3}$, in the central portion to $\frac{1}{80}$ of the possible amount of light. All luxuriant vegetation is produced under conditions of comparatively feeble, and especially of diffused daylight. Intense light is of no advantage to a plant growing in unfavourable conditions, especially in poor dry soil. Although the actual amount of light enjoyed by trees and shrubs is greater in tropical than in temperate regions, yet in the latter the leaves of deciduous woody plants receive a more intense light than those of the former at one particular period of the year, viz. at the commencement of the period of vegetation.

Action of Light on the Form of Plants.§ — Prof. K. Goebel gives the result of a series of observations on the effects of light in modifying the external form of plants, especially in the case of the Cactaceæ. The general result of an increase of light was greatly to increase the superficial area of the organs.

Effect of Climatic Conditions on the Growth of Trees.‖—M. E. Mer states that the effect of the very dry season of 1893 in the Vosges was detrimental to the growth of the trunks of the trees in girth, and still more to the length of the shoots. The low temperature and great moisture of the air during the summer of 1888 had a similar

* Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 96–102.

† Malpighia, viii. (1895) pp. 466–71 (2 pls.).

‡ Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 78–89. Cf. this Journal, 1894, p. 475.

§ Flora, lxxx. (1895) pp. 96–116 (5 figs.).

‖ Comptes Rendus, cxx. (1895) pp. 275-8.

effect in diminishing the diametral growth of the trunks, but not in the length of the shoots, at all events in some kinds of tree.

Development of Buds.*—According to Herr P. Albert, out of 15 kinds of trees examined in which the leaf-buds are provided with scales, the formation of the leaf began, in 1 species, in May of the year preceding the unfolding, in 3 species in June, in 8 in July, in 2 in August, and in 1 in September. The period of the commencement of the formation of the flowers or inflorescence varies from May to September. In those trees in which the leaf-buds are not enclosed in scales, the formation of the leaf commences in some instances in the year before the bud makes its appearance, in others in the year before it unfolds.

Nutrition of Plants by Humus.†—From a series of experiments, made chiefly on *Poa annua*, M. E. Bréal concludes that potassium humate is absorbed directly by plants, without the intervention of lower organisms.

Periodicity in the Formation of Roots.‡—Herr A. Wieler has investigated the connection between the unfolding of leaves and the formation of roots. In all the species of trees examined he finds the same law to prevail—that the formation of roots is coincident with that of leaves, or may begin earlier; it scarcely ever continues longer.

Germination of Lathræa.§—Prof. E. Heinricher has succeeded in germinating the seeds of *Lathræa clandestina*. The process is a very slow one, and takes place only in the presence of woody Dicotyledons, such as *Corylus*, *Alnus*, and *Salix*. The growth of the seedling is exceedingly slow.

Protection of Chlorophyll.‖—Prof. J. Wiesner describes the different fixed positions assumed by the leaves of tropical trees (Java) in relation to the incident light, and the various contrivances for the protection of the chlorophyll against the destructive effects of excessive insolation. These latter are chiefly two—the formation of anthocyan in the cells, and the permanence of an unturgid condition enabling the leaf to hang in a vertical position.

Ascent of Sap.¶—Mr. H. H. Dixon and Dr. J. Joly have investigated the capability of the leaf to transpire against excessive atmospheric pressure; the results lead them to believe that the draught upon the sap established at the leaf during transpiration is alone quite adequate to effect the elevation by direct tension of the sap in tall trees. They also draw the conclusion that the ascent is principally in the cell-cavity and not in the cell-wall.

* Forstlich-naturw. Zeitschr., iii. (1894) pp. 346–76, 393–419. See Bot. Centralbl., lxi. (1895) p. 228.

† Ann. Agron., xx. (1894) pp. 353–70. See Journ. Chem. Soc., 1895, Abstr., p. 28. Cf. this Journal, 1894, p. 478.

‡ Forstwissensch. Centralbl., xvi. (1894) pp. 333–49. See Bot. Centralbl., lxi. (1895) p. 21.

§ Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 117–32 (1 pl.). Cf. this Journal, 1893, p. 500.

‖ SB. Akad. Wiss. Wien, ciii. (1894) pp. 8–36. Cf. this Journal, 1894, p. 475.

¶ Ann. Bot., viii. (1894) pp. 468–70; Proc. Roy. Soc., lvii. (1895) pp. 3–5.

(3) Irritability.

Movements of the Flowers of Cyclamen.* — Herr F. Hildebrand describes the changes of position assumed by the flowers of *Cyclamen* between the opening and the closing. These vary in different species, and are shown not to be dependent on light. The most favourable position for the pollination of the stigma is obtained in some cases by a curving, in others by a twisting of the flower-stalk. With regard to the spiral curving of the flower-stalk, which brings the capsule in contact with the soil, it is observed that this sometimes takes place in one direction, sometimes in the other.

Sensitive Organs of Leguminosæ and Oxalideæ.†—An examination of these organs by Mdlle. A. Rodrigue leads her to the conclusion that the primary cause of the movements resides in the protoplasm, and that this is not in all cases equally sensitive. The anatomical characters which, in the Leguminosæ, correspond to the greater or less extent of the movements, are the more or less complete concentration of the vascular bundles in the motor organ; the nature of its liber; the more or less complete union of the bundles in the motor organ, or their separation; and the nature of the protecting arc of the liber.

Negatively Geotropic Roots.‡—Dr. J. Eriksson records examples of negative geotropism in the roots of sand-plants (*Carex arenaria* and *hirta*), some of them taking a direction vertically upwards, obviously for the purpose of promoting the absorption of water. This corresponds to a similar phenomenon in the case of the aerial roots of epiphytes, and of the roots of some swamp-plants, such as *Sonneratia* and *Avicennia*, and of some palms.

(4) Chemical Changes (including Respiration and Fermentation).

Lactic Fermentation.§ — In the first part of his work M. E. Kayser points out the origin of the lactic ferments, their morphology, their physiological functions, and their distinctive characters in various media. After noticing the methods of culture, the differences in their resistance to heat in liquid media, the time it takes to coagulate the same milk at different temperatures, the acidity produced in the different media, and their resistance to desiccation, are touched upon. In the second part are considered—

(A.) The reaction of the medium. The author finds that (1) the acidity, fixed and volatile, depends upon the particular microbe. (2) The acidity is much greater in a neutral medium. (3) For the same microbe the acidity depends entirely on the medium and the mode of culture.

(B.) Influence of the duration of the fermentation. (1) The total acidity from certain ferments constantly increases; in others it decreases at a given moment, finally increasing or oscillating around a certain limit. (2) The volatile acidity varies in the same way: it is specially

* Bot. Ztg., liii. (1895) 1te Abtheil., pp. 1–30 (1 pl.).

† Arch. Sci. Phys. et Nat., xxxii. (1894) 3 pp.; Bull. Soc. Bot. France, xli. 1894, Sess. Extraord., pp. cxxviii–xxxiv.

‡ Bot. Centralbl., lxi. (1895) pp. 273–9.

§ Ann. Inst. Pasteur, viii. (1894) pp. 737–82.

produced by acetic acid. (3) With certain ferments the total acidity increases, while the fixed acidity continually decreases, and finally only acetic acid remains. (4) After a certain day, which varies with the ferment and the cultivation medium, the total quantity of acid produced per diem regularly decreases.

(C.) Influence of age. (1) The age of the ferment has a great influence on the progress of fermentation. (2) Ferments sown on neutral media preserve for a long time their special properties, but on solid or acid media they degenerate. (3) Ferments a month old are more vigorous than those quite young; but afterwards they lose more or less rapidly their power, according to the medium on which they are sown. Thus they degenerate more quickly on onion juice without chalk than on turnip juice without chalk.

(D.) Influence of air. There are aerobic and anaerobic lactic ferments, and also indifferent (potential) ferments.

(E.) Influence of the superficial and deep culture. (1) The superficial culture produces volatile acid (acetic). (2) The fixed acidity may be considerable in deep cultures, and may attain 85, 90, or even 95 per cent. of the sugar lost, while in surface cultures it is as a rule much less.

(F.) Influence of nitrogenous matter. (1) Lactic ferments prefer pepton to other nitrogenous matter. (2) The fixed acidity increases proportionally, up to a certain limit, with the richness of the medium in pepton; the differences becoming so much the more pronounced as the ferment is exacting. (3) The volatile acidity depends but little on the richness of the medium in nitrogenous matter. (4) The lactic ferments can produce lactic acid from mere nitrogenous matter. (5) The relation between the quantity by weight of ferment and the quantity of sugar lost may be very high. (6) The same weight of ferment can transform into fixed acid more sugar by deep than by superficial culture. (7) The lactic ferments may be so rich in nitrogen as to resemble albuminous substances (15 per cent.). (8) This richness is proportional to the amount of nitrogen in the medium. (9) A deep-cultivated ferment is less rich in nitrogen than when cultivated on the surface, other things being equal. (10) After a certain period the ferment ceases to multiply; its richness in nitrogen increases with the length of the fermentation.

(G.) Influence of the amount of sugar. (1) The addition of sugar to a cultivation medium acts less energetically than the addition of pepton. (2) Each ferment seems to prefer certain sugars to others.

(H.) Salts. (3) The same ferments may give different acids with the same sugar. (4) There are ferments which give with different sugars the same acid (left, right, or inactive). (5) The same ferment may produce different lactic acids. (6) C^5 sugars [sic] may be attacked by vigorous lactic ferments. (7) The age of the seed and the successive cultivations in different media exercise an influence on the acid produced. (8) The same ferment produces the same acid, whether it be cultivated deeply or superficially. (9) There are lactic ferments which seem able to attack the inactive lactate of lime.

(I.) Diastase. A lactic diastase does not seem to exist.

In fine, the lactic fermentation is influenced by a great number of factors, and is subject to a multiplicity of variations.

Liberation of Oxygen demonstrated by Bacteria.*—Prof. Th. W. Engelmann publishes figures illustrating the use of the method which he employed in 1881 in studying the liberation of oxygen from green cells. As is well known, he used Bacteria whose movements and distribution furnished an index to the liberation of oxygen. The point of the present paper is the plate.

B. CRYPTOGAMIA.

Cryptogamia Vascularia.

Adventitious Buds of Cystopteris bulbifera.†—Herr S. Rostowzew gives a detailed description of the structure and mode of germination of the buds produced on the fronds of this fern. Their formation acts prejudicially on the development of the spores, which, though produced in large quantities, were found to be incapable of germination when adventitious buds were borne also on the same frond.

Growth of Arborescent Lepidodendra.‡—Prof. W. C. Williamson gives a very full account of the present state of our knowledge respecting the growth and development of the Carboniferous Arborescent Lepidodendra, and arranges under a number of different types the variations hitherto observed in their structure. The comparison of a very large number of sections induces the author somewhat to modify his previous view of an enlargement of the primary xylem proceeding from above downwards.

Roots of Calamites.§—Acccording to Prof. W. C. Williamson and Dr. D. H. Scott, the fossils hitherto described under the name of *Astromyelon Williamsonis* are the adventitious roots of Calamites. Their structure is in all respects that of roots, as is shown by the centripetal primary xylem, the alternating strands of primary xylem and phloem, the endogenous mode of branching, and the absence of nodes.

Muscineæ.

Respiration and Assimilation of Mosses.‖—According to Herr B. Jönnson, the intensity of respiration and assimilation varies greatly in different species of moss. Those which grow in moist situations show a much greater energy than the xerophilous species. The red colour characteristic of mosses exposed to a strong insolation causes a diminution in the intensity both of respiration and of assimilation.

Rabenhorst's Cryptogamic Flora of Germany (Musci).—Parts 24, 25 of this work, edited by Herr K. G. Limpricht, complete the account

* Arch. Néerland. Sci., xxviii. (1894) pp. 358–71 (1 pl.). Cf. this Journal, 1881, p. 962.
† Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 45–57 (1 pl.). Cf. this Journal, 1894, p. 595.
‡ Mem. Manchester Lit. and Phil. Soc., ix. (1894–5) pp. 31–65.
§ Proc. Roy. Soc., lvii. (1894) pp. 1–3.
‖ Bot. Notiser, 1894, p. 152. See Hedwigia, xxxiv. (1894), Rep., p. 25.

of the Buxbaumiaceæ with the genus *Diphyscium* (1 sp.). The pleurocarpic mosses are now entered on with the families,—Fontinalaceæ:—*Fontinalis* (11 sp.), *Dichelyma* (2 sp.); Cryphæaceæ:—*Cryphæa* (1 sp.), *Leucodon* (1 sp.), *Antitrichia* (2 sp.); Neckeraceæ:—*Leptodon* (1 sp.), *Neckera* (9 sp.), *Homalia* (2 sp.); Pterygophyllaceæ:—*Pterygophyllum* (1 sp.), *Cyclodictyon* (1 sp.), *Daltonia* (1 sp.); Fabroniaceæ:—*Fabronia* (3 sp.), *Anacamptodon* (1 sp.), *Habrodon* (1 sp.), *Clasmatodon* (1 sp.), *Myrinia* (1 sp.); and the commencement of the Leskeaceæ:—*Myurella* (3 sp.), *Leskea* (4 sp.), with the beginning of *Anomodon* (8 sp.).

Algæ.

New Genera and Species of Algæ.*—The most recent instalment of Prof. J. G. Agardh's 'Analecta Algologica' is largely devoted to a monograph of the genus *Ceramium*, the species of which, 63 in number, are described in detail and rearranged from characters derived from the structure of the frond and the arrangement of the sphærospores. In addition to remarks on other genera, the following new genera are described:—

Herpophyllum (Delesseriaceæ). Frons una pagina inferiore adfixa superiore convexiuscula, quasi ex tereti complanata, enervis cellulis subinordinatis pleiostromaticis contexta, interioribus majoribus cylindraceo-oblongis per plures series dense juxtapositis, stratum interius formantibus, exterioribus multo minoribus subrotundatis aut secus superficiem paulo longioribus, laxius juxtapositis, stratum exterius formantibus. Cystocarpia in superiore pagina sessilia, marginibus vicina, intra pericarpium hemisphæricum submonostromaticum nucleum simplicem foventia; placenta basilis, nodo oblongo constituta, sursum fila gemmidiifera plurima emittens; fila articulata parce dichotoma fastigiata, superne invicem sublibera, in articulis terminalibus clavato-obovatis gemmidia conformia subsingula foventia.

Pachyglossum (Delesseriaceæ). Frons plana crassius membranacea, linearis, prolificationibus intra marginem ortis, sæpe ex eodem loco pluribus, quasi in rosulas sparsas conjunctis uberius ramosa, facie tota conformiter cellulosa subavenia, cellularum seriebus inter paginas numerosis radiatim superpositis contexta, cellulis intimis unicam seriem inter margines formantibus suboblongis, exterioribus subcubicis. Sori in jugis linearibus intra margines utrinque elevatis evoluti, nematheciosi, inter fila elongata articulata sterilia sphærosporas paucas rotundatas triangule divisas infra superficiem sitas generantes.

Dasyclonium (allied to *Polyzonia*). Frons teretiuscula polysiphonea, pinnatim ramosa ramulisque fere ad quodque geniculum quoquoversum egredientibus dense vestita, subspongiosa; ramulis ambitu subdefinitis patentissimis, a rachide sua recurvata, deorsum nuda sursum ramellos alternantes longe acuminatos et subdivergentes emittentibus. Stichidia a rachide ramulorum transmutata leguminiformia fere in gyrum recurvata, apicibus obtusis oblonga, ramellis persistentibus a lateribus et sursum armata, sphærosporas magnas, unica serie curvata dispositas, foventia.

* Acta Univ. Lund, xxx. (1893, '94) 99 pp. and 1 pl. Cf. this Journal, 1894, p. 598.

Marine Algæ of Greenland.*—In an exhaustive account of the sea-weeds of Greenland, M. L. Kolderup Rosenvinge describes the following four new genera, the first three belonging to the Phæophyceæ, the last to the Chlorophyceæ.

Cœlocladia (Scytosiphonaceæ). Frond cylindrical, hollow, branched, plurilocular sporanges shortly cylindrical, occupying the whole of the thallus, usually from two to four coalescing by their edges.

Omphalophyllum (Punctariaceæ). Thallus probably at first saccate, soon bursting on one side and spreading out into a membranous lamina, composed of one or two layers of cells, destitute of hairs, fixed on a short umbilical stipe; unilocular sporanges scattered, similar in form to the vegetative cells.

Symphyocarpus (Ectocarpaceæ). Thallus crustaceous, composed of a basal layer and erect filaments; the former composed of a single layer of branched irregularly radiate filaments, at first free, afterwards coalescing; erect filaments short, equal in length, simple or pseudo-dichotomous, free, but packed closely together; each cell with a disk-shaped chromatophore on its upper wall; plurilocular sporanges oblong-obovoid, from two to four confluent at their edges, situated at the apex of erect filaments, opening at their apex.

Chætobolus (Mycoideaceæ). Thallus epiphytic, hemispherical or nearly globular, the cells dividing in all directions; superficial cells (except the marginal ones) ending in a long hair which is not septated nor separated by a septum; propagation probably by zoospores formed in the superficial cells.

Another new genus, *Gayella*, is formed from *Schizogonium radicans* and *Ulothrix discifera*. The following new species are described:—*Lithothamnion flabellatum, L. tenue, Laminaria grœnlandica.*

Fertilisation of Nemalion multifidum.†—By laying in a saturated solution of picric acid, washing, and staining with borax-carmine, Prof. N. Wille has been able to follow the passage of the pollinoid into the trichogyne in this sea-weed, and its coalescence with the female nucleus.

Parasitic Sea-weeds.‡—Herr F. Oltmanns describes the following new species of parasitic sea-weeds from the Baltic:—*Acrochæte parasitica* on *Fucus vesiculosus, serratus*, and *inflatus*, somewhat resembling *Mycoidea parasitica; Ectocarpus fungiformis* on species of *Fucus*; *Streblonema æquale* on *Chorda filum.*

Algæ of the Lake of Plön.§—Dr. H. Klebahn and Herr E. Lemmermann enumerate the species comprising the algal vegetation (including Characeæ) of the Lake of Plön. Several new species are described, and the following new genera:—

Klebahniella (Chætophoraceæ). Thallus disciformis v. pulvinatus, læte viridis, modo epiphyticus modo endophyticus, e filamentis irregulariter ramosis ad septa fragilibus compositus; rami diversi, alii

* Medd. om Grönland, iv. (1893) pp. 765–981 (2 pls. and 57 figs.); Ann. Sci. Nat. (Bot.), xix. (1894) pp. 53–164 (57 figs.).
† Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 57–60 (6 figs.).
‡ Bot. Ztg., lii. (1895) 1te Abtheil., pp. 207–16 (1 pl.).
§ Forschungsber. Biol. Stat. zu Plön, 1895, 67 pp. and 15 figs.

rhizoides, simplices v. ramosi, plerumque unicellulares, in mucum gelatinosum algarum nonnullarum penetrantes, alii pluricellulares, erecti, in pulvinos minutos cumulati; chlorophora parietalia. Propagatio zoogonidiis pyriformibus in cellulis ramorum terminalibus ortis.

Zachariasia (Chroococcaceæ). Cellulæ oblongæ v. ellipticæ, v. e pressione mutua parum angulatæ, distincte vaginatæ; quaternæ in tegumento communi dispositæ; chlorophora stellata.

Formation of Rhizoids by Chlorophyceæ.*—M. O. Borge states that the capacity of forming rhizoids is especially characteristic of those Chlorophyceæ which live in running water, e. g. *Cladophora, Draparnaldia, Ulothrix, Spirogyra fluviatilis.* Their formation is induced by contact with a solid substance, but may also be promoted by growing in a concentrated nutrient solution. The rhizoid is always produced near the extremity of a filament, usually from the terminal cell. If the distance from the apex is considerable, it is always formed in contact with a dead cell. *Vaucheria* and *Œdogonium* form rhizoids only on young filaments; *V. sessilis* appears never to produce them, and the same is the case with other filamentous Chlorophyceæ which grow only in stagnant water.

Membrane of Caulerpa.†—Herr C. Correns finds that, in all species of *Caulerpa* examined, moderately concentrated sulphuric acid causes the formation of granules in the cell-wall, and these granules yield the microchemical reactions of sphærocrystals. They occur also in some species of *Bryopsis*, but not in other genera of Siphoneæ. The membrane itself does not consist of cellulose in the strict sense of the term, nor is it identical with callose, fungi-cellulose, or reserve-cellulose. It exhibits a distinct striation. In some species of *Caulerpa*, but not in others, the author also describes a peculiar thickening of the membrane in the form of conical projections, which he regards as of the nature of rudimentary cystoliths. They have nothing to do with the " beams."

Fungi.

Classification of Fungi.‡—M. L. Marchand proposes the classification of the Fungi (including Lichens), under two primary divisions, the MYCOMYCOPHYTES and MYCOPHYTOPHYTES, the former comprising the Fungi and a few families of Lichens, the latter the remaining Lichens. The Mycomycophytes are again divided into two groups, the ASPOROMYCETES and the SPOROMYCETES, the former corresponding to the " Fungi imperfecti." The Sporomycetes are arranged under four heads, the *Mycomycetes, Siphomycetes, Thecamycetes*, and *Basidiomycetes*. The Siphomycetes (Phycomycetes) comprise the *Endoconidiferæ* (Chytridiaceæ, Mucoraceæ, Monoblepharideæ, and Saprolegniaceæ), and the *Ectoconidiferæ* (Peronosporaceæ and Entomophthoraceæ). The Theca-

* 'Sur la formation de rhizoïdes chez quelques Chlorophycées filamenteuses,' Upsala, 1894, 61 pp. and 2 pls. See Morot's Journ. de Bot., viii. (1894) Bull. Bibl., p. lxv.

† Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 355-67 (1 pl. and 1 fig.). Cf. this Journal, 1894, p. 215.

‡ Bull. Soc. Mycol. France, 1894. See Bot. Centralbl., lxi. (1895) p. 227.

mycetes (Ascomycetes) are divided into the *Haplotheciæ* (Glycocymaceæ [Saccharomycetes], Taphrinaceæ, Gymnoasceæ, and Laboulbeniaceæ), *Endotheciæ* (Tuberaceæ and Pyrenomycetes), and *Ectotheciæ* (Hysterineæ and Discomycetes). A corresponding classification is made of the Basidiomycetes into the *Haplobasidieæ* (Ustilagineæ and Exobasidiaceæ), *Endobasidieæ* (Ecchynaceæ, Hymenogastreæ, Lycoperdaceæ, Nidulariaceæ, Battareaceæ, and Phalloidaceæ), and *Ectobasidieæ* (Pucciniaceæ, Auriculariaceæ, Tremellaceæ, Caloceraceæ, Clavariaceæ, &c.).

New Genera of Fungi.* — Dr. C. v. Tubeuf finds the leaves of the larch attacked and destroyed by a parasitic fungus *Hypodermella Laricis* g. et sp. n., which he makes the type of a new genus distinguished from *Hypoderma* by the unicellular tear-shaped spores, four of which occupy each ascus. To the same genus belongs also *Hypoderma subsigenum*.

Herr H. O. Juel † founds a new genus of Gasteromycetes, *Hemigaster*, on a fungus inhabiting the excrement of rabbits and guinea-pigs. The fructification is round, closed, and fixed to the substratum by a short stalk; it contains a single chamber penetrated by a columel; the peridium is simple and very loose. The columel is simply a prolongation of the stalk, and passes over above into the peridium. The peripheral wall of the chamber is clothed with a basidial layer. From the central wall of the chamber, or columel, proceeds a dense weft of hyphæ which produces chlamydospores, and subsequently fills up the chamber. The basids are unicellular, and bear four terminal smooth very pale flesh-coloured spores. The chlamydospores resemble the basidiospores, but are enveloped in short hyphal branches.

Herr P. A. Karsten ‡ describes the following new genera of Fungi from Finland:—

Grandiniella. Hymenium udum, subgelatinoso-ceraceum, siccitate corrugatum v. rimosum, granulosum; granulis hemisphæricis, mollibus; cystidia subuliformia v. fusoidea; sporæ ellipsoideæ v. oblongatæ.

Chætostromella. Sporodichia erumpenti-superficialia, pulvinata, setulosa, atra; conidia pedicellata, ellipsoidea, muralia, fuliginea.

M. A. Dewevre § establishes a new genus of Mucorini, *Carnoya*, founded on *Mortierella capitata*.

Parasitism of Peronospora parasitica.‖—Herr P. Magnus points out that this parasitic fungus may produce quite different forms of disease in the host according to the age of the latter. The observations were made especially on the wallflower. The same is true also of other species of *Peronospora*.

Parasitic Fungi.—Herr B. Frank ¶ states that a very destructive disease of rye is due to the attacks of *Leptosphæria herpotrichoides*, not hitherto known as a parasitic fungus. The effects are very similar to those produced on wheat by *Ophiobolus herpotrichus*. The same author

* SB. Bot. Ver. München, Nov. 12, 1894. See Bot. Centralbl., lxi. (1895) p. 48.
† Bot. Centralbl., lxi. (1895) pp. 87–9. ‡ Hedwigia, xxxiv. (1895) pp. 7–9.
§ Bull. Soc. Belge Microscop., xxi. (1895) pp. 36–8.
‖ Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 39–44 (1 pl.).
¶ Deutsch. Landwirth. Presse, 1894, Nos. 51 and 67. See Bot. Centralbl., lxi. (1895) p. 66.

states that *Leptosphæria Tritici* is very destructive to the wheat crop throughout Germany.

Herr P. Hennings * describes the destructive effects on various species of *Veronica* of *Septoria exotica*.

Miss I. Clendenin † has found on *Geranium carolinianum* a *Synchytrium* which is probably an undescribed species.

Herr H. O. Juel ‡ finds on *Carex vulgaris* the uredoform (*Puccinia uliginosa* sp. n.) of *Æcidium Parnassiæ;* on *Agrostis borealis* and probably also on *Anthoxanthum odoratum*, the uredoform (*P. borealis* sp. n.) of *Æcidium Thalictri;* and on *Carex rupestris* the uredoform (*P. rupestris*) of *Æcidium Saussureæ.*

Herr E. Fischer § adduces reasons for regarding *Æcidium penicillatum*, which occurs on several species of Pomeæ, as belonging to *Gymnosporangium tremelloides*, a species distinct from both *G. clavariæforme* and *G. juniperinum*, but occurring also on the juniper.

Dr. U. Brizi ‖ describes in detail the phenomena which accompany the *brunissure* or blackening of the leaves of the vine. The plasmode which is found in the diseased cells cannot, he considers, be properly referred to *Plasmodiophora*, but belongs to an organism intermediate in its characters between the Myxomycetes and the Amœbæ.

Mr. N. B. Pierce¶ describes the destructive effects of the prune-rust, *Puccinia Pruni*, on prune, plum, and peach-trees in California.

According to Mr. H. J. Webber,** a parasitic fungus, *Aschersonia tahitensis*, is very destructive to the pupæ and larvæ of *Aleyrodes Citri*, which inflicts so much injury on the orange and other fruits belonging to the Aurantiaceæ.

Formation of the Lichen-thallus.††—Mr. C. C. Curtis describes a very early condition of a lichen-thallus, the gonidial elements of which bear a close resemblance to *Protococcus viridis*, as well as the mode in which they became gradually enveloped by hyphæ.

Conversion of Aspergillus into Saccharomyces.‡‡—Mr. J. J. Juhler has observed that a species of *Aspergillus* can, under certain circumstances, be converted into an alcohol-forming *Saccharomyces*. This is the first time that it has been experimentally demonstrated that the Saccharomycetes are derived from the higher fungi. The observation is confirmed by Jörgensen.

Spores of Uredo Polypodii.§§—Mr. B. M. Duggar discusses the nature of the two kinds of spore found in this fungus—one thin-walled and the other thick-walled—and assigns reasons for regarding them both as true uredospores, the former being merely an immature condition of the latter.

* Zeitschr. f. Pflanzenkrankheiten, iv. (1894) pp. 203–4. See Bot. Centralbl., lxi. (1895) p. 120.
† Bot. Gazette, xx. (1895) pp. 29–31 (1 pl.).
‡ Ofv. K. Vetensk.-Akad. Förhandl., li. (1894) pp. 409–18.
§ Hedwigia, xxxiv. (1895) pp. 1–6 (1 pl.).
‖ Nuov. Giorn. Bot. Ital., ii. (1895) pp. 118–29.
¶ Journ. of Mycol., vii. (1894) pp. 354–63 (4 pls.).
** Tom. cit., pp. 363–4.
†† Journ. New York Micr. Soc., x. (1894) pp. 63–9 (1 pl.).
‡‡ Centralbl. f. Bakteriol. u. Parasitenk. (2te Abteil.), i. (1895) pp. 16–7.
§§ Proc. Amer. Acad. Sci., 1894, pp. 396–400 (1 pl.).

Conids of Hydnum.*—M. N. Patouillard records the occurrence in *Hydnum Erinaceus* (as previously observed in *H. coralloides*) of two kinds of conid—microconids on the hymenium, among the basids, seated on basid-like conidiophores; and megaconids on the trama, between the spines of the hymenium.

Development of the Hypogæi.†—Dr. R. Hesse publishes a monograph of the Tuberaceæ and Elaphomycetes of Germany, in which a number of new genera and species are described.

The author does not lay the same stress as he has previously done on the part played by the "swarmers" in the life-history of the Hypogæi; but describes a very complicated process of impregnation in the conjugation of "archicarps" and "antherids," and also a possible conjugation of microspores.

The Tuberaceæ are divided into two groups. In the first the glebe is either chambered or solid, the sterile portion developing in the form of external asci, or of broader or narrower plates of tissue springing from the peridium, or of a pseudo-parenchyme with asci solitary or collected in clusters. In the second group the glebe is never chambered, and is composed of a single or of many hymenial plates. The Elaphomycetes are also divided into two groups, the peridium having a soft and spongy consistence in the one, with a smooth outer cortex; while in the other the peridium is tough or woody, and the outer cortex warty or spiny.

Canceromyces.‡—Dr. Van Niessen makes a preliminary communication on a case of carcinoma uteri in which was found a greenish-black fungus standing between the Blasto- and Hyphomycetes, and presenting appearances having extraordinary resemblance to the nests in epithelioma. The author seems to think that there must be some genetic connection between this fungus and the cancer, and denominates it *Canceromyces*.

Rabenhorst's Cryptogamic Flora of Germany (Fungi). — The most recently published parts (42–44) of Dr. Rehm's Monograph of the German fungi are still entirely occupied by the Pezizaceæ. The following genera of Eupezizeæ are treated of:—*Pitya* (2 sp.), *Barlæa* (12 sp.), *Humaria* (54 sp.), *Pyronema* (10 sp.), *Aleuria* (3 sp.), *Geopyxis* (11 sp.), *Discina* (5 sp.), *Acetabula* (5 sp.), *Macropodia* (5 sp.), *Plicariella* (6 sp.), *Melachroia* (2 sp.), *Urnula* (1 sp.), *Plicaria* (34 sp.), *Tarzetta* (1 sp.), *Otidea* (7 sp.), *Sphærospora* (3 sp.), *Pseudoplectania* (3 sp.), *Desmazierella* (2 sp.), *Lachnea* (48 sp.), *Sarcoscypha* (7 sp.), *Sepultaria* (4 sp.). The Ascoboleæ are commenced with *Ascophanus* (18 sp.), *Lasiobolus* (3 sp.), and *Rhyparobius*, of which 9 species are described. The woodcuts representing the generic characters are of the usual excellence; some new species are described.

* Bull. Soc. Mycol. France, 1894, p. 158. See Bot. Centralbl., lxi. (1895) p. 262.
† 'Die Hypogæen Deutschlands,' Bd. ii., Halle, 1894, 140 pp. and 11 pls. See Bot. Ztg., liii. (1895) 2te Abtheil., p. 33. Cf. this Journal, 1891, p. 230.
‡ Centralbl. f. Med. Wissensch., May 1894. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 137.

Protophyta.

a. Schizophyceæ.

Structure of Schizophyceæ.*—Herr S. Stockmayer reviews our present state of knowledge of the structure of Schizophyceæ, which he regards as Algæ with no true nucleus and no chromatophore. He was able to detect, in some species, a distinct reticulate structure in the central body. The Glaucocystideæ † appear to consist of genera of true Algæ which contain phycocyan.

Dictyosphærium.‡—Prof. A. Borzì points out that the observations of Zopf § on the life-history of *Dictyosphærium* are very much in accord with those already recorded by himself. The chromatophore has not, as has been stated, the form of a disk, but of a solid substance, frequently that of a segment of a sphere. The author considers the nearest allies of *Dictyosphærium* to be *Schizochlamys* and *Dictyocystis*.

To these observations Zopf replies.‖

Growth of Diatoms in Surface-Waters.¶—According to Mr. G. C. Whipple, the growth of diatoms in ponds is directly connected with the phenomenon of stagnation; their development does not occur when the lower strata of water are quiescent, but rather during those periods of the year when the water is in circulation from top to bottom. They flourish best in ponds with muddy bottoms. In deep ponds there are two well-defined periods of growth, in the spring and autumn. The two most important conditions of growth for diatoms are a sufficient supply of nitrates and a free circulation of air. Temperature has but little influence on their development.

Gloiotrichia echinulata.**—According to Herr P. Richter, this alga, which is a frequent constituent of "flos aquæ," has the property of extracting sulphur from the water, this being the cause of the red granules frequently observed in this organism. It has frequently been confounded with *Rivularia Pisum*.

Motility of the Cyanophyceæ.††—Herr S. Strodtmann attributes the power of spontaneous motion in *Gloiotrichia echinulata* to the red granules described by Richter. Under certain conditions these red granules are wanting, and the alga then sinks instead of floating. The red granules are probably vacuoles filled with a gas and enclosed in protoplasm, which serve to float the "flos aquæ" on the water.

Gas-vacuoles in the Cyanophyceæ.‡‡—Dr. H. Klebahn has investigated the nature of the red bodies which occur especially in those Algæ belonging to the Phycochromaceæ which form "flos aquæ" on the surface of fresh water. He assigns reasons for concluding that they

* Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 102–4.

† Cf. this Journal, 1892, p. 830.

‡ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 248–55. Cf. this Journal, 1891, p. 637.

§ Cf. this Journal, 1894, p. 605.

‖ Tom. cit., pp. 344–5.

¶ Technology (Boston), vii. (1894) pp. 214–31.

** Forschungsber. Biol. Stat. Plön (Zacharias), pp. 31–47. See Hedwigia, xxxiii. (1894) Rep., p. 35.

†† Biol. Centralbl., xv. (1895) pp. 113–5.

‡‡ Flora, lxxx. (1895) pp. 241–82 (1 pl.).

cannot consist of sulphur or of any other solid or liquid substance; but that, on the contrary, they are gas-vacuoles, containing either atmospheric air or nitrogen. Their existence is especially noteworthy in *Gloiotrichia echinulata*, but they occur also in *G. Pisum*, *Anabæna flos-aquæ*, *Aphanizomenon flos-aquæ*, and others. Several new species of *Anabæna* are described.

β. Schizomycetes.

Bactericidal Action of Light and Air.—Mr. R. F. D'Arcy and Mr. W. B. Hardy * confirm the result arrived at by Marshall Ward † that the bactericidal power of light is a peculiar property of light of short wave-length, and is at its maximum at the violet end of the blue.

Mr. F. F. Wesbrook ‡ agrees with other observers in the conclusion that oxygen is a necessary factor in the destruction of bacteria by light. Without oxygen sunlight is powerless.

Thermophilic Bacteria.§—Mr. A. Macfadyen and Mr. F. A. Blaxall give an account of those bacteria which flourish at a high temperature in manures, &c. They have active fermenting properties, and appear to be the cause of spontaneous combustion.

Fossil Bacteria.‖—M. B. Renault finds in fossil remains in the "Culm," vegetable tissues, more or less disorganised by the attacks of bacteria, accompanied, in several instances, by the bacteria themselves. These present a considerable resemblance to *Bacillus megaterium*, but are larger, septated, and with spherical spores. M. Renault proposes the name *B. vorax* for this Schizomycete, which he regards as the most ancient yet described.

Number, Vitality, and Virulence of Bacteria in Articles of Clothing.¶—For the purpose of estimating the number, vitality, and virulence of microbes in clothes, Herr E. Leitz punched out round pieces of 3 mm. diameter, which were teazed out and placed in gelatin. In this way he obtained 956 colonies from a woollen stocking, and 712 colonies from a cotton one, both of which had been worn; 33 colonies from a glove; 20 from a cotton cloth, and 9 from a linen cloth, all unused; 23 from a linen cloth in use for eight days; 26 from a piece of velvet, and 32 from a piece of silk, both worn; 22 from an unused piece of silk. The pathogenic microbes were infrequent, and confined to *Staphylococcus pyogenes*. The bacillus of enteric fever was found in the clothes after 21–26 days, *Staphylococcus pyogenes albus* after 19 days, and anthrax on a linen cloth still virulent after the lapse of a year. The coccus of erysipelas was not found after 18 hours, while the cholera bacillus on linen lasted three days. The shirts of two consumptives who sweated profusely were tested on two guinea-pigs, but the results were negative.

* Journ. Physiol., xvii. (1894) pp. 390–3. See Journ. Chem. Soc., 1895, Abstr., p. 57.

† Cf. this Journal, 1894, p. 241.

‡ Journ. Pathol. and Bacteriol., iii. (1894) pp. 70–7. See Journ. Chem. Soc., 1895, Abstr., p. 58.

§ Journ. Pathol. and Bacteriol., iii. (1894) pp. 87–99. See Journ. Chem. Soc., 1895, Abstr., p. 58.

‖ Comptes Rendus, cxx. (1895) pp. 162–4.

¶ München, 1893. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 1018.

Absorption of Bacteria from Fresh Wounds. * — Herr Schimmelbusch, in conjunction with Dr. Ricker, has made some experiments in order to ascertain how quickly bacteria arrive in the internal organs through a fresh wound. It was found that anthrax, half an hour after inoculating a fresh wound on the back or tail of a mouse, could be found in the lungs, liver, spleen, and kidneys. Saprophytes like rose yeast, *Bacillus mycoides*, *Bacillus pyocyaneus*, and mould spores, when inoculated on wounds 2–3 cm. long and 1 cm. deep on the back or upper part of the thigh of rabbits, were almost invariably found in a very short time – even five minutes—in the various organs. It was always necessary, however, to keep the whole of the organs, or, at any rate, very large pieces of them, for examination.

Distribution of Bacteria in Milk after Centrifuging.†—Herr E. Wilckens has made experiments for determining the number of bacteria in milk before and after centrifuging, and their distribution in the milk, cream, buttermilk, and deposit. One very important result obtained was that the greatest number of the germs were found in the cream, the buttermilk and the deposit containing only a relatively small number. All these together, however, did not account for the germs in the milk before centrifuging; the greater part of them, as ten experiments out of twelve showed, having disappeared during the centrifuging. The author therefore concluded that the purification of the milk was due to the centrifuging and not to the deposition of the germs.

Albuminous Bodies in Tubercle Bacilli.‡ — In order to obtain the albuminous substances that are contained in tubercle bacilli, Herr K. von Hofmann manipulated 42 four months old cultures in glycerin-agar in the following way. The bacilli, removed from the medium, were placed in an ice-box for eight days in distilled water, and filtered through a Berkefeld filter. From the filtrate, which gave the proteid reaction, was precipitated by means of 60 per cent. alcohol, 0·05 grm. of albuminous substance, which, when injected into a tuberculous guinea-pig, caused no obvious reaction. The residue on the filter was extracted for three days with 1 per thousand hydrochloric acid, and then filtered through a Berkefeld. From this filtrate, neutralised with carbonate of soda, was precipitated with 60 per cent. spirit, 0·04 grm. of albuminous substance.

The next treatment of the residue on the filter, with 2 per thousand caustic potash for eight days and subsequent filtration, produced, when neutralised with hydrochloric acid, a pretty copious deposit of albumen, which was employed for injecting tuberculous and healthy guinea-pigs. The effect of this was analogous to that of tuberculin. Tuberculous guinea-pigs injected with 0·875–3·5 mgrm. reacted generally and locally, while healthy guinea-pigs only reacted to a dose of 3·5 mgrm. with a rise of temperature.

Small quantities of albuminous substance were precipitated from the

* Deutsche Med. Wochenschr., 1894, No. 28. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 1019.

† Oesterr. Molkereizeitung, 1894, No. 14. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 969.

‡ Wien. Klin. Wochenschr., 1894, p. 712. See Centralbl. f. Bakteriol. u. Parasitenk. (1e Abt.), xvii. (1895) pp. 375–6.

neutralised filtrate by further acidulation, and this again purified by filtration and precipitation with 60 per cent. spirit.

A greater amount was obtained by boiling the residue which remained on the filter after treatment with caustic potash. Injection of the filtrate caused a rise of temperature in both healthy and tuberculous guinea-pigs, and in the latter a local reaction as well. From this filtrate a white deposit was precipitated by 60 per cent. alcohol, which induced a slight general reaction and well-marked local reaction in tuberculous guinea-pigs, while healthy animals were scarcely at all affected.

Rhinoscleroma protein caused a similar but less marked reaction. The last remains on the filter were treated with alcohol and ether, the filtrate evaporated, and the residue injected into white mice, but this exhibited no toxic properties.

The total quantity of albuminous matter amounted to about 23 per cent. of the tubercle-bacillus mass employed, and six kinds of albumen were obtained.

Adaptability of Bacteria to Unfavourable Temperatures.*—Herr A. Dieudonné has made some interesting experiments with bacteria relative to accustoming them to grow on artificial media at unfavourable temperatures. Instead of sudden and immediate change, the principle of gradual transition stages was adopted, and chromogenous bacteria were the organisms experimented with. Four series made with *Bacillus fluorescens putidus*, *Bacillus lactis erythrogenes*, *Bacillus pyocyaneus*, and *Micrococcus prodigiosus*, showed that pigment bacteria were able to accommodate themselves to unfavourable temperatures if the transitions were gradual. A pathogenic bacterium too, anthrax, became acclimatised to high temperatures when cultivated under similar conditions.

For experiments on animals the cold-blooded frog and the warm-blooded pigeon were selected, partly because they were relatively immune to anthrax, and partly because there is considerable difference between their body temperatures. Cultivations made at 37°·5 and at 12°, when injected into frogs, showed that the latter had more influence than the former; while the experiments with pigeons were not attended with such striking results.

Bacterial Gummosis of Beetroot.†—Herr P. Sorauer states that the beetroot crops in some parts of Germany are affected by the disease which attacked rape plants in Slavonia in 1890. The lower ends of the plants become black, while from the undiseased portions of the surface exudes a gummy fluid which contains bacteria, yeasts, and fungi. In the earlier stages, or less diseased portions, section of the root shows collections of gummy fluid along the vascular bundles. The bacteria were short rodlets, sometimes forming chains, diplococci, and micrococci. In the beetroot, while the vessels are blackened, the intervening portions are pale. The author considers that this gummosis is a constitutional disorder due to bacteria, affecting individuals or perhaps certain races and breeds.

* Arb. aus Kaiserl. Gesundheitsamte, ix. (1894) pp. 492–507.

† Blätter f. Zuckerrübenbau, 1894, No. 9. See Centralbl. f. Bakteriol. u. Parasitenk. (2e Abt.), i. (1895) pp. 295–6.

Bacterial Disease of Trout.*—Herren Emmerich and Weibel describe a disease which decimated the trout in a fish-breeding establishment. At first there was loss of scales in small patches, chiefly along the flanks and back. In these spots small tumours appeared, and these at first were filled with caseous masses, but afterwards with sanious pus. Later on extravasations of blood could be seen beneath the skin, and often the surface became covered with a whitish fungoid growth. The animals died in from 12 to 20 days of a disease which anatomically may be described as a furunculosis with secondary hæmorrhagic purulent deposits. Microscopical examination of the pustules, the deposits, the blood, and internal organs, showed bacilli about the length of, but rather thinner than the typhus bacillus, and very frequently in pairs. On gelatin there appeared at the room temperature in 2–3 days white points, which, increasing in size, pass from yellow to a brownish hue. The colonies lay at the bottom of little hollows. In puncture cultivations the colonies formed along the thrust-track in the gelatin in which later on a funnel was formed, together with air-bubbles; at the bottom of this funnel there was a whitish bacterial sediment. In bouillon there was a slight deposit on the wall of the vessel; this was easily shaken down, the bouillon remaining quite clear. On agar there formed a thin greyish-yellow deposit which later on becomes brownish. There was no growth on potato. The shape of the bacteria from cultures was either oval or long or short rods, rarely filaments. The optimum temperature lay between 10° and 15° C. The bacteria grew both in the presence and absence of oxygen. Resting forms were not observed. A temperature of 60° killed the cultures. The bacteria are immobile; they stained well, but not with Gram. Infection experiments made by direct subcutaneous and intra-muscular injection, by placing the fish in infected water, and by mixing together healthy and diseased animals in the same tank, were all successful.

Micro-organisms of Bitter Milk and Cheese.†—M. Ed. de Freudenreich has described two new micro-organisms which impart a bitter taste to cheese. *Micrococcus casei amari* sp. n. was found in a bitter cheese made in the Canton of Berne. On gelatin it forms round pale yellow colonies. The gelatin is liquefied, but it does not become stringy. On agar it forms grey flat shining colonies with yellowish centres. Bouillon at 35° becomes cloudy in 24 hours; and when this medium contains sugar it becomes acid. On potato the growth is scanty, whitish with yellowish edges. It grows well in the absence of oxygen, and in the presence of hydrogen. It acidifies and coagulates milk, imparting to it a bitter flavour, which, however, is not sensibly apparent until the second day. Cheeses made with milk to which this organism was added were decidedly bitter. *M. casei amari* is very resistant to heat, desiccation, and disinfectants. It is not pathogenic to rabbits, and does not grow at low temperatures (+ 6°), but thrives at room temperature, though incubation heat suits it best. In a culture four weeks old 0·8 per cent. pepton was found, and to the presence of this may be ascribed in part the bitter flavour; the author, however, points out that this is insufficient

* Arch. f. Hygiene, xxi. (1894) p. 1.
† Ann. de Micrographie, vii. (1895) pp. 1–14.

to account for it, inasmuch as the milk cultures of *M. casei amari* contain bitter bodies which do not belong to the peptones.

Bacillus liquefaciens lactis amari sp. n. was isolated from bitter cream. It is mobile and liquefies gelatin on plates, on which it forms round yellowish finely granular colonies. On potato it forms a thick film, which with age becomes whitish. Bouillon becomes turbid. Its dimensions are very variable, sometimes being short and coccoid, at others 5–6 μ long, the average joints being 1–1·5 μ long by 0·5 μ broad. On potato the ovoid form predominates. It coagulates milk without acidifying it; hence the coagulation is due to the formation of a rennet. At the outset the taste of the milk is sweetish, but in 48 hours it becomes bitter. Fresh sterilised cheese, when inoculated with this bacillus, becomes grey and acquires a disagreeable and bitter flavour. This bacillus grows well at room temperature, but better still at incubation heat. Its resistance to physical and chemical agents is feeble. It does, not, apparently, possess any pathogenic action.

Bacteria of the Mouth.*—Herr E. Rosenthal isolated from the mouth five hitherto undescribed species of microbe :—

(1) *Sarcina viridis flavescens* chiefly occurs in tetrads, the individual cells having a diameter of 0·75–1 μ. Gelatin is liquefied, and on agar at 18°–20° C. is formed a luxuriant greenish-yellow overlay with irregularly indented edges. On potato a broad dry streak of a greenish-yellow hue appears. It does not form spores, requires oxygen for its proper development, stains with Gram, but best with methylen-blue.

(2) *Micrococcus Reessii;* round cocci of 1–2 μ diameter; singly, in pairs, tetrads, chains, and groups, devoid of movement. Gelatin is liquefied extremely slowly. On agar or milk, copious growth at 37°·5. On potato, at 18°–20°, the growth is similar. Does not form spores; is a potential anaerobe. Stains well.

(3) *Micrococcus ochraceus;* round or slightly oval cells 0·8–1·2 μ in diameter, arranged much like the last. Devoid of movement. Gelatin is not liquefied. Quickly forms on agar at 18°–20° a shiny greyish-white overlay; on potato the streak is a dull yellow ochre; spore formation not observed; a potential anaerobe. Stains well.

(4) *Diplococcus Hauseri;* spherical and ellipsoidal cells of 0·8–1·4 μ in diameter; without movement. Gelatin is not liquefied. On agar, at room and incubation temperatures, a mucoid yellowish-grey overlay is formed. On potato the appearances are similar. No spores are formed; is a potential anaerobe. Stains easily.

(5) *Bacterium cerasinum;* oval to ellipsoidal cells 0·9–1·4 μ long and 0·7–0·9 μ broad; occurs singly, or in pairs or groups. Does not liquefy gelatin. On agar, at 35°–37°, forms a cherry or brick-red, smooth, bright deposit. On potato, at 18°–20°, a broad, dry, cherry-red streak appears moderately quickly. Spore-formation was not observed. Requires oxygen for its proper development. Stains well.

Streptococci of the Mouth.†—MM. F. Widal and F. Besançon have examined the Streptococci found in the healthy mouth, and also those

* Inaug.-Diss., Erlangen, 1893. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 1024–5.

† Rev. Trimestrielle Suisse d'Odontologie, 1894, p. 185. See Centralbl. f. Bakteriol. u. Parasitenk, xvi. (1894) pp. 1060–1.

from the mouths of persons suffering from various diseases. The authors turned their attention chiefly to determining whether, in all morbid states, there was but one species, and whether the virulence of the Streptococci differed from those of the healthy mouth. It was found that Streptococci from the normal oral cavity did not give rise to erysipelas or septicæmia; while in ten cases of erysipelas there were three deaths (animals experimented on), one from septicæmia and two from erysipelas. In only one case of other disease did the cocci excite inflammation. By associating Streptococci from the normal mouth with other organisms, erysipelas, septicæmia, endocarditis, &c., could be set up in rabbits. From variola cases quite divergent results were obtained; in three the Streptococci showed no pathogenic properties; while in six others these organisms were extremely virulent.

Streptococcous Infection.*—According to MM. Monod and Macaigne, infection by Streptococci occurs as a septicæmia, in which, though the microbes are disseminated throughout the body, there are no obvious collections of pus, and also as a pyæmia wherein purulent deposits are easily recognisable in different organs. Between these two forms stands a blood infection with a localisation in only one organ, and without suppuration. Streptococcous septicæmia may be primary, but is usually secondary to some other disorder, and for the most part occurs as a complication of a merely local Streptococcous infection. In another sense, septicæmia and pyæmia may be regarded as terms expressing greater and lesser degrees of virulence in these microbes. The invasion of the whole body from a local infection of Streptococci is, according to the authors, due rather to increased virulence of the microbes than to a diminished resistance on the part of the tissues; for when mixed with certain other organisms (such as *Bacterium coli commune*, *prodigiosus*, *Proteus vulgaris*), the evidence of this augmented virulence becomes manifest, as is frequently observed in septic wounds.

The Plague and its Microbe.†—Dr. Netter demonstrates the contagious nature of the plague. The microbe which causes it is remarkable for its polymorphism; when cultivated in the usual solid media, it mainly preserves the same form as in the glandular pulp of the bubo; but the short rods are also seen to be accompanied by round figures like cocci, and elongated bacilli. In liquid culture-media it forms little chains of several members placed end to end. Often at the extremity or in the middle of the chaplet is seen a large, very deeply stained sphere. On gelatin the microbic colonies are white, at first transparent, but later on they present a more opaque and yellowish centre. The microbe is very deadly to rodent mammals. It may be transported by flies which die during an epidemic, for the specific bacillus may be recognised in their alimentary canals.

Formalin Test for the Bacillus of Enteric Fever.‡—Dr. R. Abel has repeated the experiments with formalin on cultures of *Bacillus typhosus*, on the same lines as Schild,§ and has come to the conclusion

* Rev. de Chirurgie, xiv. (1894) pp. 81–106.
† Brit. Med. Journ., No. 786 (1895) p. 48.
‡ Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 1041–6.
§ See this Journal, 1894, p. 268.

that this test does not afford a useful means of differentiating the "typhoid" organism from others closely resembling it. It allows the inference that organisms which are unaffected by formalin when added to the cultivation medium, such as *Bact. coli com.*, are not "typhoid" bacilli. But the converse does not hold good, viz. that organisms which behave like the true *Bacillus typhosus* in formalin bouillon are really bacilli of enteric fever.

Difficulty of Isolating Bacillus typhosus in the presence of Bacterium coli commune.*—Dr. M. Nicolle adduces some facts in support of the view that it is impossible to isolate the bacillus of enteric fever when *Bacterium coli commune* is present. New methods, more delicate and sensitive than those now at our disposal, are requisite for this important object.

Capsule Bacillus of Suppurative Nephritis.†—Dr. A. Nicolaiex describes a bacillus which was isolated from the kidneys of a person of 75, suffering from suppurative nephritis and cystitis. Mice inoculated directly from the kidney died in three or four days of a pyæmia, there being abcesses in kidney, liver, and spleen. Cultivations from the mice were made in the ordinary media, and showed short, thick, motionless rods of variable length, with rounded ends. Many of these bacteria were possessed of a distinct capsule. They stained easily, but not with Gram. The bacillus is a potential anaerobe, and does not liquefy gelatin. On agar and gelatin it grows well, forming a greyish-white deposit. In saccharated media gas is formed (CO_2 and H). When cultivated on acid media it effects an alkaline secretion, as is shown by acidulating agar or gelatin with phosphate of potash and colouring it with litmus. If, however, the bacillus be cultivated in neutral litmus, bouillon, or in Petruschky's litmus-milk, it forms acid at first, the medium eventually becoming blue again. Mice inoculated from pure cultivations died usually in 2–3 days from a septicæmia, pathogenic changes being only observed in the kidneys, though the bacilli were demonstrable by the aid of Loeffler's methylen-blue solution in all parts of the body. These animals also died when injected with the soluble toxic products of the bacteria.

Dr. A. Kragius ‡ criticises the description of the capsule bacillus of suppurative nephritis given by Nicolaiex, and seeks to identify it with *Bacterium coli commune*, a common cause of cystitis and nephritis. It is obvious that the two bacteria have many points of resemblance, and the author adds a new one, namely, that *B. coli* obtained from infected mice often shows a capsule, or the appearance assumed to indicate one.

Dr. Nicolaiex replies § that the two bacilli differ considerably in two important particulars :—1. The capsule bacillus is larger and thicker than *B. coli*, and the capsule, though not invariably present, is sufficiently constant to make it a diagnostic criterion. 2. The growth appearances on agar and gelatin are quite different. 3. The pathogenic behaviour of the two organisms towards mice is quite different.

* Ann. Inst. Pasteur, viii. (1894) pp. 854–5.
† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 601–12 (1 pl.).
‡ Tom. cit., pp. 1006–9. § Tom. cit., pp. 1010–2.

Mallein and the Bacillus of Glanders.*—According to Dr. J. A. Bonome, the bacillus of glanders is disseminated by the secreta and excreta of the diseased organs, and also by the urine and milk of glandered animals. It is also transmitted through the placenta to the fœtus. It is extremely sensitive to drying, but is relatively resistant to high temperatures. In sterile water it dies in six days. The addition of cadaverin culture (1 : 40,000–60,000) leads to its degeneration.

On the blood-serum of glandered horses it does not thrive, but short thick granular forms appear, which are to be regarded as resting forms. On ox-blood serum the behaviour is the same, though this has even some curative effect. The blood-serum of malleinised dogs is a poor medium, as the bacilli degenerate within 24 hours. From experiments with mallein on 30 horses suspected of glanders, the author concluded that its diagnostic value was not absolute, as unglandered horses will exhibit the reaction, and conversely glandered ones may fail to show it. Mallein in small injection doses (2–4 drops in 1 ccm. H_2O) appears to possess some slight therapeutic value, as a satisfactory termination to a case of human glanders is recorded, though with glandered guinea-pigs the results were negative.

According to Herren Fr. Hutyra and H. Preisz † a rise of temperature of 1°·5 or over is positively indicative of glanders, the local and general symptoms being less important. Other diseases do not give the mallein reaction, hence in mallein there exists a most important diagnostic criterion.

Herr Oemler's ‡ experience of mallein agrees with the foregoing. Out of 43 horses 6 gave the reaction; all were glandered.

Herr Schütz § records a series of 52 cases of suspected glanders injected with mallein. In 15 the mallein reaction occurred, a rise of temperature of 1°·5 or over, and a gradual decline. In 7 a rise of 1° to 1°·4, and in 30 a trivial rise, or none at all. Post-mortem examination showed that none of the 52 horses were glandered.

Another set of 6 horses suspected of glanders were injected with mallein in doses varying from 0·5–0·3 ccm., according to age. The temperature rose in 5 cases from 1°·5 to 3°, the sixth did not react at all. Four horses were killed, and not one was glandered. The author therefore concludes that the mallein reaction is not a proof of glanders.

Herr Preusse ‖ believes that perfectly healthy horses exhibit the mallein reaction, possibly owing to the decomposition of the mallein or to the injection not having been performed with proper care. The temperature should rise to at least 1°·5, usually over, and the declination of the temperature curve should be more gradual than its ascension. Swelling at the injection site is not a characteristic sign.

From numerous experiments made with mallein Herren E. Semmer and A. Wladimirow¶ conclude that in horses suspected of glanders but unaffected with any other disease, a rise of temperature of 1°·5 to 3°,

* La Riforma Med., 1894, pp. 172–4, Nos. 120–2.
‡ Deutsche Zeitschr. f. Tiermed. u. vergleich. Pathol., xx. (1894) pp. 369 *et seq.*
† Hygienische Rundschau, iv. 1894, p. 179.
§ Arch. f. Wiss. u. Prakt. Tiermed., xx. (1894) pp. 448–69.
‖ Berlin Tierärztl. Wochenschr., 1894, No. 51.
¶ Arch. Sci. Biol. Inst. Imp. de Méd. Exp. St. Pétersbourg, i. p. 745. See Centralbl., f. Bakteriol. u. Parasitenk. (1e Abt.) xvii. (1895) pp. 338–46.

together with the formation of a considerable swelling at the site of the mallein injection, and general symptoms of disease, are indicative of glanders. Their observations show that in both glandered and healthy horses there is an initial fall of a tenth of a degree after the mallein injection. After some hours the temperature begins to rise, attaining its maximum in 8 to 15 hours after the injection. In glandered horses the temperature rises usually 2°–3°, sometimes 3°·5, in healthy ones 0°·7 to 0°·8, rarely to 1°. In horses suffering from other diseases the temperature may ascend 1°–2°, but there is no tumour formation. The tumour usually begins to form some hours after injection, and in glandered horses increases till the second or third day. In healthy horses, should it occur, it disappears on the injection day.

Tuberculosis in a Lioness.*—M. J. Straus had the opportunity of examining a five-year-old lioness who in the last months of her captivity (4 years) had become emaciated almost to a skeleton. The post-mortem revealed "fibroid phthisis" of both lungs, with numerous small cavities in the contents of which the tubercle bacillus was found. The sections showed caseating tubercles with bacilli. Tubercles were not found in the other organs. This case seems to show that the infection had taken place through inhalation, and not from feeding, as is usually the case with animals kept in captivity.

Sensitiveness of Marmot to Vibrio Metchnikovi.†—Herr W. Palmirsky finds that the earless Marmot (*Spermophilus citillus*), a great plague in South Russia, is extremely sensitive to *Vibrio Metchnikovi*. By feeding the animals on corn infected with this bacillus they speedily die, and the dead animals communicate the disease to their companions. The author suggests that *Vibrio Metchnikovi* might be used for decimating or even extirpating these destructive rodents.

Antirabic Vaccination with Virus attenuated by Heat.‡—MM. E. Puscarin and M. Vesesco record some experiments made for the purpose of determining whether an efficacious hydrophobia vaccine can be obtained by means of heat, their object being not so much scientific as the saving of expense and the prevention of some inconvenience. They conclude that it is possible to obtain a vaccine by such a method, but at present their system is not properly organised by sufficient observations.

Increasing the Virulence of Diphtheria Bacilli and the Antitoxic Serum.§—By passing diphtheria bacilli, which have lost much of their original virulence through age, through a series of animals, Dr. J. Bardach finds that this virulence may be restored. Thus, after 25 passages through dogs were obtained cultures of which 0·25 ccm. was fatal to dogs and 0·015 ccm. to guinea-pigs. The virulence had been increased 80-fold and these passages through dogs had increased the virulence more for dogs than for guinea-pigs. The diphtheria bacilli, therefore, had adapted themselves for the struggle against the cells of the canine organism. The vaccination of dogs by continually increasing doses of cultures is then described. After every injection there was marked local

* Arch. Méd. Exp. et d'Anat. Pathol., vi. (1894) p. 645. See Centralbl. f. Bakteriol. u. Parasitenk. (1e Abt.), xvii. (1895) p. 96.
† Arch. Sci. Biol. Inst. Imp. Méd. Exp. St. Pétersbourg, ii. (1893) pp. 497–503.
‡ Ann. Inst. Pasteur, ix. (1895) pp. 210–3. § Tom. cit., pp. 40–55.

and general reaction, and the animals were very slow to get accustomed to the virus, and even when established the immunity was relative and not absolute. The acquisition of this immunity is ascribed to phagocytosis and to the elaboration of diphtheritic antitoxins, which by circulating in the blood stimulate the cells, and thus accustom the tissues to the virus.

The immunising properties of dog's serum on guinea-pigs and rabbits is discussed. The serum used was quite pure (no antiseptic added), and much of it had been kept in vitro for some time. The serum was found to have not only a preventive but also a therapeutic action when administered to guinea-pigs, and this immunity lasted some months. Rabbits also could be rendered immune by inoculations of serum, but the doses require to be much greater, both absolutely and relatively to the weight of the animal, than those which suffice to vaccinate the guinea-pig. And it was found to be easier to vaccinate the guinea-pigs than to cure them, while with rabbits the curative properties of the serum are not very much less than its immunising power. The reason of this discrepancy is explained to be a feebler phagocytosis, so that in order to immunise rabbits it is necessary to strengthen the phagocytic power of the cells.

Penetration of Intestinal Microbes into the Circulation during Life.*—Dr. L. Beco finds, from observations made on bodies post mortem, that the invasion of the general circulation and of the deep viscera by intestinal microbes may take place before death, and that there is no close relation between the invasion and the existence of intestinal affections; it is probable that the microbes found in the deep organs when the autopsies are made at the usual times, have been carried there during life through the circulation. In the same way as the spleen, the liver, and the bone marrow, the thyroid appears to be a depôt for microbes deposited through the circulation.

The author then cites his experiments on animals. In the first place it should be mentioned that cultures made from healthy animals (three) remained sterile; and that on the administration of Fowler's solution, cantharidine, or emetique, there is a determination of microbes from the intestine into the viscera.

As the *Bacillus coli communis* is the predominating organism found in the viscera, under many circumstances post mortem, the author arrives at the conclusion that it is impossible, merely on the presence of this microbe in the viscera and the blood, to say that it has a causal connection with the malady.

Septic Vibrio.†—Dr. A. Besson points out that the spores of the *vibrion septique* (bacillus of malignant œdema) are extremely resistant to physical and chemical agents, and that the toxin obtained from cultures in alkaline peptonised beef bouillon is extremely active; while that obtained from filtering the œdema-serum is not so strong. The toxin possesses negative chimiotactic properties, though if it be heated to 85° for three hours it becomes positive, tubes inserted under the skin becoming filled with leucocytes.

When the spores of this vibrio are injected under the skin of healthy

* Ann. Inst. Pasteur, ix. (1895) pp. 199–209. † Tom. cit., pp. 179–98.

animals they do not develop provided that the spores be pure, and this failure to develop is due to the action of phagocytes, by which they are rapidly destroyed. But if the spores be protected against the action of the phagocytes, then they germinate and produce specific septicæmia. The methods by which the spores were protected were ingenious. First, by the use of negatively chimiotactic substances, such as lactic acid or a minute quantity of the septic toxin itself. Secondly, by imbedding spores in little lumps of peptonised gelose, or by mixing spores with a certain quantity of fine sand. The phagocytosis was demonstrated microscopically by staining some fluid, withdrawn with a pipette, with phenolfuchsin, thoroughly decolorising with dilute nitric acid, and then contrast staining with aqueous methylen-blue.

The author then proceeds to consider the conditions of the natural infection. Natural infection is favoured by the simultaneous presence of other microbes, among which are *Micrococcus prodigiosus*, *Staphylococcus pyogenes aureus*, and several other bacteria, which are described in general terms. This, of course, is a valuable contribution to our knowledge of mixed infection. But traumatism also plays a part in natural infection, and the author shows that deep and extensive wounds favour the development of spores of *B. maligni œdematis*. Necrosis of tissues—e. g. such as are produced by the actual cautery—violent bruising with much extravasation of blood, or compound fractures, may all three facilitate the development of the spores, and thus give rise to the septicæmia of the *vibrion septique*.

Relative Tendency of different Fabrics to be contaminated by Microbes.*—The different degrees to which our clothing is infected by microbes depends, under ordinary circumstances, on the physical properties of the material. The experiments made by Herr A. D. Nikolski with articles of clothing composed of wool, linen, cotton, and silk show that the conditions which favour the presence of bacteria on clothing are as follows:—The porosity, the roughness of surface, excess of wool, and of long and irregularly woven threads. If to these conditions a certain thickness of material is added, not only is the mere presence of the microbes to be feared, but their permanent settlement within the material. Besides this, thick, hairy, loosely woven materials attract moisture, retain it, and only dry very slowly. Microbes are retained much longer in wool than in cotton. Linen and silken fabrics are much less liable to contamination. For persons who come much in contact with the sick the best clothing is linen.

Heim's Text-book of Bacteriology.†—Mrs. G. C. Frankland has a notice of this work, which she does not think adapted to the use of the student. There appears to be too great love of minute detail. The work is divided into three parts:—(1) Bacteriological manipulations; the preparation of culture media, and experiments on animals; (2) the morphological and other characteristics of bacteria; and (3) diagnosis of bacteria in disease, as well as their demonstration in our surroundings.

* Thèse, St. Petersburg, 1894. See Centralbl. f. Bakteriol. u. Parasitenk. (1e Abt.), xvii. (1895) pp. 367–8.

† 'Lehrb. der Bakteriol. Unters. u. Diagnostik,' Stuttgart, 1894, 8vo, 528 pp. See Nature, li. (1895) pp. 481–2.

Works other than those reported in German periodicals seem to be almost, if not entirely, neglected. The book appears original, and will be more palatable to the teacher than useful to the student.

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Arch. f. Hygiene, XXI. p. 317.

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Hygien. Rundschau, 1894, pp. 1009–12.

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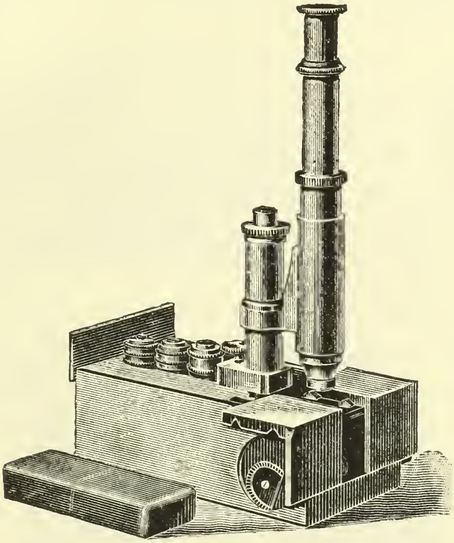
MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Portable Microscope by Nachet & Sons.—Mr. E. E. Hill writes, "This compound Microscope is probably the smallest and most compact instrument in existence. It has many advantages over similar instruments, although it has some defects. The instrument is made throughout of brass, and when enclosed within its case measures $3\frac{1}{2}$ by 2 by $1\frac{1}{4}$ in. and weighs 15 oz.; when the draw-tube is pulled out to its fullest extent, a tube-length of $4\frac{1}{2}$ in. is obtained. It has one Huyghenian eye-piece and four object-glasses, all mounted specially short. The stage is formed by the end of the brass case and a portion of the top springing open as

Fig. 52.



soon as the portion to which the limb of the instrument is attached is pulled away to open the case. The limb of the instrument slides on a grooved fitting and is retained in position by a small clamping screw. The fine-adjustment is of the direct spring form and is brought into operation by means of the milled head. The distance of the optic axis from the limb of the instrument is 3/4 in.; this is a defect for working with 3 in. by 1 in. slips, but for field and pond work a series of 6 slips 2 in. by 3/4 in. (3 with hollow and 3 plain) are supplied and packed into a small leather-covered case which packs inside the brass case. The

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

concave mirror is enclosed in the case and is moved by means of the small brass milled head outside the case. This Microscope is supposed to have been made about 30 years ago by Messrs. Nachet and Sons of Paris for Dr. Mouat, for use in India.

Fig. 53.

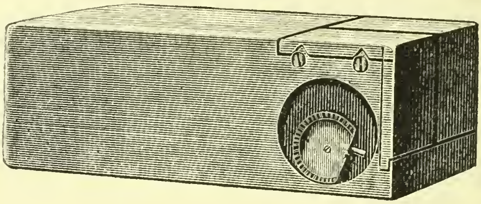
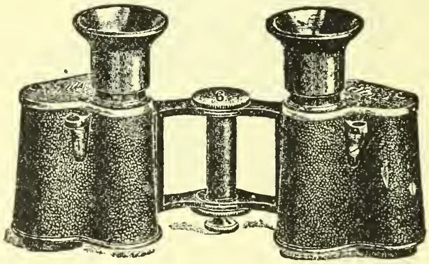


Fig. 52 shows the instrument arranged for use. Fig. 53 shows the instrument packed for carrying.

(2) Eye-pieces and Objectives.

The new Zeiss Patent Binoculars.*—Mr. E. M. Nelson gives an account of these new instruments. There are two kinds: one corresponding to the binocular field-glass (fig. 54) and the other to the binocular telescope (fig. 55). They are both astronomical telescopes consisting of an object-glass and a Huyghenian eye-piece, and the erection of the image is effected by two prisms. In the case of the simple telescope there is probably a greater loss of light by this prism

Fig. 54.



arrangement than with the ordinary erecting lenses, but in the case of the field-glasses several important points are gained by discarding the Galilean principle. Thus the large field and even definition of the Huyghenian eye-piece are secured. The most striking feature of the new instrument is that, to secure portability and increase the stereoscopic projection, the axis of the object-glass is not in the axis of the eye-piece. The author's notion of the arrangement of the object-glass, prisms and eye-piece, is seen in fig. 56; the rays are bent back twice, so that the instrument is reduced to about 1/3 in length.

* English Mechanic, lx. (1894) pp. 344–5.

FIG. 55.

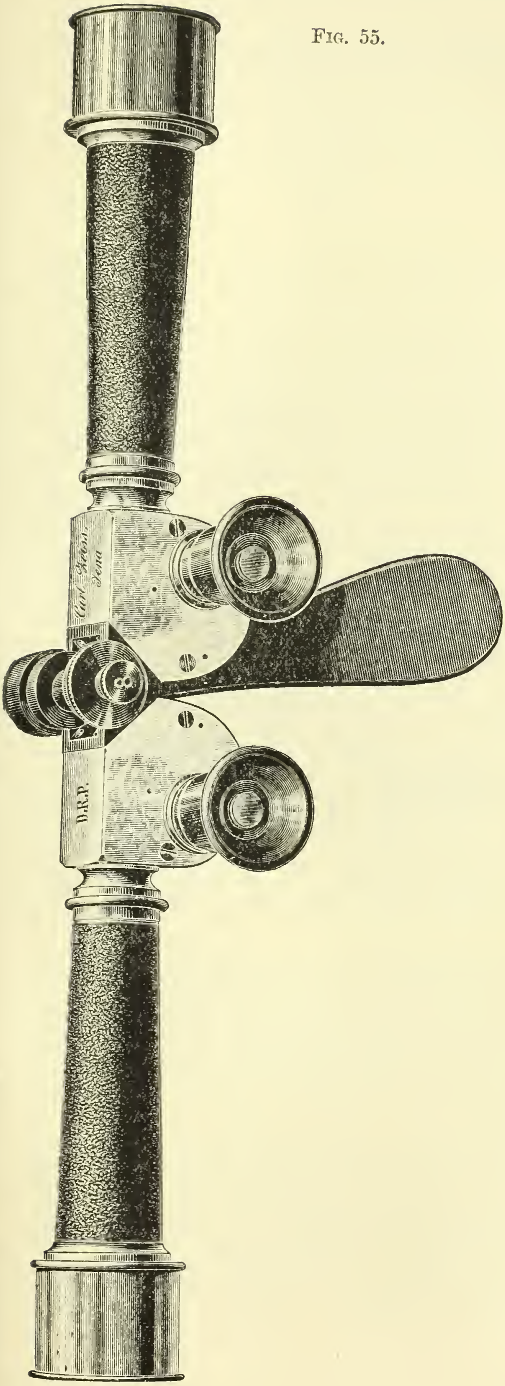


FIG. 56.

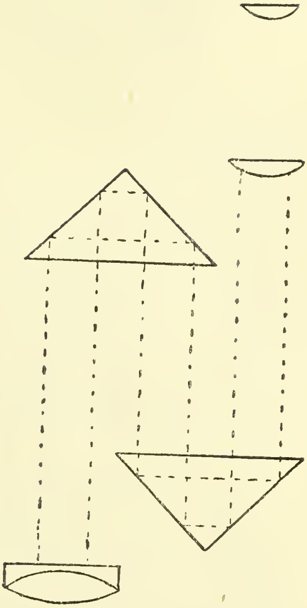
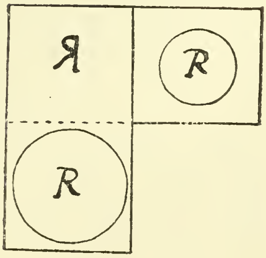


FIG. 57.



The result of the following comparison between the new Zeiss field-glass of 6 power and an old Galilean binocular of 7 power shows that the Zeiss had the better definition, and the Galilean the more light.

	New Zeiss.	Old Binoculars.
Power	6	7
Weight.	$12\frac{1}{2}$ oz.	$14\frac{3}{4}$ oz.
Length..	$3\frac{1}{4}$ in.	$8\frac{1}{2}$ in.
Diameter of field	6° full	2° bare
Diameter of objective	6/10 in.	$2\frac{1}{8}$ in.
Focus of objective	$4\frac{1}{2}$ in.	9 in.

The new instruments are made of three powers, 4, 6, and 8, and the author considers that for field, tourist, and ordinary purposes they have no rival.

The stereo-telescopes are constructed on the same principle as the field-glasses, but in them the ray is not bent back on itself. They may be used in two ways. In the first position the bodies of the telescopes point to the right hand and left hand of the object which is to be observed (fig. 55), while the axes of the eye-pieces are directed towards it. The greatest stereoscopic effect is thus obtained, while the object can be observed from behind cover, such as a tree or post. In the second position the bodies of the telescopes point up to the zenith. Here there is less stereoscopic effect, but it is possible to look over a wall without being exposed. These instruments also are made of three powers, viz. 6, 8, and 10.

In these new instruments each eye-piece screws in and out by itself, so that each eye can be focused for itself.

Fig. 57 is a plan showing the prisms in their proper positions as looked at from the object-glass. The larger circle represents the object-glass, and the smaller the field-lens of the Huyghenian eye-piece. The letter R, drawn on the object-glass, is made to represent the rays from an erect image falling on the object-glass. When the rays are brought to a focus by the object-glass, the erect image will be inverted and transposed. But because of the action of the upper prism in fig. 54, the inversion is corrected, while the transposition is left. The second prism, i.e. the lower one in fig. 54, whose edge is at right angles to the first prism, corrects the transposition, while the corrected inversion remains unaltered.

Klein's Lens with Micrometer.*—Herr F. Becke describes an arrangement for measuring the small interference figure which is obtained with the Czapski eye-piece by inserting an iris-diaphragm in the plane of the image. The author does not remove the Ramsden eye-piece and examine the image formed directly by the objective, but with an aplanatic lens—the Klein's lens—observes the image which is formed above the Ramsden eye-piece.

The apparatus consists of a cylindrical tube-support which slides with slight friction over the head of the Czapski eye-piece. In the upper part of the support is an adjustable aplanatic lens with magnification of 8 times, and an eye-piece micrometer (10 mm. divided into 100 parts) which can be adjusted by two projecting pins.

* Tschermak's Mineral. u. Petrogr. Mittheil., xiv. (1894) pp. 375–8. See Zeitschr. f. wiss. Mikr., xi. (1895) pp. 500–1.

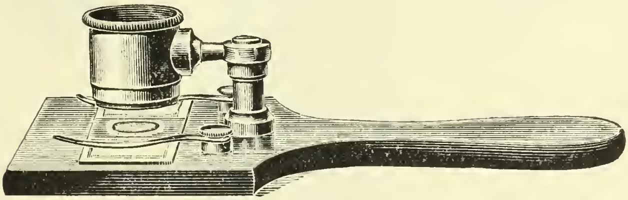
To make an observation with the Klein's lens, the part of the section under examination is first adjusted with the Czapski eye-piece; the iris-diaphragm of this eye-piece is then closed up so far that only the part of the section to be examined remains visible, and the Klein's lens is put on and adjusted so that the objective diaphragm is clearly visible; the interference picture is then plainly seen. Finally the scale is either raised or sunk until it also is sharply defined against the interference picture.

To determine the optic axial angle with this apparatus, the formula of Mallard $D = M \sin E$ must be used. In this formula E denotes the half optic axial angle in air, D the number of the scale divisions for E, and M a constant to be determined for the system by observation of a known optic axial angle. Instead of making use of the Mallard formula in each particular case, the author plots out a curve with the scale divisions as abscissæ, and the corresponding angles as ordinates.

Reichert Demonstration-Lens.*—Dr. W. Behrens describes a lens lately brought out by the firm of Reichert, which is useful for showing microscopic preparations to a large audience, since the apparatus can be conveniently passed from hand to hand without disturbing the preparation.

It consists (as seen in the figure) of a black ebonite plate, with central aperture, on which the slide is held by means of two clips as

Fig. 58.



on a Microscope stage. The continuation of the plate behind forms a handle which is held in the hand during the observation of the preparation.

A short upright between the spring-clips forms the lens-holder. At the top it carries a short horizontal arm which can rotate about the vertical axis. This arm supports a spring socket in which slides the lens, so that it can be adjusted by hand on the preparation, while the apparatus is directed towards the sky or an artificial source of light.

(3) Illuminating and other Apparatus.

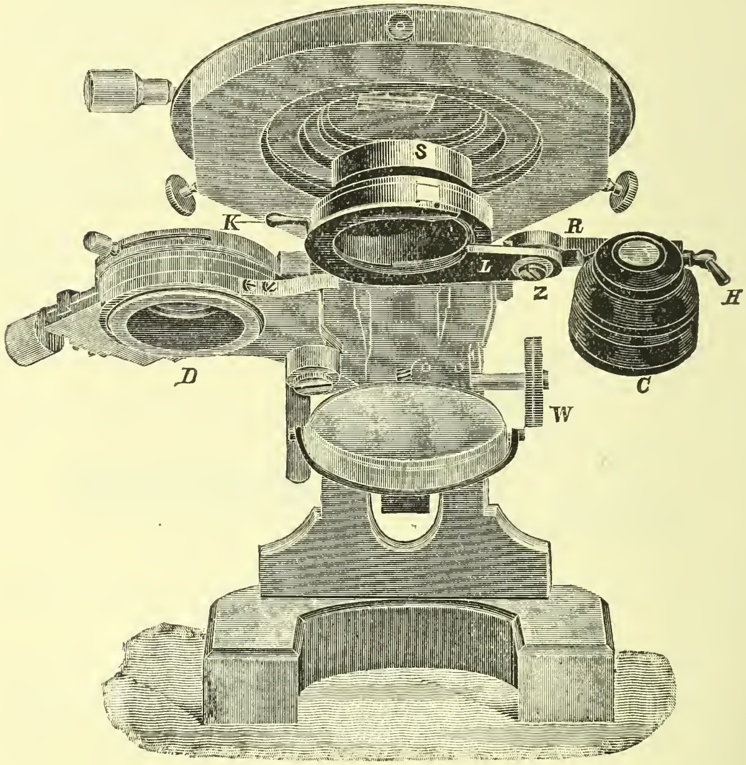
Illuminating Apparatus.†—Dr. S. Czapski remarks that the arrangements which have hitherto been proposed for the quick passage from convergent to parallel light, i. e. for the rapid removal of the condenser, either require a radical change in the stage and other parts of the Microscope (Fuess method), or have the disadvantage that the removal of the condenser is not momentary, since the whole illuminating apparatus

* Zeitschr. f. wiss. Mikr., xi. (1895) pp. 458–9. † Tom. cit., pp. 433–40.

has to be lowered by rack-and-pinion motion before the condenser can be thrown out (Reichert method). Since, in working without condenser, cylinder diaphragms are generally necessary, these have also to be introduced. These operations require time and prevent the possibility of observing the immediate consequence of the change of illumination on the preparation.

The arrangement which the author has devised is free from these two disadvantages. It requires no reconstruction of the stand and no movement of the illuminating apparatus in the line of the optic axis.

Fig. 59.



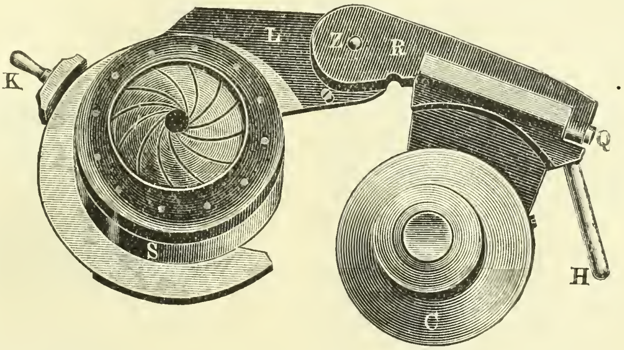
In fig. 59 the apparatus is seen as attached to the stand. In fig. 60 it is shown by itself as seen from above.

The socket S, of the size to fit into any spring socket of a Zeiss stand, carries on its lower flange a projecting piece L, which is bored through its other end for the reception of the pin Z. About this pin as vertical axis turns the frame R, to which is attached the condenser system C which is movable downwards to a stop about a horizontal axis Q. The movements about this axis and also about the vertical axis Z are both effected by the lever H.

By the movement about the pin Z up to a stop, the frame R, with the condenser C, can be rotated from the position shown in the figure, until the latter is beneath the socket S, when a further pressure on the lever H serves to press the condenser up into the socket. The position of the condenser in which its axis coincides with that of the body-tube is fixed by a pin in the socket fitting into a small groove on the condenser. The diaphragm apparatus D is then brought beneath the condenser system in the usual way.

The removal of the condenser is effected by the same manipulations in the reverse order. The diaphragm apparatus D is swung to one side, the condenser C released from the socket by the lever H, and then turned aside out of the optic axis by rotation about the pin Z.

Fig. 60.



The apparatus can be provided with a cylinder diaphragm, whose use without the condenser is often desired although it may not be considered as necessary. This diaphragm, as seen in fig. 60, is an iris-cylinder diaphragm with curved lamellæ, so that it may be brought close to the preparation. When open it allows room for the condenser system, and even when the condenser is in position it can be closed slightly before touching it. When the condenser is removed, the diaphragm can be closed to a diameter of 0·5 mm. The movement of the diaphragm is effected by the knob K projecting from the lower flange of the socket S.

New Compressorium.*—Prof. Fr. Sav. Monticelli describes a new and simple compressorium. It consists of two parts, a base plate and a ring, provided with a screw for applying the pressure.

The base plate is a rectangular brass plate with rounded angles (fig. 61) of dimensions 80 × 57 × 1 mm. In the middle of the plate rises a brass ring to a height of 9 mm. (fig. 63, E F), in thickness a little over 1/2 mm. and 47 mm. in diameter. On the inside this ring carries a screw-thread which does not occupy more than 5 mm. of the total height commencing from the upper margin. Within the ring the base-plate has a circular aperture 30 mm. in diameter. Round this aperture up to a diameter of 38 mm. the base-plate is cut through half

* Zeitschr. f. wiss. Mikr., xi. (1895) pp. 454–7.

its thickness, so that a circular step A B (figs. 61 and 63) is formed. On this step is fixed with mastic a circular glass slide of the same thickness as the step (figs. 61 and 63, O B). Between the glass slide and the contour of the ring rests a circular collar B E (fig. 63) of 4 mm. which carries in

Fig. 61.

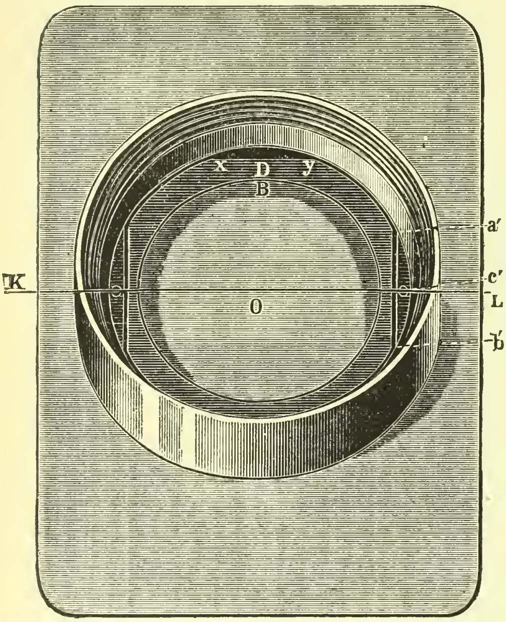


Fig. 62.

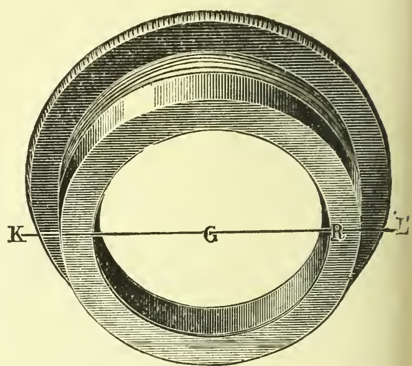


Fig. 64.

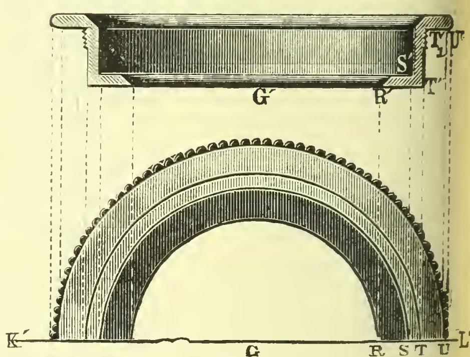


Fig. 63.

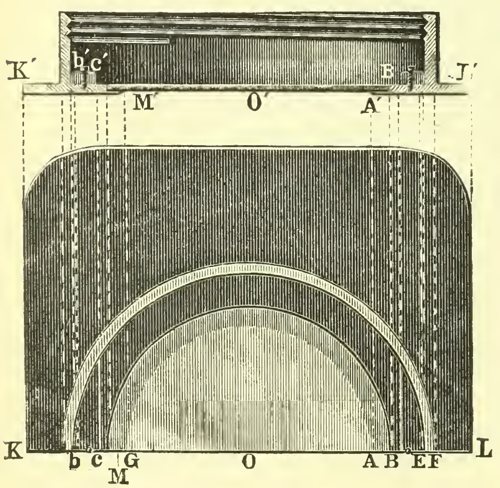
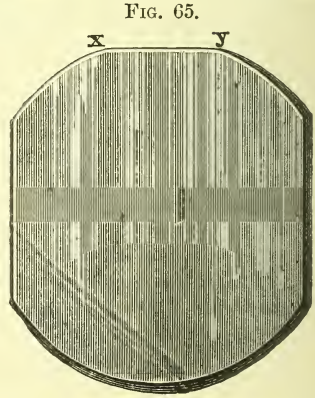


Fig. 65.



relief two brass segments ($a' b' c'$, fig. 61; $b' c'$, fig. 63) opposite each other across the diameter K L (figs. 61 and 62). On the glass slide and circular collar rests the movable cover-glass, which is of the same thickness as the segments $a' b' c'$ (figs. 61 and 63). In order that it may come in contact with the lower glass slide it is cut by two segments corresponding to the two which are on the circular collar. By this means the cover-glass can receive no movement of rotation. For convenience of removal it is cut across the top in the direction $x\ y$ (figs. 61 and 65), normal to that of the segments.

The ring of compression (fig. 64) is a ring of brass, of diameter a little less than that of the ring fixed to the base-plate. It is provided with a screw which engages in the screw-thread on the ring fixed to the base-plate. It has a diameter of 44 mm. and is provided at the top with a circular milled head (fig. 64, T U, T' U'), and below with a circular rim of 6 mm. (fig. 64, R S, R' S') which serves to augment the surface of compression on the cover-glass O (fig. 61).

The advantages claimed for the apparatus are the large field of view for microscopic observation, the condition of immobility of the cover-glass, and the possibility, by means of the screw, of insensibly increasing or diminishing the pressure.

Compressorium.*—Prof. H. E. Ziegler has made an improvement in the compressorium recently devised by him.† In the original apparatus only a small portion of the water passes beneath the cover-glass, for most of it flows between the caoutchouc ring and the lower glass plate. This is of little consequence when the stream of water is sufficiently strong, and the object is not too small; but if the object is so small that by the compression the space between the cover-glass and the lower glass plate is very narrow, the water beneath the cover-glass is almost completely at rest, and nearly all the water which flows through the apparatus takes its course between the caoutchouc ring and the lower glass plate.

The author has therefore added to the apparatus an arrangement by which all the water flowing through the apparatus must take its course beneath the cover-glass. For this purpose the caoutchouc ring at two opposite points is pressed in upon the lower glass plate by means of two pins, so that by the compression at these points there is no interval left between the ring and the plate. The space between the lower glass plate and the ring is thus divided into two parts; and the upper plate is so adjusted that the openings of the tubes conveying the water are brought over these parts.

(5) Microscopical Optics and Manipulation.

Improved Method for the Microscopic Investigation of Crystals.‡
Mr. A. E. Tutton calls attention to an important memoir on the microscopic determination of crystals, contributed by Prof. Klein to the 'Sitzungsberichte' of the Berlin Akademie der Wissenschaften for January 31, 1895. In this communication a description is given of a new stage goniometer, which allows of the examination of many of the principal zones of a crystal with one and the same setting of the crystal on its

* Zool. Anzeig., xvii. (1894) pp. 471–2. † See this Journal, 1894, p. 759.
‡ Nature, li. (1895) pp. 608–11.

holder; it also contains an account of the method of examination of a crystal by immersing it in a liquid with refractive index the mean of the refractive indices of the crystal.

The Microscope employed (made by Fuess) is of the petrological type, with circular rotating stage provided with rectangular movements. The nicols are made to rotate simultaneously, as in the Allan-Dick Microscope made by Swift.

The stage goniometer is used with the Microscope in the horizontal position. The base-plate of the goniometer is clamped upon the now vertical stage. It carries a horizontal projecting piece, terminating in the supporting cone for the goniometer circle. The adjusting movements of the goniometer are simpler and lie closer together than in the ordinary form of goniometer. The glass cell containing the immersion liquid is supported by a stand with adjustable arm placed to the left of the Microscope.

The determination of the true optic axial angle 2 V can be made at once with the instrument if the crystal is immersed in a liquid with refractive index equal to the intermediate refractive index β of the crystal.

The advantage of the method consists in the fact that it is unnecessary to prepare sections of the crystal, for if the immersion liquid is properly chosen, the crystal will lose its outline and disappear in the liquid. For observation by this method, crystals should be chosen which are equally thick in two perpendicular directions in the plane of the optic axes, and not too thick to prevent the interference figures being observed.

Prof. Klein describes the method of determining with the apparatus the extinction angles upon the various faces of a zone, and shows how the method introduces a great simplification in the study of triclinic crystals, since the position of the optic axes can be at once determined.

Mr. Tutton shows what use he made of the method of observation in the course of his investigation of the sulphates of potassium, rubidium, and cæsium.*

Indication of Magnification in Micrographic Drawings.†—Dr. D. Carazzi remarks that there are still naturalists who preserve the bad habit of not giving the indications of the magnification in the micrographic drawings which illustrate their memoirs, although nearly all are convinced of the necessity of so important an indication. The usual plan is to give with the drawing the number of the eye-piece and objective, the name of the maker, and the length of body-tube. Dr. De Vescovi ‡ has pointed out that these three elements are not sufficient, and that account must also be taken of the real size of the object, and of that of the drawing obtained with the camera lucida. But as the operations involved in this method are long and troublesome, the former plan is still usually adopted. The author shows, however, how impractical and useless the method is, owing to there being no rational system of notation amongst Microscope makers. For this reason the name of the maker has to be given, and the reader has to refer to a number of makers' catalogues in order to understand the indication.

* Journ. Chem. Soc., 1894, p. 628. † Zool. Anzeig., xviii. (1895) pp. 162–4.
‡ Op. cit., x. (1887) p. 197.

For cases which require a rigorous exactness the author would keep the rule of noting the real magnitude of the object and that of the design projected by the camera lucida, but for ordinary purposes proposes a simpler method, which consists in placing on the stage the objective micrometer, and drawing its scale on the paper with the camera lucida. In this operation the eye must be kept at the same distance from the eye-piece, and the paper must be held near the stage and on a level with it.

The operation should be repeated with all the systems in use, and a table drawn up giving for each the number obtained by taking the ratio between the dimensions of the drawing and the real length of the divisions of the micrometer.

The indications of the table constructed in this way are not rigorously exact, but they represent mean values corresponding to the personal conditions of the observer, and give the magnification with sufficient approximation, so that they are certainly preferable to the pretended exactness of the data hitherto in use.

Resolving Power of the Microscope, and the Future of the Instrument.*—M. J. Amann discusses the question of the limits to the resolving power of the Microscope. The theory of Abbe shows us that the formation of the image in the Microscope depends not only on the laws of geometrical optics, but also on the more complex phenomena of interference and diffraction. The microscopic structure beneath the objective determines the formation of a spectrum composed of a maximum corresponding to the luminous pencil not diffracted and of maxima of the second order. In the case of regular structures, the phenomenon is similar to that produced by gratings, and especially by gratings traced on transparent screens, which Quincke† has studied, and for which he has given the formula:

$$Jp^2 = p^2 \,.\, 4 \cos^2 \left\{\frac{a}{\lambda}(n-1) + \frac{b \sin a}{\lambda}\right\} \pi \,.\, \left(\frac{\sin^2 \dfrac{p\, b \sin a}{\lambda} \pi}{p^2 \sin^2 \dfrac{b \sin a}{\lambda} \pi} \right)^2,$$

representing the distribution of the vibratory movement in the plane in which the diffractive spectrum is formed.

When the source of light is very distant, the diffraction spectra are formed in the focal plane of the objective. The final image which the Microscope gives us of such structures results from the interference of the rays emanating from the spectrum in the particular conditions of delimitation of the latter by the aperture of the objective. The mathematical expression of the repartition of the vibratory movement in the plane of the image takes the form of an integral of Fourrier. For the Microscope to give us an image of these structures it is necessary and sufficient that the objective admit besides the absolute maximum, at least *one* maximum of the second order in the case of a structure similar to a

* Arch. Sci. Phys. et Nat., xxxiii. (1895) pp. 268-72.
† Pogg. Ann., cxxxii. p. 361.

simple grating. The angle a of divergence of the maxima of the second order is given by the equation

$$\sin a = \frac{\lambda}{e},$$

λ being the wave-length of the light, and e the linear separation of the elements of the structure considered.

In order to show the rôle of the wave-length in these phenomena of diffraction, the author examines a valve of *Pleurosigma angulatum* with a dry objective with aperture $a = 0 \cdot 90$, while projecting successively on the mirror of the Microscope the different parts of a spectrum.

If u denote the 1/2 angle of aperture of the objective, in order that the Microscope may give us an image of a structure composed of elements of which the linear separation is e, we must have for the axial illumination

$$\sin u = \frac{\lambda}{e},$$

and since the numerical aperture $a = n \sin u$ where n is the index of refraction of the medium between the objective and the object,

$$a = n \sin u = \frac{\lambda}{e}.$$

For illumination at its maximum of obliquity

$$a = n \sin u = \frac{\lambda}{2e},$$

whence

$$e = \frac{\lambda}{2a},$$

which is the formula of Helmholtz and Abbe. The resolving power thus depends not on the magnification, but only on the wave-length and the aperture of the objective.

The extreme limits of wave-length which we can utilise in the actual conditions are $\lambda = 0 \cdot 40\ \mu$ for direct observation and $\lambda = 0 \cdot 35\ \mu$ for photography. The angle of aperture of the objective cannot exceed 140°–160°, and the highest numerical aperture is 1·6. In these conditions the Microscope can show us elements of structure distant $0 \cdot 17\ \mu$ from each other, i. e. 5800 elements to the millimetre, with white light. With violet light $\lambda = 0 \cdot 44\ \mu$ of the spectrum we reach to $e = 0 \cdot 14\ \mu$, with 7000 elements to the millimetre; with photography $\lambda = 0 \cdot 35\ \mu$, $e = 0 \cdot 10$, i. e. 10,000 elements to the millimetre.

For the resolution of molecules, if we take for the dimension of the molecule 1/1000,000 mm., i.e. $e = 0 \cdot 001\ \mu$, we should require apertures equal to 175 to 220 or wave-lengths of $0 \cdot 005\ \mu$. This shows clearly that the vision or photography of molecules by means of the Microscope is a thing phys'cally impossible.

(6) Miscellaneous.

Microchemical Analysis.*—The publication of this volume of Prof. Behrens marks a decided advance in a method of qualitative analysis which bids fair to rival and in many cases to supersede the old blowpipe processes. To the mineralogist and petrologist, who is often compelled to work on very limited amounts of material, these microchemical methods of analysis have become almost indispensable.

The two best known previous works on the subject, by Haushofer and Klément and Renard, in which the attempt is first made to give distinctive microchemical reactions for each element, leave much to be desired in the case of the distinction between many closely-related elements. In the present case it can hardly be said that these difficulties have received their complete solution, but, as the author implies, the subject is still in its infancy, and the main object of the book is to give a short review of the rudiments of microchemical analysis and of the progress which has been made within the last ten years, and at the same time to point out the problems which need solution in the further development of this new branch of chemistry.

The book is divided into two parts. In the first, after a short historical introduction, the author states the general principles which have guided him in the choice of the microchemical reactions which are given for each element later on. Then follows a description of the apparatus and a list of the reagents used. With regard to the Microscope, any instrument which allows of magnifications from 50 to 200 times, and is provided with Nicol prisms and arrangements for measuring angles of crystals, and extinction angles, and for the observation of the optic axes in convergent polarised light, can be used. The author particularly recommends for microchemical work the Microscope (7 *b*) of Seibert.

The greater portion of the first part of the book (100 pp.) is occupied with the description of the different microchemical reactions for each element. The second part treats of the systematic use of these reactions for the investigation of mixed compounds, such as minerals, rocks (in section and in powder), alloys, &c.

Manual of Microscopy.†—This book is what it professes to be, a guide to scientific microscopy, provided that we are content to know only of the instruments, workers, and methods of Germany. Although aiming at meeting the wants of schools of medicine and pharmacy, and giving all the information required in practical microscopical work by the student of biology, whether in botany or zoology, the student is given no information that would lead him to suppose that any other nation beside Germany had ever devised or employed a Microscope, or added anything to our knowledge of microscopic biology.

The book is admirably arranged and carefully written; it is accurate, and in some points exhaustive; but to the practical microscopist who has followed the history of optical theory and practice during the last

* 'Anleitung zur Mikrochemischen Analyse,' von H. Behrens, Hamburg and Leipzig, 1895, 8vo, 224 pp., 92 figs.

† 'Das Mikroskop. Ein Leitfaden der wissenschaftlichen Mikroskopie,' von Dr. A. Zimmermann, Leipzig and Wien, 8vo, 1895, 334 pp., 231 figs.

two decades, and their influence upon the development of lenses, and the subsequent construction of the Microscope, it leaves very much to be desired. It is true that it may be fairly looked upon as a handbook; but for this very reason, if only in the interests of the student, allusions might with some show of reason be expected to what has been done in other countries and by other workers than the always industrious Germans.

The students contemplated by the author of this book are certainly those who may be supposed to use it thoroughly, and from whom, in many cases at least, may be expected not only a repetition of class work, but the prosecution of discovery and research. It may be quite right to explain what the immersion system of lenses is as concisely as is compatible with practical usefulness to the user of the book; this has been done; but both water immersion and homogeneous immersion have a history of uncommon importance, and especially the latter imparts a distinct educational value to even its modes of employment. Certainly we may not charge the error of ignoring other workers than those of Germany on the practical deviser of the homogeneous system, for he has very frankly admitted the influence of one English worker in giving it origin.

Again, in the discussion of the influence of the cover-glass as a means of introducing aberration, and the method of correcting it, we doubt whether the student is benefited by the omission of its history, any more than in similar circumstances an English, American, or French student would be benefited by a description of the apochromatic system of lenses, without reference to the laborious discovery of the Abbe-Schott glass which has done so much for the modern Microscope.

This is even more apparent in the consideration of the value and application of that most powerful instrument in modern microscopy, the condenser—the only means by which the high qualities of modern lenses can be efficiently made manifest.

Those who have followed the history of the microscopy of the last twenty years know that even under the enlightened guidance of Abbe, although objectives and eye-pieces have been gradually brought to a higher and higher quality, and their corrections have been made more complete, yet in German centres the value, nay, indispensable importance of the substage condenser was not perceived.

It may be frankly admitted that the broad scientific value of the Microscope was understood earlier, and more largely from the first, on the Continent than in England; but also from the very earliest times its highest possibilities have been most fully seen and brought out in this country. It is so to-day. The very highest critical images of the most delicate objects have been demonstrated by English, and mostly by amateur microscopy. But this has always been due to the persistent use of the substage condenser, an instrument which has been steadily progressing in optical qualities to meet the improvement in object-glasses and general optical systems.

Without going back to the time of Tulley, it is enough to start in 1850 with the "Gillett condenser," so generally and long used by English microscopists; and from then until now the leading opticians have applied their very best powers to perfect the condenser as the one method by which the higher qualities of lenses could be brought out, until we were recently provided with an apochromatic form of this instrument by the firm of Powell and Lealand.

But it was not until 1873 that even Abbe saw the need of the provision of a condenser; and this arose from the fact that critical images became a necessity by the inauguration of the science of bacteriology. But the condenser as he thus for the first time made it was simply a chromatic one: by no means of value where the objectives were of the highest order and corrected on the best modern principles. Hence it became slowly manifest even in Germany, where the condenser had for so long been deemed only a toy, that an achromatic condenser must be constructed, and we are indebted to Abbe for the introduction, in 1888, of a practical form of this. But there had existed in England for many years several forms equally simple, and decidedly more suited to English stands.

But with what slowness the necessity for bringing out the higher possibilities of the finest recent objectives comes to the German maker may be seen by the fact that the firm of Zeiss have, as is so well known, constructed an objective beautifully corrected, on the apochromatic principle, having a N.A. of 1·63. And for the illumination of this they provide a chromatic condenser—a condenser wholly without corrections —having an aperture equal to the object-glass; so that unless we use an absolutely achromatic source of light, we introduce the most vicious aberrations. But in the treatise before us the substage condenser is taken for granted. It has no history; it goes with the German Microscope, which the student is directed to use, as naturally as he is to use a knife with a microtome.

There is much on the theory and practice of illuminating that is of value, and the mechanical stage, for so many years looked upon as one of the unnecessary luxuries of the English Microscope, is carefully described, as made by Reichert, who follows Zeiss in the practical adoption of the English model.

The micro-camera apparatus of Winkel, Thoma, and Edinger are introduced with profit, as we know that such apparatus for drawing is of great service to the student; and the section on the use of the polariscope is specially clear and practical.

There is a chapter on Photomicrography; and the remainder (109 pp. out of 321) is occupied with a description of the apparatus for and methods of preparing, cutting and mounting, for study and preservation, the material and objects employed for demonstration and research, which covers in the usual way the requirements of the student.

Lens Work for Amateurs.*—A workshop receipt-book by a workman who evidently understands nothing of the theory of optical instruments. In one part of this work there is a pretence of much theoretical knowledge, but a comparison with the English translation of 'Naegeli and Schwendener on the Microscope' reveals that both the text and figures have been abstracted wholesale.

When the ipsissima verba of Naegeli and Schwendener's text are left for purposes of condensation, the blunders made by the author show

* H. Orford, 'Lens Work for Amateurs,' London, 1894 (1895), 8vo, xv. and 231 pp., illust.

that he has quite failed to understand the meaning of the passages he has been so liberally quoting.

Where the author adheres strictly to his own subject, viz. the grinding, polishing, and mounting of lenses, the work will be found full of tips, wrinkles, dodges, and all that kind of information which is so useful to an amateur.

Dental Microscopy.*—This work, which the author states is the first written on the subject, is not intended to teach dental histology, but simply the methods of research as at present in vogue in this special branch of minute anatomy, and which are only cursorily treated in the majority of ordinary text-books. There is a preliminary chapter on the Microscope and its accessories, so sketchy and imperfect, however, that it had been better omitted altogether. One or two extracts will serve to justify this opinion. Mr. Smith advises the purchase of a substage with focusing and swinging (*sic*) adjustments and an Abbe condenser, but all the subsequent reference made to the latter is that it should be used with the 1/6 objective in conjunction with the concave mirror and a small diaphragm. It is little wonder, therefore, that the author is of opinion, "It will be some time before the beginner can manipulate the substage condenser in a satisfactory manner," and thinks "it is unnecessary to add a long account of it; experience in its use, as throughout microscopy, is by far the best instructor." In recommending the student to use low powers only for many weeks, Mr. Smith remarks that with these "the tendency towards errors of refraction of light is considerably lessened," whatever this may mean, and that with high powers "there is greater fear of spherical and chromatic aberration." This is indeed Microscopy as she is taught. When, however, we come to the essential and larger part of Mr. Smith's work, viz. the preparation of hard and soft dental tissues, there is little to find fault with and much to commend; the methods advised are those found most suitable by the latest investigators here and abroad, and nothing of consequence appears to have been omitted in the processes of decalcifying, hardening, and staining. The book is illustrated by eight lithograph plates, and there is the inevitable chapter on photomicrography. It will, no doubt, be of service to such as are specially concerned with the minute structure of the teeth.

Lacquering of Microscope Tubes and Stands.†—Some practice is required in order to successfully lacquer a Microscope tube. The best process is to close the ends with cork and immerse in hot water. Before applying new lacquer the old must be removed by means of a soap solution containing benzol and alcohol (1 part of olive oil soap, 3 parts of 94 to 95 per cent. alcohol, 3–4 parts benzol, 1 part of caustic potash). The tube is then thoroughly cleaned and polished and placed in the hot water. The lacquer, which consists of red shellac dissolved in 95 per cent. alcohol in the proportion of 1 : 10, is poured into a deep saucer. The tube is then taken out of the water, carefully dried, and the lacquer applied with a broad brush.

* A. Hopewell Smith, L.R.C.P., M.R.C.S., &c., 'Dental Microscopy,' London, 8vo, 1895.

† Central-Ztg. f. Optik u. Mechanik, xvi. (1895) pp. 55–6

The following solutions for different colours have given good results:—

Light golden yellow:—1 part shellac, 1 part turmeric, 4 parts alcohol.

Golden yellow:—25 parts shellac, 4 parts turmeric, 1 part dragon's-blood, 70 parts 95 per cent. alcohol.

Dark golden red:—2 parts orleans, 30 parts turmeric powder, 3 parts red sandalwood, 480 parts 95 per cent. spirit, allowed to stand with frequent stirring for 2–3 days; 60 parts shellac, 15 parts sandarac, 15 parts mastic, 15 parts Canada balsam are then added, and, after all is dissolved, 10 parts of oil of turpentine.

American Microscopical Society.—A circular has been sent us announcing the next meeting of this Society. It will be held at Cornell University, in Ithaca, N.Y., on August 21st, 22nd, and 23rd. It is pointed out that the equipment of the University in all lines for carrying on microscopic work should add to the attractiveness of Ithaca as a place of meeting. As nearly all the opticians have expressed a desire to be present and make an exhibit of their Microscopes and microscopical apparatus, the members will have an opportunity to see all the new and standard apparatus. Following what they call "our prototype," the Royal Microscopical Society of London, the American Society not only publishes papers upon the Microscope, its manipulations and accessories, but also on the results of investigations in which the Microscope plays an important part. It is added that the University possesses one of Rogers' dividing engines, and the Department of Physics has kindly promised to show the members exactly how microtomes are made. A special feature of the coming meeting will be the setting apart of one or more sessions for the reading of papers and methods and the demonstration of special or new methods.

β. Technique.*

(1) Collecting Objects, including Culture Processes.

Cultivation Media containing Thyroid Extract.†—Dr. K. Kopp finds that nutrient media containing some thyroid gland juice possess an important value for discriminating between certain micro-organisms. The media are prepared from fresh sheep's thyroid, which is carefully freed from fat, and having been finely minced is soaked in an equal bulk of sterile water for about three hours. The infusion is, after straining through linen, filtered through a porcelain filter. The extract thus obtained is mixed with an equal bulk of 20 per cent. gelatin which contains 1 per cent. of salt. One per cent. agar is made on similar lines, 2 grm. agar, 6 grm. glycerin, 1 grm. salt, and 100 grm. water are mixed with an equal volume of the extract, both being at a temperature of 40° C.

Cultivation media containing thyroid extract were found to exert

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 81–3.

on some micro-organisms an inhibitory effect, on others the growth appearances were characteristic, in other cases the addition appeared to have little or no influence. The author gives a table showing the results obtained by cultivating *Bacterium coli commune* and *Bacillus typhosus* in these media.

Cultivation Media containing Egg-Yolk.*—Dr. Nastiukoff prepares three kinds of nutrient media in the following way:—

(1) Egg-yolk solution: 1 litre of distilled water plus 0·5 ccm. 10 per cent. solution of caustic soda plus 100 ccm. of egg-yolk. The yolk is freed from any albumen by Bunge's method (filtration through blotting-paper). The 10 per cent. yolk solution is placed in a flask and steamed for about 2 hours, and then, having been allowed to stand for a day, is filtered. The filtrate is distributed into test-tubes and sterilised in the usual way. The fluid is clear, and by transmitted light yellow; by reflected, greenish.

(2) To 300 ccm. of yolk are added 100 of 1 per cent. caustic soda solution and 600 distilled water, the ingredients (the latter two having been previously sterilised) being stirred the while with a glass rod. The 30 per cent. yolk solution may be at once distributed into test-tubes and heated in a water-bath to 75°–85°. Even at 75° the solution solidifies without impairment of its transparency, and by repeatedly heating to 85° it is sufficiently sterilised.

(3) To 1 litre of the 10 per cent. yolk solution are added—15–20 ccm. agar or 80–100 gelatin, and the whole boiled until it is completely dissolved. The thick opaque mass is filtered through a hot-water filter. Or the ordinary neutral agar or gelatin in equal parts may be mixed with the egg-yolk solution, the mixture evaporated down to one-half by boiling and afterwards filtered. Before filtering it is better that the fluid stand for about 2 hours in the steamer, in which the sterilisation is afterwards performed. Thus prepared the medium resembles very much the ordinary agar or gelatin.

Fig. 66.

According to the author, these media are excellent for influenza bacilli, gonococci, diphtheria bacilli, glanders, typhoid, cholera, and other pathogenic micro-organisms.

Simple Method for cultivating Anaerobic Organisms in Liquid Media.†—Dr. Ad. Schmidt finds that a simple test-tube, into which a bent glass tube fits through the intermediation of a caoutchouc plug, is an excellent apparatus for making anaerobic cultures in liquid media. The test-tube should be made of thick glass and hold about 30 ccm. The tube should be about 15 cm. long, and its long arm fits into the plug, the lower end being a few mm. above the bottom of the plug. After the test-tube is filled with some medium, the plug is put in and the fluid rises into the glass tube (see fig. 66). The apparatus is then sterilised, and should, owing to evaporation, the media sink down, more of the fluid must be put in. The apparatus is inoculated by carefully removing the stopper. The author says the apparatus works very well.

* Wratsch, 1893, No. 3, pp. 33 and 4. See Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 492–3.

† Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 460–1 (1 fig.).

Funnel for filling Test-tubes with Media.*—Dr. J. J. van Hest uses the following apparatus for distributing cultivation media in test-tubes, &c. :—Fig. 67 shows an enamelled or glass funnel, attached to the pipe of which is a caoutchouc tube *b*, which can be closed by a pinch-cock. To the tube is joined an outflow glass tube *c* for dipping into the test-tube. When the medium is poured in through the funnel its flow is stopped at any desired point by the pinch-cock. Smearing of the tube and consequent damage to the apparatus for cultivation often happens, but this may be avoided by the simple device shown in fig. 69, which is nothing more than a second tube placed between *c* and the test-tube. Over the end of *c* is pushed a caoutchouc ring (fig. 67) at a distance of 4–6 mm. from the end. The apparatus shown in fig. 68 can be used without any special practice, but that in fig. 67 requires some acquaintance, at least for manipulating quickly.

Fig. 67.

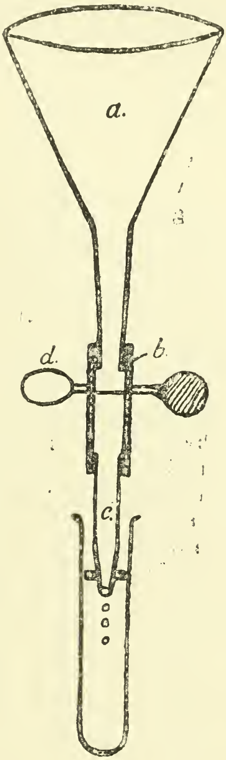


Fig. 68.

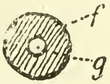


Fig. 69.

Modified Papin's Digester.†—Dr. J. J. Van Hest has used for some years a steriliser which can reach 100°–130°. The apparatus consists of a cylindrical iron kettle with an iron top. The steam is produced from heating a small quantity of water. The lid is fixed on by means of a number of small screw clamps, and between the pan and its cover is a thin layer of rubber for the purpose of effectually closing the apparatus. In the middle of the lid is a valve which can be loaded with leaden discs. The pieces to be sterilised are placed on a sieve or stand at the bottom of the apparatus. The top is then screwed on and the valve kept open until the thermometer marks 100°. By this time all the air has been driven out, and the valve is then closed by placing on it as many lead discs as are necessary to attain the desired temperature. When this is reached, the excess of steam escapes through the valve. The temperature is pretty constant.

(2) Preparing Objects.

Intercellular Bridges.‡—Herr H. Boheman fixed smooth muscle-cells with Heidenhain's corrosive sublimate, Kultschitzky's solution of

* Centralbl. f. Bakteriol. u. Parasitenk., 1e Abt., xvii. (1895) pp. 462–3 (3 figs.).
† Tom. cit., pp. 463–4 (1 fig.). ‡ Anat. Anzeig., x. (1894) pp. 305–15 (6 figs.).

bichromate of potash and copper sulphate in 50 per cent. alcohol, Rabl's platinum chloride and picric acid; and succeeded well in demonstrating the intercellular bridges. After fixing he stained his preparations with a solution of rubin (patent-acid rubin ·25 grm., 2 per cent. acetic acid, saturated picric acid 100 grm.), using 3–4 ccm. to 100 ccm. of absolute alcohol. Golgi's silver method also gave good results.

Examination of Central Nervous System of Desmognathus fusca.*—Mr. P. A. Fish decalcifies the cranium of this salamander by Perenyi's mixture or Gage's decalcifier. The latter is made up by adding 3 ccm. of strong nitric acid to 100 ccm. 70 per cent. alcohol, and gives uniformly good results. The tissue was fixed either by potassium bichromate, corrosive sublimate, picric alcohol, or a mixture which may be called picro-aceto sublimate. This last is composed as follows:—50 per cent. alcohol, 1000 ccm.; glacial acetic acid, 5 ccm.; corrosive sublimate, 5 grm.; picric acid, 1 grm. This gave most satisfactory results, and brought out many histological details that were not demonstrable by the other methods. For staining, Delafield's hæmatoxylin gave most excellent results. Contra-staining with Van Gieson's picro-fuchsin gave most brilliant effects. Herrick's modification, which consists in adding a tablet of ·5 of a gram of corrosive sublimate and ·5 grm. of ammonium chloride to about half a litre of the stain, was found to work very satisfactorily. Another satisfactory modification is the addition of 1 ccm. of glacial acetic acid and 1 ccm. of a saturated aqueous solution of corrosive sublimate to 100 ccm. of the hæmatoxylin. For histological details the short silver nitrate method of Golgi and Weigert's hæmatoxylin method were mainly employed. In the silver method the author used 3 per cent. potassium bichromate 100 ccm., 1 per cent. osmic acid 20 ccm. The tissue was allowed to remain in this mixture from 24 to 48 hours, according to the temperature. It was then rinsed rapidly, and placed in a weak solution of 1/4 per cent. silver nitrate for 15 or 20 minutes. This was changed a couple of times until the fluid remained clear. It was then immersed in a 3/4 per cent. silver nitrate solution, and left there for two days or longer. The object was cleared and cut in a mixture of 3 parts red oil of thyme and 1 part of castor oil.

If the specimen is stained *in toto* the method is a very expeditious one. It was found that the sections, after absorbing the superfluous oil with tissue paper, could be fixed to the slide by means of a drop or two of ether-alcohol, and that they might then be passed through the various alcohols, and stained similarly to the paraffin or ordinary collodion methods. Any tendency toward crumbling or tearing on the part of the sections may be obviated by painting the cut surface of the object with a thin layer of 1 per cent. collodion before making each cut; this will also enable one to cut much thinner sections.

Preparation of Fish Eggs.†—Mr. J. T. Cunningham has found it very difficult to preserve fish ova satisfactorily for cutting, as the germinal vesicle, or the protoplasm, or both, are more or less destroyed by the preserving reagents. He finds that the much-vaunted mixtures of Flemming, namely, chromic, osmic, and acetic acids are not satisfactory,

* Journ. Morphol., x. (1895) pp. 234–5.
† Journ. Mar. Biol. Ass., iii. (1895) p. 270.

and that the fault lies in the acetic acid, which causes shrinkage of the nucleus and destruction of its delicate reticulum. Chromic and osmic acids alone, when the chromic is not too strong, have a good effect, but at the same time have the disadvantages of contracting the nucleoli, preventing staining, and making the yolk hard and brittle.

Examination of Nephridia of Phylactolæmatous Polyzoa.*—Mr. A. Oka, in his investigation, first stupefied the colonies with a fluid prepared after Cori's receipt (10 per cent. solution of methyl-alcohol in 0·75 per cent. salt solution with a few drops of chloroform), and then fixed them with Flemming's fluid. After washing in rain-water they were gradually hardened in alcohol. For staining he used Boehmer's hæmatoxylin, sometimes in connection with alcoholic solution of eosin. The stupefying fluid used seems to work especially well upon such forms as these.

Examination of Segmenting Ova of Isopods.†—Prof. J. P. McMurrich recommends, for developing eggs of Isopods, fixing in alcoholic picro-sulphuric acid, staining in Kleinenberg's hæmatoxylin, and washing in acid alcohol until all the stain is removed from the yolk. The egg should then be cleared in oil of cloves, and examined as a transparent object.

Study of Young American Sponges.‡—Mr. H. V. Wilson found that the young *Esperella* is, after metamorphosis, so thin that it cannot be scraped off the dish without injury. He therefore coated the dishes with a thin layer of paraffin; collodion was also used. For fixing purposes, he found that very much the best fluid was the mixture of acetic acid, alcohol, and osmic acid recommended by Zacharias. He allowed this to act for from 10 to 20 minutes. Kleinenberg's picric method was of use for special points, as it often preserved the individual cells in a more natural and uncontracted condition than the Zacharias fluid, but in general it disassociated the elements too much.

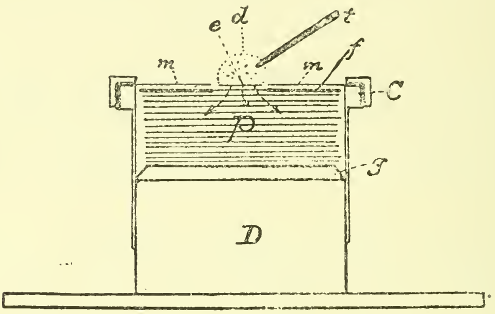
A new Method of Entrapping, Killing, Imbedding, and Orienting Infusoria and other small objects for the Microtome.§—Mr. J. A. Ryder, feeling the want of a reliable method for this purpose, has, after trying a number of devices, hit upon a plan that is not only very simple, but is also capable of wide application, since organisms as small as 12·5 μ in diameter may be cut and held. He makes a filter from thin slices of elder-pith, which are perforated at pretty regular intervals by openings caused by cutting through the very thin cellulose walls of certain of the pith-cells. A good supply of the little pith-filters should be cut, and kept in stock in a pill-box ready for use at any time. The next step is to take some ordinary good white filtering-paper cut in discs or squares about 1 in. in diameter.

A small drop of water on the end of a wooden toothpick should be used to moisten a point at the centre of one of these paper discs or squares, so as to make a damp area just about the area of one of the discs of pith. A wire 1/16 in. thick should be heated at one end, and with it some melted paraffin should be placed on the paper disc. This

* Zool. Mag., 1895, pp. 25. † Zool. Anzeig., xviii. (1895) pp. 109–11.
‡ Journ. Morphol., ix. (1894) pp. 286 and 7.
§ Amer. Natural., xxix. (1895) pp. 194–8 (1 fig.).

may be heated with the hot wire so as to saturate the whole of the paper disc, except the central moistened spot, which must be left unsaturated, with paraffin. The next step is to prepare a discoidal pad about 1 in. in diameter composed of ten to twenty superposed thicknesses of filter-paper; upon this a disc of filter-paper is superposed. Fig. 70 shows the arrangement of the parts. The cap-ring C of a large-sized live-box holds a perforated mica cover *m m* in place. The perforation of the mica should be a little larger than the disc of paper *e*, immediately below which lies a disc of filter-paper *f*, which is saturated with paraffin, except at its centre. Then follows the pad of several thicknesses of filter-paper P.

Fig. 70.



The mode of preparation is as follows:—Place P upon the glass disc *g* of the live-box or compressor, then lay *f* upon P, then put the cap C in place and slip it close down over the drum D, so as to hold *f* firmly down upon P. Next moisten the central exposed part of *f*, that is the part not saturated with paraffin, with a little water, pick up one of the little discs of filter-pith by one edge with a fine forceps, and lay it down on the moist centre of *f*, when it will at once flatten out and adhere to *f*, and just neatly cover the central area not saturated with paraffin. On the apparatus so prepared place a drop of water D swarming with animalcules from a vigorous culture on *e*, when it will be found that the water will be drawn rapidly through *e* and *f* into P, in the direction of the arrows. In this way several drops of water may have a large part of their population separated out and caught upon the surface of *e*. To kill the contents of D it is only necessary to add a little saturated corrosive solution or 1 per cent. osmic acid. The animalcules are at once precipitated by the killing agents upon the upper surface of *e*, where they are caught and held in the meshes formed by the pith-cells. The filter *e* should now be gently removed by means of a needle and forceps. With gentle handling Mr. Ryder finds that Ciliates will remain attached to *e*, and may be passed through a dozen reagents without becoming detached, and that the pith-disc may be imbedded in paraffin very readily by the watch-glass method. The pith-discs may also be mounted entire, and in this way most instructive preparations may be prepared. Staining is also entirely under control, and with this method it has been found possible to cut 18 longitudinal serial sections and 50 transverse serial sections of *Paramæcium* with a thickness of

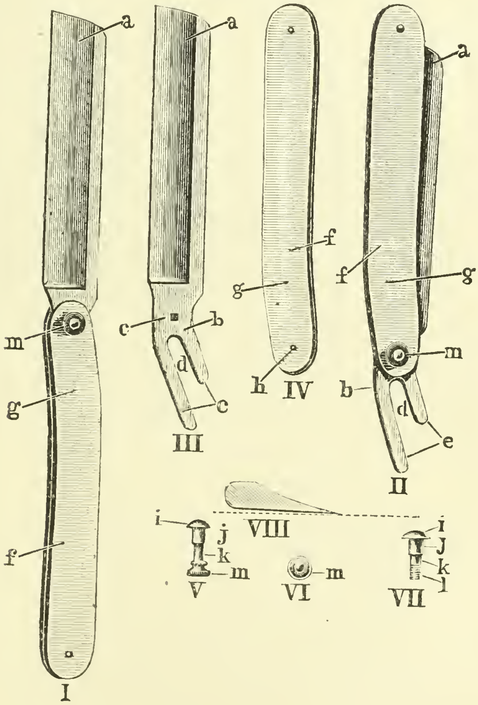
2·5 to 5 μ. The fixation of the sections on the slide may be effected by Gustav Mann's albumen method. Mr. Ryder adds that a very simple form of this apparatus for holding the filter-paper in position may be obtained from Messrs. Charles Lentz and Sons, of Philadelphia.

(3) Cutting, including Imbedding and Microtomes.

Sectioning Fern-Prothallia.*—Mr. M. B. Thomas describes a process for imbedding fern-prothallia and other delicate objects in collodion, and sectioning with the microtome. Before imbedding the object must be well hardened and dehydrated. It is then placed in a solution of 1·5 grm. gun-cotton in 100 ccm. of equal parts of ether and alcohol; the liquid is slowly evaporated until solid collodion remains behind. The subsequent treatment is much the same as that of objects imbedded in paraffin.

Universal Razor for Microscopists.†—Dr. Éternod has devised, for the use of students, a razor which can be used for cutting sections either

FIG. 71.



by hand or by the microtome. It is composed of the following parts:—(1) A special blade, (2) an aluminium handle, (3) a bolt for connecting

* The Microscope, 1893, pp. 167–8. See Bot. Centralbl., lxi. (1895) p. 317.
† Zeitschr. f. wiss. Mikr., xi. (1895) pp. 465–9.

the blade with the handle. The blade (fig. 71, I *a*, II *a*, III *a*) is of English steel of mean temper. The cutting part is perfectly straight and of as simple a form as possible. The blade is plane and slightly oblique on its lower surface, but a little hollow on the upper surface (VIII). Its back is thick and rounded on two sides for convenience of sharpening. The form of the back also allows of the blade being easily fastened by means of the clamp to the different sliding microtomes. The shank of the blade (II *b*, III *b*) is perforated by a square hole (III *c*), and is terminated by a fork set obliquely to the rest of the blade. The slot (II *d*, III *d*) between the two branches of the foot (II *e*, III *e*) serves to receive the pressure-screw of certain sliding microtomes (e. g. Schanze's).

The handle (I *f*, II *f*, IV *f*), of aluminium, has a slight bend (I *g*, II *g*, IV *g*), so as to diminish the quantity of metal of the handle and to preserve the blade better when it is closed. The head of the handle is pierced on one side with a square hole, and on the other with a round one (IV *h*), in which the bolt fits. The steel bolt (V, VI, VII; I *m*, II *m*) consists of (1) the head at its lower end (V *i*, VII *i*), (2) a square part (V *j*, VII *j*), (3) a cylindrical part (V *k*, VII *k*), (4) a screw part (VII *l*), and lastly (5) a milled head (I *m*, II *m*, V *m*, VI *m*, VII *m*). The square part of the bolt *j* fits into the square hole on one side of the handle and into the square hole of the blade (III *c*), while the cylindrical part fits into the round hole on the other side of the handle.

Rapid Method for Hardening and Sectioning.*—Dr. J. Coats gives a method for hardening, of which the principles are rapid hardening in alcohol, cutting with the microtome without removing the alcohol and without freezing the tissue, and rapid staining. Put shortly, his method is as follows:—(1) Select an illustrative part of the fresh tissue and remove a slice with a sharp knife. (2) Place in absolute alcohol and heat the vessel in a water-bath to about 40° C. for half an hour to an hour. (3) Dry the tissue and place it on the freezing plate of the microtome in a large drop of anise oil. (4) Freeze the anise oil, which freezes at a high temperature, and cut sections. The upper surface of the knife may be moistened with alcohol while cutting. (5) Place in alcohol to remove anise oil. (6) Float out in water and place on slide for staining. (7) Stain by any approved rapid method, and mount.

(4) Staining and Injecting.

Examination of Wandering Cells of the Frog.†—Dr. A. A. Kanthack and Mr. W. B. Hardy give an account of the methods employed by them in the investigation of the wandering cells of the Frog. They find that differences in the texture of cell-substance are brought into marked prominence by the use of iodine, and they say that this reagent cannot be too highly praised in this connection. The nuclear type of the various cells has been studied with the aid of a solution of methyl-green slightly acidulated with acetic acid, and with a drop of osmic acid added. The nuclear characters were also shown by treatment with an alkaline alcohol-osmic acid solution of methylen-blue. With this solution

* Amer. Natural., xxviii. (1894) pp. 827-9.
† Phil. Trans., clxxxv. B. (1894) pp. 283 and 4.

eosinophile granules are entirely uncoloured and unchanged. Amphophile granules are stained blue, while the basophile granules appear violet with daylight, and brilliant rose with yellow light. The substance which produces the rose-coloured modification of methylen-blue does so whether it be present as granules in the cell-substance, or dissolved in the surrounding fluid. The study of the living cells and their behaviour towards noxious or innocuous substances has been carried out by injecting various substances into the lymph-spaces of the frog, and withdrawing drops of lymph for examination at varying intervals of time, and by hanging drops. The hanging drops were suspended on the under side of a cover-slip in moist chambers, sufficiently large to provide air enough for the needs of a small drop of lymph for about ten hours, without introducing a fresh supply. The cover-slips used were always carefully cleaned with acid and absolute alcohol, and then sterilised by heat, immediately before use.

Gold Impregnation.*—Mr. C. L. Bristol gives an account of a method of using formic acid and gold chloride suggested to him by Miss J. B. Platt. He has used it in tracing the nervous system of *Nephelis lateralis*, and has found it reliable. In leech tissues it differentiates all nerve tissue, though the results with other tissues are poor. It has been used successfully on larval vertebrate material also, by varying the strength of the formic acid, or the time of its application. The following process was employed:—The leech is put into 20 or 30 times its bulk of 10 per cent. formic acid, and left from 3 to 5 minutes. It dies well extended. It must now be transferred without washing to 1 per cent. gold chloride for 25 minutes, then put without washing into 1 per cent. formic acid for 24 hours, or until reduction is complete. This is indicated by a rich purple colour over the whole specimen. It must now be washed slightly in tap water; run up through the alcohols to chloroform, saturated with hard paraffin. When the impregnation appears to be very slight, stain the sections on the slide with erythrosin or some other deep red anilin stain for contrast. These sections will often show the most exquisite details. Transparent larvæ 5 to 10 mm. long require a milder treatment, such as 5 per cent. formic acid for 2 or 3 minutes, 1 or $\frac{1}{2}$ per cent. gold chloride for 10 minutes, weak formic acid for 1 to 4 hours. The reduction of the gold chloride may be stopped at any point by transferring to alcohol. The gold chloride solution was exposed to sunlight for some time before using; this may not be an essential factor in the process, but it has been suggested that failure to ripen the solution by sunning may be the cause of many of the failures in gold staining.

Brain of Pike.†—Herr L. Neumayer used the chrom-osmic-silver method as modified by Ramón y Cajal. The objects were placed in a mixture of 1 part of 1 per cent. osmic acid and 4 parts of 2 per cent. potassium bichromate solution. He left the objects two days in the osmic acid and potassium bichromate solution, two days in 0·75 nitrate solution. To add a few drops of formic acid to the silver nitrate solution is very advantageous. A second or third repetition of the whole

* Amer. Natural., xxviii. (1894) pp. 825-6.
† Arch. f. Mikr. Anat., xliv. (1895) pp. 345-65 (1 pl.).

process for one day in each solution was attended with good results. Thereafter the brain was placed for an hour in absolute alcohol, and cut in celloidin.

Minute Structure of Electric Organ in Torpedo.*—Herr N. Iwanzoff tried over a score of different fixatives, &c., but his best results were obtained when he used chromic salts—especially bichromate of potash—after injection with osmic acid, and stained with aqueous solution of hæmatoxylin. Osmic acid and Flemming's fluid alone, or these with subsequent use of potassium-gold-chloride, were employed when staining was not desired. His paper includes a long discussion of various methods used by Fritsch and others.

Differentiation of Hypodermic Glands.†—M. E. G. Racovitza describes a means of differentiating hypodermic glands in Annelids (*Micronereis variegata*), when one wishes to study the order of appearance, number, or distribution, without investigating minute structure.

The Annelid is placed gently in water on a slide, flooded with acetic acid, washed in distilled water for a few seconds, and then placed in mixture A, viz.:—Solution of methyl-green (Grubler) 0·3 per cent., 1 vol.; fluid of Ripart and Petit, 1 vol. The latter consists of chloride of copper 0·3 grm., acetate of copper 0·3 grm., crystallised acetic acid 1 grm., camphorated water, not saturated, 75 grm., distilled water 75 grm. The Annelid is coloured uniformly green in a few minutes; but after 3–6 days the body generally is decolorised, while the glands are intense blue.

Then the specimens are placed in mixture B, viz.:—Pure glycerin, 1 vol.; fluid of Ripart and Petit, 1 vol. Thereafter the body is clear as crystal, except the glands, which are intensely blue.

(5) Mounting, including Slides, Preservative Fluids, &c.

Formol as a Preserving Fluid.‡—Mr. F. C. Kenyon has an interesting essay on this subject. The first half of it is a free translation of a paper by Prof. T. Blum.§ It has been found that the properties of formol as a preservative medium may be summed up as follows:—Animal objects are hardened without shrinking, and without losing their microscopic structure or staining properties; the natural form and colour is preserved; the eyes remain much clearer than in alcohol; the mucus of slime-producing animals is not coagulated and remains transparent; the colouring matter of blood in tissues apparently disappears, but may be quickly restored by a high per cent. alcohol; plant structures are more or less well preserved; most fruits keep well; chlorophyll is not extracted, but after a long action of the fluid delicate leaves may be changed; other colouring matters are retained for varying periods with individual plants; microscopic sections of plants that have been a long time in formol give fine preparations. Dilute formol is incombustible, and is much cheaper than alcohol. To the results of Blum the author adds some experiments of other German naturalists and some notes of his own. He obtained some startling effects with salamander blood.

* Bull. Soc. Imp. Nat. Moscou, 1895, pp. 407–89 (3 pls.).
† Arch. Zool. Expér., ii. (1894) No. 3, pp. viii–x.
‡ Amer. Natural., xxix. (1895) pp. 82–91.
§ Ber. Senck. Naturf. Gesell. Frankf. a. M., 1894, pp. 195.

A few drops of blood were placed on a slide in a 1 per cent. solution of formaldehyde and watched under the Microscope. The corpuscles, and especially the nuclei, were seen to swell rapidly; the nuclei became as large almost as the original corpuscles, and were seen to pop out of the corpuscle like a grape from its skin. The envelopes then became very pale and finally disappeared from view, but the nuclei remained very distinct. Staining with Ehrlich-Biondi mixture showed that the body of the corpuscles had simply been rendered very transparent by the solution, while immersion in alcohol coagulated the fibrin into an opaque straw-yellow mass, and brought the corpuscle faintly back into view. This explains the phenomenon of the return of the colour of blood-vessels noted by Blum, and is due to the coagulation of the fibrin, which may also be stained somewhat by the colour drawn from the corpuscles. Mr. Kenyon concludes that it may be said, for general purposes, that solutions of at least more than 2 per cent. must be used in order to avoid the swelling and the decolorisation of specimens; solutions of from 4 to 8 per cent. will give the best results. For histological purposes, formaldehyde combined with alcohol will give better results than either used alone. Weak (1 to 2 per cent.) solutions, by swelling nuclei, may serve the very important special purpose of demonstrating the presence of cells not otherwise readily distinguished.

Preservation of Marine Animals.*—Mr. W. A. Redenbaugh has applied the method of preservation suggested by T. Tullberg a few years ago, in which a novel use was made of magnesium sulphate. A method which was found successful with various marine animals was the following:—The animal is killed by slowly adding a ·1 per cent. solution of chromic acid until the water contains from ·03 to ·05 per cent. of the acid. Sections of tentacles showed that the cells were not attacked by the substances employed. The author has found that the desired results may be obtained in a much simpler manner than that described by Tullberg. Complete stupefaction of the organism must be produced, so that when it is removed to a killing fluid no contraction takes place. The process, however, must not be carried on so slowly that maceration may ensue. For Cœlenterates the most beautiful results were obtained with sea anemones, which ordinarily are so difficult to preserve in a well-expanded condition. They were allowed to expand in a dish with as little water as possible; crystals of magnesium sulphate were then placed in the bottom of the dish and allowed to dissolve slowly until a saturated solution was obtained. A large *Physalia* treated in this way was preserved in 4 per cent. formalin with all the tentacles and polyps fully extended. For Echinoderms the method was found to be equally successful. Annelids, placed in a saturated solution of Epsom salts, became in a very short time perfectly limp, and were easily extended upon a glass plate, and treated with a fixing reagent. *Balanoglossus*, when taken soon after being collected, was thus preserved in nearly a perfect state. Good results were also obtained with Gephyreans and Nemerteans. For Ascidians it is best to add the saturated solution of sulphate intermittently with a pipette. A number of experiments were made upon Ctenophores, and successful results were obtained with the

* Amer. Natural., xxix. (1895) pp. 399–401.

following method:—To a solution of equal parts of 2 per cent. formalin and Perenyi's fluid was added enough common salt to increase the density of the mixture to that of sea-water, that is, until a Ctenophore placed in it barely floated. This adjustment of the density of the surrounding medium prevented the Ctenophores collapsing of their own weight. After remaining for about half an hour in this fluid they were transferred to 4 per cent. formalin. The density of each had been increased by the addition either of Epsom salts or common salt. The former is probably better than the latter for increasing the density of the fluid.

Preserving Brains.*—Dr. A. Lanzillotti-Buonsanti advocates the use of formalin for preserving brains. This fluid contains 40 per cent. of formic aldehyde, and may be mixed with water in various proportions. The author left dogs' brains for 10–12 days in a 2 per cent. solution, and then placed them for a like period in glycerin. The results were better than with Giacomini's method.

Wiese's Preserving Fluid.†—Dr. A. B. Meyer publishes a letter from Wiese to the effect that his fluid is disappointing only because collectors use it carelessly and not enough. Each object must have 3–4 times its own volume of preserving fluid. But the letter does not make clear whether even a large quantity of the fluid will prevent soft specimens, such as fishes, from falling to pieces, which was what Meyer complained of.

(6) Miscellaneous.

Standard Unit of Size for Micro-organisms.‡—Mr. G. C. Whipple, after pointing out that the results of the microscopical examinations of water by the ordinary methods are often misleading owing to the custom of recording the number of organisms present in a cubic centimetre of water examined, without regard to their character or size, shows that it is advisable to use some unit by which the actual quantity of animal and plant matter present may be expressed; such a standard would be a square 20 microns wide, having an area of 400 square microns. This is suggested because it has already been used in estimating amorphous matter, because it is about the size of several common organisms, and because it is a unit whose size can be easily carried in the mind.

It will be found of great advantage to have the ocular micrometer divided as follows: the square, which should cover one square millimetre on the stage of the Microscope, is first divided into four equal squares, and each of these quarters subdivided into smaller squares, each of which is equivalent to twenty-five standard units.

Two plates are given showing how there is a general parallelism between the profile (curve) of the albuminoid ammonia and that of the organisms expressed in terms of the standard unit, while the curve of the actual numbers of the organisms does not accord well with the chemical analyses.

It should be noted that this volumetric method has been used for over two years at the Boston Waterworks, and several other biological laboratories have since adopted it.

* Mon. Zool. Ital., v. (1894) pp. 273–5.
† Zool. Anzeig., xviii. (1895) pp. 122–5.
‡ Amer. Mon. Micr. Journ., xv. (1894) pp. 377–81 (2 pls.).

Microscopic Characters of Powdered Drugs.*—In discussing the botany of the present edition of the British 'Pharmacopœia,' in view of the approaching revision of that work, Dr. J. Reynolds Green says, "In the present volume no description is given of the microscopic characters of powdered drugs. When we consider that in the present day most pharmacists purchase many drugs in the condition of powders, it appears desirable that they should be able to identify the powder apart from the drug in the unaltered condition. This can be done only by microscopic examination. Many of the constituents of vegetable tissues have a very definite value in this respect; many starches are extremely distinctive; the tissues of seeds are very unlike those of roots, and so on. It is only necessary here to call attention to a few illustrations of this point. Ipecacuanha, when powdered, can be recognised with tolerable certainty by two points—the vascular elements are in the form of perforated tracheids, true vessels being absent; the starch grains are of a peculiar appearance. Jalap in powder again shows distinctive starch grains, peculiar crystals, and numerous resin-containing cells. The powdered seeds of strychnos nux vomica would be easily identified by the application of the micro-chemical tests for brucine and strychnine.

Many powders need special investigation, of course, to enable accurate diagnostic tests to be ascertained; for example, rhubarb, liquorice, and gentian powders. A new 'Pharmacopœia' would be much improved by the introduction of the distinctive features which such powders present, and these could without much difficulty be determined. Within the last ten years much more accurate information has been obtained on the point of the definite micro-chemical tests which various constituents of vegetable tissues respond to. Those which are given in the present 'Pharmacopœia' are often negative, and some depend on very variable constituents. In the case of many decoctions it is stated that they do or do not give an indigo-blue colour with iodine. This test is of little value as given; it, of course, is only a test for the presence of starch in the drug under discussion. The presence of starch in many roots will depend on their condition when gathered; the quantity of starch, and therefore the depth of the colour of the decoction on addition of the iodine, will vary very greatly from time to time. In many cases where this test was said to give a negative result, the reason for applying it is not apparent. The value of the test will depend on its distinguishing the drug under examination from another, for which it might be mistaken, which does contain starch. In such a case, why should not the two drugs be mentioned as differing in this respect?

Some of the micro-chemical tests given are not only not distinctive, but actually inaccurate. Thus Cusparia bark is said not to give an arterial red coloration when the fractured surface is touched with nitric acid. In many cases this treatment does produce a red colour, though perhaps not quite that of arterial blood. Presumably this test is meant to distinguish Cusparia bark from that of nux vomica."

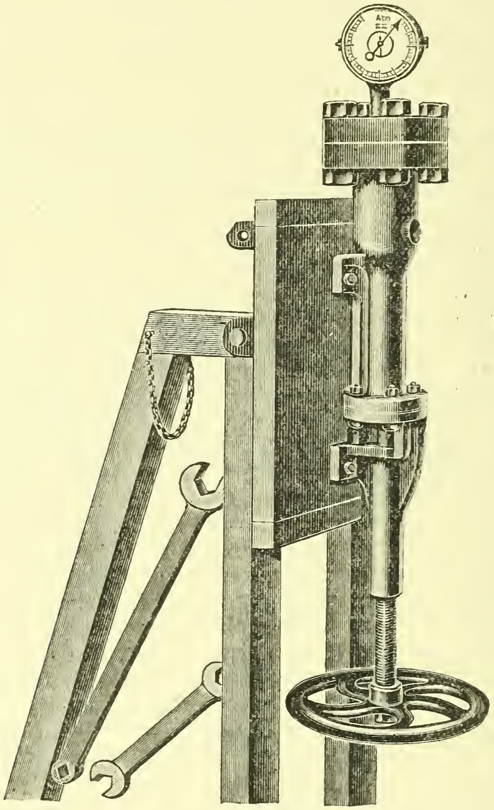
Intrahydraulic Pressure as a new Method of Investigation.†—Dr. Stanislaus von Stein has constructed an apparatus with which to

* Brit. Med. Journ., No. 1786 (1895) pp. 668–70.

† Zeitschr. f. wiss. Mikr., xi. (1894) pp. 321–6.

systematically study the effect of pressure on certain tissues and organs. A strong wooden frame which is fastened to the floor by screws, carries a board which can move about a horizontal axis, so that it can be adjusted either vertically (as in the figure) or horizontally. To this board is screwed the hydraulic press made of phosphor-bronze, at the lower end of which is seen the wheel with the pressure screw (310 mm. long). Above this is the piston, the press-cylinder with thick walls, and the strong

Fig. 72.



cover with four screws (these three parts are together 355 mm. long) surmounted by the manometer which is adjusted up to 2000 atmospheres. The total weight of the whole apparatus amounts to 60 kg.

To use the instrument, the four screws of the cover are loosened with the long spanner seen in the figure, the bolts removed and the cover with the manometer taken off. The space (38 mm. in diameter and 179 mm. long) is then filled with water up to the brim. The cover is replaced with the cylindrical projecting piece (11 mm. high and 56 mm.

broad) on its lower end fitting into the opening. Between the edges and the projecting piece which is provided with a row of concentric grooves, is a copper ring which is pressed into the grooves when the cover is screwed on. With good packing of the piston the apparatus keeps a pressure of 700 atmospheres for a considerable time. With phosphor-bronze a pressure of 1500 atmospheres could not be obtained, the cylinders breaking at 1100 to 1200 atmospheres. For these high pressures a steel cylinder must be used. The author describes several interesting experiments which can be made with the apparatus to show to what high pressure living things and cell-protoplasm may be subjected without being destroyed.

Scientific Models.*—Prof. W. His pleads for the higher appreciation of scientific models, which he thinks as worthy of citation as printed documents. Thus Hochstetter should have referred in a recent criticism to His's models of eye-development prepared by Ziegler. For there, His has in visible clearness expressed his conclusions as to the complex relations of the different parts.

* Anat. Anzeig., x. (1895) pp. 358-60.

PROCEEDINGS OF THE SOCIETY.

Meeting of 17th April, 1895, at 20 Hanover Square, W.
The President (A. D. Michael, Esq., F.L.S.) in the Chair.

The Minutes of the Meeting of 20th March last were read and confirmed, and were signed by the President.

The List of Donations (exclusive of exchanges and reprints) received since the last meeting was submitted, and the thanks of the Society were given to the donors.

	From.
10 Slides (consisting of 2 of Seeds of Orchid, Septum of Club-rush, Wing of Hakea-seed, *Auliscus cœlatus*, Spicules of *Gorgonia* and *Melitæa*, *Sertularia elongata*, *Sert. unguiculata*, and Gizzard of Green Grasshopper)	*Mr. W. M. Bale.*
R. Braithwaite, British Moss Flora, pt. xvi. (4to, London, 1895)	*The Author.*

Prof. F. Jeffrey Bell said that their list of donations included the valuable gift of a lantern with Microscope attachment, presented by the South London Microscopical and Natural History Club, which would no doubt prove extremely useful to the Society—also Part 16—completing the second volume of Dr. Braithwaite's British Moss Flora—and some slides from Mr. Bale, sent from Australia, but at present without any communication with reference to them.

The President said they had already at the previous Council Meeting expressed their thanks to the South London Society for their valuable and useful donation, and the meeting would no doubt also desire to vote the thanks of the Society to Dr. Braithwaite and Mr. Bale.

Prof. Bell said they had received a special communication from the Imperial Institute relative to an exhibition of examples of photographic art which it was proposed to hold in that building. One section was to be devoted to photomicrography and apparatus connected therewith, and Sir Frederick Abel asked the Secretary of the Society to draw the attention of the Fellows to the matter as set forth in this communication. It would therefore be laid upon the table in the Society's Library for the perusal of any one who felt interested in the subject.

Mr. A. Letherby read a short paper upon the structure of the Podura scale, and exhibited a photograph in illustration of his opinion that the scale consisted of an upper and under layer, and that the so-called exclamation markings were perforations in the upper membrane.

Mr. E. M. Nelson said he had seen this photograph and noticed the remarkable sharpness of the image and the clearness with which it showed the postage-stamp fracture. All were aware that there were differences of opinion as to what the markings really consisted of, some regarding them as elevations and others as depressions; but, so far as he knew, this perforation theory was new.

Mr. G. C. Karop could say little on the matter from personal experience, as he did not possess and had had never been able to obtain a satisfactory amount of Podura scales to experiment with. Possibly a study of these and other scales from the developmental side might throw some light on the interpretation of their final structure, but, so far as he knew, there was no memoir on the subject. Arising, as they presumably did, as hollow vesicles which afterwards collapsed, the superimposed membranes by infolding, puckering and contraction, might give rise to many of the usual appearances of these objects; but the very considerable regularity of marking was hardly explicable on simple mechanical grounds alone, and quite obviously insufficient to account for separate featherlets as described by Mr. Letherby and other authors.

Mr. J. W. Gifford said that the postage-stamp fracture appearance was borne out by his own photographs taken with monochromatic light by means of his screens; the appearance always remained the same, and he therefore had no doubt as to its reality.

The President did not know if he had correctly grasped the precise mode in which Mr. Letherby put the matter before them. In Insects, as a rule, every scale, no doubt, was distinctly formed of two membranes—it being, so to speak, constructed like a Japanese fan, of two strained surfaces over a skeleton between them. Did Mr. Letherby suggest that each of these was double, and that there were two perforated and two unperforated membranes, or did he intend to say that it was the upper or the under part which was perforated? It would, of course, be very interesting to know that there were such perforations as those referred to.

Mr. Letherby said he had seen many scales in which the two membranes were certainly separated, but he did not think there were more than two membranes, and it was the under one to which the stalk was attached. He had one scale on his slide where the upper membrane alone was attached to the cover-glass. He had no doubt about the perforations, but at present he could add nothing to what he had put before the meeting.

The President thought it rather rash to prophesy as to what might be known in future, but there could be no doubt that the photograph exhibited was remarkably clear, and that their thanks were due to Mr. Letherby for this, and also for the very instructive note with which it had been accompanied.

Dr. R. G. Hebb having been requested to occupy the chair,

The President gave an interesting *résumé* of his paper "On the Form and Proportions of the Brain in the Oribatidæ and in some other Acarina," the subject being illustrated by drawings upon the blackboard, and by some excellent sections exhibited under several Microscopes in the room.

Mr. Nelson said the little he had done in connection with the subject consisted in making a few calculations based upon a number of drawings which Mr. Michael had sent to him. These consisted of figures of very irregular shapes, and the only thing to be done was to divide them up into more regular forms and then square out the contents. By way of testing the accuracy of this he made a model in accordance with the measurements and measured the water displaced. The two methods agreed in their result within a very small fraction.

Prof. Bell said that Mr. Michael's comparisons between the weight of the brain in man and the Acarina was a matter to be regarded more as one of curiosity than of absolute value, because it would, he thought, be found that the proportional weight of the brain to the whole of the body in different families could scarcely be relied upon as a standard of intelligence. If, for instance, they took the brain in man—which was perhaps the heaviest, with the exception of the elephant's—as being 1/50 the weight of the body—they would find that this was surpassed by some of the American apes, where it varied from 1/25 to 1/15; by the sparrow, where it was 1/27; and still more by the titmouse, in which the proportion was as much as 1/12. He would like, however, to ask Mr. Michael if he had within any particular family found any difference in the proportions in the case of larger or smaller individuals?

The President said that Prof. Bell was no doubt right in saying that the comparisons made were of no great value, but he still thought there was something to be learnt from them. He had not worked out a sufficient number to be able to speak positively upon the point which had been raised, but as far as he had gone he had not found that he got the largest proportions in the smallest forms. Amongst the *Gamasidæ* it so happened that the one which showed the smallest sized brain was the smallest creature, but in other cases it had not been so. He inclined to the opinion that proportionate size followed the family rather than individuals, but the number of species which he had been able to examine in this particular was scarcely sufficient to enable him to form any accurate opinion.

Prof. Bell said that the observations of Gulliver on the comparative size of the blood-corpuscles seemed worth mentioning in this connection, because he found that their size, in animals of the same family, was proportionate to the size of the animal; but this relation to size did not hold good with regard to animals of different families. This fact was so well established as to afford a very good test as to affinities amongst Mammals.

The Chairman thought that the Society was much indebted to Mr. Michael for his very interesting paper, and proposed that a hearty vote of thanks be given to him accordingly. This having been put to the meeting, was carried unanimously.

The following Instruments, Objects, &c., were exhibited:—

The Society:—Mr. Bale's slides.
Mr. J. W. Gifford:—Photographs.
Mr. A. Letherby:—Photograph of the Podura Scale.
Mr. A. D. Michael:—Slides and drawings illustrating his paper.

New Fellows.—The following were elected *Ordinary* Fellows:—Mr. Edgar J. Millard and Mr. Charles Powell White.

MEETING OF 15TH MAY, 1895, AT 20 HANOVER SQUARE, W.
THE PRESIDENT (A. D. MICHAEL, ESQ., F.L.S.) IN THE CHAIR.

The Minutes of the meeting of 18th April, 1895, were read and confirmed, and were signed by the President.

The List of Donations (exclusive of exchanges and reprints) received since the last meeting was submitted, and the thanks of the Society were given to the Donors:—

	From.
Annual Report of the Bureau of Ethnology, Eleven and Twelve, 1889–91. (2 vols. 8vo, Washington, 1894)	*U.S. Government.*
Contributions to North American Ethnology, ix. (4to, Washington, 1894)	*Ditto.*

Prof. F. Jeffrey Bell said it had been remarked that the Dutch were famous for giving too little and asking too much; but if this were true, he thought that their American friends might be said to err in the opposite direction. They had during the past month been presented by the American Government with two volumes of Ethnological Reports, for which, of course, their thanks would be duly expressed, although he fancied that works of that class would be more likely to be usefully appreciated by the Society over the way than in the Library of one which was devoted to microscopical science.

Mr. J. Swift exhibited an improved form of the Nelson Microscope-lamp, fitted with mechanical movements by which the position of the burner could be moved both horizontally and vertically within certain limits, so as to facilitate the adjustment of the light without the need for moving the lamp-stand. He also showed a Wales Microscope, which had been fitted with one of the new mechanical stages, allowing a movement of 2 in. with a slide 3 in. long.

The President thought the application of mechanical movements to the lamp would certainly be found of great advantage in certain cases, enabling the position of the flame to be altered with great nicety without disturbing anything else. They were much obliged to Mr. Swift for bringing it under their notice.

Mr. T. Comber read a paper, "On the Development of the young Valve of *Trachyneis aspera* (otherwise known as *Navicula aspera* and as *Stauroneis pulcherrima*)"; the subject being well illustrated by a number of exceptionally fine lantern photographs exhibited upon the screen.

Dr. D. H. Scott said that his knowledge of the subject dealt with in the paper was very slight, but he should like to be allowed to express his admiration of the beauty of the photographs exhibited, and the astonishing way in which the various stages were shown in this remarkable process of development.

The President said that he should also like to express his extreme admiration as to the way in which this paper had been worked out, and how thoroughly the point was covered by the photographs. He believed that it was by studying the subject in this way and watching the earliest development in the various forms that more would be done to establish a true knowledge of these organisms than by examining any quantity of mature specimens. He thought Mr. Comber had entered upon a line of research which gave very great promise of valuable results.

Miss Ethel Sargant's paper on "The First Nuclear Division in the Pollen-Mother-Cells of *Lilium Martagon*, &c.," was communicated to the meeting by Dr. Scott, who, after expressing his regret that the rules of the Society did not permit the writer of the paper to read it in person, said that he had followed her work in this direction for the last two years, and was able to say that it was of the highest order of merit. He then gave a full *résumé* of the contents of the paper, freely illustrating the subject by numerous diagrams upon the board, showing the nuclear spindle and the divisions of the chromosomes, with the peculiar forms most commonly assumed, with the object of showing how the V shape was attained, the question being whether this did not result from a second incomplete fission at right angles to the first; or whether, as Miss Sargant maintained, the V shape was entirely due to bending of the segments.

Prof. J. B. Farmer said he had listened with great pleasure and much interest to Dr. Scott's explanation of the methods of cell-division as detailed in the paper before the meeting, although he did not agree altogether as to the conclusions formed. He had seen a number of Miss Sargant's preparations, and they were certainly very good. At the same time it was obvious that in forming an opinion a great deal necessarily depended upon the interpretation put upon what was seen, because since they could not see the changes take place, they were obliged to draw inferences from what they observed as the results of those changes. He had himself followed up the subject upon much the same lines in a paper published in 1894, taking in the first instance *Lilium Martagon*, and checking the results by similar observations on five other species of lilies, of which he found *Lilium auratum* to give the best results. The process of cell-division began either at one end or in the middle and went on towards the ends of the anthers, so that it was possible to trace the progress of development and to check the results by the examination of a very large amount of material. It was quite true that in the division which formed the pollen-mother-cell first into two and then into four, up to that stage each had twenty-four chromosomes, but at that stage the nucleus came out of rest with twelve chromosomes, a very complicated set of changes taking place during the period preceding the twelve. No matter how they looked at it, they would always have a beaded row like [diagram drawn]. It was quite certain that they got these figures; they were quite common and were easily seen, especially in *Lilium speciosum* and *Lilium tigrinum*, and in the early stage they always showed two rows of chromatin beads. With regard to the proportions in which it had been said that the several forms occurred, he thought the incurved form was not nearly so common as had been represented by Miss Sargant, and the opinion expressed as to the further development in which the incurved ends had turned round towards the observer was one which he could not accept, more especially as Miss Sargant showed that it must occur at a comparatively late stage of development. This, however, did not agree with his own observations, according to which the appearance was to be found at an early stage of division. Moreover, the width of the chromosome, as a whole, at this stage was hardly great enough to support Miss Sargant's view of the matter. As to what the interpretation of the phenomena might be, he did not wish to make any definite statement; but a view which he had already expressed still seemed to possess a certain degree of probability, namely, that the original arrangement of the chromatin resembled a flattened ring or ellipse; that during development the ring-like character was lost, owing to the sides of the ellipse approximating; that the chromosome, which now would appear as a rod, doubled over on itself in a fashion something like the Greek letter Ω. After illustrating his meaning by drawing figures on the board to represent the stages referred to, he showed that it followed as a consequence that the division of the chromosome was not really longitudinal at all, but transverse. The V shape immediately adopted by the daughter-chromosomes would then be due to the opening out of the halves of the hitherto closed ring. He thought, also, that all the work done on the animal side of the subject went to show that the chromosomes in this so-called "reduction" division, split transversely. He pointed out the difference between the first and second nuclear divisions in the pollen-grain, which had an important bearing on the question. He was pleased to find that both Miss Sargant's and his own observations concurred as to the existence of these peculiar figures, the point of difference being really largely one of interpretation.

Mr. J. E. S. Moore said, It was well known that at a corresponding period in the development of the reproductive elements in animals a similar reduction in the number of the chromosomes occurred; and it had lately been shown that this reduction was brought about in the resting condition of the nuclei before the mitosis in which the reduced number of the chromosomes first appeared. Further, this correspondence in the manner of chromatic reduction both in animals and plants had been shown by Prof. Farmer and himself to extend through so many minute structural details, that the interpretation put upon the phenomena now observed appeared to him to be improbable, since it excluded the possibility of such a correspondence; and more especially because the variations in the form of the lily chromosomes described appeared to be analogous to what he had himself seen in a corresponding period in the spermatogenesis of Newts, and consequently they could be used equally well to support his own and Prof. Farmer's view that the process of chromatic reduction is identical both in animals and plants.

Dr. Scott, in reply, said that Miss Sargant's work rested on a broad basis of observation. There were several stages observed by her which did not appear to be explained by the other hypotheses which had been suggested. Mr. Moore's comparison with corresponding karyokinetic processes in animals was very interesting, but it seemed to him unsound to base an argument on the assumption of a minute agreement between animals and plants in these respects. Such an agreement had to be proved by detailed observations. Miss Sargant had now extended her investigations to the first division of the embryo-sac nucleus, and had found it to agree essentially with that of the pollen-mother-cell.

The President said that it was a matter for regret that the rules of the Society prevented Miss Sargant from being present to state her own case, but it could hardly have suffered much with so able an advocate as Dr. Scott; she could not possibly be in better hands. He (the President) should not venture to express his own opinion upon a point of botanical embryology upon which two such competent judges as Dr. Scott and Prof. Farmer differed; but whatever the issue might eventually be, he thought all would agree that Miss Sargant's work was well worth putting before the world, and that they, as a Society, were greatly indebted to her for her paper, and to Dr. Scott for the able and interesting manner in which he had brought it before the meeting.

The thanks of the Society were then voted to Miss Sargant, and to Dr. Scott, Prof. Farmer, and Mr. Moore for the part they had taken in the discussion of the subject.

The following Instruments, Objects, &c., were exhibited:—

Mr. T. Comber:—Lantern Photographs illustrating his paper.

Mr. R. Macer:—*Melicerta ringens* and *Stephanoceros Eichornii.*

Mr. J. Swift:—Nelson Microscope-Lamp; Wales Microscope, with new mechanical stage.

New Fellows.—The following was elected an *Ordinary* Fellow:—Dr. Robert R. Andrews.

Oct 2, 1895

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

AUGUST 1895.

TRANSACTIONS OF THE SOCIETY.

IX.—*Notes on the Podura Scale.*

By Alfred Letherby, F.R.M.S.

(*Read* 17*th April*, 1895.)

[With additions.]

Plate VII.

The photographs on plate VII. are intended to demonstrate the existence of two membranes :

One a delicate hyaline membrane from which the stalk extends; and

One a denser (optically) brownish membrane superimposed upon the other.

The latter is perforated all over in the form known as exclamation marks.

It is not easy to suspect the existence of these perforations when examining a perfect scale; but when portions of the darker membrane have been removed (by accident or otherwise), a postage-stamp fracture is readily seen. This fracture is a strong presumptive proof of the perforation.

The photographs show scales with portions of the upper membrane removed, and on one in the centre of the scale (figs. 1 and 4) is a small portion partly dislodged. The shadows on one side of the scales are as clearly indicated as in the perfect specimen. On the reverse side there is a marked absence of these shadows. It is also worthy of notice that when the darker membrane is entirely absent

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EXPLANATION OF PLATE VII.

Fig. 1.—× 950.
„ 2 and 3.—× 1000.
„ 4.—Same as fig. 1, slightly different focus. × 900.
„ 5.—Scale with exclamation marks absent. × 2000.
„ 6.—× 2000.
„ 7.—× 2000. Larger scale broken across, exhibited to show entire absence of any indication of spines or separate scales where exclamation marks are.

from the edges, a common and uniform appearance is presented. Both this and the fracture markings are always to be seen in specimens such as are here shown.

Although this state of the Podura scale appears to have escaped notice, all the slides I have seen possess many examples confirming this view. The cleavage of the denser membrane invariably presents the same structural appearance. This separation of the two membranes is common with the smaller scale, and, so far as my experience goes, entirely absent in the larger ones.

The distinction of colour between the two membranes is more perceptible with apochromatic objectives; nevertheless, it can be seen with achromatics and daylight illumination.

Probably no object of any importance concerning insect anatomy is served by this explanation; I cannot help thinking, however, some light is thrown on the interpretation of appearances of objects when viewed under the Microscope; seeing a minute perforation when focused on the upper plane presents, not a clear transmission of light, as might naturally be expected, but an opaque or dark stroke.

Those who are inclined to regard these appearances as having been produced by the presence of some foreign fluid will do well to consider the following points:—

The cleavages are all of the same character.

The edges of the scales when the upper membrane is removed present a uniform appearance, one that could never be invariably produced by a fluid flowing over the scale. In the perfect scale the markings are perpendicular, whereas in the imperfect ones at these edges they are segments of a circle diagonally arranged.

If there is a substance flowing over and obliterating the markings, why is it that the markings of a scale in optical contact with it, but below the scale, are clearly visible through it, without the faintest indication of interference lines, thus showing the delicate membrane to be perfectly transparent?

Many portions of the upper membrane become ruptured and can be seen scattered over the slide and adhering to the cover-glass. When these fragments are present, even if such scales are not in the field of observation, their existence on the slide can be predicted.

Sometimes there are faint markings which, examined hastily, might be mistaken for obliterated exclamation marks; these are due to the greater and lesser density of the lower membrane caused by the removal of the upper one. When photographed the illusion vanishes.

On the scale photographed there is no indication of any foreign fluid present likely to produce these appearances. If such a fluid existed in small quantities it should show a clearly defined margin. This is also absent.

If this invisible fluid is present, producing such extraordinary uniform results, it must be by the operation of some unfamiliar attributes.

Again, if these results are produced by a fluid substance, how is it that the larger scales fail to display these characteristics? I regard the smaller scales as of more delicate construction than the larger ones, and therefore more easily ruptured.

These are points an explanation of which may reasonably be demanded of those inclined to regard these appearances as having been produced by the presence of foreign matter.

The photographs were taken with a Powell and Lealand 1/12 apo. obj. N.A. 1·40. Powell and Lealand apo. condenser N.A. 1·40. Reichert's compensating ocs. 8 and 18. Critical illumination with paraffin lamp. Aplanatic cone of condenser used N.A. ·80. Approximate diameters × 900, × 1000, × 2000.

X.—*Development of the Young Valve of Trachyneis aspera Cleve.*

By Thomas Comber, F.R.M.S., F.L.S.

(*Read* 15*th May*, 1895.)

Plate VIII.

The structure of the valves of diatoms has from time to time engaged the attention of the observers of those organisms, and has, indeed, occasionally been the subject of active controversy; but, so far as I am aware, no attempt has hitherto been made to study the development of the valves, to investigate the various stages through which they pass in the course of their silicification, or even to collect facts which will serve to elucidate the process of formation.

It will, therefore, perhaps be of interest to the Society to have placed on record, for the benefit of future students, some observations, which I have had the opportunity of making, on the development of the valve of *Trachyneis aspera* Cleve, perhaps better known under its former generic name as *Navicula aspera* Ehrenberg, or to British diatomists as *Stauroneis pulchella* Smith. Although they refer to only a few closely allied forms, they serve to illustrate the successive stages through which a diatom-valve may pass in the course of its formation; and are possibly the more instructive, because in this group, which Cleve has recently separated under the generic name of *Trachyneis*, the valve possesses a highly complex structure. Cleve describes it as consisting of "an interior coarsely dotted striation, a median stratum of more or less transverse flexuose strong costæ anastomosing where they bend towards each other, and thus forming a network of diamond-shaped or rectangular alveoli, and an exterior stratum with very fine puncta forming longitudinal, sometimes slightly oblique, fine striæ."

It is well known that by far the most usual mode of multiplication in diatoms is by subdivision. The two valves of a frustule separate from each other, their connecting zone gradually widening to admit of their doing so. When there is sufficient space between them, two new valves are formed inside, each facing one of the old valves; and when the new valves are sufficiently developed, the parent frustule

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EXPLANATION OF PLATE VIII.

Fig. 1.—Frustule of *Trachyneis aspera* var. *oblonga* Cleve, undergoing subdivision. × 250.
„ 2.—Fragment of one of the inner valves of the above frustule. × 1000.
„ 3.—Immature valve of *T. aspera* var. *pulchella* Cleve. × 1000.
„ 4.—Eye-spot layer of the mature valve of the same. × 1000.
„ 5.—Mature valve of *T. aspera* var. *oblonga*. × 1000.
„ 6.—Mature valve of a form of *T. aspera*. × 1000.
„ 7.—Mature valve of *T. aspera* var. *Schmidtiana* Cleve. × 1000.

divides into two frustules. It is to the process of development of these young inner valves that my remarks will have reference.

My attention was first drawn to the subject when preparing for Dr. Murray lists of the species of diatoms found in certain of the 'Challenger' dredgings. In that from Station 145, off Marion Island, there occurs pretty frequently a large form of *Trachyneis aspera*, distinguished by Prof. Cleve as var. *oblonga* (= *Stauroptera oblonga* Bailey). One frustule, which was in course of subdivision, presented a peculiar appearance. The old valves had separated from each other, and two new valves had been formed inside of them; but these had a structure evidently different from that of the old valves, and the difference was so great as to at once attract attention, even under the low power (2/3-in. objective) which was being used, by the variation of colour when dry. The two outer valves were grey, like those of the other frustules present in the material, but the two inner valves were a bright azure. On this being noticed, the specimen was isolated and mounted; but, in getting rid of an air-bubble, which formed within it, it was slightly broken (fig. 1). In one respect this was an advantage, for a fragment of one of the inner valves became detached, and admitted of closer examination under a higher power than was possible when it was enclosed within the connecting zone of the frustule. It was found to be thin and flexible, and its structure very simple, consisting of parallel costæ, with some tendency to anastomose (fig. 2). The mature valves are much thicker and more robust, and their structure more complex (fig. 5). It exhibits more or less elongated areoles, across each of which is a series of fine cross-bars, and beneath each a large circular marking, analogous to the so-called "eye-spots," that frequently occur in the valve of disciform species.

These cross-bars appear to be on the outer surface of the valve; but, if they form an "exterior stratum," as stated by Cleve, I have never been able to detach it, as a separate layer, from the rest of the valve. The "eye-spots" are on an inner layer, which is readily detachable. Schmidt figures such a detached layer, Atlas, plate 48, fig. 23, calling it an "untere Schalenschicht," and in some gatherings such layers are not unfrequent. Fig. 4 represents such an "eye-spot" layer.

The valve, no doubt, developes gradually, passing insensibly from one stage to another without any sharp division between them; but I will mention those stages which I have actually observed.

In the first, parallel costæ are discernible within the parent frustule, but are so rudimentary and ill-defined as to be hardly recognisable as yet forming a valve.

The second is that which has already been illustrated (figs. 1 and 2) and described.

In the third (fig. 3) the costæ, instead of being straight and parallel, have become slightly flexuose, the undulations of one costa approaching those of the adjacent ones at certain definite and regularly disposed points, at which they become connected together by short transverse costæ. There are thus formed quadrangular interspaces, somewhat resembling in shape the areolæ of the mature valve, but, as yet, with only the slightest vestige of bars across, and with no eye-spots beneath.

In the last, or mature stage (fig. 5), the cross-bars and eye-spots have developed. So far as my observation goes, they appear almost simultaneously. At first they are very delicate, and visible only with great difficulty; but they gradually increase in strength until they reach the condition of the perfectly formed valve.

In one variety of the species the original costæ become connected by the transverse ones, so as to form short areolæ, only towards the axis of the valve; and remain parallel, and without union, near the margins (fig. 6). In this marginal portion, therefore, the ultimate areolæ are linear, and very elongated. The cross-bars on them are numerous; but, however elongated the areolæ may be, I have never seen more than one eye-spot beneath each.

In another variety (fig. 7) similar elongated areolæ are found near the median line.

The question whether in any other genera of diatoms the course of the development of the valve resembles, in its main features, that which we have seen to take place in *Trachyneis*, requires further investigation before it can be answered; but a few circumstances may be mentioned, as perhaps having some bearing upon this point, although, as yet, only suggestive. The only instance I can adduce of direct observation of a similar condition is of a frustule of *Caloneis probabilis* Cleve, in which the young inner valves are in a flexible costate condition, with the puncta between much less conspicuous than in the mature valves. [Shown on screen.]

In a paper on the structure of the valve in *Pleurosigma*, read before the New York Microscopical Society, and published in their Journal for April 1891, Mr. T. F. Smith describes the ultimate structure of the outer layer of the valve of *P. formosum* as consisting of long fibrils, placed side by side, lengthwise on the valve, and undulating so as to form oblique rows of interspaces; and he figures (his fig. 9) two of these fibrils isolated. Never having met with anything of the kind myself, I cannot express any opinion as to whether these "fibrils" are at all analogous to the primitive costæ of *Trachyneis* when they have passed into the slightly undulated condition; and that it is by the subsequent coalescence of the fibrils, at adjacent undulations, that the well-known areolæ of the mature *Pleurosigma* are formed. One obvious difference is that, while Mr. Smith describes the fibrils of the *Pleurosigma* as longitudinal to the valve, the costæ of the *Trachyneis* are transverse.

Among those species of *Navicula*, which Prof. Cleve has recently included in *Diploneis*, there are some forms, which puzzled the older observers. They had a costate structure, and were therefore properly referable to the genus *Pinnularia;* but in all other respects they were undistinguishable from other forms, which had what were termed moniliform striæ. Thus Prof. Gregory, in his paper on the diatoms found in Glenshira Sand, published in 1856, described a costate form (his fig. 15) as having "Every appearance of being a variety of *N. didyma* (agreeing precisely, as it does, in form and size with the commonest small form of that species, which is very abundant in the deposit), and if that be so, we have moniliform and costate striæ in the same species."

In the same paper he figures, as *N. nitida,* another simply costate form, which Prof. Cleve refers, I believe rightly, to his *Diploneis Crabro,* a species which normally has its costæ "alternating with double rows of alveoli."

Yet another instance is the form called by O'Meara *Pinnularia arraniensis.* He describes it as having "Striæ coarse . . . distinctly costate"; but it is now referred by Prof. Cleve to *Diploneis nitescens,* which ordinarily has its costæ alternating with rows of alveoli.

Again, Prof. Cleve considers *Navicula Doczyi,* Pantoczek, to be "a finely costate variety of *D. Smithii.*" Its costæ are described as only "indistinctly punctate"; whereas in *D. Smithii* the costæ are "alternating with double rows of alveoli."

Is it not possible that, in each of these cases, the forms with simple costæ may be the immature stages of the others? If they ever occur pure this cannot be the case; but such of them as I have met with have always been in company with the forms of more complex structure; e. g. *N. nitida* is always associated with *D. Crabro,* and may well be regarded as merely an immature state of that species, in which the intercostal alveoli have not yet developed sufficiently to be conspicuous.

In other sections of the genus *Navicula,* what appear to be, in like manner, costate forms of species normally punctate or granulate, occasionally occur. Thus *Pinnularia divaricata,* O'Meara, is described as having costæ that in some aspects "appear as if they were slightly notched by longitudinal lines which, though they produce a furrow, do not sink so deeply as to give a moniliform character to the sculpture of the valve." It is now commonly referred to *Navicula latissima,* a species having striæ conspicuously punctate.

I have also a specimen in every respect like *Navicula angelorum,* Cleve, except that its structure is much less conspicuously punctate.

Further observation is, however, required to determine whether the suggestions made regarding these other species can be accepted or not. They are at present advanced merely as suggestions, whereas the immature costate condition of *Trachyneis aspera* is an observed fact.

XI.—*On the Anatomy of Nyctotherus ovalis.*

By Wm. Cecil Bosanquet, M.A., Fellow of New College, Oxford.
(Communicated by Prof. F. Jeffrey Bell, Sec. R.M.S.)

(*Read* 19*th June*, 1895.)

Plate IX.

While practising a method of cutting sections of small objects, I took for the "corpus vile" of experiment *Nyctotherus ovalis* of the Cockroach, since the host was easily procured and the parasite abundant. On examining the sections one or two points were brought out which seemed worthy of record.

Body Substance.—Stein (1) and Bütschli (2) describe in this animal portions in front of the nucleus (*Kōrnerfeld*) of specially granular appearance, and the endoplasm behind, containing apparently globules of fat. In the sections this difference was not visible, the portions behind and in front of the nucleus being very similar in structure. In those specimens which were best preserved the body-substance of the animal seemed to consist of either a fine reticulum of protoplasm or a number of rounded granules closely packed together (plate IX. fig. 1). In one specimen which was very much larger than the rest, measuring ·36 × ·27 mm. instead of about ·13 × ·07 mm., there appeared to be oval granules—the "paraglycogen granules" of Bütschli (3)—imbedded in a protoplasmic ground-substance; these granules showed in their centres an appearance of splitting somewhat similar to that which I have described (9) in a Gregarine of *Lumbricus herculeus*, and due, no doubt, to the action of the reagents employed in hardening (plate IX. fig. 2) The granules were visible in both the front and hinder portions of the animal, but were more numerous in the latter.

Micronucleus.—The most noteworthy appearance seen in the sections was, however, the body shown in figs. 3 and 4, which consisted of a spherical vesicle with amorphous contents; the latter

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EXPLANATION OF PLATE IX.

Fig. 1.—Network of protoplasm in the body of *Nyctotherus ovalis*. × 900. Diagrammatic.

Fig. 2.—Protoplasm and paraglycogen-granules. × 900. Diagrammatic.

Fig. 3.—Section of *Nyctotherus ovalis*, showing macronucleus, micronucleus, and vacuole. × 450.

Fig. 4.—Similar section, showing macronucleus, micronucleus, anus, and part of pharynx. × 450.

Fig. 5.—Section of large specimen of *Nyctotherus*, showing macronucleus and micronucleus. × 110.

Fig. 6.—Section showing large macronucleus and pharynx in section. × 450.

Fig. 7.—Similar section of individual with very long cilia. × 450.

Fig. 8.—Portion of similar section, showing macronucleus and part of pharynx. × 450.

seemed in all cases to have shrunk away from the wall of the vesicle in the process of hardening. This body occupied always the same position just above the nucleus of the animal, and could be seen in specimens mounted whole, though it was not very apparent until closely looked for. It was found in all the well-preserved specimens of the smaller-sized *Nyctotherus;* in the large specimen (plate IX. fig. 5) a slightly different appearance was seen, a body being found in the same position, but resembling the rest of the nucleus in structure. This is probably the micronucleus of *Nyctotherus ovalis,* a body which, according to Bütschli (2) is probably present in all Ciliata, with the exception of the Opalininæ and multinuclear forms. He states that "it is generally single, and situated close to the surface of the macronucleus; in shape it is spherical or ellipsoid, and in size it varies from 1 to 10 μ in its longest diameter. Structurally it consists of a delicate membrane, often brought out very distinctly by reagents which coagulate the contents. These sometimes appear attached to one pole of the membrane, at other times lie free in the centre, and are either homogeneous or form a finely granular reticulum. In the elliptical micronuclei there seems to be a differentiation of the contents into staining and non-staining substances (chromatin and achromatin)."

Kent (4) states that in *Nyctotherus ovalis* there is no distinct endoplastule, and Stein (1) says that a nucleolus is not to be found in this animal; nor can I find any allusion made to a micronucleus in this Protozoon, except by Maupas (8) who notes that "it is deprived of affinity for colouring matter." In *Nyctotherus cordiformis* Stein and Schneider (5) describe a nucleolus separated from the nucleus by a considerable interval, situated, according to the illustrations, between the nucleus and the pharynx. The latter observer notes that it is one of the smallest micronuclei in existence, and lays special stress on its separation from the macronucleus.

Macronucleus.—The different appearance presented by the macronucleus in different specimens is shown in figs. 3, 4, 5 and 6. In some cases, as in fig. 4, it is small, more or less spindle-shaped in section, and filled with small round bodies which stain deeply with hæmatoxylin, their size and number varying in different specimens. These are named by Schneider (5) "chromatospherites," and were described by him as being isolated bodies, not the optical effect of the nodes of a filament or network, as Bütschli seems to regard them; that the former is the case seems proved by the specimen shown in fig. 4, in which one of these bodies has fallen out of the nucleus into the surrounding protoplasm. They are regarded by Rhumbler (6) not as organised structures, but as masses of storage material formed by the coagulation of a substance which is at first fluid, then becomes viscid, and finally solid. In other specimens, as in fig. 6, the nucleus is much larger, unstained by hæmatoxylin, and presents a granular appearance.

Cilia.—The length of the cilia also varies in different individuals. Fig. 7 shows an instance in which they are remarkably long. Fig. 3 one in which they are of normal length.

Cuticle.—The cuticle was thick enough to present a very distinctly double-contoured appearance, shown in all the figures.

Pharynx and Anus.—The pharynx is shown in section in plate IX. figs. 4, 6, 8, slightly in fig. 3. The anus and contractile vacuole are seen in fig. 4.

Karyophores.—The protoplasmic bands, thus named by Schuberg (7), which appear to sling the macronucleus in position, are seen in position in most of the drawings; specially in figs. 3 and 6.

In conclusion, I must offer my best thanks to Mr. E. A. Minchin, Fellow of Merton College, Oxford, for his kindness in criticising these notes, and for much valuable assistance; to him are due such references as I have been able to give to the literature of the subject.

Works referred to in the above notes:—

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(2) Bütschli, O., "Protozoa," Bronn's 'Klassen und Ordnungen des Thierreichs,' Bd. i. Abth. iii., Infusoria, pp. 1492 *et seq.*

(3) Bütschli, O., "Notiz über das Vorkommen einer dem Amyloid verwandten Substanz in einigen niederen Thieren," Arch. f. Anat. u. Physiol., 1870, pp. 362–5.

(4) Kent, W. Saville, 'A Manual of the Infusoria,' London, 1881, 1882, p. 580.

(5) Schneider, Aimé, "Fragments sur les Infusoires," Tablettes Zoologiques, i. pp. 84–7.

(6) Rhumbler, L., "Ueber Entstehung und Bedeutung der in Kernen vieler Protozoen . . . . vorkommender Binnenkörper (Nucleolen), &c.," Zeitschr. f. wiss. Zool., lvi. (1893) pp. 328–64 (abstracted in Journ. Roy. Micr. Soc., 1893).

(7) Schuberg, A., "Die Protozoën des Wiederkäuer-magens," Zool. Jahrbücher, Abth. f. Systematik, iii. (1888) pp. 394, 395.

(8) Maupas, E., "Sur Coleps hirtus," Arch. de Zool. Exp. et Gén., (2) iii. (1883) p. 360.

(9) Bosanquet, W. C., "Notes on a Gregarine of the Earthworm (*Lumbricus herculeus*)," Quart. Journ. Micr. Sci., 1894, pp. 423–4.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, Etc.

*Including Original Communications from Fellows and Others.**

ZOOLOGY.

VERTEBRATA:—Embryology, Histology, and General.

a. Embryology.†

Sedgwick's Theory of the Embryonic Phase of Ontogeny as an aid to Phylogenetic Theory.‡—Mr. E. W. MacBride does not discuss the correctness of Mr. Sedgwick's views as expressed in his essay published last year,§ but rather, assuming them to be true, points out some of their consequences. These may be summed up thus:—the earliest well-marked larval stage which has been discovered is the blastula, a sphere of uniformly ciliated cells. At first, all its elements were alike in structure and function; later on, coincidently with its acquiring the capacity for moving in a definite direction, a change would take place. The form first becomes elongated, and it is interesting to observe that the free-swimming blastulæ of both *Echinocyamus* and *Eudendrium* have this form. As the cells at the posterior end were least favourably situated with regard to promoting the locomotion of the colony, and best situated for seizing food-particles, they would become specially digestive. Any increase in their number would only take place coincidently with invagination, if the form of the colony were to be preserved, and at the same time the digestive cells were to remain in contact with the surrounding medium. Thus was the archenteron formed. The cells at the anterior end, on the contrary, were in the best position for receiving stimuli from the outer world, and here we should expect the first sense-

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, &c., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development and Reproduction, and allied subjects.

‡ Quart. Journ. Micr. Soc., xxxvii. (1895) pp. 325–42.

§ See this Journal, 1894, p. 433.

organ to appear, and here they are seen in various larvæ. There are other suggestions of a similar kind.

Significance of the Proliferated Epithelium in the Fœtal Mammalian Jaw.*—Mr. R. Broom points out that the gum of a seventh month human fœtus is covered, especially on the inner side, by a layer of epithelium many times thicker than that covering the adjoining mucous membrane. On serial section, it is found that, though this ridge of gum extends all round the alveolar margin, the thick coating of epithelium is only met with in the region of the incisors and canines. The suggestion readily offers itself that this epithelial protection is directly connected with the requirements of the young mammal in grasping and retaining the nipple, but as, within certain limits, the younger the fœtus the greater the development of the epithelial ridge, one is led to think that the proliferated epithelium has a deeper significance than merely the strengthening of the gum during the short period of sucking. Even in the human fœtus of ten weeks, there is a ridge of thick epithelium covering the incisor part of the jaws. A similar condition seems to exist in all the higher Mammals. In Marsupials the thick layer of epithelium passes back to the molar region, and differs from the typical mammalian condition in extending to and covering the inner part of the lips. Even in placental Mammals the epithelial armature of the jaw is developed at such an early date as to suggest its being the remains of an ancestral horny beak. So far as we can make out, the most primitive mammal would appear to be derived from the higher Amphibians. As is well known, the larva of the Frog and of most of its allies is provided with a horny beak on the front of each jaw which fulfils all the requirements of teeth. It is highly probable that the jaws of Mammals likewise possessed beaks in their young stages, and the proliferated epithelium which arms the front of the fœtal mammalian jaw may be supposed to be the remains of this.

Development of Vessels and Blood in the Great Omentum of the Rabbit.†—M. P. François comes to the conclusion that the vascular plexuses of the great omentum of the Rabbit grow at the expense of the terminations of the pre-existing vessels of collateral buds, and at that of independent vascular elements. The terminal extremities of the vessels and the buds are transformed into capillaries in three different ways. They are gradually hollowed out, or primitive vascular vacuoles are formed, which fuse later on, or there is a degeneration of the axial protoplasm. When a capillary terminates in a vascular bomb-like ending the artery and the vein of this swelling both arise from the capillary; this explains why these two vessels are ordinarily close together. The existence of vaso-formative cells independent of the general vascular plexus is incontestable. The vaso-formative cells have the same characters as the points of growth. A single cell may be sufficient to form a vaso-formative plexus. The canalisation of the cells and the vaso-formative plexuses is effected by the formation of primitive vascular vacuoles, which secondarily fuse, or by the degeneration of the axial protoplasm. The vaso-formative plexuses are not the only ones which are found in

* Ann. and Mag. Nat. Hist., xv. (1895) pp. 420–1.
† Arch. Biol., xiii. (1895) pp. (1895) pp. 521–58 (4 pls.).

the great omentum; others may be seen in the course of a capillary, or at the end of a small artery or vein. Sometimes one may meet with them on the course of a capillary loop which connects the artery with a vein. In this case the artery is continued insensibly into the capillaries of the plexus. The cells and the vaso-formative plexuses, and the points of growth of the vessels play a part in the formation of the blood, for they give rise to blood-corpuscles. These are of an intracellular nature, and even of an intra-protoplasmic; they do not contain any nucleus. The author has found it impossible to make certain of the origin of the vaso-formative cells; it is not possible to assume that they are derived from the lymph or from the connective tissue, for there are too great differences between them and the lymphatic or connective cells. In character they approach the points of growth of the blood-vessels. It follows that the blood-corpuscles of Mammals have the same origin as the blood-vessels.

Development of the Hepato-enteric Diverticula of the Axolotl, and of the Peritoneal Cavity of Mammals.*—M. A. Brachet finds that in the Axolotl two hepato-enteric blind diverticula of the cœlom fuse to form the hepato-enteric cavity of the adult, but that the right diverticulum takes a larger share than the left. In the Chick, as shown by Duval, the right sac alone forms the cavity of the adult. In the Rabbit the right diverticulum is alone developed. The hepato-enteric diverticulum causes the division of the primitive dorso-ventral mesenteric septum into two parts. The right is the meso-lateral, and the left contains the digestive tube. The former will ultimately give rise to the dorsal ligament of the liver, while the left becomes divided by the digestive tube into three parts. It is very difficult to determine in the young embryos the respective limits of the future stomach and duodenum, but it is probable that the diverticulum is produced in the plane of this boundary, and, in a general way it may be said that the dorsal meso-gastrium arises from a fold of the primitive dorsal mesentery; that the meso-duodenum is formed by the whole of this mesentery; that the ventral meso-gastrium or gastro-hepatic ligament also arises from the fold of the primitive ventral mesentery, while the duodeno-hepatic ligament is formed by the unfolded part of the primitive ventral mesentery. The author comes to the conclusion that the mesenteries of the Rabbit and of the Axolotl are not exactly similar.

Young Monotremes.†—Prof. J. T. Wilson describes and figures a young example of *Ornithorhynchus anatinus*, which appears to be the smallest and youngest specimen that has yet been under observation. Some details as to the external parts are given, and it is urged that the epithet of "horny" is not one which is correctly given to the beak of the Duckbill.

Messrs. J. P. Hill and C. J. Martin ‡ have an abstract of their paper on two embryos taken from the intra-uterine egg of *Platypus*. Owing to the relatively very early great lateral extension of the mesoderm, and from the presence of a very distinct yolk-containing endoderm, the vesicle of the *Platypus* embryo of this stage is regarded as transitional between

* Arch. Biol., xiii. (1895) pp. 559–618 (4 pls.).
† Proc. Linn. Soc. N.S.W., ix. (1895) pp. 682–90. ‡ Tom. cit., pp. 783 and 9.

the yolk-sac of *Sauropsida* and the typical mammalian blastodermic vesicle. There are 17 pairs of somites, which in the middle region of the trunk possess distinct cavities. Just external to the outer edges of the somites, with the exception of the first three, and between them and the lateral zone of mesoderm, there occurs a narrow intermediate zone, which contains the *Anlage* of the Wolffian body. At its posterior end this *Anlage* becomes reduced to a single cell, which passes directly over into the ectoderm. A distinct blastopore is present and leads into a canal which runs forward into the head-process of the primitive streak, and opens into the cavity of the vesicle. The embryo more nearly resembles that of the Virginian Opossum of 73 hours, as described by Selenka, than any other embryo known to the authors. The marked retardation in the formation of the medullary folds, and in the folding of the embryo, is one of the most characteristic features of the embryo at this stage.

Gastrulation of Lacerta.*—Prof. L. Will continues his observations on the early stages of Reptiles. The process of gastrulation in the Lizard appears to resemble that of other Reptiles already examined by him. The primitive plate differs in form from that of the Gecko and the Tortoise, in being much less wide in form, and in not exhibiting the variations in length and breadth which are to be seen in the others. The terminal phase of the process of gastrulation consists in the formation and the final disappearance of the primitive groove. In its formation both invagination and epiboly take part. The author thinks that his observations show that the homologue of the primitive stripe of the Amniota is to be sought for in the yolk-plug plus the lips of the blastopore in the Anamniota. In the Lizard the notochord arises, for its whole extent, from the upper wall of the archenteron. The mesoderm arises in exactly the same way as in the Gecko, with the exception perhaps of the region in front of the mesodermal plate. No part of the primary endoderm becomes definite enteric epithelium. The latter arises from the secondary endoderm.

Experiments with Frogs' Eggs.†—Mr. T. H. Morgan has been making experiments with the view of obtaining half embryos and whole embryos from one of the first two blastomeres of the Frog's egg. These observations were undertaken because Mr. Morgan was of opinion that the results recently obtained by O. Schultze showed that the differences in the results of Roux and Hertwig were owing to the difference in position taken by the living blastomere after the operation. In all he has operated on 155 eggs, and from these he got eight embryos. From those eggs with a black pole turned upwards he got six half embryos, that is, embryos having only the right or left side of the body developed. These embryos are in every respect like those described by Roux. In some of the eggs with a white pole turned upwards, the third horizontal cleavage appeared nearer the upper pole, so that the smaller white cells were cut off above. The two embryos which successfully developed were of half size, having both right and left medullary folds, and they are unquestionably perfect embryos of half size. The conclusion follows that the

* SB. Ak. Wiss. Berlin, 1895, pp. 335-42.
† Anat. Anzeig., x. (1895) pp. 623-8.

position in which the egg is placed after the operation is an important factor in determining whether a half embryo or a whole-embryo of half size will develop from one of the first two blastomeres. Mr. Morgan thinks that the results of both Roux and Hertwig are true, in so far as they apply to the embryos described by each, and the conclusions of each are wrong, in so far as they deny the possibility of the results of the other. The author thinks that the results show that the phenomena of half or whole development of an embryo from one of the first two blastomeres is entirely a protoplasmic phenomenon, the results having nothing whatever to do with a qualitative division of the egg, at the first cleavage or with a later post-generation. Whether we get a half or a whole embryo will depend upon the subsequent arrangement of the protoplasm in the uninjured blastomere, and upon the relation of the protoplasm to the uninjured and injured halves. If the egg is turned after one blastomere has been injured, so that a rotation of the contents of the uninjured blastomere takes place, then a whole embryo tends to develope. The completeness of the development depends upon the extent of the rotation, but this rotation of the protoplasm is not the only factor determining whether a half embryo or a whole embryo of half size is produced.

Development of the Hypophysis.*—Prof. G. Valenti finds on the dorsal surface of the archenteron (in larvæ of *Bufo variabilis*) two quite distinct buds. The foremost, nearest the pharyngeal membrane, is directed towards that ectodermic pouch which Kuppfer regards as the primitive mouth, and represents what Kuppfer calls the preoral intestine. The other, situated more dorsally, grows up between the anterior end of the notochord and the inferior wall of the brain, and appears to Valenti to give origin to the epithelial lobe of the hypophysis. According to Kuppfer, this epithelial lobe is due to a union of an ectodermic portion (primitive mouth) and an endodermic portion (preoral intestine).

Theory of Development.†—Herr Hs. Driesch has summed up his views in regard to ontogeny in a book entitled 'Analytic Theory of Organic Development.' As we have previously recognised, his theory has grown round a series of brilliant experimental researches.

The ovum, or its nucleus rather, is a mixture of potentialities, but there is no structural preformation beyond what is implied, and that is not a little, in the "form." These potentialities are expressed in the successive steps of development, which are induced by stimuli and determined by the mutual relations of parts. The formative factors are either chemical or physical; thus an organism may grow chemically and actively by assimilation, or physically and passively by absorption of water. Changes are induced partly by internal factors, such as the influence exerted by the nucleus (*a*) in virtue of its position, (*b*) by its "induction." External factors, such as gravitation, are also operative. The internal physical "inductions" are conditions of tension, pressure, contact, and mass; others are chemical. As to the succession of events,

* Anat. Anzeig., x. (1895) pp. 538–40 (1 fig.).

† 'Analytische Theorie der organischen Entwicklung,' Leipzig, 1894, 8vo, xiv. and 185 pp., 8 figs.; reviewed by Dr. T. Garbowski, Biol. Centralbl., xv. (1895) pp. 306–32.

the general idea is that each period is the condition of its successor. Each blastomere has the power of responding to certain developmental stimuli, this is its "prospective potency"; as organs arise this potency diminishes in their elements, the more so the later they are in being formed.

The response of the nucleus to stimulus is conceived of as a fermentative effect on the cell-plasma, so that the reaction-power of the latter is altered. Again, nucleus and cytoplasm are, as it were, two poles, alternately active and receptive; the plasma communicates an induction-stimulus to the nucleus, and receives in turn the fermentative response. But it is beyond us to condense this contribution to the philosophy of biology. From a natural mixture of experimental data and logical assumptions the author gradually works up to the mystery of the organism—its threefold rhythm, its causal, structural, and functional harmony.

Hertwig's Theory of Development.*—Prof. J. Nusbaum criticises, but with a pleasing appreciation, Prof. Hertwig's theory of development. As is well known, Hertwig is "der hervorragende Verteidiger des Neoepigenetismus" the emphatic antagonist of Weismann, "der Schöpfer des Neoevolutionismus."

Hertwig maintains that the ovum developes as it does, not merely because it is what it is, but because it grows in a certain environment, the subject of a metabolism which implies external relations, and that the result is determined from stage to stage by the mutual dynamic relations of the segmentation-cells and subsequent parts.

He maintains that *Anlage*-product is by no means identical with the *Anlage;* that the ovum may have particles which serve as *Anlagen* for horn, hair, bone, &c., but that it has not the *Anlagen* of a horn, a hair, a bone; that it is in itself an organism. The endoderm cells are not invaginated because they possess certain groups of determinants; rather they become endoderm because they are invaginated. The gastrulation is determined by the mutual influences of the germinal cells.

Nusbaum regards this position as unfounded. With Weismann, he regards each step in development as the necessary result of the specific organisation of the germ-plasma. Gastrulation is a phylogenetic necessity, determined by the particular structure of the *Anlage* substance.

He combats Hertwig's position by citing cases where the endoderm, for instance, is plainly differentiated before the invagination. Such cases appear to Nusbaum to require Weismann's interpretation—that in the early cleavages there is unequal partition of the hereditary qualities. For plants and lower animals, however, he believes in equal partition, which is also true in the first few cleavages of most higher animals.

To Nusbaum the external conditions are simply stimuli, not operative factors; they allow the nature of the *Anlage* to assert itself. Similarly, the mutual influences of the cells are merely stimuli which call the *Anlagen* in the germ-plasm of the associated cells to activity and development. One can hardly help feeling that the truth is likely to be in the combination of the doctrines of the two schools, with an elimination of the exaggerations on both sides.

* Biol. Centralbl., xv. (1895) pp. 286–94.

A Case of Apparent Telegony.*—Dr. O. vom Rath makes some general observations on Telegony, and then tells this tale, the moral of which is plain:—

A family who had lived for many years in Tunis migrated, in 1888, to Baden, taking with them a beautiful pair of kittens. These were none the worse for the change, but grew up very unwilling to leave the house, and more or less vicious. The female cat (*m*) was grey-brown with black stripes, the tom (*n*) was pitch black, with a large white spot on the right breast, and with a naturally *half-sized* left ear. In each litter which they cast were some abnormal kittens, with rudimentary ear and tail. All these and all the males were destroyed, the normal females were given away. But as the tom became ever more vicious, he was castrated; after which he showed himself peaceful and lazy.

The she-cat (*m*), crossed with an unblemished German tom, still produced abnormal kittens in each litter. This looked like a clear case of telegony.

Further inquiries showed, however, that a normal daughter of *m*, crossed with a normal German tom, had borne a red male with rudimentary left ear and rudimentary tail; and inquiries as to the pedigree of *m* and *n* showed that (*x*) the *mother* of *m* had a rudimentary tail, but no rudimentary ear, and was like *m* in colour. This *x* had been paired with a red tom (*r*) who had rudimentary ear and tail; there was but one litter (destroyed), and *r* shortly afterwards died. Then *x* was paired with a normal black younger brother (*y*) of the deceased *r*. From this normal *y* and from this *x* (with rudimentary tail) *m* had sprung. But the two parents of *x* and the two parents of *r* and *y* were relatives, belonging to a family in which a rudimentary ear and tail were common. The whole family sprang from a pair which the owner of *m* and *n* had found in a hollow tree near Tunis.

Dr. vom Rath has more to tell, but enough has been cited to show the correctness of his conclusion that there was no telegony at all. There was a strong family tendency to having rudimentary ear and tail. But it is evident that if he had not had patience to search out the whole story, the case for the occurrence of telegony would have appeared a good one.

External Traces of Hind Limbs in Cetacea.†—Prof. W. Kükenthal described some time since in a *Phocæna*-embryo two flat prominences lateral to and somewhat above the genital organs. These he regarded as external vestiges of hind limbs. Guldberg disagreed with this, but found two other prominences which he held to be the vestiges. Kükenthal maintains that these are rudiments of mammary glands. In younger embryos, however, Guldberg appears to have succeeded in finding true and distinct rudiments; from a flattening of these the stage first described by Kükenthal may have arisen.

β. Histology.

Red Blood-corpuscles of Vertebrates.‡—The, we regret to say, late Prof. J. A. Ryder, has a short memoir on the adaptive forms and vortex

* Biol. Centralbl., xv. (1895) pp. 333–44.
† Anat. Anzeig., x. (1895) pp. 534–7.
‡ Proc. Amer. Phil. Soc., xxxii. (1894) pp. 272–5.

motion of the substance of the red blood-corpuscle of Vertebrates. The fact that these corpuscles are discoidal or elliptical flattened bodies seems to have been neglected by physiological writers. Mr. Ryder has attempted to show that not only has the shape of these bodies very great physiological significance, but that these shapes are also adaptive. What he attempts to do is to show that it may be that there is a vortical flux of substance from the centre to the periphery, or from the periphery to the centre of every such corpuscle during life, and that moreover, such a flux, taken in conjunction with the viscosity of the substance of the corpuscle and its original or embryonic globular form, is responsible for its shape. The flattening and vortical flux of the substance of the corpuscle may be regarded as adaptive physiological devices, by means of which its respiratory efficiency is vastly increased. The first condition satisfied by the flattened form of the red blood-corpuscle is an increase of its superficial area. This would indeed also be the case with the corpuscle were it elongated into a filament, but such filaments would inevitably tend to choke up or occlude the vessels. It is pointed out that there is an actual saving of energy consequent upon transforming the primitively globular blood-cells into discs instead of into filaments. It may therefore be assumed that the size of the corpuscle is directly related to the rate of metabolism of the organism. Thus, in the sluggish Batrachia, the corpuscles are large, in the more active fishes and reptiles smaller, and in mammals and birds still smaller. The author thinks that it is self-evident that a double vortical flux must take place from two opposite poles of a primitively globular blood-corpuscle, in passing from its primitive shape to that of its complete or adult elliptical or discoidal form, upon mere contemplation of the geometrical conditions that must accompany the transformation of the same fluid globular mass to the form of a disc with rounded edges. The fact that the *Amœba* cannot move without developing a vortical flux of its own substance through itself, is, it seemed to Mr. Ryder, evidence of the possibility and probability of the same thing occurring in red corpuscles. If the foregoing hypothesis is true, we have no less than ten millions of vortex rings of particles twirling together in pairs for every cubic millimetre of blood that circulates through the vessels of our body.

Organic Structure.*—Dr. F. Dreyer discusses Bütschli's further investigations on organic structure. (1) Bütschli previously described the fine foam-like structure observed in coagulated white of egg, gum arabic, and gelatin; he has since worked with "soluble starch," collodium, resin, &c., with similar results. (2) While dry silicic acid shows no microscopic structure, that which becomes glassy in water has temporarily a fine webbed appearance. (3) A study of the sphærocrystals and crystals of inulin and the like has shown again a webbed appearance; but this may be due to layered groups of globulites (i. e. droplets of a highly over-saturated solution of the substance). (4) Cellulose membranes of *Caulerpa prolifera*, bast cells of *Nerium Oleander*, &c., show a webbed appearance, and artificial cellulose as well as the natural product. (5) Cellulose precipitated on cotton fibres from a solution repeated the concentric webbed structure of the fibre, and

* Biol. Centralbl., xv. (1895) pp. 267–85.

Dreyer refers to two analogous cases, the calcification within fossil Echinoderms and the encrusting of sponge spicules with lime. (7) Interesting sphærocrystals of what appeared to be cellulose were also obtained from the solution. (8) The carapace of the crayfish also showed a clear webwork.

Bütschli points out that it is no longer warrantable to infer from the complex structure of cellulose or chitinous membranes that these have arisen by direct chemical modification of corresponding structure in the plasma. It seems more likely that the plasma produces the membrane-making substances in the form of solution which coagulates or is precipitated superficially, there assuming in contact with the medium the webbed structure which he has described. Dr. Dreyer points out in a clear way the far reaching importance of Bütschli's work.

γ. General.

What is a Tendency?*—Mr. A. W. Bennett submits to critical examination the question which forms the heading of his essay. It will be remembered by those who have followed recent discussions on the inheritance of acquired characters that much use was made of the terms tendency and predisposition. Mr. Bennett has failed to find an exact definition of these terms, and urges that if they are used vaguely and without any definite meaning they have no more value than the essences and humours of medieval naturalists. The chief object of his remarks is to show, that accepting Weismann's own definition of acquired characters, there is still in these characters an hereditable factor which renders it impossible to draw any satisfactory distinction between them and non-acquired characters.

Action of Light on Animal Life.†—Mrs. G. C. Frankland draws attention to some recent experiments of Dr. Masella with guinea-pigs inoculated with cholera and typhoid bacilli respectively. Investigation was directed as to the effects of insolation previous to inoculation, and the effect of insolation on the animal after infection. In the case of both cholera and typhoid it was found that previous exposure to sunshine increased the animal's susceptibility to these diseases. When the exposure to sunshine took place after infection fatal results were greatly accelerated, for instead of dying in from 15 to 24 hours, they succumbed in from 3 to 5. Dr. Masella does not attempt to give any explanation of the remarkable results he has obtained, but Mrs. Frankland suggests that the action of sunshine should be tried on anti-toxines. It would be of great interest to ascertain how the potency of these protective fluids outside the body is affected by exposure to sunshine, and also of the result, if any, insolation had on their generation within the animal's system. Dr. Masella would have us believe that his investigations explain the greater prevalence and virulence of typhoid and cholera in hot countries where the sun shines with greater power and more continuously. Mrs. Frankland, with a dry humour, suggests that the London water companies may congratulate themselves that these two water-borne diseases may be made to yield not only to efficient purifying processes at their hands, but that they have an unexpected ally in the limited amount of sunshine which Londoners enjoy.

* Science Progress, iii. (1895) pp. 143–6. † Nature, lii. (1895) pp. 86 and 7.

Numerous Variations in One Individual.*—Herr F. Helm describes no less than nine abnormalities in the thoracic region of a woman sixty years of age. The variations were:—An incomplete development of the first right rib, a dorsal prolongation of the insertion of the right M. scalenus anterior, an abnormal relation of the subclavian artery to the M. scalenus ant., a cartilaginous union of the sternal ends of the first and second rib on the right, asymmetry of the breastbone, eight true ribs on the right, ossification of the cartilage of the two first ribs and fusion of these with the sternum, a true joint on the course of the first left rib, and an accessory phrenic nerve. These are described in detail, and correlated with the records of similar variations. The general interest of their occurrence is their accumulation in one individual.

Origin and Inheritance of Individual Characters and Diseases.†—Herr F. Rohde reports on the present state of the question. His book has five parts:—(1) Heredity in the strict sense; (2) Transmissible variations; (3) Inheritance and variation in pathological conditions; (4) Origin and inheritance of individual characters and diseases; (5) Critical *résumé* of theories. In his general position, the author agrees with Weismann.

Physiological Chemistry of Plants and Animals.‡—Herr E. Schulze first discusses the resemblance between the proteids, fats, and carbohydrates in plants and animals. As to the proteids, analogous substances occur in the two series, though none may be identical. Representatives of albumins, globulins, and nucleoalbumins occur in plants. In regard to fats, there is closer correspondence; triglycerides are common in both, the same fatty acids occur. The agreement in regard to carbohydrates is well known:—grape sugar occurs in small quantity in animals, glycogen in some Algæ and Fungi, tunicin is almost identical with cellulose, paramylum from the human brain, &c., seems practically identical with starch, and so on.

Similar nucleins occur in the two series; lecithin can be isolated from plant-seeds, &c.; analogous animal and vegetable cholesterins are known; cholin or trimethylæthoxylium-hydroxyd has been got from many seeds; the betain of beet-sap occurs in human urine and in the edible mussel. The correspondence holds for xanthin, leucin, tyrosin, allantoin, creatin, creatinin, &c.

The author then compares the animal and plant metabolism as regards synthesis, disruption, fermentation, &c., and substantiates the conclusion of his useful paper that there is no essential difference between the *Stoffwechsel* of the two series.

Mollusca.

Torsion of Body of Mollusca.§—Dr. J. D. F. Gilchrist has studied the torsion of the Molluscan body from the negative point of view of the untwisting after torsion. With the disappearance of the osphradium

* Anat. Anzeig., x. (1895) pp. 540–54 (3 figs.).

† 'Ueber den gegenwärtigen Stand der Frage nach der Entstehung und Vererbung individueller Eigenschaften und Krankheiten,' Jena, 1895, 8vo, x. and 149 pp.

‡ Vierteljahrschr. Naturf. Gesellsch. Zürich, xxxix. (1894) pp. 243–74.

§ Proc. Roy. Soc. Edin., xx. (1895) pp. 357–69 (9 figs.).

there is a turning backwards of the pallial complex (*Bulla*), and with the falling backwards of the visceral mass there is a dragging backwards of the heart, and further retreat of the pallial organs, with a diminution of the pallial cavity (*Philine*). When the shell becomes flattened out or rudimentary it ceases to exercise any distorting influence on the body, and the foot and mantle become the modifying factors, leading to characteristic variations. In the Nudibranchs the original bilateral symmetry of the Mollusc is apparently resumed, but the lost organs of the one side do not again reappear. The author thinks he sees indications in the *Tectibranchiata* that there are two lines of development according to the relative preponderance of the mantle or foot. Judging from this evidence alone, we should presume that the cerata are neither the homologues of the mantle nor of the foot, but they may be the one or the other in different cases, and there is no reason why they should not sometimes be both.

a. Cephalopoda.

Retina of Cephalopods.*—Herr M. v. Lenhossék has studied the eyes of *Sepia*, *Eledone*, and other Cephalopods, using especially Golgi's method. The optic cells are long narrow elements, palisade-like in their arrangement, extending vertically through the retina. Their inner ends or rods reach the homogeneous membrane which lines the cavity of the eye; their proximal ends enter into relation with the optic fibres which are distributed from the posterior convex side. Only the rod projects into the epithelium, the nucleated protoplasmic part of the optic cell is separated from the epithelium by a limiting membrane. The distal end of the rod is pigmented and swollen like a club; the proximal end is a pigmented spindle, and between the spindles, above the limiting membrane, there are indifferent pigmented epithelial cells. Below the spindle is a clear portion—the *Stäbchensockel*—slightly expanded at the level of the limiting membrane. Beneath this is the cell proper, which passes into an optic fibre. In short, the optic cells are true nerve-cells—the origins of the optic fibres. These grow out as processes of the cells centripetally to the optic lobe.

Thus, contrasted with a Vertebrate eye, the Cephalopod eye has but one layer, divided into a dioptric and a nervous part. Or do the optic cells of the Cephalopod eye represent only the rods and cones of the Vertebrate eye, the other layers being displaced into the optic lobe? To the fact that the rods of Invertebrate eyes are turned towards the cavity of the eye, while in Vertebrates they are towards the brain, the author does not attach great importance. The difference follows from the different mode of development. Starting from the epithelial sensory nerve-cells of the earthworm, von Lenhossék briefly sketches the possible evolution of the eye.

Gigantic Cephalopod from Japan.†—Prof. K. Mitsukuri and Mr. S. Ikeda give an account of a gigantic Cephalopod which was caught in the Bay of Tatewama. They give a detailed account of this specimen, which appears to belong to the genus *Architeuthis*. In many respects the gigantic Cephalopod seen by Hilgendorf in Tokyo appears to agree

* Zeitschr. f. wiss. Zool., lviii. (1894) pp. 636–60 (2 figs.).
† Zool. Mag., vii. (1895) pp. 39–50.

with their specimen, but the authors have been unable to see the German naturalist's description of *Megateuthis martensi*.

β. Pteropoda.

Pteropoda of the 'Albatross' Expedition.*—Mr. J. I. Peck reports on the Pteropods collected by the 'Albatross' during the journey from Norfolk, Va., to San Francisco, Cal. Of the three families of the Thecosomatous Pteropods the Limacinidæ are represented only by two live specimens of *Limacina inflata*, which were taken at a depth of 880 fathoms. This would agree with Haeckel's statement that this particular species is one of those belonging to zonary and bathybial faunæ. The Cymbuliidæ are not represented in the collections at all. The Cavoliniidæ are represented quite completely both at surface and bottom. There appear to be no marked distinctions between the kinds and distribution in the Atlantic and Pacific waters upon either side of northern South America. The shells in deposits confirm the evidence of the surface collections, so far as there is any evidence from deposits from the ocean floor. The author gives various notes on the species which were collected.

γ. Gastropoda.

Heteropoda of the 'Albatross' Expedition.†—Mr. J. I. Peck has a short notice of the Heteropods collected during the voyage of the 'Albatross' around South America. But little material was obtained, though the individual specimens are, in nearly every instance, beautiful representatives of the various genera of this widely distributed group. *Atalanta*, *Carinaria*, and *Ianthina* were found. Of the third genus, all the specimens taken were found within a few degrees of the Equator.

Formation of Snail Shell.‡—M. Moynier de Villepoix explains that, when in 1891 he described the formation of the shell in *Helix* as due to a pallial gland (*bandelette palléale*) which secreted lime and organic matter, he was unaware that MM. E. Mer and Longe had described this in 1880 under the name of *coin epithélial*. They have therefore priority. The author finds the same shell-making gland in *Paludina vivipara* and other aquatic Gasteropods.

δ. Lamellibranchiata.

Seat of Coloration of Brown Oysters.§—M. J. Chatin, who has already studied green oysters and shown that their coloration is situated in special cells, the macroblasts, which are chiefly in the apical region of the branchial papillæ, has now made a study of brown oysters, and finds that here too it is the macroblasts which are the site of the brown coloration. If one takes an oyster in which a brown colour is beginning to appear, one finds that most of the macroblasts are still colourless, and the protoplasm of the cells is diaphanous and homogeneous; the nucleus is very apparent, and is large and spheroidal. Little by little this appearance changes, at first the periphery of the cell, and then the circum-nuclear zone become altered, for granulations become visible even

* Proc. U.S. Nat. Mus., xvi. (1894) pp. 451–63 (3 pls.). † Tom. cit., pp. 463–5.
‡ Comptes Rendus, cxx. (1895) pp. 512–3. § Tom. cit., pp. 884–7.

under a low power of the Microscope. As the granulations multiply and increase, pigmentation rapidly becomes more and more marked. The nucleus becomes masked, and the different stages which the author has already described in the green oyster are here reproduced.

Brachiopoda.

Evolution of the Brachiopoda.*—Miss Agnes Crane has a very interesting article on this subject, in which she points out that the revolution of thought concerning the evolution of these animals is due to the recognition of the value of embryology and auxology. She sees no reason to change the opinion which she has held for some years that where the Brachiopoda go the Polyzoa must follow. A critical account is given of the work of various zoologists, and it is urged that one stumbling-block in the way of the late Mr. Davidson was his strong belief in the immutability of genera. A table too elaborate for us to reproduce is given as an attempt to indicate the generic and ordinal evolution of the Brachiopoda.

Bryozoa.

Nephridium of Endoproctous Polyzoa.†—Prof. A. Oka, who has lately ‡ compared the nephridium of the phylactolæmatous Polyzoa with that of the Endoprocta, basing his remarks on the facts stated by Joliet, has lately cut sections of a large number of Endoprocta. He soon found out that the description of the organ given by the French naturalist was quite correct so far as the external form was concerned, but the mode of termination of its free extremity was not correctly made out by him. As a matter of fact, the short tubes do not open into the body-cavity at all, but end blindly in a large cell with a set of long cilia in a cavity of its cell-body, as has already been pointed out by Foettinger. It is clear, at any rate, that the nephridium of the Endoprocta is constructed entirely upon a different plan from that of the phylactolæmatous Polyzoa, so that the two organs ought by no means to be compared with each other; while the nephridium of the latter is formed by the differentiation and folding of the epithelial lining of the body-cavity, and serves as the passage of exit for the leucocytes, that of the Endoprocta resembles in structure the excretory organs of parenchymatous worms or the pronephros of certain Molluscan larvæ.

Barenthsia misakiensis.§—Mr. Asajiro Oka, who has already published a notice on this species in the Japanese language, now favours us with an account in one that is more widely understood in Europe. He states that each colony is composed of a certain number of individuals in various stages of development, which are fixed upon stolons that form perfect networks. The stolons are chitinous tubes divided by imperfect septa into a number of segments in such a way that the segments that carry individuals are always separated by a segment which carries no polyps. The animals of every colony are all of one sex only. The author makes a critical comparison between this new species and the

* Geol. Mag., ii. (1895) pp. 65–75; 103–16 (2 pls.).
† Zool. Mag., vii. (1895) pp. 65 and 6. ‡ See this Journal, *ante*, p. 303.
§ Zool. Mag., vii. (1895) pp. 76–86 (1 pl.).

four that have been described by European naturalists, and enters into some details with regard to the anatomy of the Japanese form.

Arthropoda.

α. Insecta.

A Manual for the Study of Insects.*—Prof. Comstock has prepared an elementary systematic text-book, designed for the use of students in high schools and colleges, and for teachers in primary and secondary schools. Its most distinctive feature is a series of analytical keys, by means of which the family to which a North American insect belongs can be determined. The author believes it is so arranged as to make it possible for the student to classify any insect to its family, and to learn the habits of the insects of that family; while, in the case of the more common species, he may also learn the name of his insect. The number of figures is large, and as they have been specially prepared for the work, we are saved the disagreeable *rencontre* with old friends which we frequently have in so many manuals. Prof. Comstock has devoted himself for many years so closely to the classification of Insects, that the work is probably one which has more than an ordinary value.

Integument of Insects.†—Dr. J. Vosseler has discovered in the integument of insects two layers of different physical and chemical characters. Externally there is the chitinous layer, and internally there is a layer which completely agrees with cellulose. The cellulose may be obtained by chemical reagents from the skin of insects.

Epidermic Cells of Insects.‡—M. J. Chatin finds that cuticular and other modifications are due to the reticular hyaloplasm of the epidermic cells. The viscous protoplasm meantime becomes more granular and more abundantly pigmented. Similarly, during the process of cuticularisation, the nucleus exhibits changes, showing the intimate solidarity of cytoplasm and nucleoplasm. It elongates, curves upon itself, becomes horse-shoe shaped, and so on.

Miocene Insect Fauna of Œningen, Baden.§—Mr. S. H. Scudder has lately had the opportunity of examining a large collection of fossil insects from this place, consisting of about 3500 specimens, of which fully one-half may be made use of to advantage. From the better specimens the author has separated over 400 species. From a table which he gives, it appears that the relative number of species in the different orders is almost strictly identical in his enumeration and that of Heer. It enables one to assert with much assurance that in number of species the Coleoptera of Œningen are vastly preponderant, including about two-thirds of all. They are followed by the Hemiptera, and they by the Hymenoptera; the Diptera are a good deal less numerous, while the Neuroptera and Orthoptera are feebly represented. For the first time a true Acridid has been recognised. Among the Diptera there is a new generic type allied to *Tabanus*, and there is a single specimen of a

* 'A Manual for the Study of Insects,' by J. H. Comstock and A. B. Comstock, Ithaca, N.Y., 1895, 8vo, vii. and 701 pp., 797 figs.

† Jahresh. Ver. Naturk. Württemberg, l. SB. pp. lxxxv.–lxxxvi. See Zool. Centralbl., ii. (1895) p. 117.

‡ Comptes Rendus, cxx. (1895) pp. 1285–8.

§ Geol. Mag., ii. (1895) pp. 116–22 (1 pl.).

minute fly, unusually well preserved, which forms the type of a new genus of the Mycetophilidæ; this it is proposed to call *Necromyza*. The ants compose the bulk of the Hymenoptera.

Phylogeny of Lepidoptera.*—Prof. A. S. Packard is of opinion that the significance of Walter's interesting discovery that *Eriocephala calthella* has maxillæ constructed on the type of those of biting insects was apparently overlooked by him as well as by others. Its bearings, however, on the phylogeny of Lepidoptera seem to be of the highest interest. The feature affords a basis for a division of the Lepidoptera into two grand divisions, or sub-orders, for which Prof. Packard proposes the names of Lepidoptera laciniata and L. haustellata. Diagnoses, which are too long to be repeated here, are offered of these two sub-orders; to them the attention of entomologists should be directed. The Lepidoptera haustellata may be divided into the Palæolepidoptera and Neolepidoptera. The last series may be divided into two sections, corresponding in the main to the *Pupæ incompletæ* and the *P. obtectæ* of Dr. Chapman. The author concludes with a provisional genealogical tree of the order, based mainly on the pupal and imaginal characters, which we regret our space does not enable us to reproduce.

Fungus Growing and Eating Habit of Sericomyrmex opacus.†—Mr. F. W. Urich states that a species characterised by the habit of growing and eating mushrooms is well represented in Trinidad. The nests of the ants which form the subject of the present note are found commonly about Port of Spain, in gardens, and from their peculiar raised entrance can be readily recognised. In young colonies this entrance leads into a small chamber about 6 inches below the surface of the ground. As the colony increases the ants do not enlarge this original chamber, but, piercing its side, form another near it, with a small entrance below. In large colonies, or those consisting of about, but not not more than 200 individuals, the nest consists of two or three chambers which open on the original excavation. This last is no longer used for growing the fungus in, but forms a sort of antechamber, which generally contains material brought in by the ants to grow their mushrooms on. The mushroom gardens consist of a grey spongy chamber, consisting of a great number of little irregular cells and resembling a coarse sponge, among which are scattered larvæ, pupæ, and ants, The walls of the cells consist of small round pellets, resembling dust shot, and are penetrated by and enveloped in white fungus-hyphæ, which hold the mass together. Strewn thickly upon the surface of the garden are to be seen round white bits about a quarter of a millimetre in diameter, and it is on these that the ants feed.

Glandular Parts of Hymenoptera.‡—M. E. Bordas has devoted a lengthy memoir to the study of the glands of the Hymenoptera. In all of them he finds that the salivary glands are thoracic, post-cerebral, and super-cerebral in position. Many are provided with lateropharyngeal racemose glands in front of the brain. All have mandibular glands, and some have external mandibular glands also. Other glands which

* Zool. Anzeig., xviii. (1895) pp. 228-36.
† Trans. Ent. Soc. Lond., 1895, pp. 77 and 8.
‡ Ann. Sci. Nat., xix. (1895) pp. 1-362 (11 pls.).

are found are sublingual in position, and unicellular in structure. The lingual glands are in front of the mentum, and with them there are found connected paraglossal glands. In some more than others the maxillary glands are very distinct. These glands the author associates with definite segments of the head, the first of which, we notice, he calls an ophthalmic gland. The excretory canals of the racemose glands are provided with internal spiral threads arranged in planes perpendicular or oblique to the axis of the tube. A study of the digestive canal shows that it may be divided into six parts. The Malpighian tubes are, in larval Hymenoptera, four in number. These larval tubes disappear from before backwards, during the nymph stage, but persist during the stage which is known as the pseudo-nymph. As the number of these glands is the same in nymphs as in adults the various changes which ensue consist solely in a progressive elongation. The number of the organs is in general in converse relation to their length, and the more numerous they are the more delicate are they. The Hymenoptera possess a larger number of urinary vessels than any other Insect, and this number, which may be sometimes more than 100, does not only vary according to the families, but even with the genera. The fourth part of the author's work deals with the poison glands, and has already been noticed.*

Intermediate Forms among Ants.†—Dr. F. v. Wagner in an expository review of Weismann's "Romanes Lecture," quotes a letter from Forel which is of interest in relation to the question whether the intermediate forms between fertile females and workers represent the direct results of modified nutrition (Spencer, Hertwig, &c.), or are the outcome of germinal variation (Weismann). At München, Forel found a nest similar to that which he had previously described from Uetliberg, with numerous transitional forms, some hardly larger than the smallest workers. But in neither case did the adjacent nests show a similar condition. The facts, according to Forel, are clearly in favour of Weismann's interpretation.

A Supposed Semi-aquatic Phasmid.‡—Mr. C. O. Waterhouse has some notes on the *Phasmid* to which the late Prof. Wood-Mason gave the name of *Cotylosoma dipneusticum*, and which he suggested might be modified for an aquatic life, as it was provided with tracheal gills. Mr. Waterhouse points out that nothing seems to be known as to the habits of the species; it may or may not be aquatic. The specimen on which Wood-Mason's description was founded is dried, and it is impossible to say definitely that the lateral plates are tracheal gills. A characteristic figure is given.

Life-history of Pericoma canescens.§—Prof. L. C. Miall and Mr. N. Walker make a contribution to the life-history of the Psychodidæ, of which little seems to be known. What we do know is due chiefly to the observations of Fritz Müller on Brazilian species. The authors have found larvæ and pupæ of one species of this family in considerable numbers in a paved channel which receives overflow water from the

* See this Journal, 1894, p. 445. † Biol. Centralbl., xv. (1895) pp. 81–91.
‡ Ann. and Mag. Nat. Hist., xv. (1895) pp. 498 and 9 (1 fig.).
§ Trans. Ent. Soc., 1895, pp. 141–53 (2 pls.).

stream at Meanwood, near Leeds. The larva feeds upon green Algæ and is found entangled in the filaments. It breathes air and often creeps out of the water altogether. The larva is described as having a body 8 mm. long, which consists of a head followed by eleven segments. The body is densely covered with chitinous tubercles, which for the most part are very minute. These appear under the Microscope like nails imbedded in the flexible skin. This external armour is a great obstacle to anatomical examination, and no doubt protects the living animal either from the attacks of its enemies or from abrasion. The more exposed parts of each ring of the body are protected by chitinous shields in addition to the tubercles. The dorsal shields of the first three annuli are divided along the middle line. The use of this arrangement is clear at the time of pupation, when the integument splits along these annuli to allow of the escape of the pupa from the larval skin. The sides of the body bear a flexible armour of regular and close-set setæ. There is a lateral fringe of much longer setæ, all of which point backwards, and so appear to be able to save the larva from being swept away by a sudden rush of water. Unlike most aquatic dipterous larvæ, this species is provided with anterior as well as posterior spiracles. The two pairs of anal processes consist of a stout chitinous rod, bearing a fringe of fine filaments, which project from the sides and tip. The anal processes stand out from a dorsal projection which overhangs the anus. Each filament is set with very fine hairs, so that it somewhat resembles a plume. The larva may often be seen to run the anal filaments through its mouth, thus cleansing them from diatoms, desmids, &c., which are probably devoured. The larvæ seem most at home in water just deep enough to cover the body. They then bury themselves in mud, sand, or Algæ, bringing the tip of the abdomen to the surface of the water. The outspread filaments of the four processes then form a cup, filled with air, and from this air can be taken into the spiracle. If this tranquil mode of life be interrupted by heavy rain causing a sudden deepening of the water and a great increase in the force of the current, the larva will either cling to the weeds and remain submerged for hours, or it wil leave the water altogether, and creep upon the wet herbage, or if the water be still, it can float on the surface. In any case, it can keep up a certain amount of respiration and prevent its spiracles from being wetted with water. The authors make an interesting comparison between this and other aquatic larvæ, and the paper concludes with a valuable critical account of the literature and the early stages of the Psychodidæ, for which the authors are indebted to Baron Osten Sacken.

Amitosis in Ovaries of Hemiptera.*—Herr F. Preusse has investigated the ovaries of *Nepa cinerea* and some other Hemiptera. There is no doubt that amitosis plays an important part in the multiplication of cells both in the young stages and in the older follicles. In the younger egg-chambers, mitoses also occur abundantly, but no transitional forms were observed. The author cites other cases in which amitosis is of functional importance.

Cecidomyia Avenæ sp. n.†—M. P. Marchal finds that *Cecidomyia destructor* Say does not develop on oats, while the new form which he

* Zeitschr. f. wiss. Zool., lix. (1895) pp. 305–49 (2 pls.).
† Comptes Rendus, cxx. (1895) pp. 1283–5.

has found on oats (*C. avenæ* sp. n.) does not develop on wheat. They are distinct species, with the following differences:—

Larva. (*a*) *C. destructor.* Sternal spatula bifurcated; anal segment ending in a bilobed dorsal prolongation, whose lobes bear dorsal papillæ in fours. (*b*) *C. avenæ.* Dorsal spatula ending in a spear-shaped point; anal segment without bilobed prolongation, dorsal papillæ implanted directly on the segment.

Adult. (*a*) *C. destructor.* Last joint of the palp of almost uniform diameter throughout its length; sides of the abdomen with white greyish hairs. (*b*) *C. avenæ.* Last joint of the palp much narrowed in its apical third; white greyish hairs forming a band on each side of the abdomen.

The author notes that this new pest has been checked by the parasitic larvæ of *Platygaster* and other Chalcididæ which destroy the young *Cecidomyia.*

Lachninæ.*—Herr A. Mordwilko completes a summary of his investigations on Tree-lice (Lachninæ), and gives a diagnostic table of the species of *Lachnus* which he has found on Conifers:—*L. grossus* Kalt., *L. Bogdanowi* sp. n., *L. pinihabitans* sp. n., *L. pini* Kalt., *L. piceæ* Walk., *L. nudus* De Geer, *L. tæniatus* Koch, *L. pinicola* Kalt., *L. pineus* Mord., *L. pineus* var. *curtipilosa* Mord., *L. pineus* var. *hyperophila* Koch, *L. juniperi* De Geer, *L. flavus* sp. n., *L. juniperinus* sp. n., *L. fasciatus* Kalt., *L. pichtæ* sp. n., *L. pineti* Fab., and *L. agilis* Kalt.

δ. Arachnida.

New Human Parasite.†—Dr. H. Miyake and Prof. J. Scriba describe under the name of *Nephroages sanguinarius* a new parasite from the urino-genital apparatus of man. They point out that Sarcoptids have very rarely been found in any deeper layers than the skin. A Japanese peasant, aged 37, was brought into the hospital, suffering from hæmaturia of a year's duration. The urine was found to contain the mites, which ceased to appear in it after an operation on the kidneys. *Nephroages* exhibits considerable differences in the size of the two sexes, the males having an average length of 117 μ and a breadth of 79 μ. The females varied between a length of 200 and 360 μ and a breadth of 80 to 120 μ. The parasite has four well-developed pairs of legs, all with five joints of equal size. Although the authors have no doubt that the investment of the body consisted of chitin it showed the remarkable peculiarity that it completely disappeared when imbedded in Canada balsam. In directing the attention of their fellow workers to this new parasite, the authors express the hope that those who have patients suffering from fibrinuria in tropical and subtropical countries will look for the presence of this parasite.

ε. Crustacea.

Locomotor Apparatus and Movements of Crayfish.‡—Dr. Th. List begins his study with a description of the articulations of the walking-legs in *Astacus fluviatilis.* The joints are all uniaxial (*Scharniergelenke*),

* Zool. Anzeig., xviii. (1895) pp. 93–104.
† Mitth. Med. Facultät. K. Japan. Univ., iii. (1894) pp. 1–10 (2 pls.).
‡ Morphol. Jahrb., xxii. (1895) pp. 380–440 (5 pls., 3 figs.).

but the movements of the animal suggest the mobility of ball-and-socket joints; it follows that the several segments of the legs must move in different planes. How the movements observed follow from the structure is explained by mathematical methods. The relative lengths of the different appendages and the segments of these; the angles between the various joint-axes; the muscles of the parts, and so on, are discussed in detail. An analysis of the forward walking is given:—thus, the first three legs pull while the fourth shoves; the reverse is true in walking backwards. In forward movement, the legs act in order from the first to the fourth; the first of the right acts along with the third of the left the third with the first, the second with the fourth, the fourth with the second; the body always rests on six feet. By attaching small pieces of sponge wetted with different stains to the ends of the legs, List was able to trace out the footprints of the crayfish on land. Through this and similar observations he has worked out a very complete account of the locomotor movements.

Brachyura of Indian Seas.*—Messrs. A. Alcock and A. R. Anderson have undertaken to name the large collection of shore and shallow water crabs recently made on board the 'Investigator'; 119 species were collected, of which it can safely be said that six appear to be new. Of the rest 28 seem to be new to the Indian fauna.

Reproduction of Cancer pagurus.†—Mr. Gregg Wilson thinks that there is some reason to believe that spawning only takes place in every second year of the crab's life. The belief that fertilisation is internal must be abandoned. It does not appear to have been as yet noticed that the sperms that are found in the vasa deferentia of the male crab are never free, but always in packets which may be either globular or bolster-like. The author has not been able to ascertain how long the berries are carried by the mother crab, and indeed little is known about the habits of berried crabs. The males are mature when much smaller than the females.

Amphipods of Bate's and Westwood's British Sessile-Eyed Crustacea.‡—Mr. A. O. Walker has published what should be an exceedingly useful revision of the Amphipods described in Bate and Westwood's well-known work. In this revision Mr. Walker has based his labours on the work of Prof. G. O. Sars, and his memoir, though short, is the result of much labour.

Amphipoda from the Tropical Atlantic.§—The Rev. T. R. R. Stebbing describes nine new species of Amphipoda which were obtained by the 'Buccaneer' while laying cables on the west coast of Africa. A fresh definition is given to the family Scinidæ. The author objects to the term jumping-legs applied to one pair of appendages by Bovallius in the genus *Scina*. There are some notes on the characters of the Rhabdosomidæ, and it is to *Rhabdosoma* and *Scina* that all the new species described by the author belong.

* Journ. Asiatic Soc. Bengal, lxiii. (1895) pp. 197–209.
† Proc. Roy. Soc. Edin., xx. (1895) pp. 309–14.
‡ Ann. and Mag. Nat. Hist., xv. (1895) pp. 464–76.
§ Trans. Zool. Soc. Lond., xiii. (1895) pp. 349–71 (5 pls.).

Cladocera of Basle.*—Herr T. Stingelin has a preliminary notice of the result of two years' work on these freshwater Crustacea. He has discovered no less than 68 species, among which are a number of new forms, and there are, as may be expected from the number, many species which are comparatively rare. The author has been able to convince himself of the local variation of various species, and he is able to show that in certain waters quite different species are dominant at different times; forms which in the summer of 1893 were most abundant totally disappeared in the summer of 1894.

Copepod Studies.†—Dr. W. Giesbrecht continues his studies on Copepods. He deals first with the morphology of the abdomen in the female. From his own researches, taken along with those of Claus, Maupas, and Canu, it seems almost certain that all free-living Copepods pass through (about) five "Copepodid-stages" between the last nauplius stage and sexual maturity. At each stage there is a moult, and with each moult an additional segment is gained. As Claus showed, the anterior portion of the last trunk-segment is periodically constricted off as a new one. The first Copepodid stage has five free segments between head and feet; the adult has typically ten segments equally divided between thorax and abdomen. But this typical number is not found in the majority, and where it occurs it is usually in the males only. By suppressed division, or, more usually, by secondary coalescence, the number of abdominal segments is often reduced. Dr. Giesbrecht explains what happens in different cases. Thus, in the *Gymnoplea*-species, the formula for the abdomen in the fifth Copepodid stage is 1, 2, 3, 4 + 5, if it be four-jointed; 1 + 2, 3, 4 + 5, if it be three-jointed. There are many similar results, but the next chapter has greater general interest.

The author proceeds to discuss the luminosity of pelagic Copepods. He has observed that of *Pleuromma abdominale*, *Pl. gracile*, *Leuckartia flavicornis*, *Heterochæta papilligera*, *Oncæa conifera* a small list compared with the number of forms in which no trace of luminosity could be detected. After describing the varied position of the luminous glands, he seeks to substantiate the important conclusion that the stimulus provoking luminosity causes primarily the emptying of the glands, and that the luminosity occurs not in the living protoplasm of the glandular cell, but as a secondary effect of the medium on a secretion of the gland. There does not appear to be any reaction between the secretion of the luminous glands and that produced by ordinary skin glands. All that the author can venture to assert is that there are two necessary factors in producing luminosity, the secretion and water. Is the process chemical? If so, is there in the secretion some substance which, like potassium, becomes luminous in contact with water; or does contact with water bring two substances in the secretion into reaction? After a careful review of observations and speculations, Giesbrecht concludes that in the phenomenon of luminosity physiological processes are involved only to the extent of producing the luminous substance and placing it in the conditions required for its being luminous. The luminosity itself is a secondary phenomenon, accompanying a chemical,

* Zool. Anzeig., xviii. (1895) pp. 49–51.
† MT. Zool. Stat. Neapel, xi. (1895) pp. 631–94 (1 fig.).

or in some cases perhaps physical process. From the relative or absolute blindness of luminous Copepods, Giesbrecht concludes that the biological use of the luminosity is probably to mislead such enemies as fishes.

Finally, the author discusses the pigmented knob on one side of the first thoracic segment of *Pleuromma*. We have not space to do more than state his conclusion that it is not an eye, nor a luminous organ, but a gland of unknown function.

Annulata.

Oligochæta of the Pacific Coast of California.* — Mr. G. Eisen describes three Oligochætes from the Pacific Coast; the first of these is the type of a new genus which he calls *Phœnicodrilus* (*P. taste* sp. n.); it contains small slender terrestrial forms closely allied to *Ocnerodrilus*, from which they differ only in the absence of a prostate. A temporary generic diagnosis is offered, and a full account is given of the anatomy of the only species which is as yet known. The absence of a prostate is rightly considered to be a fact of considerable interest, and the author thinks that it clearly demonstrates that the presence or absence of this organ cannot be taken for the foundation of families of Earthworms. The absence of a prostate in an Ocnerodrilid is not unexpected, for the species of *Ocnerodrilus* may themselves be arranged in a series according to the size of this organ. *Ocnerodrilus occidentalis* has a very large one, while *O. hendrici* has a most diminutive one, so that the absence in *Phœnicodrilus* is only one step further. Mr. Eisen thinks that this fact should have some influence upon our views of the classification of the Oligochæta, and that several genera or families which have hitherto been considered far apart solely on account of the presence or absence of a glandular prostate must now be brought closer together. *O. taste* was first found at an altitude of 4000 feet, but since then it has been found almost on the level of the ocean. It lives in damp soil and occurs in great numbers. *Pontodrilus michaelseni* is the only species of the genus which has as yet been found on the Pacific coast. It inhabits a very narrow moist line between the high tide and dry soil of the shores of the Gulf of California near Guaymas, Mexico. It differs from all other species which have been referred to this genus, with the exception of *P. marionis*, in possessing a glandular crop occupying somites xiv. to xvi. While Perrier only found blood-glands in the blood-vessels, or at the end of the capillaries investing the nephridia, Eisen has found them in this species only in the capillaries of the salivary and septal glands, where they occur in very large numbers. At the same time it is to be noted that individual specimens vary in the number of blood-glands which they possess and, as Perrier has shown, they are of all sizes and shapes. A useful table is given in which the chief anatomical characters of the species of *Pontodrilus* and *Photodrilus* are compared. The third species described is *Eclipidrilus fragilis*, of which Eisen has already given some account. His present researches show that the species is less aberrant in its anatomical characters than he first supposed, and he is now inclined to consider that the family of the Eclipidrilidæ is not isolated, but rather a sub-family of the Lumbriculidæ.

* Mem. Cal. Acad. Sci., ii. (1895) pp. 63–122 (15 pls.).

Nerve-Cord of the Earthworm.*—Herr B. Friedlaender reasserts his conclusion that the "giant-fibres," or "Leydig's fibres," were rightly interpreted by Leydig as medullated nerve-fibres. He has some strong criticism of the fallaciousness of methods (e. g. Golgi's), the insufficiently careful use of which has led experts to call medullated nerve-fibres supporting elements! He has shown and photographed complex anastomoses between Leydig's fibres and associated ganglion cells, as also with the second root of the double nerves. As to the rest of the nerve-cord, he is even inclined to believe that it consists predominantly of medullated fibres, in the differentiation of which there are, of course, many degrees. It is left an open question whether the sheath of Leydig's fibres is wholly a medullary sheath, but the author inclines to believe that there is also a supporting webbed structure.

Origin of Pigment and Colour-marking in Hirudinea.†—Dr. A. Graf has a preliminary notice of his work on this subject, and concludes that the colour-marking of these animals is not inherited, but is freshly acquired in each individual during the period of metabolism. It is probable that in many other groups of animals, similar factors have a part in the formation of the markings. It is possible that, and it is worth while to enquire whether, the arrangement of the other systems of organs is not inherited, but freshly acquired in every individual; in other words, the author suggests that but few characters are inherited, while the other organs adapt themselves to definite chemical and physical laws.

Nemathelminthes.

Ankylostomum Larva in Small Intestines of Cattle.‡—In the slaughterhouse at Göttingen, Herr Ströse found in the small intestine of cattle, small nodules which contained Nematode larvæ. They did not appear very clearly through the serosa, and hence might be easily overlooked. The nodules lay in the mucosa, which was much thinned, and they were invested with a connective tissue capsule. The contents of the nodules were caseous friable detritus, and a small parasite of 2·83–3·85 mm. long and 0·16 mm. broad. Sexual organs or their indications were not present. The author calls the parasite *Anchylostomum* v. *Dochmius bovis*. Drawings of the nodules and of the larva are given in a plate.

Cuticular Structures of Nematodes.§—Dr. A. van Bömmel has made an investigation into the structure of the cuticular formations of *Ascaris lumbricoides*, *A. megalocephala*, and *A. mystax*. Unfortunately his paper consists of so many paragraphs filled with direct references to the figures that without the republication of them it would be impossible to give a fair account of his observations.

Chætognatha of the Bay of Amboyna.‖—M. E. Béraneck has a report of the Chætognatha collected by MM. Bedot and Pictet in the

* Zeitschr. f. wiss. Zool., lviii. (1895) pp. 661–93 (1 pl.).
† Zool. Anzeig., xviii. (1895) pp. 65–70.
‡ Zeitschr. f. Tiermed. u. vergleich. Pathol., xxi. pp. 110–4. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 537.
§ Arbeit. Zool. Zoot. Inst. Würtzburg, x. (1895) pp. 191–212 (1 pl.).
‖ Rev. Suis. Zool., iii. (1895) pp. 137–59 (1 pl.).

Malay Archipelago. After some account of the observations and conclusions of previous writers, he states that he proposes to follow the classification of Langerhans, although he recognizes that it is defective in some particulars. He gives a diagnosis of the genus *Sagitta*, of which he found a new species which he calls *S. bedoti*. In addition to this, three already described species were recognised by him in the collection. Of *Spadella* he forms a new species, which he calls *S. voujai*. The author is of opinion that we shall have to carefully distinguish between such pelagic species as are cosmopolitan, and such as are restrained to a definite area. With regard to their habits, there appears sufficient evidence that these voracious worms do not hesitate to eat their own kind.

Platyhelminthes.

Distribution of Planarians.*—Dr. W. Voigt discusses a case in which *Planaria gonocephala* seems to be in the act of extending its range up-stream into the region of *Planaria alpina* and *Polycelis cornuta*. He considers the possible ways in which the range of a Planarian may be extended. It or its cocoon may be carried by bird or amphibian; but the transport of the whole animal is probably infrequent in the case of those inhabiting mountain streams. Moreover, a few minutes' exposure weakens them greatly, and an hour's exposure may be fatal. Therefore the passive distribution of Planarians is probably for the most part in the cocoon-stage, which resists desiccation with some success. But the likelihood of cocoon transport varies in different species; thus *Pl. gonocephala* lays its cocoon under a stone, *Pl. alpina* free on the bottom. The extension of range on the part of *Pl. gonocephala* which the author believes to be occurring is too regular to be due to passive transport; the animal is actively spreading. The author gives facts showing that the present retreat of *Pl. alpina* before *Pl. gonocephala* cannot be explained by conditions of temperature, chemical composition of the water, nutrition, or the like. He observes that *Pl. alpina* appears to be shy of the larger *Pl. gonocephala*, though it is never attacked by its fellow species. Probably the slime is disagreeable. But as this holds only for immediate proximity, it cannot be a reason for the retreat of *Pl. alpina* before *Pl. gonocephala*. Nor, as the author shows in detail, is this to be explained in reference to the enemies or the food-supply of the two species. It must be granted, however, that *Pl. gonocephala* is the stronger, much abler, for instance, to capture a *Gammarus*; its habit of laying its cocoon below a stone is also advantageous. As Kennel has suggested, the facts of distribution lead to the conclusion that *Pl. alpina* and *Pol. cornuta* are relicts of the Glacial epoch. Voigt supposes that they had in pre-Glacial times reached the higher regions of the streams; while *Pl. gonocephala* frequented those lying lower. As the Ice Age set in the two former species retreated, with other freshwater animals, from the mountains to the plains. Now if *Pl. gonocephala*, with *Dreissenssia polymorpha* and others, perished in Middle Europe, but subsequently returned from warmer regions to the old home, the distributional facts which Voigt has observed would be explained. It should be further noted that *Pl. alpina* lays its cocoons from December to May, and that

* Zool. Jahrb. (Spengel) Abth. Syst. Geogr. Biol., viii. (1894) pp. 131–76 (3 maps).

the young are all hatched by the first half of July, while *Pl. gonocephala* reproduces from the beginning of July to the beginning of September; its young have, therefore, less time to lay up stores for the winter. Thus the short summers of the Ice Age would be more fatal to *Pl. gonocephala* than to the others. Voigt has much more to say than we have space to notice, but enough has been cited to suggest the thoroughness of his careful inquiry. He invites the co-operation of other naturalists to assist in the more complete working out of the problem.

Land Planarians from the Blue Mountains, New South Wales.*— Prof. A. Dendy describes nine species obtained in the Blue Mountains, of which seven are known to be represented in Victoria by identical or slightly varietal forms. Of the remaining two, one has been found in Tasmania, and the other is represented in Victoria by a closely allied, if not specifically identical form. Prof. Dendy takes the opportunity of revising the nomenclature of the common and widely distributed *Geoplana sanguinea.*

Asexual Reproduction of Freshwater Turbellaria.†—Herr J. Keller describes this in *Stenostoma Langi* sp. n. About the middle of the intestinal region a new brain is formed, and at the same place a new pharynx appears medio-ventrally. Olfactory grooves and eyes follow. About 24 hours after the beginning of the "regeneration," the animal begins to constrict in front of the new organs. The original individuality is lost in forming two equivalent zooids, for the anterior part cannot be called the mother. On an average this process of paratomy takes a week; it is slower, and the zooids are smaller in winter; it seems to occur all the year round except in some weeks of October, when large-sized hermaphrodite forms occur. These do not die after reproduction, as has been stated.

Keller describes for the first time the two eyes of *Stenostoma.* The vesicle consists of a single layer of epithelium, at the posterior end of which there is one large (retinal) cell with a refractive body (rhabdome) towards the centre of the vesicle. A ganglion cell connects the retinal cell with the brain. There is no pigment.

The brain is wholly regenerated from unbranched connective tissue cells (*Stammzellen*); the olfactory pits arise from modification and invagination of epidermic cells; the eyes, the pharynx, the skin-glands of the head are all regenerated from Stammzellen, which also form the gonads. The new protonephridium is formed from the cells of the original longitudinal canal.

Hermaphroditism of Prorhynchus.‡—Mr. J. Percy Moore rightly remarks that unisexuality is so nearly universal among the Nemertines that an additional case of hermaphroditism is of interest. Two specimens of *P. tenuis* found near Philadelphia were clearly seen to be hermaphrodite. The number of genital sacs is very much reduced, and the gonads are not regularly paired. In no case was a distinct communication with the exterior observed, though contact with the skin is frequently very intimate. In the two undoubtedly bisexual individuals

* Proc. Linn. Soc. N.S.W., ix. (1895) pp. 729–34.
† Vierteljahrschr. Nat. Gesellsch. Zürich, xxxix. (1894) pp. 337–44 (1 fig.).
‡ Zool. Anzeig., xviii. (1895) pp. 63–5 (2 figs.).

the anterior part of the body is male, the posterior female. One individual is chiefly male, possessing six distinct testes and three distinct ovaries, the other mainly female with a single well-marked anterior testis, and the remaining gonads female. Both ovaries and testes have usually the appearance of solid masses of protoplasm.

Gyrodactylus.*—Dr. L. Kathariner gives an account of this ecto-parasitic Trematode, found on freshwater fishes. A general description is given of the form of the body, of its investment, and of the glands that are found on its surface. The muscular system is of the type common to most Trematodes. The central nervous system, on which earlier authors make no reports, lies in front of and above the pharynx. It forms a band which is slightly concave backwards, and its corners are produced into two cords which pass to the ventral surface, where they may be followed to about the middle of the body. From the anterior margin of the brain commissure there arise two nerve-trunks, which at first diverge from and then converge towards one another. In histological structure the substance of the brain and of the nerve-trunks appears to consist of very fine fibres which stain with difficulty. Among the fibres there appear a certain number of ganglionic cells. A detailed description is given of the digestive canal. The wall of the intestine appears to be devoid of muscles, but around the intestine there are numerous parenchymatous muscles, some of which pass to it radially from the dermomuscular tube, while some form circles around it; this, of course, is not the first Trematode which has been shown to be devoid of an enteric musculature. In a living *Gyrodactylus* the excretory apparatus may be distinctly seen to consist of four longitudinal trunks. The two larger of these have their orifices in the anterior part of the body which is behind the pharynx, and they are provided with an enlargement which functions as a contractile vesicle. There are some difficulties in demonstrating the course of the vessels, as in preserved animals nothing can be seen of them. The animal under investigation is hermaphrodite, with well developed male and female organs, as Wagner was the first to show. These organs are described by the author in detail, and he adds critical remarks on the observations of his predecessors. Laurer's canal is absent. After a few notes on the mode of life of this parasite the author concludes with enumerating the species of the genus. To the *G. elegans* first described he adds two new species which he calls *G. medius* and *G. gracilis*.

Histology of Trematoda.†—Dr. A. Schuberg first discusses the peripheral ganglionic cells of these parasites. They are confined to the middle and hinder parts of the body where they are more or less regularly arranged. Blue-coloured branched cells were more common in the anterior third of the body. They are not isolated elements, but are specially grouped around the cerebral commissure. Cells that stain blue were also found in the suckers and in other muscular organs such as the pharynx; they may be distinguished from the peripheral elements by their somewhat smaller size. In good preparations, and with high powers, it was often possible to follow the processes of the cells for a

* Arbeit. Zool. Zoot. Inst. Würzburg, x. (1895) pp. 127–64 (3 pls.).
† Tom. cit., pp. 167–88 (1 pl.).

considerable distance. This is especially the case in fresh preparations, while in those that are preserved the processes are less distinct. The cells which are placed on the intestine may often be shown to have processes which branch upon the intestine, and form a kind of plexus on it. In good methylen-blue preparations it was often possible to see that the fine blue filaments pass into the muscular fibres. These can best be seen in the longitudinal muscles in the median and hinder thirds of the body. The author enters into considerable details as to the results of his observations of these cells. Dealing next with the terminal cells, he is enabled to show that the terminal cells of the excretory capillaries are completely closed and pass directly into the walls of these vessels. The latter consist of a very flat epithelium which is made up of a few cells. The terminal cells are provided with processes which radiate out between the parenchymatous cells. No cleavage spaces were seen between the latter cells, and the author is confident that they do not exist. The tuft of cilia carried by the terminal cell is of some length. Terminal cells appear to be wanting from the suckers and pharynx. The subcuticular cells, to which considerable attention has been devoted, and which have been the subject of very various explanations, are next considered. The author thinks that the number of hypotheses about them is sufficiently large to justify him in refusing to add to their number.

Tænia dendritica Goeze.*—*Tænia dendritica*, says M. E. Riggenbach, has hitherto only been found in the intestine of the Squirrel. The length of the worm is 10–15 cm., the breadth increases from 0·24 mm. to 1·5 mm. The scolex is round, there is no rostellum, and the vertex is flat. There are four suckers. The ripe proglottides are 6–8 times as long as broad. The genital sinus is situated about the second fifth of one side of each proglottid. When the uterus begins to form, the testicle and yolk-sac disappear, the vas deferens, vesicula seminalis, and receptaculum seminis remaining. The uterus extends along the length of the proglottid, and exhibits lateral flask-shaped diverticula. The ova in utero are 0·016 mm. broad and 0·002 mm. long.

Cysticercus inermis in Cattle.†—In the slaughterhouse at Dresden a *Cysticercus inermis*, the size of a pea, was found in the gland of an ox which had been seized on account of advanced tuberculosis. Besides this, says Herr Noack, six others were found in the muscles after the animal had been cut up.

Herr Mejer ‡ narrates another instance of *Cysticercus inermis*, which was found in the interlobular connective tissue of the left lung of an ox. Besides this, another specimen was discovered in the tongue, three in the heart, and six in the muscles.

Incertæ Sedis.

New Enteropneusta from New South Wales.§—Mr. J. P. Hill has published an abstract of his description of a new species allied to

* Centralbl. f. Bakteriol. u. Parasitenk, 1te Abt., xvii. (1895) pp. 710-6 (1 pl.).
† Deutsche Tierärztl. Wochenschr., 1895, p. 64.
‡ Tom. cit., pp. 64–5. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 536–7.
§ Proc. Linn. Soc. N.S.W., ix. (1895) pp. 736–7.

Balanoglossus, for which he proposes the name of *Ptychodera australiensis*. Like other species of its genus it is littoral in its habits, and occurs in considerable abundance at certain points along the coast of New South Wales. The species is especially characterised externally by the great development of the genital wings, which completely hide the gill area and extend far into the hepatic region, and by the presence of two longitudinal epidermal stripes which extend over the anterior two-thirds of the tail region, and overlie the two ciliated bands of the intestine. In the mode of formation of the proboscis pore this species appears to be the most variable of all Enteropneusts which have as yet been examined. In most the pore occupies a median position, when it may be formed in one of three ways: (1) From the union of both dorsal proboscis pockets into a single proboscis canal; (2) from the left; or (3) from the right pocket alone forming the canal. An interesting feature is said to be presented by the ventral wall of the heart-bladder which is infolded into the cavity of the bladder, forming a tube free anteriorly, and communicating with the central blood space by a narrow longitudinal slit. This is regarded as a special modification to ensure the better performance of the propelling function of this ventral wall. Another interesting point in connection with the vascular system is the presence of a well-marked vessel which passes in the "chondroid" tissue, occupying a space between the anterior portion of the keel of the proboscis skeleton and the posterior portion of the end plate.

Echinoderma.

Comet-form of Linckia multifora.*—Mr. S. Hirota has made a study of the comet-shaped form of *Linckia*, which has from time to time attracted the attention of various naturalists. He comes to the conclusion that, in a typical comet, the central organs are generally developed as in a normal young form with a disc of the same size. The younger the comet, the relatively greater in girth are the regenerated arms. The stone-canals are formed on both sides of the base of the principal arm, and the madreporic plates from ordinary ossicles on the dorsal edge of the wound. A local constriction of an arm is not to be taken as the preparation for self-breaking, which takes place abruptly, but indicates the junction between the original and the regenerated parts of an arm. The breaking may be caused in any arm, and at various positions, at the will of the animal. This breaking may from its frequency be considered as an ordinary mode of reproduction, but it does not probably serve any purpose in the fertilisation of generative cells. It is highly probable that the mouth is formed secondarily, but not directly from the wound itself.

Fertilisation of Echinoid Ovum.†—Prof. Th. Boveri has, with the practical assistance of Dr. R. Lautenbach, reinvestigated the much-studied phenomena of fertilisation in Echinoids. He packed numerous ova in the epidermic castings of *Cryptobranchus japonicus*, and thus cut many at once, staining after Heidenhain's iron-hæmatoxylin method. Of any ovum-centrosome (*ovocentre* of Fol) not the least trace was to be

* Zool. Mag., vii. (1895) pp. 67–76 (1 pl.).
† Verh. Phys. Med. Gesellsch. Würzburg, xxix. (1895) pp. 1–75.

seen. Only in association with the sperm-nucleus was there a centrosome, which by dividing formed the two pole-corpuscles of the first segmentation-spindle. In detail, Boveri explains his grounds for believing that Fol's "quadrille" was a misinterpretation. He believes still, as in 1887, that the centrosome of the Echinoid ovum is an organ which degenerates, and plays no part in development. He also discusses the observations of Guignard and Conklin, which support those of Fol.

Centrosomes usually lie in the protoplasm, but they may, as Brauer has shown, lie within the nucleus. Similarly, the spindle fibres arise here from parts which lie in the nucleus, and there from parts which lie in the cytoplasm. Boveri holds fast to the conclusion that the centrosome is an independent and permanent organ of the cell. It divides into two, and forms the dynamic centre for the daughter-cells.

The astrosphere is that complex of rays which is centered around the centrosome; it is no permanent structure, but usually disappears completely after division, arising quite anew in the preparation for the next division. But Boveri maintains, at the same time, his position that there is a specific substance—the archoplasm—composing the astrosphere. He proceeds to a stringent criticism of Heidenhain's theory of cellular mechanics and his heresies in regard to the centrosome. One has hope that between two such masters a secure conclusion may eventually be reached.

Cœlentera.

Turbinaria.*—Mr. H. M. Bernard has some morphological and systematic notes on this very difficult genus of the *Madreporaria*. He urges that Milne-Edwards rejected the most natural character of the genus in abandoning the method of budding, and using in its place more artificial distinctions. A study of a series of the genus shows that the corallum of *Turbinaria* typically appears in its early stages as a small cup, but this cup-stage is generally transitory. It is at any rate clear that the cup-shape of the corallum must no longer be thought to be a specific distinction. A cross section through the stalk of a minute cup reveals a single, rather large, polyp-cavity surrounded by a thick spongy wall, which shows an irregular series of radiating plates bound together by irregular concentric synapticulæ. This central polyp in the stalk is the parent polyp of the young corallum, and the spongy cœnenchyma is a simple thickening of its walls. Surrounding the central cavity there is a series of longitudinal canals running parallel with the polyp-cavity. All these are in open communication with one another and with the polyp-cavity through pores. The axial polyp in the stalk of a minute Turbinarian colony buds laterally, and the buds form a simple ring round the axial polyp. The fundamental difference between Turbinarians and Madreporarians is due to their different methods of budding. As soon as the polyps at any time forming the actual edge of the cup have, by radial growth, developed sufficiently from their next neighbours to admit of buds appearing between them, these appear, while the parent polyps bend sharply upwards towards the axis of the cup. As soon as this bending is effected, a fresh bud or fresh buds grow out close to the bend. It is thus by the continual addition of a fresh series of polyps

* Ann. and Mag. Nat. Hist., xv. (1895) pp. 499–521 (2 pls.).

outside the one last formed that the edge of the corallum grows outwards into an ever-expanding cup or disc. The author next describes the flowing of the cœnenchyma and the thickening of the cup. This results frequently in filling up the bottom of the cup, when all the polyps which formed the cup at its younger stages are completely submerged. Outside it streams down over the stalk, not only thickening it, but expanding its base of attachment. The two typical elements of increase in the growth of the corallum are therefore, typical budding, and the flow of material building up the cœnenchyma. In addition to this, nearly all Turbinarian coralla with uneven surfaces seem to have the cœnenchyma accumulating in the valleys, as it does in the bottom of the early cups. The author has distinguished eight principal growth-forms among the Turbinarians in the collection of the British Museum. These he distinguishes by the following terms:—Crateriform, Peltate, Frondens, Foliate, Mesenteriform, Tabulate, Glomerate, and Bifrontal, but it is not to be supposed that these definite types exhaust the possible transformations of the early cup. When our collections are more complete other normal methods of growth will no doubt have to be added. With regard to the taxonomic characters supplied by the calicles, those which appear to be of the most importance are—the characters of the protuberant calicles; the character of the septa; the interseptal loculi; and the columella. The influence of position on the character of the calicles opens up a great field for investigation. As the cœnenchyma is very prominent in *Turbinaria* it, too, may offer characters of specific importance. Certainly the fineness or the coarseness of the texture has a certain value. It is of interest to note that the general aspect of the cœnenchyma seems to vary with geographical position. There are groups of specimens from various parts of the world, evidently collected at the same time, and from nearly the same spot. In each case, all the specimens of these groups look at first sight strangely alike. So strong is the likeness between the specimens in each case, that, without some definite principles of classification, one could hardly avoid lumping them all together.

Actiniæ of 'Albatross' Expedition.*—Prof. J. Playfair McMurrich has an extended account of the Actiniæ collected by the 'Albatross' during the winter of 1887–8. After a critical account of the classification of the Anthozoa, and especially the Actiniæ (in which he recognises the following tribes:—(1) Rugosæ; (2) Antipatharia; (3) Alcyonaria; (4) Edwardsiæ; (5) Ceriantheæ; (6) Zoantheæ; (7) Protactiniæ; and (8) Hexactiniæ; and for which he proposes a fresh classification based primarily on whether the tentacles are arranged in cycles or radially) he proceeds to an account of the specimens collected. Of the genus *Edwardsia* a new species, *E. intermedia*, was found, represented by a single specimen. In the Protactiniæ a new genus *Oractis* is proposed for the forms with twenty mesenteries. In the Halcampidæ a new genus *Halcurias* is formed for *H. pilatus.* In the Antheidæ, *Myonanthus ambiguus* is a new type remarkable for its power of completely retracting the tentacles. *Pycnanthus* is a Paractid unlike any of the present known genera, while *Cymbactis* is remarkable for the absence of any thickening

* Proc. U.S. Nat. Mus., xvi. (1894) pp. 119–216 (17 pls.).

of the mesoglœa at the bases of the tentacles. The author proposes to place *Phellia pectinata* and *P. spinifera*, which were described by Hertwig, in a new genus which he calls *Chitonanthus*. Our space will not permit of our enumerating the large series of new species which were found in this collection. In conclusion, the author briefly discusses the geographical and bathymetrical distribution of the Actiniaria, but it is hardly yet time to enter into an exhaustive discussion on this subject. The researches of the 'Albatross' have, however, demonstrated that certain deep-sea species have a very wide distribution.

Zoanthus chierchiæ sp. n.*—Prof. A. R. v. Heider describes this new species from the 'Vettor Pisani' collection. The colony occurred on loose stones; the polypes are close together, connected by cœnenchyma; the individuals measured at most 12 mm. in length, with an oral disc 4–5 mm. in diameter: the largest had 40–55 tentacles in a double ring. The species seems nearest to *Z. macgillivrayi* of Haddon and Shackleton. Like some other investigators, Von Heider notes that numerous variations from the norm occur in the mesenteries of Zoantheæ. A full description of the minute structure is given, but we can only refer to a few points. Between and beside the canals in the body-wall there are certain cells and fibres imbedded in the mesoglœa, which are usually regarded as connective or muscular; these von Heider believes to be nervous. The mesenteries, originally muscular and respiratory, have here undergone further differentiation, for many of them possess a glandular cushion, probably digestive. No reproductive cells were observed, but the author believes that a marked proliferation of endoderm in the deeper parts of the mesenteries must be regarded as serving for the reception of the genital elements.

New Rhizostoma.†—Mr. K. Kishinouye describes under the name of *Mastigias physophora* a new Rhizostome which is found abundantly in summer on the coasts of Shima and Sagami. The largest specimen is about 100 mm. broad, but specimens as much as three times as wide are said by fishermen to have been seen by them. The author confines himself to a comparatively short general account of this new species.

Character and Distribution of Perigonimus.‡—Prof. C. W. Hargitt (along with Dr. H. L. Osborn) found a species of this interesting genus of Gymnoblastic Hydroids in the waters of Long Island, and has followed up the quest at Naples.

Hargitt slightly modifies the generic characters given by Hincks:—Cœnosarc sheathed in a chitinous, sub-chitinous, or gelatinous perisarc; hydrocaulis branching or simple, from a filiform hydrorhiza; hydranths fusiform, with a single verticil of filiform tentacles surrounding the base of a conical hypostome; gonophores developed from the cœnosarc. Gonozooids free and medusiform. Umbrella deep bell-shaped; manubrium short; radiating canals four; marginal tentacles two or four, often increasing with age, springing from non-ocellated bases.

The genus is amongst the simplest of Gymnoblastic hydroids; at least twelve species are known; the habit is distinctly commensal—on

* Zeitschr. f. wiss. Zool., lix. (1895) pp. 1–28 (3 pls.).
† Zool. Mag., vii. (1895) pp. 86–8 (1 pl.).
‡ MT. Zool. Stat. Neapel, xi. (1895) pp. 479–87.

spider-crabs, *Turritella communis*, *Buccinum*, *Dorocidaris*, &c.; the larger proportion of species have been reported from the environs of the British Isles and North Sea, but the geographical range is wide.

Protozoa.

Relation of Nucleus to Function in Protozoa.*—M. F. Le Dantec has shown that assimilation in freshwater Rhizopods only occurs when the nucleus is present. Balbiani, Hofer, and Verworn attribute to the nucleus an influence on digestive secretion, but the author says there is no digestive secretion in Foraminifera, and that in Lobosa and Ciliata the secretion in the vacuoles has simply diffused from the protoplasm. What the nucleus does is to conserve the chemical composition of the protoplasm, its equilibrium and integrity of form, and it is thus that it is indispensable to assimilation and regeneration.

Ciliated Infusorians in the Stomach of Ruminants.†—Dr. R. Eberlein deals first with the genus *Ophryoscolex*, describing *Oph. inermis* Stein from ox, sheep, and goat, *Oph. caudatus* sp. n. from sheep, and *Oph. purkynei* Stein from sheep. In his study of the new species, he observed that the cuticle of the body is directly continued into the spines and tail-process, and that the shell is formed of a deposit of silicic acid compounds. The genus *Diplodinium* is next discussed; including *D. magii* Florentini, from ox and sheep, *D. bursa* Florentini, *D. caudatum* sp. n., *D. dentatum* or *D. denticulatum* (for they seem to be one), *D. rostratum* Florentini, *D. ecaudatum* Florentini. The third genus is *Entodinium*, including *Entodinium bursa* Stein in almost all Ruminants, *Ent. caudatum* Stein, and three other species. The family Isotrichidæ is represented by *Isotricha prostoma* Stein, in every Ruminant, and *I. intestinalis* which is equally common, and *Dasytricha ruminantium* Schuberg.

Then follows an account of *Butschlia parva* Schuberg, and *B. neglecta* Schuberg.

In cattle, sheep, and goats the same forms occur; and a study of llama and camel shows the same forms, at least when they are fed with similar fodder. Their occurrence appears to be quite normal, or at least not pathological. They appear to digest part of the cellulose, converting it into an absorbable material. Their origin is from the hay and water, but there is no evidence to show that the life-cycle can be completed outside of the alimentary canal of Ruminants.

Kentrochona Nebaliæ.‡—Dr. J. Rompel describes this new Infusorian, one of the Spirochoninæ, which he found attached to the thoracic feet of *Nebalia Geoffroyi*. It lies on the surface of epipodite and exopodite, closely fixed by a gelatinous cushion to the cuticle, flattened dorsoventrally. The resting macronucleus is a circular hyaline disc, and a dorsal arching appears to correspond to its position. The posterior micronucleus forms a smaller dorsal protrusion, and gives the impression of a spindle stretching from dorsal to ventral surface. Near it is a second spindle-shaped body. In *Kentrochona* the peristome is simpler

* Comptes Rendus, cxx. (1895) pp. 335–7.
† Zeitschr. f. wiss. Zool., lix. (1895) pp. 233–304 (3 pls.).
‡ Op. cit., lviii. (1894) pp. 618–35 (1 pl.).

than in the allied *Spirochona*, for it is a funnel but without the spiral; there are four peristomial spines to which the generic title refers.

A definite centrosome is present, quite distinct from the micronucleus. It divides only at one pole during nuclear division, which suggests that it has not directly to do with the latter. After the completion of the nuclear spindle, there is one centrosome at one pole, and there are two at the other. From the observed stages of nuclear prophases, the division appears to be mitotic.

The stimulus to budding seems to come from the division of the nucleus; no part of the peristome is taken over into the bud, which is distinctly nucleated. Budding is most frequent when the host has cast its shell, when a new dwelling has to be found.

New Infusoria.*—Dr. A. C. Stokes publishes a description of a number of Infusoria which he believes to be undescribed. In addition to the forms that are undoubtedly Infusoria, the author includes descriptions of three species of *Trachelomonas*.

Vasicola annulata.†—Dr. A. C. Stokes describes a second species of this genus, which differs from the *V. ciliata* described by Tatem in having a brackish water or marine habitat. It is stated that this species affords a brilliant example of the production of a membraniform ectosarc.

Calcituba polymorpha.‡—Dr. F. Schaudinn gives a description of the structure and life-history of this Foraminifer. From naked plasmodia there arise large, many-chambered, stellate individuals. The plasmodium settles on growing algæ, and forms a shell; from this first chamber, dichotomous calcareous tubes grow in a radial direction. While the peripheral ends of the tubes grow on, the central part falls to pieces, when the algal substratum is destroyed, and fragments including a variable number of chambers sink to the floor. Thus from the large, star-shaped individual, a ring of radially disposed smaller individuals arises; the latter form more new chambers at their peripheral ends, while the older central parts break up and fall away—a process which in some respects resembles strobilation. The fragments may find new algæ and grow further, or they may encyst, or they may liberate plasmodia, which directly, or after a period of independent life, or after division, give rise to the stellate individuals.

The plasm includes clear vacuoles, reserve granules, pigments, excretory granules, &c. The matrix shows a webbed vacuolar structure. Two plasmic fluids of different consistency and refractive index exhibit streaming movements. The shell consists of a chitinous excretion and four or five layers of little capsules whose walls are thickly covered with refractive granules of carbonate of lime. The making of this shell is carefully described.

The nuclei occur in four stages:—(1) Homogeneous, intensely stainable, membraneless nuclei, with great variety of size (2–10 μ).

(2) Nuclei with a vacuolar (optically reticulate) framework, more

* Proc. Amer. Phil. Soc., xxxiii. (1894) pp. 338–45 (1 pl.).
† Journ. New York Micr. Soc., xi. (1895) pp. 47–51 (1 fig.).
‡ Zeitschr. f. wiss. Zool., lix. (1895) pp. 191–232 (2 pls.).

refractive than the nuclear sap; in the framework there are found chromatin granules; there is a delicate nuclear membrane.

(3) Nuclei with the chromatin condensed in an irregular clump, in the centre or at the side of the membrane; from this clump linin threads radiate through the nuclear cavity, and are attached to the membrane.

(4) Nuclei with the chromatin in homogeneous compact spherules (1–5 μ in size, 20–100 or more in number); these lie on the membrane, while the central part is filled with colourless, structureless nuclear sap.

Division of Ceratium.*—Herr R. Lauterborn has investigated the division of cell and nucleus in *Ceratium hirundinella*. The resting nucleus has a fine-meshed, reticular-webbed structure, with one or two nucleoli which may be central or peripheral in position. Division occurs at night. The nucleus increases in volume; its regular structure becomes a tangled coil; the nuclear threads arrange themselves approximately parallel to the shorter axis, so that the nucleus appears fibrous. Fine connections are seen between the nuclear threads, nucleoli are still visible at the poles, and there is an obscure rod-like body, visible in picrocarmine preparations, which often appears divided in later stages. The shorter axis of the nucleus, the subsequent division-axis, lies at an angle of about 45° to the transverse groove of *Ceratium*, from left above to right below. It elongates in the direction of the division-axis; the nuclear threads are constricted at the equator; the daughter-nuclei go apart. An oblique constriction from left below to right above divides the plasm. In one case where the constriction had reached the middle, a distinct intermediate body was seen. The shell is split along a definite oblique line, approximately parallel to the division-plane of the plasm. Marginal regeneration begins at once, furrow and horns soon appear, and with further growth complete separation of the daughter-individuals is effected, each with a shell partly old, partly new.

It will be noted that the division is not direct, as Blanc said, nor strictly mitotic, as Zacharias reported. Thus no longitudinal cleavage of the chromatin-elements was observed, nor an achromatic spindle. It suggests the division of the macronucleus in Ciliata.

Coccidia met with in Mice.†—Mr. J. Jackson Clarke, on dissecting a white mouse kept in a place previously occupied by rabbits, found large numbers of Coccidia in every part of the alimentary tract beyond the cardiac opening of the stomach. Study of the parasites which were observed led him to conclude that they were probably identical with the Sporozoa described by Eimer in the intestines of mice and called *Eimeria* by Schneider. *Eimeria* itself is probably only a variety of *Coccidium oviforme*, and may be but a modification of *C. oviforme* determined by the smaller dimensions of the epithelial cells of the intestine of the mouse, as compared with those of the rabbit. The appearance of large numbers of swarm-spores in the gastric glands of the mouse is very similar to that presented by the Sarcosporidia, and suggests that the latter is but one phase of a Sporozoon, which may have in other phases a form resembling that of the Coccidia.

* Zeitschr. f. wiss. Zool., lix. (1895) pp. 167–90 (2 pls.).
† Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 277–83 (1 pl.).

Observations on various Sporozoa.*—Mr. J. Jackson Clarke describes the result of an examination of the seminal vesicles of *Lumbricus agricola* taken in the month of May. His observations on *Klossia* were made in some common grey slugs examined in July. In conclusion, attention is drawn to the recent work of L. Pfeiffer on the *Myxo-*, *Sarco-*, and *Micro-sporidia;* as that author has presented Mr. Clarke with a number of preparations, he has been able to confirm his results.

Development of Spermatobium.†—Mr. G. Eisen describes a new genus of parasitic *Sporozoa* under the name of *Spermatobium.* The genus is found in two Oligochætes from the Pacific Coast of North America, and it is confined to their sperm-sacs. In the young stages it occupies the interior of a sperm-cell, but, later on, it lives free in the sperm-sac outside the sperm-cells. The author describes various stages in the life-history of the form, the various phases of which are stages in sporulation. These he divides as follows:—A. Preparatory stages and amitosis; (1) Diffusion or budding of the macronucleus; (2) formation of numerous micronuclei. B. Formation of the spores: (3) attraction by the micronuclei of cytospheres forming sporoblasts; (4) divisions of micronuclei by karyokinesis; (5) transformation of each sporoblast into a shuttle-spore; (6) to these may probably be added another stage, the formation of sickle-sperms in the shuttle-spore, but this stage has not been observed, and its existence can only be inferred from what takes place in other Sporozoa. With regard to the division of the adult, of which a short account is given, the author thinks that the object of this division is not the propagation of the species, but rather a convenient subdivision of the large forms. New macronuclei are sometimes formed in the new individual, but not always. Micronuclei are always formed previous to the segregation of the new individual. In one of the principal stem-separating individuals the process of sporulation may be more advanced than in any of the other parts while all yet connected together. *Spermatobium* appears by its characters to be intermediate between *Klossia* and *Monocystis*, and the author thinks that it demonstrates that Gregarines cannot properly be systematically divided according as their habitat is intracellular or cœlomic. In *Spermatobium* the young individual inhabits the mother-cell just as does *Monocystis*, and the adult dwells free in the fluid surrounding the sperm-cells. While *Spermatobium*, like *Monocystis*, developes a shuttle and pseudo-navicellar spores, the formation of the sporogonium, the sporoblasts and the spores resembles much more that of *Klossia*.

Trichomonas in the Urine of Man.‡—Dr. F. Marchand, Mr. K. Miura, and Dr. G. Dock, almost simultaneously call attention to the presence of *Trichomonas vaginalis* in the urine of man. It is not certain how the parasite passed into the urinary ducts, but it is not unreasonable to suppose that it occurred during coition.

Molluscum contagiosum and Pigeon Pock.§—Sig. P. Mingazzini has studied the *acne varioliforme* of man and that of birds, and concludes

* Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 285–302 (3 pls.).
† Proc. Cal. Acad. Sci., v. (1895) pp. 1–33 (1 pl.).
‡ Zool. Centralbl., ii. (1895) pp. 110–1.
§ Bull. R. Accad. Med. di Roma, xx. (1893–4) 27 pp. (2 pls.). See Ann. de Microgr., vii. (1895) p. 123.

that both are due to a parasite belonging to the Sporozoa. The parasite develops within the cytoplasm, close to the nucleus, and by its slow increase gradually supplants the cell-contents, assuming the characteristic shape and appearance known as molluscum grains. Thus the grains are the parasites.

The author's experiments to show that the acne of birds can be inoculated and transmitted were quite successful, and not only were healthy individuals directly infected, but also indirectly, e. g. by cohabitation of healthy and contaminated individuals. The author fixed his material with acetic acid sublimate, and stained the sections with Boehmer's hæmatoxylin, borax-carmine, by Gram's method, and with methylen-blue.

Observations on Variola and Syphilis.* — M. J. J. Clarke has studied the Sporozoa of variola from inoculations on the cornea of guinea-pigs and rabbits. Staining the sections with picrocarmine or hæmatoxylin and eosin. The smallest parasites, which are intracellular, exhibit peripheral processes which recall the Suctoria; these lie in depressions of the nucleus, though really in the cytoplasm. As they increase in size they possess a well-defined outline, inside which may be seen a peripheral layer of granules. The largest forms are of two varieties, one similar to the last described, but containing a nucleus which may be fragmented or dividing, and free elongated bodies with expanded ends. The parasite, whether free or intracellular, may contain spores, and, owing to its strongly refracting properties, can be detected in unstained sections. In variola very similar appearances are found, and the parasites of vaccinia and variola are asserted by the author to be homologous with those of cancer and sarcoma.

The author also describes certain appearances which he has observed in syphilitic sores, and which have a striking resemblance to Sporozoa, and he confirmed these observations by inoculating the cornea of a guinea-pig with syphilitic virus. Bodies stainable with eosin were found both in the cytoplasm and in the nucleus, but spore-formation and the presence of a nucleus in these intracellular parasites were not detected. The material was fixed with Foà's solution.

Hæmatozoa of Ophidia.† — Dr. A. Billet has, in Tonquin, found hæmatozoa in *Python reticulatus*, *Bungarus fasciatus*, and *Tropidonotus stolatus*. In *P. reticulatus* the parasite, which is longer than a red corpuscle, lies coiled up within the disk; one extremity is rounded and the other tapering. There is a central nucleus and chromatin granules. The author designates it *Danilewskya pythonis*. In *B. fasciatus* the commonest endoglobular form of the parasite is a falciform body, usually closely embracing the nucleus, and in general appearance it resembles the crescents found in human malaria. Its length is about half that of the blood disk. It is called by the author *Laverania bungari*. The parasite of *Tropidonotus* is not described, though its existence is affirmed.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 300–3 (1 pl.).
† Ann. de Microgr., vii. (1895) pp. 171–3.

BOTANY.

A. GENERAL, including the Anatomy and Physiology of the Phanerogamia.

a. Anatomy.

(1) Cell-structure and Protoplasm.

Reduction of the Chromosomes in Sexual Cells.*—Dr. V. Haecker points out that the account given by Strasburger of the period when the reduction of the number of chromosomes takes place is not in harmony with the observations of zoologists on the same process in the animal kingdom, and suggests that it may be the result of an erroneous interpretation. He especially contests the statements of Strasburger that "the reduction takes place directly, both in the mother-cells of the pollen and in the mother-cells of the embryo-sac, and in such a manner that the reduced number of chromosomes is at once apparent in the prophase-stage"; and that "the diminution in the number of chromosomes by half is due to the fusion into one of two chromosomatic individuals." He thinks it possible that the reductions observed by botanists are only "pseudo-reductions."

(2) Other Cell-contents (including Secretions).

Cytoplasmic Crystalloids.†—Miss L. H. Huie records the occurrence of protein crystalloids imbedded in the cytoplasm of the unicellular hairs which spring from the placenta in the ovary of *Scilla patula;* the only instance of cytoplasmic crystalloids hitherto recorded being in the potato-tuber. They appear to have some relation to the nucleole. It is suggested that the function of these placental hairs, so rich in protoplasm and crystalloids, is to nourish the pollen-tube, and guide it to the micropyle of the ovule. The mode of fixing and staining is described in detail.

Plurality of Chlorophylls.‡—M. A. Gautier calls attention to the fact that he had already, previously to the observations of Etard, pointed out that the chlorophyll of living plants is not uniform in its composition, that of rye-grass differing in this respect from that of spinach; while that of *Aspidium Filix-mas* differs again in its properties from both the above.

Protophyllin.§—M. C. Timiriazeff maintains that the protochlorophyll of Monteverde is identical with the substance already known as protophyllin, which can be obtained artificially from chlorophyll by a process of reduction. Protophyllin is immediately oxidised by the action of light, and this is the cause of the greening of etiolated parts of plants.

* Ann. Bot., ix. (1895) pp. 95–101. Cf. this Journal, *ante*, p. 64.
† La Cellule, xi. (1895) pp. 83-92 (1 pl.).
‡ Comptes Rendus, cxx. (1895) pp. 355–6. Cf. this Journal, *ante*, p. 330.
§ Comptes Rendus, cxx. (1895) pp. 465–7. Cf. this Journal, 1894, p. 702.

Localisation of the Alkaloids in the Solanaceæ.* — M. P. Molle has investigated the distribution of the four alkaloids, atropine, hyoscyamine, hyoscine, and nicotine in the various organs of the Solanaceæ. He finds them generally distributed through the aerial parts, but most concentrated in the youngest vegetative organs, especially in the epiderm and the vascular bundle-sheath; they abound also in the root-cap. In the floral organs the largest quantity is contained in the carpels and ovules. In the mature seeds the alkaloids occur only in the integument, never in the embryo or endosperm.

Distribution and Function of Carotin.†—Dr. H. Ritter Schrötter-Kristelli has found carotin in the aril of *Afzelia Cuanzensis* (Leguminosæ) dissolved in a fatty oil, and not—as in all cases hitherto observed in flowering plants—in connection with the chromatophores. It has been described by Zopf as being in a similar way dissolved in a fatty oil in the rudimentary sporanges of a species of Mucorini. The author believes carotin to be nearly related to the group of cholesterins, and to have a function connected with the respiration of the plant. For the group of the yellow pigments of plants and animals to which carotin belongs he proposes the name *lipoxanthins*. They occur in green leaves, autumn leaves, many flowers and fruits, arils, roots (carrot), in *Euglena* and the eye-spot of the swarm-spores of Ulvaceæ, in lichens, bacteria, and Myxomycetes. These must be distinguished from another group of yellow pigments which are dissolved in the cell-sap, and are not connected with the chromatophores. A copious bibliography of the subject is appended.

Classification of Mucilages.‡—Instead of the usual primary classification of mucilages into the two groups, cellulose-mucilages and true mucilages, M. L. Mangin proposes to distinguish them first of all into simple and mixed mucilages. The former are then classed under three heads—cellulose-mucilages, pectose-mucilages, and callose-mucilages, the characteristics of which are given in detail with respect to their physical, chemical, optical, and staining properties. Cellulose-mucilages are very rare, being almost confined to those derived from the roots of Orchideæ, known as salep. Among pectose-mucilages are included those of the Malvaceæ, Tiliaceæ, Rosaceæ, and Abietineæ, and the mucilaginous sheath of certain algæ, such as *Zygnema*, *Glœosporium*, *Nostoc*, &c. Callose-mucilages occur in sieve-tubes, the membrane of the sporange of the Mucorini, &c., &c. Among mixed mucilages the only combination known to the author is that of cellulose and pectose-mucilages in varying proportions. They occur especially in seeds and pollen-grains, and are formed at the expense of cell-walls in contact with the air. Indeterminate mucilages, which cannot be included under either of the above categories, also occur, such as that of the endosperm of the seed of the carob.

Mucin in Plants.§—According to M. J. Ishii, the mucilages found in plants are not, as a rule, protein compounds, like those of animals,

* Bull. Soc. Belge Microscopie, xxi. (1895) pp. 8–20.
† Bot. Centralbl., lxi. (1895) pp. 33–46.
‡ Bull. Soc. Bot. France, xli. (1894) Sess. Extraord., pp. xl.–ix.
§ Bull. Agric. Coll. Imp. Tokyo, 1894, pp. 97–100. See Journ. Chem. Soc., 1895, Abstr., p. 128.

but carbohydrates. But an investigation of the mucilaginous matter found in the tuberous roots of the yam, *Dioscorea japonica* and *D. batatas*, showed that it contains nitrogen, and possesses all the essential characteristics of animal mucin.

Mucilage of the Malvaceæ.*—M. A. Guiraud has investigated the distribution of the mucilages in the officinal Malvaceæ, especially in *Malva sylvestris* and *Althæa officinalis*. He states that the receptacles are not of lysigenous origin, as has usually been stated. The mucilage is found in all the organs, and results from the gelatinisation of the walls of special cells found only in the secondary parenchyme. It may remain in enclosed cells, or may flow out into passages or receptacles formed by a dissociation of the tissue.

In the root the formation of the mucilage coincides with that of the secondary structures. In the stem of *Malva* the mucilage-cells appear first in the pith, then in the cortical parenchyme, the collenchyme, and the hypodermal parenchyme; it is most abundant in the periphery of the stem, where it arises partly in the cells, partly in the intercellular spaces. In the leaf its formation follows a similar course to that in the stem, occurring both in the cells and in special receptacles; it is especially abundant in the leaf of *M. sylvestris*. Mucilage is very abundant in the flowers of *Althæa* and *Malva*, but its distribution is very variable; in *M. sylvestris* it occurs in large quantities in the epiderm of the calyx and epicalyx, and in the fundamental parenchyme of the petals.

Presence of Emulsin in Manihot.†—M. L. Guignard notes the presence of emulsin in several Brazilian species of *Manihot* which yield the starch known as manioc. Its localisation is the same as that of papayin in the Papayaceæ, viz. in the laticiferous system of the embryo. Myrosin is also present, but not within the laticiferals.

(3) Structure of Tissues.

Cuticularisation and Cutin.‡—M. C. Van Wisselingh has established, by physical and microchemical investigations, an essential difference between the processes of cutinisation and suberisation. Cork is never formed at an early period; it always makes its appearance in the phellogen on the inner side of the cell-wall, and is in direct contact with the protoplasm. The cuticle, on the other hand, is always present in the embryo, clothing the outer side of the epidermal cells; it is always separated from the cell-contents by layers of cellulose.

Cutin always consists partially of fusible constituents, though the temperature at which their fusion takes place varies greatly, from below 100° to 200° C. Phellonic acid is never present. Cutin is, as a rule, less easily saponified by potassium hydrate than suberin. The products of saponification differ from the corresponding products in the case of

* 'Du développement et de la localisation des mucilages chez les Malvacées officinales,' Toulouse, 1894, 117 pp. and 4 pls. See Bot. Centralbl., lxi. (1895) p. 376.

† Bull. Soc. Bot. France, xli. (1894) Sess. Extraord., pp. ciii.–vii. Cf. this Journal, 1894, p. 468.

‡ 'Over Cuticularisatie en Cutine,' Amsterdam, 1894, 32 pp. and 2 pls. See Bot. Centralbl., lxii. (1895) p. 234.

cork; they generally consist of yellowish spheres or masses, largely composed of readily fusible substances.

Development of Sieve-tubes in Angiosperms.* — In the vine (especially near the root-tips) M. L. G. Chauveaud finds sieve-tubes which result from the transformation of procambial cells without septation, and consequently without the production of the so-called "companion-cell." They may lengthen to as much as 50 times their diameter. The indirect mode of formation of sieve-tubes is not therefore, as has been stated, universally characteristic of Angiosperms as contrasted with Gymnosperms. The author has observed the direct mode in several other instances. The two modes of development may even occur in the same bundle, as is the case with wheat.

Structure and Arrangement of Laticiferous Tubes.† — Dr. O. Chimani has studied this subject, especially in the case of those plants which yield gutta-percha and caoutchouk. The best staining reagent for the resin of the latex was found to be a solution of alkanna in acetic acid.

Gutta-percha is yielded almost exclusively by plants belonging to the Sapotaceæ; caoutchouk by plants belonging to the natural orders Moraceæ (including Ficeæ), Euphorbiaceæ, and Apocynaceæ. The characters of a number of species are described in detail, especially the dimensions of the laticiferous tubes. The tubes of the Sapotaceæ are distinguished by their remarkably short segments; but the septa are resorbed in the middle, leaving only a very thin membrane. The solid particles contained in them have a bone-shaped form. The tubes of those plants which yield caoutchouk are usually branched, but they never anastomose; they are often segmented. They frequently have an elongated lens-shaped transverse section, due to partial obliteration; this occurs especially in *Landolphia* (Apocynaceæ). The medullary sheath exhibits peculiar large interruptions. The presence of latex was determined in the hairs of *Castiloa elastica*.

Tanniferous Cysts in the Root.‡ — Dr. A. Pistone describes a peculiar structure which he finds in the radical cone of *Phœnix dactylifera*, causing tubercles which superficially resemble those of the roots of Leguminosæ. It is due to the presence of cysts containing tannin; this tannin is formed in the cell itself, and accumulates temporarily between the intercellular substance and the cell-wall. After a time one of the walls becomes invaginated, and the pocket thus formed constitutes a receptacle in which are formed spherical drops; the substance of which they are composed remains in this form until it is required for the use of the plant. The membrane which surrounds these drops, and the peduncle which attaches them to the cell-wall, are composed of cellulose derived from the wall of the enclosing cell of which they form a part.

Phloem-islands in the Xylem of Strychnos.§—M. E. Perrot has investigated the mode of formation of the phloem-islands in the xylem of the stem of *Strychnos nux-vomica* and of other species of the genus,

* Comptes Rendus, cxx. (1895) pp. 165–7.
† Bot. Centralbl., lxi. (1895) pp. 305–13, 353–60, 385–94, 417–26, 449–61 (2 pls.).
‡ Nuov. Giorn. Bot. Ital., ii. (1895) pp. 62–9.
§ Journ. de Bot. (Morot), ix. (1895) pp. 90–5 (3 figs.); Bull. Soc. Bot. France, xlii. (1895) pp. 209–12.

and his results are not altogether in accordance with those of Scott and Brebner.* He states that the phenomenon is not due to the secondary formation of a complementary cambium, but to a gradual resumption of the normal function. The cambium-layer, notwithstanding its frequently strong sinuosities, remains continuous, but becomes unilateral in places, in a similar way to a periderm, which forms bark only, and not phelloderm, in the centripetal direction.

Monocotyledons with Secondary Growth.†—M. J. H. de Cordemoy enumerates the comparatively few cases in which this phenomenon is known in Monocotyledons:—In the Aloineæ and Dracæneæ among Liliaceæ; in *Agave*, *Fourcroya*, and *Crinum* among Amaryllideæ; in *Aristea corymbosa* among Irideæ; and in the roots of Dioscoreaceæ. The secondary tissue is composed of parenchyme and tracheid-vessels. The presence of this tissue indicates the highest type of Monocotyledons, and is a step in the passage to Dicotyledons.

Formation of Callus in Cuttings.‡—Herr H. Tittmann has made a series of observations on the formation of callus in cuttings of woody plants (chiefly *Populus nigra* and *pyramidalis*). If the cutting have two cut surfaces, he finds the callus to be formed equally on both when placed in similar conditions. The process is simply traumatic, and is independent of the action of light or of gravity. A polarity is subsequently developed in erect cuttings, causing the formation of shoots at one end, roots at the other. If inverted, the basal callus may be induced to form shoots, while the apical callus does not form roots. Under unequal conditions of the two ends of the cutting, callus may be produced at one only. If a cutting is ringed, each portion behaves like an unringed cutting; and they cannot again be united into a single cutting unless the continuity of the bark is restored.

Anatomy of the Santalaceæ.§—From an examination of 21 out of the 28 genera of Santalaceæ, Herr M. Behm derives the following general anatomical characteristics of the order:—The vascular bundles are collateral; the walls of the vessels which are in contact with the parenchyme of the medullary rays usually have bordered pits, as also has the xylem-prosenchyme; there are no mucilaginous epidermal cells in the leaf; the guard-cells of the stomates have almost always, right and left, a pair of parallel companion-cells; there are no glandular hairs or secretion receptacles; while groups of silicified cells, and single crystals, or clusters of crystals, are common. The genera *Champereia*, *Myzodendron*, and *Grubbia* present several abnormalities in their anatomical structure.

Anatomy of the Caprifoliaceæ.‖—Dr. L. Linsbauer describes the anatomical structure of a number of species of Caprifoliaceæ, which order he divides, from morphological and anatomical considerations,

* Cf. this Journal, 1890, p. 199.

† 'Rech. sur les Monocotylédones à accroissement secondaire,' Lille, 1894, 108 pp. and 3 pls. See Bot. Centralbl., 1895, Beih., p. 89. Cf. this Journal, *ante*, p. 67.

‡ Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 164–95.

§ Bot. Centralbl., lxii. (1895) pp. 65–74, 97–107, 129–39, 161–70, 193–210.

‖ Verhandl. K. K. Zool.-bot. Gesell. Wien, xlv. (1895) pp. 43–68 (1 pl.).

into the three tribes Sambuceæ, Viburneæ, and Lonicereæ. The genera are not, as a rule, to be distinguished by anatomical characters; but this is the case, in some instances, with the species. *Sambucus* appears to be invariably characterized by the presence of tannin-receptacles. The anatomical characters point to a near alliance between the Caprifoliaceæ and the Rubiaceæ.

Structure of Christisonia.*—Mr. W. C. Worsdell describes the structure of several parasitic species of this genus belonging to the Orobanchaceæ, and the modifications in that structure induced by their mode of life. These are mainly as follows:—The branching and anastomosing root-system; the rhizome-like character of the roots and the absence of root-hairs; the development in one species of tubers from which the haustoria and the young lateral roots and stems are produced, and which serve as store-houses for the nutrition of the plant; the modified anatomical structure of the cylinder of the root, in which the xylem has become reduced and the phloem correspondingly developed; and the reduction of the conducting tissue of the stem, correlated with the absence of foliage-leaves, which are replaced by scales. The tubers of *C. subacaulis* belong to the root. The haustorium is of exogenous origin, as in *Rhinanthus*.

(4) Structure of Organs.

Doubling and Reduction in Flowers.†—According to Dr. L. J. Celakovsky, the true nature of a normal doubling of the parts of a flower cannot always be determined from the phenomenon itself. It is not a division of original simple leaves, but a union, or at least an approximation, of parts which were at first distinct and at an equal distance apart. Normal doubling is the result of an incomplete passage from a larger to a smaller number of parts. In some Hypericaceæ and Malvaceæ, and in the Myrtaceæ, the petals are the result of a basipetal branching from the base of the polyandrous primordia; in the Primulaceæ from the base of the simple rudiments of stamens.

Opening and Closing of Flowers.‡—From a series of observations on a number of different flowers, Herr F. Oltmanns states that, in the case of ephemeral flowers, the time which they remain open is greatly lengthened by keeping them in the dark; and they then behave like flowers which open and close periodically. Those flowers which only close late in the evening agree in all essential points with leaves which exhibit nyctitropic movements. In the case of flowers which open at night, even a diminution of light causes them to open, an increase of the light to close.

Flower of Naias.§—Herr P. Magnus enters into a full description of the morphology of the male and female flowers of *Naias*, and dissents in several points from the interpretation of Schumann.

* Ann. Bot., ix. (1895) pp. 103–36 (2 pls.).
† SB. K. Böhm. Gesell. Wiss., 1894, 142 pp. and 5 pls. (German). Cf. this Journal, *ante*, p. 68.
‡ Bot. Ztg., liii. (1895) 1te Abtheil., pp. 31–52.
§ Ber. Deutsch. Bot. Gesell., xii. (1894) pp. 214–24 (1 pl. and 3 figs.).

Mechanics of the Dehiscence of Anthers.*—Herr C. Steinbrinck has investigated the cause of the dehiscence of ripe anthers, and agrees with previous observers in his account of the structure of the anther-wall at the line or point where the dehiscence takes place. The wall consists of three layers of cells, the middle of which is provided with thickening-fibres. In his mechanical explanation of the rupture he agrees most nearly with Schrodt, ascribing the cause chiefly to changes which take place in the thin portions of the radial walls.

Female Flower of Coniferæ.†—M. M. Radais has studied the development and structure of the female flower in the various tribes of Conifers. It is only, he states, in the Taxoideæ that the seed remains naked till maturity; and in them it is protected by a very firm integument, and frequently by an aril as well. In the Pinoideæ the ovule is naked only till the time of flowering; from that time the scales of the cone afford it an even more complete protection than that possessed by many Angiosperms. The ovule, with its integument, takes over, in Coniferæ, nearly all the functions which, in Angiosperms, belong to the flower.

The author regards the Coniferæ as Archegoniatæ, in which the phenomena of impregnation have been modified in consequence of this process taking place outside the water. The megasporange (nucellus) is furthermore enclosed in an integument homologous to that of the ovule of Angiosperms. The antherozoid is replaced by a non-motile gamete; and this is accompanied by a reduction in the size of the male prothallium, and in a modification in its form to facilitate the carriage of the male to the female gamete. The detention of the pollen-grain which, in Angiosperms, is effected by the stigma, is, in Conifers, brought about by the integument of the ovule.

The term flower is used in a somewhat different sense, homologically, in Conifers to what it is in Angiosperms; the ovule of the former corresponding to the pistil of the latter, i. e. to a female flower of the simplest kind.

Phyllotaxis.‡—M. C. De Candolle derives the following general conclusions from a study of the various forms of phyllotaxis:—With radial shoots the phyllotaxis depends essentially on the elongation of these shoots by transverse growth; the foliar protuberances must be considered as the effects of local accelerations of transverse growth. This accounts for the diminution of longitudinal growth at the growing point. During the development of each shoot the relation of growth in length to transverse growth usually increases at first and subsequently diminishes. It is this diminution which causes a crowded phyllotaxis, such as that of buds and of floral organs, near the extremity of shoots or of their ramifications.

Anisophylly.§—Prof. J. Wiesner describes several fresh examples of anisophylly in tropical plants, including a new form which he terms

* Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 54–61 (5 figs.). Cf. this Journal, 1885, pp. 91, 1032.

† 'La fleur femelle des Conifères,' Paris, 1894, 103 pp. and 27 figs. See Bot. Centralbl., lxi. (1895) p. 329.

‡ Arch. Sci. Phys. et Nat., xxxiii. (1895) pp. 121–47 (1 pl.).

§ Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 89–93.

lateral anisophylly. He regards the phenomenon as generally connected with arrangements for the supply of light to the foliage. It is especially frequent in trees and shrubs with large deciduous leaves, and is, therefore, less commonly met with in tropical than in temperate vegetation. Lateral anisophylly affords no special advantage to the plant.

Rain-leaves, Dew-leaves, and Snow-leaves.*—Pursuing his observations on the adaptations of leaves to excessive rainfall, Herr J. A. Jungner states that, in the Cameroon Mountains, these consist of a pendent position of the lamina, smooth surface, an apiculate apex, the absence of teeth on the margin, and the presence of a cushion at the base of the lamina, the very short petiole being frequently entirely converted into a structure of this kind; when the leaf is compound each leaflet has its own cushion. The object of these cushions appears to be to give a certain motility to the leaf or leaflet, by means of which it can assume the most favourable position in relation to the external conditions.

It is not all the plants growing in rainy climates that have leaves of this description, though they are by far the most common; the author notes also the occurrence of what he calls "Dew-leaves" and "Snow-leaves." The former are erect and usually obovate in shape; this form is especially adapted to utilise the dew, and to protect the leaf against the injurious effects of excessive light.

Hanging Foliage of Tropical Trees.†—Mr. F. W. Keeble discusses the purpose of the pendent position of the young leaves of many tropical trees, belonging almost entirely to the Cæsalpinieæ, and points out the advantage which the foliage may thus derive in protection against excessive insolation and transpiration.

Leaves of Alpine Plants.‡—A study of the leaves of alpine plants leads M. F. Boergesen to the following general conclusions:—The greater number of species have stomates on both surfaces of the leaf, frequently even in greater numbers on the upper surface. The stomates are not depressed beneath the surface. The mesophyll has a very lacunar structure. The palisade-tissue is but feebly developed, in connection with the feeble intensity of the light; in many species growing in high latitudes it is entirely wanting. The development of the mechanical tissue is, in general, inconsiderable, and it is often almost entirely absent.

Leaves of Conifers.§—According to Herr K. J. May, the length of life of the leaves of evergreen Conifers varies between $1\frac{1}{2}$ and $10\frac{1}{2}$ years, differing often greatly in the same species according to the conditions of growth. In some conifers the fall of the leaf takes place at one period only of the year, either in the spring or the autumn; while in others it continues without intermission throughout the year.

* Bot. Notiser, 1893, 94. See Bot. Centralbl., lxi. (1895) p. 434. Cf. this Journal, 1892, p. 62.

† Ann. Bot., ix. (1895) pp. 59–94 (1 pl.). Cf. this Journal, *ante*, p. 194.

‡ Journ. de Bot. (Morot), ix. (1895) pp. 1–7, 21–7 (4 figs.). Cf. this Journal, *ante*, p. 194.

§ Zeitschr. f. Forst. u. Jagdwesen, xxvi. (1894) pp. 648–60. See Bot. Centralbl., 1895, Beih., p. 25.

Leaves of Cycadeæ.*—Dr. A. Nestler has examined the structure of the leaves in the various genera of Cycadeæ, especially in reference to the distribution of the stomates. With very few exceptions, they occur on the under side of the leaf only, and the same is true of the rachis. The development of the hypoderm and of the palisade-tissue varies in the different genera. Deposits of calcium oxalate occur commonly in thin-walled parenchymatous cells scattered through the mesophyll, especially in the immediate neighbourhood of the vascular bundles and fibres of sclerenchyme.

Vegetative Organs of the Taccaceæ and Dioscoreaceæ.†—M. C. Queva enters into this subject in great detail, taking as types of the Taccaceæ *Tacca pinnatifida* and *Ataccia cristata*. In the former the tuber makes its first appearance as a slight swelling at the base of the second leaf of the seedling.

In the Dioscoreaceæ he distinguishes three kinds of tuber, those belonging to the type of *Tamus*, of *Helmia*, and of *Dioscorea*, in addition to the rhizome of the type of *Dioscorea quinqueloba*. The tuber of *Testudinaria elephantipes* belongs to the *Tamus* type.

Anatomy of Typhaceæ.‡—Sig. F. Saccardo discusses the morphology of the vegetative and reproductive organs of *Typha* and *Sparganium*, and concludes that there is less essential difference in the floral structure than was assumed by Engler. The differences, on the other hand, between these genera and the Pandanaceæ are much more deeply seated, especially in their histological structure. The Pandanaceæ are undoubtedly an ancestral type from which *Sparganium* is descended, and *Typha* again from the latter.

β. Physiology.

(1) Reproduction and Embryology.

Part taken by the Antipodals in Polyembryony.§—Herr S. Tretjakow has studied the phenomenon of polyembryony in *Allium odorum*. Besides the central nucleus of the embryo-sac, the ovum-cell, and the two synergids, there are three antipodals, one of which is larger than the other two, and resembles the ovum-cell in the arrangement of its contents, while the other two more resemble the synergids. Polyembryony results from the development of one or all of the antipodals as well as of the ovum-cell. This appears to be parthenogenetic, the author never having been able to detect any impregnation of the antipodals by the pollen-tube. He was able, however, to follow out the formation of an eight-celled body from the division of the nucleus, the process being strictly analogous to that of an ordinary embryo. A process of nuclear division was also observed in one of the synergids.

The author regards the antipodals as homologous with the vegetative cells of the female pro-embryo of some ferns, for the development from them of embryos is analogous to the phenomenon of apogamy in ferns.

* Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 341–68 (4 pls.).

† 'Rech. sur l'anat. de l'appareil vég. des Taccacées et des Dioscorées,' Lille, 1894, 457 pp., 18 pls. and 702 figs. See Bot. Centralbl., lxi. (1895) p. 401. Cf. this Journal, *ante*, p. 69.

‡ Malpighia, ix. (1895) pp. 3–30 (6 pls.).

§ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 13–7 (1 pl.).

Antipodal Cells of Knautia.*—M. Molliard describes a process which takes place in the embryo-sac of *Knautia arvensis* (and *Dipsacus pilosus*) after impregnation. A constriction appears in the sac, which separates a smaller basal portion, containing the antipodals, from the larger upper portion. The cells of the nucellus adjacent to the lower portion of the embryo-sac now divide and put out processes into the sac, which form a more or less compact tissue round the antipodals, completely filling up the portion of the embryo-sac beneath the constriction. This completely divides the sac into two portions, the upper occupied by the embryo and the endosperm, the lower by the antipodals surrounded by the nucellar tissue. This new tissue finally disappears along with the tissue of the nucellus.

Cross-pollination and Self-pollination.†—Herr O. Ekstam describes the arrangements for pollination in a number of species of the Swedish Alps, belonging to the orders Polygonaceæ, Ranunculaceæ, Geraniaceæ, Caryophyllaceæ, Saxifragaceæ, Ericaceæ, &c. *Cerastium vulgare* is described as being always self-pollinated.

Mr. C. Robertson ‡ describes the mode of pollination, and the insect-visitors of *Dodecatheon Meadia* and *Steironema ciliatum* (Primulaceæ), *Enslenia albida* (Asclepiadaceæ), *Gentiana puberula*, and of several species of *Phlox*, *Lithospermum*, *Physalis*, and *Mimulus*. In several instances a copious bibliography is appended.

Mr. J. McLeod § treats of the same phenomena in 667 species of flowering plants, natives of Flanders. Among these, 215, or 31·8 per cent., are anemophilous; this very large proportion is due to the great extent of water, and to the heavy rainfalls. These conditions are especially favourable to the hygrophilous and anemophilous Gramineæ, Cyperaceæ, and Juncaceæ, and unfavourable to insects. The author makes the observation that in the enormous majority of anemophilous and hygrophilous plants, the fruit contains only one or a very small number of seeds, corresponding to the very small number of pollen-grains deposited on the stigma by the wind, as compared to that carried by insects.

Mr. J. Schneck ‖ describes the adaptations in the flowers of *Cleome spinosa* (Capparideæ) for pollination by humming-birds, humming-bird-moths, honey-bees, and wasps.

Cleistogamous Flowers.¶—Sig. A. De' Bonis describes the cleistogamous flowers of *Portulaca grandiflora*, *Salpiglossis sinuata*, and *Lamium amplexicaule*. The production of these flowers he attributes to unfavourable vital conditions, especially sterility of the soil.

Hybridisation without Crossing.**—M. A. Millardet records a number of cases in which the impregnation of one variety of strawberry by the pollen of another variety did not produce, as is usually the case, intermediate forms, but forms reproducing perfectly the characters of

* Bull. Soc. Bot. France, xlii. (1895) pp. 9–10.
† Ofv. K. Vetensk.-Akad. Förh. Stockholm, li. (1894) pp. 419–31.
‡ Bot. Gazette, xx. (1895) pp. 104–10, 139–49.
§ Bot. Jaarb. (Gent), vi. (1894) pp. 119–511 (many figs.). See Bot. Centralbl., lxi. (1895) p. 331.
‖ Bot. Gazette, xx. (1895) pp. 168–70 (2 figs.).
¶ Bull. Soc. Bot. Ital., 1895, pp. 21–4, 69–70.
** Mém. Soc. Sci. Phys. et Nat. Bordeaux, iv. (1894) pp. 347–72 (1 fig.).

either the male or the female parent, most usually the latter. For hybrids which thus exhibit no characters of crossing the author proposes the term *pseudo-hybrids*. The phenomenon is not confined to the genus *Fragaria*, but occurs also in *Vitis* and *Rubus*.

(2) Nutrition and Growth (including Germination, and Movements of Fluids).

Germination of Myristica fragrans.*—Herr A. Tschirch points out the purpose of the light lines which are visible to the naked eye on sections of the nutmeg, permeating the whole length of the endosperm, bordering the rumination-projections, and passing over into open crevices near the cotyledons. These lines consist of two or three layers of cells, differing in form and in their contents from the rest of the endosperm, and furnishing a conducting path for the tips of the cotyledons which serve as absorbing organs; these enter the crevices, and then pass along the lines to the other end of the seed, absorbing the reserve-materials from the endosperm.

Influence of Calcium and Magnesium on the Development of the Cell.†—As the result of experiments on the growth of species of *Spirogyra*, *Zygnema*, and *Mesocarpus*, Herr T. Bokorny states that calcium has more influence on their development than any other mineral ingredient except potassium. In its absence their growth is very feeble. The absence of calcium has especially a deleterious effect on the formation of chlorophyll; while the absence of both calcium and magnesium acts prejudicially on the development of the nucleus.

Action of the Water of the Soil on Vegetation.‡—From a series of experiments on the growth of plants in different soils—chiefly on *Erigeron canadensis* and *Phaseolus vulgaris*, and on the production of root-tubercles in *Lupinus albus*—M. E. Gain finds that each species has its own optimum of humidity, and that this has a special influence on the development of the tubercle-microbe *Rhizobium Leguminosarum*. This optimum further varies in each species according to its stage of growth. Saturation of a soil previously dry introduces important perturbations in the supply of sap. Transpiration is most energetic when the soil is moist. If the optimum of turgescence of a plant is exceeded, transpiration decreases. There is, in fact, at every moment of growth, an optimum turgescence for the functions of nutrition.

Grand Period of Growth in the Fruit of Cucurbita.§—Mr. A. P. Anderson gives a long series of tables and diagrams illustrating the rate of growth of the fruit of *Cucurbita pepo* from the time of fertilisation to that of ripening. The development can be divided into three periods:—a period of active and continuous increase from the time of pollination to the grand maximum; one of decline in the daily increase, and rise in the daily decrease from the grand maximum to the beginning of ripening;

* Ber. Pharm. Gesell., 1894, pp. 260–4 (1 pl.). See Bot. Centralbl., lxii. (1895) p. 84.

† Bot. Centralbl., lxii. (1895) pp. 1–4.

‡ Rev. Gén. de Bot. (Bonnier), vii. (1895) pp. 15–26, 71–84, 123–38 (1 pl. and 2 figs.).

§ Minnesota Bot. Studies, 1895, pp. 238–79 (10 pls.). Cf. this Journal, 1894, p. 369.

and the ripening period. During this latter period an extended decrease (due to transpiration) lasting throughout the daily hours was quickly followed by the maximum increase. At the time of the grand maximum the fruit gained 782 grams in weight during 24 hours. The variations in length of the internodes occurred simultaneously with corresponding increase and decrease in the weight of the fruit.

Growth of the Root.*—Prof. W. Pfeffer corrects an erroneous statement in a previous publication, viz. that the growth in length of the apex of the root is promoted if growth is checked in the rest of the root. This statement was founded on erroneous observation.

Dependence of the Leaf on its Power of Assimilation.†—From a series of experiments, chiefly on *Phaseolus*, *Acacia*, and *Mimosa*, Dr. L. Jost states that substances formed in the parts of a plant exposed to light may be used up, in the darkened parts, for the formation of new organs, or the development of those already formed. A leaf formed in the dark, and continuing in it, can, therefore, attain its normal development without itself assimilating; while a leaf formed in the light will not unfold and become green in the dark, or in an atmosphere free from carbon dioxide. It follows therefore that the production of the chlorophyll pigment is dependent directly on its power of assimilation, while the development of the leaf is only indirectly dependent on that process.

Assimilation and Respiration.‡—Mr. F. F. Blackman claims to have shown, by a new application of the baryta method of determining the amount of carbon dioxide exhaled by plants, that, under normal conditions, practically the sole pathway for carbon dioxide, in passing into or out from the leaf, is through the stomates; although, under abnormal conditions, such as the closing of the stomates, a passage of the gas through the cuticle by osmose may take place. Isolated green leaves, when fully illuminated, allow no carbon dioxide to escape from them. The principal novelty in the process employed consists in the use of only a very small quantity of solution of baryta to absorb the carbon dioxide formed, the whole being titrated with acid in the tube in which the absorption has taken place. The plants experimented on were *Ampelopsis hederacea*, *Ricinus communis*, *Alisma Plantago*, and *Iris germanica.*

(3) Irritability.

Sensitive Movements under Coloured Screens.§—As the result of a series of experiments on several plants with sensitive leaves (*Oxalis stricta* and several species of *Cassia*), Dr. J. M. Macfarlane somewhat modifies his previous view that the paraheliotropic movements of sensitive plants are due chiefly or entirely to the action of solar heat-rays. He finds the exciting agents to be certain of the light-rays. When sensitive plants are placed under coloured screens, the leaflets fold as in the nyctitropic state, most powerfully under red, less so under yellow, only feebly or not at all under green light, while under blue

* Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 481–3.
† Tom. cit., pp. 403–80 (1 pl. and 1 fig.).
‡ Ann. Bot., ix. (1895) pp. 161–8; Proc. Roy. Soc., lvii. (1895) pp. 162–8.
§ Bot. Centralbl., lxi. (1895) pp. 136–46, 177–84. Cf. this Journal, 1894, p. 593.

screens the leaflets remain open as in ordinary daylight. In all cases nyctitropic movements are accelerated under a red screen; not quite so strongly under a yellow screen; under a green screen the movements practically coincide in time with those of exposed plants, and are beautifully regular in sequence; under blue light there is a distinct retardation of the normal nyctitropic period. Up to 38°, or even 43° C. in some species, heat-rays appear to fail in stimulating the tissues. The general result is that the heat-rays, the less refrangible light-rays, and the more refrangible light-rays, are all trophic up to a certain point. Orange, yellow, and green screens to the protoplasm, whether in the form of pigmented walls, pigmented cell-sap, or chlorophyll, are of a protective character, and permit the normal functions to be carried on unimpeded by the injurious action of the more intense blue-violet rays.

Geotropism.*—From a series of observations on this subject made by Herr F. Czapek, he concludes that, as a rule, the seat of the geotropic sensitiveness of the root lies in its apex, over a zone of from 1·5 to 2 mm. immediately below the root-cap. The geotropic curvature is, however, chiefly manifested in a zone at some distance from the sensitive portion. In older portions of the growing stem, on the other hand, the sensitive zone coincides for the most part with that of growth and curvature. The conditions which favour geotropic curvature are the same as those which favour growth in length; while curvature and sensitiveness are dependent on different conditions. The maximum of geotropic curvature is reached when the organ deviates from the horizontal at an angle of about 45°. This condition is attained when the root of a seedling grows obliquely upwards or a shoot obliquely downwards. In secondary roots the maximum geotropic curvature appears to occur at an angle of from 60° to 90°.

Geotropic Curvature of Nodes.†—Herr R. Barth has investigated this subject in a variety of plants. He finds the position of the motile zone to vary. It may be situated at the base of the internode, or, less often, at its apex, or both base and apex may take part in its formation. In some cases it is only the portion of the stem which is enclosed in the base of the leaf that curves; in others only the portion of the node which belongs to the leaf-sheath; in others again both stem and sheath take part in the geotropic curvature. Motile nodes are in general distinguished from the rest of the stem by the absence of sclerenchyme and hard-bast, while the collenchyme is usually very strongly developed, although it may be replaced by thin-walled parenchyme. In some plants geotropic curvatures are manifested only in the nodes, while in others the whole of the growing internode takes part in the upward curvature. In those leaves in which the leaf-sheath is strongly developed, the movements take place in some only so long as growth continues, the leaf-sheath being usually passive; while in other instances the geotropic reactions continue in the fully developed node. In many grasses the leaf-sheath as well as the stem participates in the movements. The

* Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 243–339 (1 pl.). Cf. this Journal, *ante*, p. 74.

† 'Die geotropischen Wachsthumskrümmungen d. Knoten,' Leipzig, 1894, 39 pp. See Bot. Centralbl.. lxi. (1895) p. 364.

epiderm is not essential for the production of geotropism, while both the pith and the peripheral parenchymatous tissue appear to play an essential part in it.

Influence of Contact and Traction on Twining Leaf-stalks.*—Herr M. von Derschau recalls the fact that contact causes in twining leaf-stalks a more or less pronounced increase in thickness, and a mechanical strengthening. These results are the greatest when the vascular bundles have a crescent-shaped arrangement, since the vascular bundle-ring is then closed. When the weight is small traction affects a twining leaf-stalk in the same way as contact, while with a heavier weight the effect is the reverse. The observations were made chiefly on plants belonging to the Solanaceæ, Scrophulariaceæ, Ranunculaceæ, and Tropæoleæ. In some cases the upper, in others the under side of the leaf-stalk was found to be the most sensitive. Light falling on one side retards the twining. The leaf-stalks of *Lophospermum scandens* are especially heliotropic.

Mechanics of Irritation-Curvatures.†—Herr G. F. Kohl explains the phenomena of irritation as simply turgor-curvatures, which become subsequently fixed by growth, due to the fact that the concave side of the organ in question contains a larger quantity of osmotic substances than the convex side, and therefore possesses a higher degree of turgidity. The cells on the concave side are regarded by the author as the active ones in inducing the phenomenon. He contests on several points the conclusions of Wiesner, Noll, and Wortmann.

(4) Chemical Changes (including Respiration and Fermentation).

Amylo-chlorophyllous Phenomena.‡—An extended series of observations on the mode of formation of starch-grains and chlorophyll-bodies in the plant has led M. E. Belzung to the following general conclusions. The first process which takes place in the embryo is the formation of starch, the result of the activity of the protoplasm, the chlorophyll-body being a secondary formation. With few exceptions the chlorophyll-pigment is diffused through the protoplasm of the young embryo. The substratum of the future chlorophyll-body—leucite or plastid—is always fully formed by the time the seed arrives at maturity. The protoplasm has always a reticulate structure; it is the protoplasm of the amyliferous vacuoles which constitutes the chromatophore or leucite. The starch-grains which are destined to constitute the reserve food-material in the ripe seed are an exception to this rule, and increase in the meshes where they are originally deposited. In proportion as the embryo becomes green, and the mass of green corpuscles more abundant, the starch-grains are resorbed; they are a part of the material for building up the green chlorophyll-grains.

In adult green organs, especially leaves, the starch-grains which are

* 'Einfluss v. Contact u. Zug auf rankende Blattstiele,' Frankfurt-a.-M., 1894, 36 pp. and 3 pls. See Bot. Centralbl., lxi. (1895) p. 433.

† 'Die Mechanik d. Reiz-krümmungen,' Marburg, 1894. See Bot. Ztg., liii. (1895) 2te Abt., p. 147.

‡ Journ. de Bot. (Morot), ix. (1895) pp. 33–49, 61–72, 101–8, 134–53, 181–9 (2 pls. and 2 figs.). Cf. this Journal, 1892, p. 57.

formed in the light in the chlorophyll-bodies are a result of the assimilating power of these latter, being one of the products of the substance itself of the chlorophyll-bodies, a kind of secretion from the green substance. The resorption of the chlorophyll, which in leaves takes place only at the period of the autumnal fall, is almost completely effected in fruits before they ripen.

The two essential phases in the life of a plant—the embryonal phase during which the green cell is built up at the expense of materials which it has not elaborated, and the adult phase in which its formative activity is manifested by new embryonal conditions—constitute a remarkable example of organic reversibility.

Production of Sugars during the Germination of Barley.*—M. P. Petit states that, during the soaking of barley in the process of malting the proportion of reducing sugar varies only slightly, while the quantity of saccharose continually increases. The variation in reducing power represents the activity of respiration.

Chemical Processes during the Germination of Vicia sativa.†—Herr D. Prianischnikow has investigated the changes which take place in etiolated seedlings of the vetch. The loss of nitrogen during germination may be accounted for by the solution of a portion of the nitrogenous matter in the water used for softening the seeds. In the decomposition of the proteids, amido-compounds are chiefly formed. Of the amides, asparagin is formed in much the largest quantity. In the decomposition of the starch, cane-sugar is formed. There appears to be no relation between the decomposition of the proteids and that of the carbohydrates; most of the former are decomposed in the first ten days, while the plants still contain abundance of carbohydrates. Salts of calcium increase the energy of the vital processes in the plant. In non-etiolated plants the proportion of asparagin to the other amides decreases, instead of increasing, during germination.

B. CRYPTOGAMIA.

Cryptogamia Vascularia.

Classification of the Archegoniatæ.‡—Prof. L. M. Underwood proposes a classification of the Archegoniatæ, the chief feature of which is the inclusion of the Gymnosperms in this subkingdom, and the consequent abolition of the primary division of the vegetable kingdom into Cryptogamia and Phanerogamia. The Archegoniatæ are divided into three classes, the Bryophyta, Pteridophyta, and Gymnospermæ. The next division is into orders, of which the Bryophyta comprise seven, viz. the Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Andreæales, Archidiales, and Bryales; the Pteridophyta four, viz. the Filicales, Equisetales, Sphenophyllales (fossil), and Lycopodiales; and the Gymnospermæ four, viz. the Cycadales, Cordaitales (fossil), Pinales, and Gnetales. Some of these orders are made up of only a single

* Comptes Rendus, cxx. (1895) pp. 687–9. Cf. this Journal, 1894, p. 230.
† Landwirthsch. Versuchs-Stat., xlv. (1894) pp. 247–88 (2 figs.) See Bot. Centralbl., 1895, Beih., p. 72.
‡ Bull. Torrey Bot. Club, xxii. (1895) pp. 124–9.

family; others, as the Bryales, Filicales, and Lycopodiales, of a considerable number. The Characeæ are excluded.

Origin of the Sexual Organs of the Pteridophytes.*—Prof. D. H. Campbell traces the probable origin of the archegone of Pteridophytes to a form like that of the Anthoceroteæ, which have the sexual organs completely imbedded in the thallus, and which differ from all other Bryophytes in having an antherid of endogenous origin. The elongated neck of the archegone and the projecting antherids of the Leptosporangiatæ are probably secondary developments.

Adventitious Shoots of Phegopteris sparsiflora.†—Herr R. Sadebeck describes the structure and mode of formation of the tuberous adventitious structures on the frond of this fern. Their structure and mode of growth correspond with those of the rhizome. They lengthen by apical growth. Their cells contain a large amount of reserve food-material, but no differentiation of organs takes place while they are still attached to the mother-frond. The formation of these buds seems to be a provision for the maintenance of the species in connection with the very sparse production of sporanges.

Root of Angiopteris.‡—Dr. L. Koch describes in detail the structure and the mode of growth of the apex of the root of *Angiopteris evecta*, which present in many respects a condition intermediate between the single apical cell usual in Vascular Cryptogams, and the group of equivalent cells which make up the growing point in Flowering Plants.

Fossil Plants of the Coal-measures.§—The late Prof. W. C. Williamson and Dr. D. H. Scott give full details as to our present knowledge of the structure of *Calamites*, *Calamostachys*, and *Sphenophyllum*. Notwithstanding that the old idea that the so-called "ribbed" stem of *Calamites* is analogous to that of *Equisetum* has now been shown to be erroneous, there can be little doubt as to the affinity of the two genera. *Calamostachys* is also undoubtedly closely allied to *Calamites*; while *Sphenophyllum* occupies at present an isolated position among Vascular Cryptogams.

Muscineæ.

Braithwaite's British Moss-Flora.‖—Part xvi. of this fine work completes vol. ii., and with it the Acrocarpous Mosses. The present part is devoted to the two small families, Meeseaceæ and Mniaceæ, the former comprising the genera *Meesea* (1 sp.) and *Paludella* (1 sp.); the latter *Gymnocybe* (2 sp.), *Orthopyxis* (1 sp.), *Timmia* (1 sp.), *Mnium* (14 sp.), and *Cinclidium* (1 sp.). In a supplement three species are added which had been omitted in previous parts, as well as additional particulars about a few other species, and a number of additional localities.

Functions of the Elaters of Hepaticæ.¶—According to Prof. K. Goebel, the function of the elaters of the Hepaticæ is not always the

* Bot. Gazette, xx. (1895) pp. 76–8. Cf. this Journal, 1892, p. 394.
† Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 21–31 (1 pl.).
‡ Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 369–402 (2 pls.).
§ Phil. Trans. Roy. Soc., clxxxv. (1895) pp. 863–959 (5 pls.). Cf. this Journal, *ante*, p. 338.
‖ Vol. ii. 1895, 268 pp. and 49 pls.
¶ Flora, lxxx. (1895) pp. 1–37 (1 pl. and 13 figs.).

same; they may serve the purpose of violently dispersing the spores, or of simply causing them to constitute a loose mass which is readily dispersed by the wind; or they may serve for the conveyance of nutriment to the sporogenous cells; the latter is the only function of rudimentary elaters.

The author arranges the elaters of Hepaticæ under a number of different types, dependent on their mode of formation and functions. In the *Jungermannia* type, which is by far the most common, and in the *Frullania* type, the elaters serve for the violent dispersion of the spores. In the *Aneura* and *Pellia* types the elaters are not free, but are attached by one end to the wall of the capsule; and in *Aneura* and *Metzgeria* they do not spring directly from the wall of the capsule, but from four masses of tissue which have been termed *elaterophores.* In *Fossombronia* and in the Marchantieæ their chief or sole function is the conveyance of nutriment to the sporogenous cells.

Prof. Goebel draws attention to the homology between the elaters of the Hepaticæ and the capillitium of the Myxomycetes, and structures of similar function in the Lycoperdaceæ and in the Orchideæ.

Oil-bodies of the Hepaticæ.*—Herr W. v. Küster regards these bodies as peculiar to the Hepaticæ. They contain a fatty oil, but the so-called membrane is a secondary product, the result of the treatment. The oil-bodies are always formed by new formation, not by division. They may be formed in the dark, in organs which do not contain chlorophyll, and remain unchanged till the death of the cell. They agree with elaioplasts in their mode of development, but differ from these bodies in their chemical reactions.

Algæ.

Algæ and Fungi of Drinking-water.†—Dr. G. v. Istvánffi has investigated the organic life of the water supplied to Buda-Pesth for domestic purposes. He finds germs of Algæ to be present during the whole year, especially during the spring and autumn, and when the rainfall is exceptionally high. The forms are chiefly unicellular; diatoms and *Scenedesmus acutus* are especially mentioned. Of Fungus-germs by far the most abundant are those of Saprolegniaceæ, which were found invariably at all seasons, especially the swarmspores. All the various organisms observed occur also in the waters of the Danube.

Batrachospermum.‡—Dr. F. Brand contests the view of Sirodot that there is any true alternation of generations between *Batrachospermum* and *Chantransia.* He distinguishes four different forms of thallus, which, however, pass into one another by insensible gradations, viz.:—(1) The horizontal thallus or primitive growth, which arises both from the carpospores and from the non-sexual sporules of *Batrachospermum* and *Chantransia*; (2) Rudimentary filaments, springing in an upward direction from the horizontal thallus; (3) *Chantransia*-filaments; (4) *Batrachospermum*-filaments, the most highly differentiated form of

* 'Die Oelkörper d. Lebermoose,' Basel, 1894. See Bot. Centralbl., lxxii. 1895, p. 111.

† Bot. Centralbl., lxi. (1895) pp. 7–14.

‡ SB. Bot. Ver. München, Jan. 14, 1895. See Bot. Centralbl., lxi. (1895) pp. 280–4 (1 fig.).

the thallus. The term prothallium is not correctly applied to any of these forms.

Polymorphism of Monostroma.*—As is the case with others of the lower Algæ, Prof. R. Chodat states that *Monostroma bullosum* assumes, in cultivation, several distinct forms, viz. a transitory or *Schizochlamys* form and a permanent "hypnocyst" form, in which the cells are thick-walled and their contents coarsely granular. These hypnocyst cells may become detached, and then give rise, by cell-division, to a "hypnothallus" form, which may be subfilamentous and chroolepoid, or massive and expanded. From the alga in this state are produced the zoogametes. In its *Schizochlamys* condition it is scarcely distinguishable from *S. gelatinosa.*

Euastropsis, a new Genus of Hydrodictyaceæ.†—An organism previously described as *Euastrum Richteri* is made by Prof. G. Lagerheim the type of a new genus *Euastropsis*, belonging to the Hydrodictyaceæ, with the following diagnosis:—Cœnobium libere natans, bicellulare; cellulæ chlorophoro laminiformi, parietali, amyligero, pyrenoide plerumque singulo, nucleo singulo; multiplicatio macrozoogonidiis; macrozoogonidia primo ovalia, dein rotundata, ciliis vibratoriis binis, stigmate nullo, bipartitione succedanea contentus cellulæ utriusque cœnobiis orta, in vesicula inclusa per rimam strati externi membranæ exeuntia; bina polo antico achroo conjunguntur et cœnobia plura formant. The chief distinction between *Euastropsis* and *Pediastrum* is that in the former the swarm-cells unite into several daughter-colonies, the cœnobe consisting of only two cells. It appears to form a link between *Pediastrum* and *Tetraedron.*

The life-history of *Tetraedron minimum* is also followed out in detail. *Pediastrum* is, in all probability, derived genetically from *Tetraedron.*

Reproduction of Aphanochæte.‡—M. J. Huber records the observation, in *Aphanochæte repens*, of a sexual mode of reproduction, through impregnation of nearly spherical ciliated oospheres by smaller pear-shaped four-ciliated antherozoids. Both bodies are invested in a hyaline vesicle, and the movements of the oosphere are but very feeble. A diminution of light appears to favour the formation of zoospores at the expense of sexual reproduction. This is the first instance in which a conjugation of motile heterogametes has been observed in the Confervoideæ.

Development of Pediastrum.§—Prof. R. Chodat and M. J. Huber have experimented on the cultivation of that very variable species, *Pediastrum Boryanum*, in various nutrient solutions, and find the production of the so-called varieties to be largely due to differences in nutrition. They suggest caution in the publication of new species or varieties where the author is not able to follow out the life-history of the organism.

* Bull. Soc. Bot. France, xli. (1895), Sess. Extraord., pp. cxxxiv.–xlii. (1 pl.).
† Tromsö Mus. Aarsheft, 1894, 24 pp. and 1 pl. See Bot. Centr., 1895, Beih., p. 2.
‡ Bull. Soc. Bot. France, xli. (1895) Sess. Extraord., pp. xciv.–ciii. (1 pl.).
§ Bull. Soc. Bot. Suisse, 1895, 14 pp. and 1 pl.

Fungi.

Cell-wall of Fungi.—Further investigation of the composition of the cell-wall of Fungi (sclerote of *Claviceps purpurea*, receptacle of *Agaricus campestris*) leads M. E. Gilson * to the conclusion that its chemical constitution and physical properties are very different from those of cellulose. It is insoluble in cupric ammonium oxide, and is not coloured blue either by chlor-zinc-iodide or by sulphuric acid. Moreover, it contains nitrogen. The author proposes for this substance the term *mycosin*. He prepared its crystalline chloride, and from it derives the formula for mycosin, $C_{14}H_{28}N_2O_{10}$.

M. E. Gilson † has further established the presence, in the cell-wall of a number of Fungi belonging to the Basidiomycetes, of chitin, a substance not hitherto detected in the vegetable kingdom. True cellulose is never present in these cases, but the chitin is always accompanied by other carbohydrates.

Herr E. Winterstein ‡ confirms this observation in the cases of *Agaricus campestris*, *Boletus edulis*, and *Morchella esculenta*.

Sclerotes and Mycelial Cords.§—M. C. Bommer points out that the degree of development of the mycele has no relationship to the genetic relationships of a fungus, being dependent on its mode of life. In relation to this function he classifies myceles under four heads, viz.:—(1) Those that perform the function of attachment; (2) those that protect against injurious external influences; (3) those that serve for propagation; (4) those that serve for the accumulation of reserve substances. The first kind are rare, and are illustrated by the haustoria of parasitic fungi. The second kind are much more common, as in the cortex of many Hymenomycetes. The third kind are represented by a variety of structures exhibiting great differences in their complexity. Under the fourth head come sclerotes. which may be of two types, the first consisting of myceles which have undergone but slight modification, the second of a mass of metamorphosed hyphæ. They form a pseudo-parenchymatous tissue enclosed in a cortex, and contain a quantity of oil and glycogen. They are peculiar to the Ascomycetes and Basidiomycetes, and do not occur in the lower orders of Fungi.

Influence of Snails and Toads on the Spread of Agaricini.‖—Sig. P. Voglino discusses the part played by snails and toads in the propagation of certain Fungi. In the digestive canal of these animals he finds abundance of spores of species of *Russula*, *Tricholoma*, *Lactarius*, and other Agaricini, the power of which to germinate has not been destroyed by passing through the body of the animal.

New Chytridiaceæ.¶—M. E. De Wildeman records observations on a number of parasitic Chytridiaceæ, and describes the following new

* La Cellule, xi. (1895) pp. 5–15. See Bot. Centralbl., lxi. (1895) p. 289. Cf. this Journal, 1894, p. 215.
† Comptes Rendus, cxx. (1895) pp. 1000–2.
‡ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 65–70. Cf. this Journal, 1894, p. 234.
§ 'Sclérotes et cordons mycéliens,' Bruxelles, 1894. See Bot. Centralbl., lxii. (1895) p. 51.
‖ Nuov. Giorn. Bot. Ital., ii. (1895) pp. 181–5.
¶ Ann. Soc. Belg. Microscopie, xix. (1895) pp. 63–82, 88–117 (3 pls. and 3 figs.).

species:—*Rhizidium Autrani* on a *Cosmarium; Cladochytrium irregulare* on the epiderm of the stem of an aquatic grass; *Lagenidium intermedium* on *Closterium Ehrenbergii; Rhizophlyctis operculata* on the tissues of higher plants; *Rhizidiomyces Spirogyræ* and *Rhizophidium dubium* on a *Spirogyra*. He further gives a revised synopsis of the species of the genus *Lagenidium*.

Development of the Mucorini.*—From further investigation of species of *Pilobolus, Mucor, Sporidium, Rhizopus, Chætocladium, Mortierella*, and *Piptocephalis*, M. M. Léger states that the young thallus and immature reproductive organs are entirely filled with a very dense protoplasm occupying the whole of the mycele and sporangiferous tubes; it is only at a later period that it assumes the form of parietal bands. From the time that the spores and the columel are being formed, the protoplasm has performed its work, and undergoes modification, becoming trabecular and partially transformed into oil; at a later period the protoplasm entirely disappears. In the young filaments and the spores the nuclei contain a nucleole surrounded by cytoplasm and a fine membrane; in the older filaments and the columel they lose their membrane and become reduced to a mere nucleole. The development of the chlamydospores closely resembles that of the sporangiospores.

Cordyceps.†—Mr. G. Massee gives a monograph of this genus of ascomycetous Fungi, all the species of which are parasitic on insects belonging to the Hemiptera, Diptera, Lepidoptera, Hymenoptera, and Coleoptera. The relationships between species of *Cordyceps* and species of the conidial form known as *Isaria* are discussed. Sixty-two species are described, including one new one.

Laboulbeniaceæ.‡—Mr. R. Thaxter gives a synopsis of all the known species of this order of Fungi. A number of new species are described, and the four following new genera:—

Sphaleromyces.—Receptacle consisting of two superposed cells, the distal bearing the appendage laterally, and the stalk-cell of the perithece terminally; perithece asymmetrical, the apex somewhat pointed, separated from the short stalk-cell by three basal cells; appendage clearly distinguished from the receptacle, composed of a basal cell bearing a series of superposed cells, each giving rise from its inner upper angle to a single short septate branch which may bear flask-shaped antherids; spores once septate, involved in mucus; asci arising in a double row from a single large ascogenous cell.

Compsomyces.—Receptacle of two superposed cells, the distal bearing on its extremity a cluster of appendages and one or more stalked peritheces; appendages sterile or fertile, simple or branched, septate, the fertile ones bearing one or more single one-celled antherids separated by oblique partitions from the extremity of successive cells composing the main axis of the appendage; peritheces symmetrical, conical, borne on two superposed stalk-cells and three small basal cells, the basal

* Comptes Rendus, cxx. (1895) pp. 647–9. Cf. this Journal, 1894, p. 701.
† Ann. Bot., ix. (1895) pp. 1–44 (2 pls.).
‡ Proc. Amer. Acad. Arts and Sci., xxix. (1894) pp. 92–111. Cf. this Journal, 1894, p. 95.

stalk-cell producing from its distal end a simple sterile appendage; asci eight-spored: spores once septate.

Moschomyces.—Receptacle composed of a sucker-like compact mass of parenchymatous cells penetrating the softer chitin of the host, and giving rise above to numerous free cells, from the distal ends of which are produced solitary stalked peritheces and appendages; perithece very large, sub-conical, pointed, the apex symmetrical, borne on two simple superposed stalk-cells followed by three small basal cells, the basal stalk-cell bearing from its distal end a single simple sterile appendage; appendages septate, sparingly branched or simple, the fertile ones stouter, bearing one-celled antherids laterally; asci subcylindrical, eight-spored, arising in great numbers and in many rows from a single ascogenous cell or centre; spores minute, acicular, once septate.

Camptomyces.—Receptacle of two superposed cells, the upper bearing the short-stalked perithece laterally, and the antheridial appendage terminally; perithece narrow, with coarse-lipped asymmetrical apex; appendage consisting of a single large basal cell bearing the antherid terminally; antherid multicellular, subconical, with a prominent terminal pore for the discharge of the numerous roundish antherozoids; trichogyne developed as a small vesicular prominence above a permanent ear-like appendage which arises laterally from the young perithece; ascogenous cells two.

The genus *Hesperomyces* is now dropped, and its species are placed under *Stigmatomyces.*

Origin of Wine Yeasts.*—By cultivating *Saccharomyces* on sterilised grapes, Herr A. Jörgensen has been able to trace the whole course of development from the mould-fungus form to the *Saccharomyces* form. The original material was sought for on grapes, on the ground that if there were a genetic connection between mould fungi and wine yeasts the conversion would be constantly going on under natural conditions. After much trouble the long sought-for vegetation was found; it consisted of typical branched hyphæ on which cells had developed, and among these some showed an endogenous *Saccharomyces*-like spore-formation. From this material cells were isolated and cultivated on sterile grapes, on acid and on alkaline gelatin. On alkaline gelatin the vegetation exactly resembled *Chalara*; on acid gelatin there was the typical aspect of a *Dematium.* By transferring the *Dematium* to the alkaline medium the *Chalara* form appeared, and conversely.

On sterilised grapes the growth at first resembled the *Dematium* vegetation; but after a few days the uppermost part of the mycele began to show septa, and in this way clumps of small rectangular cells and lines of conids appeared; gradually these cells assumed an oval shape. After a time, spore-formation took place in the upper conids, and the most perfect of these oval cells, which contained 2–4 spores, were quite indistinguishable from the ordinary *Saccharomyces* cells of wine yeasts.

The optimum temperature was found to be about 20° C.; and if the temperature rose or fell beyond this point, the number of torula cells increased, and at 35° the endospore formation was not observed and the mycele gradually died off. A too moist substratum or too moist air

* Centralbl. f. Bakteriol. u. Parasitenk., 2[te] Abt., i. (1895) pp. 321–6.

was also detrimental, as was also a too dry environment. The spore-forming cells fermented wine must, and the vegetation of the sediment was undistinguishable from that of ordinary wine yeast.

Cultivations on sterile grapes from sediment-cells only produced the sprouting and spore-forming generations, but the mycele formation could be reproduced from the quadrangular non-sporing elements.

In fine, the author has shown that the *Dematium* and *Chalara*-like mould fungi which appear on grapes, through a series of gradual transition forms, finally develop vegetations which have been described under the name of *Saccharomyces ellipsoideus;* and he further states that as the result of numerous examinations of grapes from various countries, in no single instance was the *Dematium*-like fungus absent.

In conclusion, the author mentions that he has also found that species of *Aspergillus* and *Sterigmatocystis* occurring on wine possess a diastatic ferment which, under favourable conditions, attacks the starch with great energy, their conids being converted into yeast-cells which excite an alcoholic fermentation.

Ferments of the Manufacture of Arrack.*—Dr. F. A. F. C. Went and Herr H. C. Prinsen-Geerligs have investigated the nature of the organisms of the substance known as "raggi," which is used in Java for the fermentation of arrack from rice-starch. Among other fungi they find a very interesting organism which they name *Chlamydomucor Oryzæ* g. et sp. n. It consists of a much-branched but unseptated mycele, and possesses the property of converting amylodextrin and ordinary dextrin into dextrose. It is aerobic, coagulates milk, does not invert saccharose, and does not ferment glucose. It may be obtained either from rice-meal or from the sugar-cane. The authors suggest that it may be a stage in the cycle of development of *Rhizopus Oryzæ.* In the same material was found also another new organism, *Monilia javanica* sp. n., which has the power of fermenting dextrose, saccharose (which it first inverts), maltose, raffinose, and levulose, but not lactose; also a true *Saccharomyces*, *S. Vordemannii* sp. n., which is the principal agent in the manufacture of arrack.

Classification of Lichens.†—In an exhaustive paper on the lichenology of northern Italy, Sig. F. Saccardo lays stress on the form of the sporids as a generic character in Lichens. Thus, he separates from *Peltigera* the species with fusiform sporids, erecting them into a new genus *Peltigerella*, and from *Sticta* the species with pluriseptate hyaline sporids, for which he constitutes another genus with the name *Lobaria.* In the same way *Arthoniella*, *Pyrenardia*, and *Thelidiella* are respectively formed from the species of *Arthonia*, *Arthopyrenia*, and *Thelidium* with uniseptate hyaline sporids.

Parasitic Fungi.—Mr. C. P. Clinton ‡ identifies *Cæoma nitens* as the æcidio-stage of *Puccinia Peckiana*, parasitic on several species of *Rubus*.

Mr. S. M. Tracy and Mr. F. S. Earle § describe no fewer than

* Verhandl. K. Akad. Wetensch. Amsterdam, 1895, 2de Sect., 31 pp. and 4 pls. (German). † Atti Soc. Ven. Trent. Sci. Nat., ii. (1895) pp. 83–241 (1 pl.).
‡ Bot. Gazette, xx. (1895) pp. 116–7.
§ Bull. Torrey Bot. Club, xxii. (1895) pp. 174–9.

25 new species of parasitic Fungi from N. America, belonging to the genera *Puccinia*, *Ustilago*, *Dimerosporium*, *Asteridium*, *Læstadia*, *Sphærella*, *Lembosia*, *Vermicularia*, *Diplodia*, *Hendersonia*, *Pestalozzia*, *Scolecotrichum*, *Cercospora*, and *Tetraploa*.

Mr. G. Massee * attributes the "spot" of Orchidaceous plants to a hitherto undescribed species, *Plasmodiophora Orchidis*.

Herr O. K. Juel † identifies *Æcidium Parnassiæ* with a new species of *Puccinia*, *P. uliginosa*, parasitic on *Carex vulgaris*; the æcidium on *Thalictrum alpinum* with another new species, *P. borealis*, on *Agrostis borealis*, and probably also on *Anthoxanthum odoratum*; and the æcidium on *Saussurea alpina* with *P. rupestris*, parasitic on *Carex rupestris*.

M. E. Prillieux ‡ describes the injuries inflicted on the grain of sorghum by *Ustilago Sorghi*. It converts the ovary into a large pocket filled with a brown powder, the spores of the parasite, and containing in its centre a column, which is a portion of the axial tissue of the host excited to abnormal development by the action of the parasite.

Sig. A. Berlese § attributes a common disease of the root of the vine and of other fruit-trees to the attacks of *Armillaria mellea* and *Rosellinia necatrix*, though Schizomycetes may assist in the destruction.

Herr B. Frank ‖ describes 11 kinds of parasitic fungus recently found infesting corn-crops in Germany, including two new species, *Sphærella basicola* and *Septoria Avenæ*.

M. A. Prunet ¶ attributes a widely spread disease of the mulberry in the S. of France, the chytridiose of the mulberry, to the attacks of an undescribed species of *Cladochytrium*, *C. Mori*, differing from *C. viticola* only in the smaller size of its zoospores, cysts, and zoosporanges.

Sexual Organs of the Uredineæ.**—M. P. Nypels has investigated the mode of formation of the æcidia and spermogones in several Uredineæ, especially in *Æcidium Ranunculacearum*, *A. Euphorbiæ*, and *A. Frangulæ*. He states that these organs are formed directly from the mycelial filaments, and is unable to confirm the observation of Massee of the existence of true sexual organs in the first named of these species.

Microsporon.††—M. P. Vuillemin proposes to make this genus of parasitic fungi the type of a new family, MICROSPORACEÆ, a group of Phycomycetes which has the same relation to the Cœnobieæ as the Saprolegniaceæ have to the Siphoneæ, and *Entomophthora* to the Conjugatæ. They resemble the Cœnobieæ in their isogamy, in the mode of formation of the colonies, and in the presence of pseudopodes and of a pulsating vacuole, but differ in the absence of chlorophyll and of vibratile cilia. *Microsporon vulgare* is a facultative parasite on the human skin, differing

* Ann. Bot., ix. (1895) p. 170.

† Förhandl. K. Vetensk.-Akad. Stockholm, li. (1894) pp. 409–18. See Bot. Centralbl., 1895, Beih., p. 81.

‡ Bull. Soc. Bot. France, xlii. (1895) pp. 36–9 (1 fig.).

§ Boll. Entomol. agrar. e Patol. veg., ii. (1895) pp. 6–8. See Bot. Centralbl., lxii. (1895) p. 122.

‖ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 61–5.

¶ Comptes Rendus, cxx. (1895) pp. 222–5.

** Bull. Soc. Belge Microscopie, xxi. (1895) pp. 70–4. Cf. this Journal, 1888, p. 782.

†† Comptes Rendus, cxx. (1895) pp. 570–3.

essentially from the Saccharomycetes in the absence of any process of budding. The author excludes from the genus the filamentous forms which have sometimes been placed in it.

Sexual Reproduction in the Basidiomycetes.*—M. P. A. Dangeard claims to have detected the mode of sexual reproduction in *Tremella mesenterica* as a type of the Basidiomycetes. The process is similar to that which takes place in the Ustilagineæ,† the "oospore" being the young basid. Each "oospore" contains two nuclei, which are distinctly nucleolated. Immediately after the coalescence of the two nuclei, the "oospore" begins to enlarge, ultimately attaining a considerable size. The combined nucleus undergoes two successive bipartitions, thus forming an internal promycele. Each of the four cells so formed puts out a germinating tube, at the apex of which is developed the spore, and into this spore the nucleus finally finds its way.

Development and Fertilisation of the Tuberaceæ.‡—M. P. A. Dangeard takes the common truffle as a type of the life-history of the Perisporiaceæ and Tuberaceæ. The mycele forms a rhizomorph round the roots of the oak, which is necessary for the development of the truffle, since the latter derives its nutritive reserve-substances chiefly from the roots of the former. The rhizomorph is of two kinds—colourless, and brown; the former only contains protoplasm and displays vital activity. Sexual reproduction takes place, as in other Ascomycetes, by the coalescence of two sexual cells, each containing two nuclei, the process resulting in the development of the asci. The spores, when mature, contain numerous nuclear elements resulting from repeated bipartition of a single original nucleus.

Eomyces Crieanus g. et sp. n.§—Prof. F. Ludwig has found in the brown flux from *Æsculus Hippocastanum* colourless colonies of spherical cells with tetrahedral arrangement, resembling the tetrads of some yeast endospores, but showing themselves to be of a much lower organisation by their simple and peculiar reproduction. The diameter of the cells is usually 5–7 μ, occasionally 3 μ, and these subdivide so that the daughter-cells form the corners of a tetrad. The daughter-cells round themselves off so that they appear free, though usually they remain connected. Indeed, several generations of these tetrapartite subdivided cells may be seen joined together. There is no external cell-membrane; and this serves to distinguish *Eomyces* from *Prototheca*, to which it is allied.

Morphology and Systematic Position of the Tubercle Fungus.‖—According to Mr. A. C. Jones, there is a greater probability that the exciting cause of tubercle is a phase in the life-history of some higher pleomorphic fungus than that it is, according to the accepted notion, an essentially parasitic organism, transferable only from animal to animal, and without vegetative existence outside the animal body. The author

* Le Botaniste (Dangeard), iv. (1895) pp. 88–90.
† Cf. this Journal, 1894, p. 719.
‡ Le Botaniste (Dangeard), iv. (1895) pp. 63-87 (7 figs.).
§ Centralbl. f. Bakteriol. u. Parasitenk, xvi. (1894) pp. 905–8 (1 fig.). Cf. this Journal, 1894, p. 604.
‖ Centralbl. f. Bakteriol. u. Parasitenk., 1[te] Abt. xvii. (1895) pp. 1–16, 70–6 (1 pl., 23 figs.).

supports his view by the following considerations:—In the tissues and secretions the tubercle organism appears as a shorter or longer rodlet propagating itself by transverse fission. But occasionally in the sputum, and always in old agar cultures, filamentous forms appear which are non-septate and show true branching. These thread-like forms only appear on the surface of the medium, whilst in the deeper parts of tissues and of fluids, places to which oxygen has not free access, only the short rodlets are found. The rodlets do not contain spores such as are met with in other bacilli, though in the filaments and in the rodlets there are forms which possess many of the physical characters of spores, but are distinguished from typical endospores in various ways. Indeed, the illustrations impart the notion that certain oval bulgings in the course of filaments are intended for spores. Under certain circumstances there may originate in close proximity to the tubercle bacilli certain forms which have, in their general structure and properties, much that resembles the clubs of *Actinomyces*, the appearances exhibited by the forms being probably of inorganic origin, and the result of certain chemical reactions between the organism and its environment.

Protophyta.

β. Schizomycetes.

Effect of Light on Bacteria.—Prof. Dieudonné * has used in his experiments principally pigment bacteria (*Microc. prodigiosus* and *Bac. fluorescens putidus*), for the reason that very slight degrees of degeneration can be recognised by diminished pigment production, but in some cases *B. typhosus*, *B. anthracis*, and *B. coli commune* were also used. One or two loopfuls of a bouillon culture grown at room temperature for 36–48 hours were mixed with agar and gelatin and poured into Petri's capsules, the under side being exposed to the light. The under surface was covered with a cross of blackened paper. Direct sunlight in March, July, and August was found to exhibit an inhibitory effect after 1/2 hour, and in November after 1½ hour. The indications of the inhibitory effect were the non-development of pigment and of trimethylamin, neither of which returned until the second subculture in gelatin. With *M. prodigiosus* the inhibitory effect was further noticeable from the slow and slight liquefaction of the gelatin. It is interesting to note that the sun's power was as strong in March as in July and August. The germs were quite killed in 1½ hour in March, July, and August, and in 2½ hours in November. The electric arc light (900 candles) inhibited in 5 hours, and killed all germs in 8 hours, while the action of the incandescent electric light was less marked.

That the heat-rays have no inhibitory or lethal influence is shown by the fact that the light-rays pass through a layer of alum solution 1½ cm. thick, the results being as in direct exposure. By absorbing certain rays by means of different solutions of bichromate of potash, chloride of copper, ammoniated sulphate of copper, sulphate of quinine, and by means of the electric arc spectrum produced with a Rutherford's prism, it was determined that the ultra-red, red, orange, and yellow rays

* Arb. a. d. Kaiserl. Gesundheitsamte, ix. (1894) p. 405. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 646–7.

allowed of a very luxuriant growth. Between the D and E lines of the spectrum there was no perceptible diminution of growth; between E and F the inhibitory effect became apparent, and in the blue, violet, and ultra-violet parts of the spectrum the plates were perfectly sterile.

That the light-rays have a direct unfavourable action on the bacteria and not on the media, is shown by first exposing the media to the light and inoculating them afterwards, the development of the colonies being quite the same as when the media were inoculated beforehand.

Prof. H. Marshall Ward * publishes full details of his series of experiments on the action of light on bacteria. He arrives at the general conclusion that the injurious action of light is probably common to all the lower forms of vegetable life, and even to all living protoplasm.

Fossil Bacteria.†—In addition to the species already described, M. B. Renault finds two fresh ones in the silex of Grand' Croix, which he names *Micrococcus Guignardi* and *M. hymenophagus;* these have attacked chiefly the cellulose of vegetable cells. The former was found in the interior of the wood of *Calamodendron*, in roots, and in the integuments of seeds, on the cell-walls; the latter in the intercellular spaces and on the middle membrane; the cuticle is not attacked.

Cell-contents of Bacillus oxalaticus.‡—For observing cell-contents, *Bacillus oxalaticus* Zopf, says Herr W. Migula, is a very favourable object on account of its size. In the middle of the cells there is visible, even without staining, a clear space which resembles a vacuole, and this was demonstrated by plasmolytic experiments conducted with the greatest care. In this respect the bacillus differs from the Alga-Schizophytes which possess a nucleus resembling a filament. The author also communicates some observations on the division of cells. In young cells the plasma appears to be quite homogeneous, while later on small highly refracting granules and a clear spot (vacuole) appear in the centre. The granules are arranged as a ring-shaped zone along the wall, and from this there is formed a plasma bridge which divides the vacuole. With the continued enlargement of the cell, the division of the vacuole becomes more marked. Later on, traces of the future septum arise from the ring-shaped granular zone.

Cilia of the Microbe of Hog-Cholera.§—M. Ferrier finds that the hog-cholera microbe possesses flagella as long as 35–55 μ, the length of the organism being about 1 μ. The number of the cilia is from four to seven. The author states that there is no mention in any work of the cilia of hog-cholera microbes, but they are beautifully shown in Sternberg's 'Bacteriology,' 1892, p. 444, pl. vi.

Cladothrix invulnerabilis.‖—Dr. E. Acosta mentions the fact that *Cladothrix invulnerabilis* is resistant to drying and keeping. A potato

* Phil. Trans. Roy. Soc., clxxxv. (1895) pp. 961–86 (1 pl. and 23 figs.). Cf. this Journal, *ante*, p. 215.

† Comptes Rendus, cxx. (1895) pp. 217–20. Cf. this Journal, *ante*, p. 346.

‡ Arb. aus d. Bact. Inst. d. Techn. Hochsch. zu Karlsruhe, i. (1894) p. 187. See Hedwigia, xxxiv. (1895), Rep., p. 5.

§ Centralbl. f. Bakteriol u. Parasitenk., 1te Abt., xvii. (1895) pp. 535–6. See Lyon Médical, 1894, No. 40.

‖ Crónica Méd.-Quirúr. Habana, 1894, No. 18. See Centralbl. f. Bakteriol. u Parasitenk., 1te Abt., xvii. (1895) p. 465.

cultivation which had become as hard as a stone was found to be capable of germination after the lapse of a year.

Chromogenous Cladothrix.*—Dr. A. Ruiz Casabó, while examining his own sputum, obtained from a puncture culture on alkaline agar a brick-red colony which gradually spread along the track to the bottom of the tube. Microscopical examination showed a thick, ramifying, red fungus, the branches of which were all of the same diameter. On the fifth day the growth broke up into cocci, which, when sown on other media, produced in 36 hours the original form. The growth of the fungus on glycerin agar, bouillon, milk, and potato was good both for luxuriance and colour. On cocoa-nut milk there was no pigment. Gelatin was liquefied, and inoculations on guinea-pigs were negative. When sown in agar tubes and air excluded by covering the surface, germination was observed in 50 hours, and the colony developed along the track as high as 0·25 cm. from the free surface. There was no staining of the medium by transmitted light.

Bacillus gossypinus.†—Mr. J. M. Stedman attributes the rot-disease of the cotton-boll to a previously undescribed microbe to which he gives this name. It is an aerobic spore-forming bacillus, straight and truncate, with slightly rounded corners, 1·5 μ long and 0·75 μ in diameter, usually solitary, sometimes in pairs, occasionally in chains of three or four. It is quite distinct from the fungus which causes anthracnose.

"Adenite equina."‡—Dr. G. Catterina has investigated the ætiology of this disease of horses, the chief indication of which is a running from the nose. He finds, both in the discharge and in the blood of the infected animals, a *Streptococcus* which appears to be the cause of the malady, and which is well stained by fuchsin. The microbe is pathogenous to rabbits, kids, and white mice; but not to dogs or cats.

"Excretion" of Bacteria in Disease of the Medulla of the Kidney.§—Prof. J. Orth cites many cases in which he observed the accumulation of micro-organisms in the canals and tubules of the kidney. They lie free in the cell-cavity, forming bacterial cylinders; they occur without there being any abscess or gross change in the cortex. It appears therefore that they pass from the blood through the glomeruli into the urinary canals. Hence the author calls them *Ausscheidungsherdchen.* A criticism of Herr v. Wunschheim's opposition to this view is given.

Bacterial Flora of Cheese.‖—Herr H. Henrici gives a historical retrospect of our knowledge of the ripening of cheese, and then proceeds to describe how cultivations should be made and observed. A large number of micro-organisms are described, their morphological and physiological characteristics being given so that any particular species can be recognised. The most important results arrived at by the author

* Crónica Méd.-Quirúr. Habana, 1894, No. 13. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 466.
† Agric. Exp. Stat. Auburn (Alabama), Bull. No. 55, 1894, 12 pp. and 1 pl.
‡ Bull. Soc. Veneto-Trentina Sci. Nat., vi. (1895) pp. 1–5.
§ Nachrichten K. Gesellsch. Wiss. Göttingen, 1895, pp. 19–29.
‖ Arb. a. d. Bact. Inst. de Techn. Hochsch. zu Karlsruhe, i. (1894) p. 1. See Hedwigia, xxxiv. (1895), Rep., pp. 4–5.

are that obligatory anaerobic bacteria are never found in cheese; that as the bacterial floras of ripe cheeses are very different, it would seem to follow that the ripening process is either set up by different species or that those which have brought it about are already dead. A large number of species probably participate in the ripening process.

Formation of Sulphuretted Hydrogen by the Cholera Vibrio in Hens' Eggs.*—According to Herr Kempner, the hen's egg is a very suitable medium for cultivating the cholera vibrio. The conditions of the medium are approximately those of the intestinal canal, viz. a large quantity of albumen and a small or negative amount of oxygen; the vibrio may retain its virulence for 1–2 months in the egg. During the growth of the vibrio a large amount of sulphuretted hydrogen is evolved, as may be shown by the mercury and lead tests and also by the smell, even when the cultivation has stopped. For determining the purity of an egg cultivation the gelatin plate is quite sufficient. The Fraenkel-Weichselbaum pneumococcus retains its virulence in an egg-culture for at least two months and the bacillus of swine erysipelas for quite $3\frac{1}{2}$ months.

Effect of severe Cold on Anthrax.†—Herr C. Klepzoff records some interesting observations as to the effect of prolonged and severe cold on the vegetative form of anthrax. Virulent cultivations exposed for 12 days to a temperature varying from $-14°\cdot9$ to $-31°\cdot0$ C. were found to be quite dead. An exposure for 25 days to a temperature varying from $-1°\cdot0$ to $-24°\cdot0$ gave similar results; the series was tested daily, but up to the twenty-fifth day colonies developed, though with increasing infrequency. No very noticeable peculiarity was observed in the colonies that grew up after exposure, except on gelatin where the liquefaction was less energetic than normally. The author agrees with Pictet and Young, who submitted anthrax to a temperature of $-130°$ C., that very severe cold will kill anthrax, and further that a lesser degree (24 days at $-10°$ C.) causes a diminution in the pathogenic properties of this organism.

Experimental Streptococcous Meningitis.‡—By injecting rabbits with Streptococci, MM. F. Vidal and F. Besançon succeeded in setting up paralysis in 7 animals out of 116, the palsy appearing 7 days to 2 months after the inoculation. The Streptococci injected were derived from 89 different sources, the successful ones having come—(1) from the mouth of a person suffering from erysipelas, (2) from mouth of a small-pox patient, (3) from the uterus of woman suffering from puerperal fever, (4) two cases from the normal mouth, (5) two cases from pseudo-diphtheritic membrane. The injections of the cultures were made subcutaneously or intravenously, or both in combination. In all the 7 cases the palsy was followed by death. In some cases the muscles were in a condition of spasm, in others they were flaccid.

The spinal cord was examined in four cases only, an admission which considerably discounts the value of the word myelitis. Sections showed affections of the white as well as the grey matter. In the grey matter

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 660. See Arch. f. Hygiene, xxi. (1894) p. 317.
† Centralbl. f. Bakteriol. u. Parasitenk., 1 Abt., xvii. (1895) pp. 289–95.
‡ Ann. Inst. Pasteur, ix. (1895) pp. 104–19 (2 pls.).

the lesions were chiefly in the lumbar region: (1) vascular, e. g. hyperæmia, extravasation of red corpuscles and exudation of leucocytes; (2) parenchymatous, affecting the nervous substance, chiefly the multipolar cells, which were in condition of granular or vitreous degeneration, vacuolation, or atrophy. In the white matter the changes also were well marked, and chiefly in the posterior columns, where there were foci of degeneration principally affecting the axis-cylinders, though the myelin sheath and the neuroglia also participated.

The lesions observed by the authors are ascribed by them to the impregnation of the nervous centres with soluble products of microbic origin, and are therefore toxic in nature.

Duration of Protective Power of Diphtheria Antitoxin.*—Dr. R. Abel finds, from examination of the blood-serum of persons who have suffered from diphtheria, that from the eighth to the eleventh day after the disappearance of the membrane, a substance protective against diphtheritic infection and intoxication can be demonstrated by experiments on guinea-pigs. Later on this substance seems to disappear.

The protective substance also exists in a number of healthy adults who have never had diphtheria; hence such persons would be immune to this disease, and only those take diphtheria whose blood is devoid of this protective.

Testing the protective power of the blood was performed by subcutaneous and intraperitoneal injection of guinea-pigs with small or large quantities of this blood-serum; 24–48 hours later the animals were infected with a more than fatal dose of diphtheria.

Bacillus of Tubercle in the Nasal Cavities of Healthy Persons.†—M. J. Straus has examined the nasal cavities of healthy persons who have been in frequent association with consumptives (physicians and sick-attendants). The nasal cavities were swabbed out with sterilised cotton-wool plugs, which were then steeped in water or bouillon, and the fluid injected into the peritoneal cavity of guinea-pigs. In 9 animals, killed 3–5 weeks after injection, tubercular changes and tubercle bacilli were found. In all, 29 persons were examined, and the bacilli came from 2 doctors, 6 attendants, and one lay person. These results are confirmatory of Cornet's experiments on the dissemination of the tubercle bacilli outside the body.

Swine-Plague, Hog-Cholera, and Pneumoenteritis of Pigs.‡—Dr. W. Silberschmidt concludes from an examination of the virus of these three porcine diseases, that they are due to one and the same organism. Though differing somewhat in morphological characters, the three micro-organisms showed their relationship in the products of their metabolism, their pathogenic properties, and in the morbid symptoms and lesions found in infected animals (rabbits, guinea-pigs, mice, pigeons). The difference in their virulence and toxicity is merely quantitative. Rabbits can be vaccinated against virulent microbes by means of blood and sterilised cultures, and the resistance lasts for several months. Animals

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 36–7.
† Arch. Méd. Exp. et d'Anat. Path., vi. (1894) p. 633. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 96.
‡ Ann. Inst. Pasteur, ix. (1895) pp. 65–101.

vaccinated against the most active virus are refractory to the less virulent microbes, but the converse does not hold good; and those immunised against microbes of low virulence succumb to the injection of a microbe of greater virulence, though they exhibit a greater resistance than the control animals.

Immunisation is also possible by means of the serum of vaccinated animals, but it is only transient; yet there seems hope that an effective serum may eventually be obtained.

Intestinal Vibrios and Cholera.*—Dr. J. Sanarelli considers that all vibrios are choleraic, and that water vibrios are neither the survivors of former epidemics nor common saprophytes, but are doubtless derived from the intestines of animals, and perhaps from man himself. Among the species of cholera vibrios are varieties furnishing toxic and vaccinating substances of different activities. And as regards the action of these vibrios on the organism, the author declares the peritonitis of guinea-pigs to be devoid of specific characters, and would explain the morbid process occurring in the intestinal canal on the same lines. For here, too, the vibrios do not induce an infection nor a general intoxication; they simply destroy the intestinal epithelium, thus converting an absorbing surface into a transudation one. Thus the poisoning of blood is not the cause of death in intestinal cholera; the cholera toxins are not absorbed when the intestinal epithelium is intact, and there is no longer absorption when the epithelium is shed.

Immunity to cholera cannot be conferred by attempting to impart preventive qualities to serum, nor by administering living vibrios by the stomach; but a mild form of enteritis must be set up, which, if cured, may protect against a fatal enteritis, and this intestinal tolerance may be imparted by means of the vibrio toxins. Hence, as human cholera is but a toxic enteritis, there is a possibility of a prophylactic method, based on accustoming the intestine to the cholera poison, being realised.

The author's experiments, which are very numerous, are given with considerable amplitude of detail.

Cholera Vibrio and Low Temperatures.†—The connection between cholera epidemics and water supply renders interesting the question whether the disease can be transferred by ice derived from contaminated streams. It has been stated several times that the cholera vibrio can bear cold for several days, and Dr. Weiss, on the strength of his experiments, is in a position to confirm the views of earlier observers in so far as they refer to water. Quite otherwise, however, are the vibrios affected by cold if they are present in a medium agreeable to them. In bouillon they live for 21 days, and in water containing much bouillon three days longer than in water to which only two drops of bouillon are added. In stools the cholera vibrios perish from cold more quickly than in water; hence it would seem that when the vibrios and the stools reach running water the organisms die off in a few days. Consequently it is unlikely that the cholera vibrio can be transferred from ice, and this agrees with the fact that contagion from ice has not been observed.

* Ann. Inst. Pasteur, ix. (1895) pp. 129–77 (2 pls.).

† Zeitschr. f. Hygiene u. Infekt., xviii. (1894) pp. 492. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 720.

Pathology of Intestinal Anthrax.*—Herr Krumbholz narrates a case of a person who died with symptoms suspicious of cholera, where the post-mortem examination was made half an hour after death. In the peritoneal sac was a large quantity of turbid yellow serous fluid. The intestinal mucosa showed several swellings of a dark red hue, due to œdema and engorgement; the spleen and abdominal lymphatic glands were much enlarged. Microscopical examination of the ascitic fluid and blood revealed the presence of anthrax bacilli, and this was confirmed by cultivation. As the post-mortem examination was made so soon after death, the case becomes important as proving that the infection took place through the lymphatic vessels and not through the blood circulation; for the microscopical examination of the intestine showed that while the lymph-capillaries were crowded with bacilli, the blood-capillaries were free.

Distinction between the Typhoid Bacillus and Bacterium coli commune.†—The chief results of the observations of Herr L. Müller are that *Bacterium coli commune* grows more luxuriantly than the typhoid bacillus in almost all media. In a puncture cultivation of grape-sugar-gelatin, gas-bubbles are developed; this never occurs with the typhoid bacillus. Sterilised milk is coagulated in 24 hours at 37° by *B. coli commune;* by the typhoid bacillus with difficulty in weeks. Grown on faintly acid potato, the polar granules (contraction of the plasma at the poles of cells) are very characteristic of the bacillus of typhoid, while *B. coli commune* at most shows a few gaps in the plasma.

Pyogenic Action of Micrococcus tetragenus.‡—Herr Vignerat mentions the case of an Italian who wore round his neck a scarf infected with nasal secretion. This man had an abscess on the neck, from the pus of which was obtained a pure cultivation of *Micrococcus tetragenus.* The pyogenic properties of tetragenus were demonstrated by injecting blisters with pure cultivation (blisters raised on eight persons suffering from phthisis). A painless suppuration followed, and then subsided in 14 days. From the pus of the blister *M. tetragenus* in pure cultivation was obtained. These observations confirmed the suspicion that *M. tetragenus* is pyogenic to man.

Bacteriology of Influenza.§—The organism which Dr. S. Jarron regards as the specific cause of influenza was almost constantly found in the sputum (51 out of 62 cases); in the urine drawn off with a sterilised catheter (17 out of 24); in the blood (12 times at the time of highest temperature); and in pleural effusions. It is a polymorphic diplobacillus, about 3 μ long; it is invested with a capsule, a characteristic which distinguishes it from other micro-organisms. Under certain circumstances it may assume the streptococcus form. It is best cultivated in bouillon at 25°, and its development ceases at 42°. On potato it

* Ziegler's Beitr. zur Pathol. Anat., xvi. pt. 2. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 666.

† Arb. a. d. Bact. Inst. d. Techn. Hochsch. zu Karlsruhe, l. (1894) p. 113. See Hedwigia, xxxiv. (1895), Rep., pp. 5–6.

‡ Zeitschr. f. Hygiene, xviii. (1894) p. 411. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 470–1.

§ Thèse de Bordeaux, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt. xvii. (1895) pp. 469–70.

forms spores, and thrives in sterilized urine. In its morphological characters and pathological properties this organism is apparently identical with the influenza microbe described by Roux, Pittion, and Teissier. Intravenous injections showed that the urine of influenza patients contained specific toxic substances, and these toxines were also sought for in the sputum and in cultures sterilised with naphthol, &c. Such cultures killed rabbits in doses of 13 ccm. per kilo weight of animal. The author concludes from this that influenza is an intoxication from the soluble products of the organism.

New Vibrio from Sputum.*—Dr. Brin has found in the sputum of a case of pneumonia both Fraenkel's pneumococcus and a new vibrio. He describes its growth on various media, its morphology, its staining reaction, and the results of experiments on animals. To guinea-pigs it was but slightly virulent, and to mice not at all.

Tonsils as Site of Entry for Suppurative Micro-organisms.†—According to Dr. Buschke, suppurative organisms often gain access to the body through the tonsils, and he quotes four cases in support of his assertion. The first was a simple fracture of the middle of the shaft of the humerus. In the course of the third week, when the fracture was fairly well united, a sore throat (follicular tonsilitis) developed, and in the tonsilar crypts *Streptococcus longus*, almost in pure cultivation, was found. On the third day of the tonsilitis the streptococcus was detected in the blood. On the fourth there was a rigor, followed by suppurative osteomyelitis and periostitis in the pus, from which crowds of the same streptococcus were found. The other three cases are less convincing.

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* Hygienische Rundschau, 1894, No. 20. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 470.

† Deutsche Zeitschr. f. Chirurgie, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 369–70.

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Zeitschr. ges. Brauwesen, 1895, pp. 326-8, 348-50, 359-62, 368-70, 374-7, 390-1.

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Bonn, 1895, large 8vo, ix. and 231 pp.

WINKLER, F.—**Bakteriologie und Heilkunde..** (Bacteriology and Hygiene.)
Wien Med. Presse, 1895, pp. 125–9, 172–5, 212–6.

MICROSCOPY.

α. Instruments, Accessories, &c.*

(3) Illuminating and other Apparatus.

Method of Indicating the Magnification in Drawings.†—M. Ch. Janet, referring to Dr. D. Carazzi's note on the indication of magnification,‡ explains the method which he employs when the drawings are not made with the aid of the camera lucida. He replaces the ordinary eye-piece micrometer by one ruled in squares, of which the sides are 0·5 mm. long, and draws on a piece of paper also ruled in squares. Knowing by a table made once for all what is, on the object examined, the lineal dimension corresponding to the side of the squares of the micrometer eye-piece, he chooses the size of the square on the drawing-paper, so that all the details necessary can be conveniently introduced into the drawing.

(6) Miscellaneous.

Practical Microscopy.§—The microscopist who is acquainted with the literature of his subject, or what passes for such, will remember that a book bearing exactly the same title as the present, except that it was called a new and revised edition, was published in 1889. Those who made themselves acquainted with that production of Mr. Davis know that there was much in it which could hardly be said to be up to date at the time of publication. So far as we can see, the differences between the two volumes before us lie in the title which is given to the edition, and in the advertisements which are to be found on the covers. The misprints of the edition of 1889 are, so far as we can see, accurately reproduced in the edition of 1895. The same ignorance of the conventions of microscopists or of the elements of the Greek language which are indicated by the use indifferently of micra for micron and of micras for micra are here again well in evidence. We need not stop to point out that a work which was unsatisfactory and not up to date in 1889 is hardly one that is worthy of reproduction in 1895.

Optical Institute of Zeiss in Jena.‖—Dr. M. Doll gives an account of the development of the Optical Institute of Zeiss in Jena. It was founded in 1846 by the late Dr. Carl Zeiss. In 1866 Prof. Abbe joined the establishment, and has now, since the death of Dr. Carl Zeiss, in 1888, become the chief manager. From small beginnings the Zeiss establishment has become at the present time the largest firm for the supply of purely scientific instruments in and out of Germany. In 1880 larger premises were built. With a staff of over twenty scientific officers, the number of workmen now numbers 450. The glass factory in connection with the optical institute was a creation of

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Zool. Anzeig., xviii. (1895) pp. 259–60.

‡ See *ante*, p. 368.

§ 'Practical Microscopy,' by George E. Davis, 3rd and revised edition, London, 1895, 8vo, 436 pp., 310 figs. in text.

‖ Central-Ze.t. f. Optik u. Mechanik, xvi. (1895) pp. 98–9.

Prof. Abbe. At his instigation, in the year 1881, Dr. Otto Schott commenced his experiments in the preparation of optical glass of varying refraction and dispersion. These experiments were brought to a successful conclusion in the year 1883, when the glass works of Schott and Genossen were definitely established.

Up to the year 1890 the Jena Institute concerned itself only with microscopical optics. What advances were made in this department, thanks to the theoretical and experimental investigations of Prof. Abbe, are well known. Since the year 1890, however, the firm has undertaken the construction of other optical instruments. In the first place must be mentioned the photographic objectives, and especially the Zeiss anastigmatic, of which within the last four years over 10,000 have been made. Dr. P. Rudolph is the scientific manager of this department.

A third department, of which Dr. C. Pulfrich is the head, is devoted to the construction of optical and mechanical measuring instruments. Last year the firm began the construction of the new kind of binocular field-glass described *ante*, pp. 360–2.

Professor Huxley.—Although our Fellows will have, no doubt, read various accounts of the life of this great naturalist, it is right that we should have in our own Journal some notice of our distinguished Honorary Fellow. Born at Ealing in 1825, without any exceptional advantages of schooling, indeed to judge from his own account rather the opposite, Thomas Henry Huxley became a student of medicine at the Charing Cross Hospital. On the teaching staff of that school there was then Mr. Wharton Jones, whose physiological teaching seems to have made a deep impression on the young medical student. It was at Jones's advice that Huxley's first little paper, an account of "Huxley's layer" at the base of human hair, was published. Greatly to his good fortune, Huxley attracted the notice of Sir John Richardson, and was by him placed as assistant-surgeon on board H.M.S. 'Rattlesnake.' The captain of this exploring vessel was Owen Stanley, who was a brother of the late Dean Stanley, and had many of the talents and social virtues of his family, while the naturalist on board was the distinguished Macgillivray. From 1846 to 1850 the 'Rattlesnake' was engaged in exploring the waters near the Great Barrier Reef of Australia and the islands in the Pacific. The young assistant-surgeon had numerous opportunities of studying the life of the ocean, and when he returned home he found that his accounts of various Medusæ had lifted him into a position of some authority among the younger naturalists of his time. Among those with whom he associated was Edward Forbes, who had the highest regard for the abilities of his young friend, and when Forbes was in 1856 appointed Professor of Natural History at Edinburgh, Huxley was selected as his successor as Lecturer on Natural History at the Royal School of Mines, and Palæontologist to the Geological Survey. In his interesting autobiographical sketch Huxley tells us that he took this post with a notice that he would give it up as soon as he could obtain one in which he could devoted himself to physiology; but he held the offices for thirty-one years, and a large part of his work was palæontological. So capable was this young naturalist of filling the post of lecturer on natural history, that his first course of lectures was printed in the *Medical Times and Gazette* for 1856 and 1857, and was for many years a kind of secret manual for other professors and lecturers on the subject. Those who regretted that his Manual of the Anatomy of Vertebrated Animals (1871) and the Anatomy of Invertebrated Animals (1877) were hardly up to date would, had they used his lectures in 1856, have found that he was then as much before as afterwards he appeared to be behind the time. With regard to some of his other works we may speak very differently. His Lessons in Elementary Physiology, first published in 1866, was, even to many medical men, a revelation as to the amount of physiological knowledge which had been certainly acquired; secondly, in the work which, in conjunction with Dr. Martin, he wrote on Practical Biology, he gave an enormous impetus to that practical teaching in biological laboratories, without which no biological student's education is now considered to be complete. It is impossible to reproduce a list of the numerous essays and memoirs which Prof. Huxley published. Perhaps the most notable of all are those in which, dealing largely with already well-known facts, conclusions were deduced from them which at once put investigators on a higher plane. One of his earliest contributions (1853) was published in the first volume of the new series of the Transactions of this Society (pp. 1–19, 3 pls.), and was entitled "*Lacinularia socialis.* A Contribution to the Anatomy and Physiology of the Rotifera." In 1858 he gave his famous Croonian lecture in which the vertebral theory of the skull, to which Owen had devoted so much time, was completely destroyed. In 1863 he published 'Man's Place in Nature,' and only those who were alive at the time have any idea of the storm which raged around his head. In it he carried to their logical conclusions the doctrines of which for four years he had been the chief prophet, the doctrines that are contained in Mr. Darwin's 'Origin of Species.' This is not the place to speak of Mr. Huxley's relations with the great philosopher of our age, but it must be said that all personal and private considerations were put aside in his efforts to aid Mr. Darwin in promulgating the doctrine of natural selection and the conclusions which flowed from it. Professor Huxley was professor not only at the School of Mines, he was for some years Hunterian Professor at the College of Surgeons, and for some time also Fullerian Professor of Physiology at the Royal Institution. In 1869 he was President of the Geological Society, and in 1870 of the Ethnological Society. In 1870 he was also President of the British Association, and in 1873 was Lord Rector of Aberdeen. Of the Royal Society, Huxley was elected a Fellow in 1851; in 1873 he was made a secretary, and in 1883 he became its president. The two most important honours that were conferred on him in late years were his nomination to the Privy Council, whereby he became a Right Honourable, and a Trusteeship of the British Museum. It was not till 1891 that he was made an Honorary Fellow of this Society.

Although we have confined ourselves to summarising the chief events in Prof. Huxley's life as a naturalist, it is not to be forgotten that by his services on the London School Board, by his criticism of the methods of the Salvation Army, and by his services on various Royal Commissions, he did more than most men do for society at large. He was buried on July 4th, at East Finchley Cemetery, and, by order of the Council, this Society was represented by its Secretaries.

The late Prof. Williamson.—We regret to have to report the death of one of our Honorary Fellows, Dr. W. C. Williamson, Emeritus Professor of Botany in Owens College, Manchester. Prof. Williamson, who was born in 1816, was best known for his extensive and long-continued researches on the minute structure of fossil plants. His capacities as a naturalist were so well known that, on the foundation of Owens College in 1851, he was made Professor of Natural History, and was required to teach every branch of biology. As the college increased, special chairs for various of these branches were founded, so that at last he was able to confine himself to botany. In 1892 he resigned his chair, and, settling near London, was an occasional attendant at our meetings.

The following is a list of Prof. Williamson's contributions to the Transactions of this Society:—

On the Structure of the Shell and Soft Animal of Polystomella crispa; with some Remarks on the Zoological Position of the Foraminifera. (Trans. Micr. Soc. London, ii. (1849) pp. 159–80, pls. 25 and 26.)

On the Minute Structure of the Calcareous Shells of some Recent Species of Foraminifera. (Trans. Micr. Soc. London, iii. (1852) pp. 105–28, pls. 17 and 18.)

Further Elucidations of the Structure of Volvox Globator. (Trans. Micr. Soc. London, N.S. i. (1853) pp. 45–56, pl. VI.)

On the Minute Structure of a Species of Faujasira. (Trans. Micr. Soc. London, N.S. i. (1853) pp. 87–92, pl. X.)

On the Structure and Affinities of some Exogenous Stems from the Coal-measures. (Monthly Micr. Journal, ii. (1869) pp. 66–72, pl. XX.)

The late Dr. Anthony.—Our late Fellow, who died on June 1st last, at Edgbaston, Birmingham, served for several years on the Council of the Society, and was deeply interested in its welfare. He was M.D. of the University of Cambridge, some time Fellow of Caius College, and F.R.C.P. Dr. Anthony was eighty-one years of age at the time of his death.

β. Technique.*

(1) Collecting Objects, including Culture Processes.

Resistance of Lower Vertebrates to Artificial Microbic Infection.†—In his experiments on the mode of resistance of certain lower Vertebrates to artificial microbic invasion M. A. Mesnil used *Gobio fluviatilis*, *Perca fluviatilis*, *Carassius auratus*, and the frog. The microbes were the bacilli of anthrax and of mouse septicæmia. The general conclusions at which the author arrived were that Teleostean fishes resist the bacillus of anthrax by means of phagocytosis. The lymph of these fish has neither bactericidal nor attenuating properties. The eosinophilous, or rather, cells with granulations, are either absent or insignificant in number. The frog, in which eosinophilous cells are frequently abundant, resists anthrax in the same manner as fish. By means of its phagocytes it also incorporates the living virulent microbes of mouse

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c. (6) Miscellaneous.

† Ann. Inst. Pasteur, ix. (1895) pp. 301–47.

septicæmia. At 35° the frog is still immune to anthrax, the bacteria being destroyed as at 20°. But in frogs which die less than 2–3 days after inoculation, in consequence of the leucocytes being paralysed, the microbes which are still alive develop freely in the blood and organs. When microbes are introduced directly into the blood they are seized on much more quickly than those injected into the dorsal sac, and in this destruction the macrophages of the liver play an important part. The eosinophilous cells of the frog and lizard are endowed with a positive chemiotaxis, less than that of ordinary phagocytes; the granulation cells of the lizard are capable of commencing the digestion of the bacteria which they have incorporated.

Procuring and transmitting Diphtheritic Discharges for Examination.*—Prof. D. J. Hamilton advises an ordinary 3/4 in. wide test-tube, fitted with a tight plug of cotton into which is inserted the handle of a small goat's hair brush. The brush must be firmly fixed, and its end reach nearly to the bottom of the tube. The whole is, after having been sterilised, ready for use. In starting a cultivation on blood serum or other medium the brush is merely rubbed over the surface.

Preparing Kidney-Juice Cultivation Media.†—Dr. O. Henssen prepares kidney-juice media in the following way. The kidneys must be taken out directly the animal has been killed, and after the capsule has been removed the organs are finely minced and then pulped on a mortar. An equal bulk of water is then poured over the mass, and after three hours the juice is squeezed out through a fine linen cloth. The juice is then drawn through a sterilised clay filter by means of a water pump. The filtrate is of a straw yellow colour. It is warmed to 40° C., and then mixed with an equal bulk of $2\frac{1}{2}$ per cent. agar, heated to the same temperature. The mixture is then allowed to stand for 24 hours, in order to see if it be sterile, after which it may be used for cultivating micro-organisms.

Apparatus for clearing Agar without Filtration.‡—Dr. M. Bleisch has devised an apparatus for obtaining clear agar without filtering. The apparatus consists of a cylindrical glass vessel holding about two litres, and furnished at top and bottom with a tube, the lower one being closed with a perforated caoutchouc plug, and kept firm by means of a clamp. The perforation is for the passage of a glass tube of suitable length, capable of being pushed up and down. The lower end is supported by a brass plate, fixing it to the apparatus, which in its turn is supported on a stand. Before using it the tube is pushed up as high as it will go, and the lower aperture closed by tightening the clamp. Warm water should then be poured into the apparatus to see if all the parts fit tight, and after the water has been removed agar is poured in through a funnel until the top of the glass rod just remains above the level of the fluid. The apparatus is then placed in an incubator at 50°–60° C. After the sediment has settled (and the deposition may be hastened if phosphate be used instead of carbonate of sodium), the apparatus is removed and placed at a convenient height. To the lower end of the

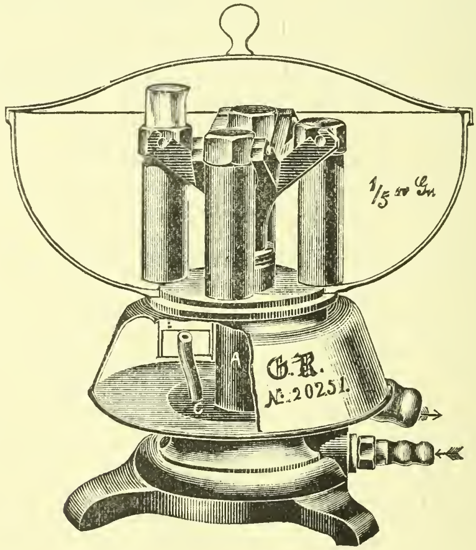
* Brit. Med. Journ., 1895, i. p. 298.
† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 403.
‡ Tom. cit., pp. 360–2.

glass tube is fitted on a rubber tube with clamp. The tube is then pulled down a few centimetres. The clamp on the tube is then opened, and the agar runs through into some suitable recipient. The glass tube must be lowered from time to time as the agar descends until the whole of the clear fluid is removed. On account of the relative waste of material it is not advisable to make the apparatus smaller.

Simple Method for isolating Bacteria on Agar and Blood-Serum.*—Prof. G. Banti fills the ordinary test-tubes and tubes 2–3 cm. wide with the requisite quantity of agar, and allows it to set obliquely, the condensation water running to the bottom. The material to be examined is then diluted with a few ccm. of bouillon or sterile water, and 1, 2, or 3 drops of the mixture placed in the condensation water of three tubes or more, according to the dilution of the material, or the number of bacteria present, which of course must previously be determined by microscopical examination. In some cases, of course, it is not necessary to dilute the material, but it can be placed straight away in the condensation water. When the two ingredients are mixed by shaking gently the condensation water is allowed to flow over the agar surface, and then the tube placed upright in the incubator. This simple procedure is said to possess all the advantages of plates without their inconvenience.

Centrifuging Agar.†—Dr. C. S. Haegler uses a centrifuge for preparing agar; by this procedure the clarifying is shorter and simpler

Fig. 73.

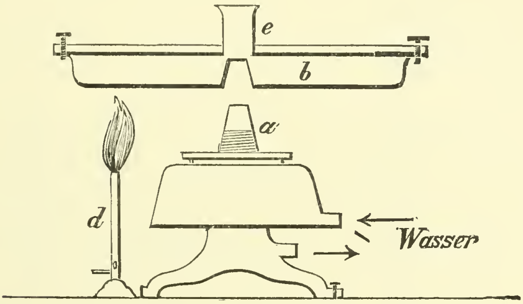


than clearing gelatin. The centrifuge is driven by water-power, and to the stem is screwed on a plate (fig. 74 *b*), having a lid fastened on

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 556–7.
† Tom. cit., pp. 558–60 (2 figs.).

with screws, a rubber band interposing; while the agar mixture is being prepared in a steamer, autoclave, or over the open fire, the plate is gently warmed with a Bunsen's burner, and when ready the agar mixture is poured on to the plate (or pan *b*) through the funnel opening *e*. The centrifuge is set in motion, and the burner removed. In about half an hour the agar is cooled and set, and on examining the contents of the pan it will be found that the agar is perfectly clear, all the particles

Fig. 74.



having been sedimented in a layer of 2–3 mm. at the periphery. It only remains to cut off the sedimented layer to obtain a mass of perfectly clear agar, which is then distributed into test-tubes, &c.

There are two points of importance in the manipulation: the first is that the pan should be thoroughly warmed before the agar is poured in; and the second, that when this is done, the centrifuge should be made to work up as fast as possible, otherwise the agar may be slightly opalescent. The centrifuge used by the author is Runne's (fig. 73).

Preparation of Mallein.*—Herren Fr. Hutyra and H. Preisz prepare mallein in the following way. After the virulence of the glanders bacilli has been considerably increased by repeated transferences through guinea-pigs, cultures are made on potatoes in capsules. When the cultures and the potatoes have become quite dry and black they are placed in a glass vessel and just covered with a fluid composed of equal parts of distilled water and glycerin and 3–5 per cent. chloride of mercury. After having been incubated for 10–14 days at 37°·5, the mixture is filtered and then steam sterilised for an hour. The fluid obtained is dark brown, but there is no connection between darkness of colour and intensity of action. For one dose 0·3–0·5 ccm. sufficed, and this the authors diluted with 0·5 per cent. carbolic acid up to 3·0 ccm.

Bacteriological Examination of Water.†—Herr G. Marpmann points out that for practical purposes the bacteria in water may be divided into two great classes, pathogenic and sewage bacteria. The pathogenic include the typhoid bacilli, pyogenic cocci, and the cholera vibrio;

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 341.
† Tom. cit., pp. 362–7.

the sewage, the coli group, and numerous peptonising putrefaction bacteria. By cultivation these may be split up into other groups: (i.) the typhoid which will grow on agar containing 0·2 per cent. citric acid, but not on agar containing 2 per cent. carbonate of soda; (ii.) the cholera vibrios which will grow on agar containing 2 per cent. carbonate of soda; and (iii.) the sewage bacteria which will not grow on agar with 0·2 per cent. citric acid.

The agar cultures are kept at 30°, and acid or alkaline meat broth may also be used at the same temperature. If there should be a small number of germs their number should be increased by mixing equal volumes of the water and sterilised bouillon and keeping it for 24 hours at 30°. Samples should then be tested in acid and alkaline media. If there be any clouding, then (i.) growth on alkaline gelatin at 10°–18° C. = sewage bacteria; (ii.) growth on alkaline agar at 30°–37° C. = cadaver bacteria; (iii.) growth on acid gelatin at 20°–22° C. = typhoid bacteria. Though the same results may be arrived at by examining the bouillon yet the recognition is safer and easier on gelatin or agar surface.

The next step is to test by plate cultivations; this will determine the species, e.g. typhoid, coli bacteria, vibrios, pyogenic organisms, and possibly anthrax. Should a colony be suspected to be typhoid, inoculate on saccharated medium, then there will be development of gas with coli organisms but not with typhoid. If there be growth on citric acid media, then it is typhoid. If there be growth at room temperature on alkaline gelatin then sewage bacteria are present. If at room temperature an alkaline cultivation shows no growth, but does on incubation, the water is impure from excrement and cadaver bacteria are present. Any water which on alkaline gelatin or agar gives colonies is harmful.

Simple Appliance for Bacteriological Examination of Air.*—Dr. P. Miquel describes a very ingenious device for examining air. The apparatus consists of a conical flask A (fig. 75), furnished with vertical and lateral tubes *t*, *t′*. The vertical tube is slightly constricted, and in it are placed two cotton-wool wads, *b*, *b′*, the latter lying against the constricted neck, and being intended to catch any germs which may have escaped through the medium. In the lateral tube *t′* is fitted a thin glass rod ("pointe de verre") kept in position in *t′* by means of a cork or caoutchouc plug. The diameter of the pointed glass rod used for flasks of 7–8 cm. at the base, varies from 1 to 2 mm. The flasks are prepared for use by first inserting the cotton-wool plugs, and then pouring in as much gelatin as will suffice, when the flask is slightly inclined, to cover the rod, except at the end furthest from *t′*. The vessels are then sterilised for half an hour at 110°. When the apparatus is removed from the autoclave, the flasks are tilted so that the tip of the glass rod just projects above the level of the gelatin. In this position it is left until the gelatin is set.

When the apparatus is used, it is clamped to a support (fig. 76, B) the tube *t′* being directed downwards. To the tube *t* is fixed a caoutchouc tube in connection with an aspirator. The glass rod is now withdrawn, and this is effected by first gently warming the plug which supports it in the tube *t′*, and carefully pulling it out, giving it at the same time a

* Ann. de Microgr., vii. (1895) pp. 103–9 (2 figs.).

turn to the right and to the left. Thus a long narrow passage is left in the medium. The aspirator is now set going at the rate of 1 litre every 2 or 3 minutes, and when a sufficient volume of air has passed the opening at t' is plugged with cork slightly burnt in the flame.

FIG. 75.

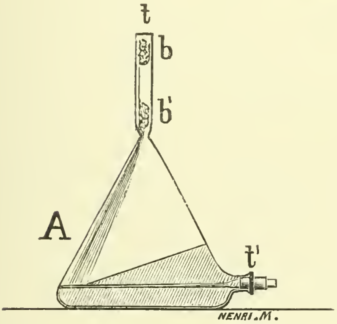
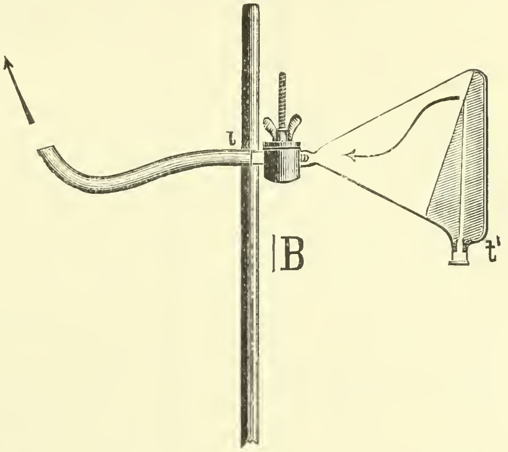


FIG. 76.



When the flasks reach the laboratory, the gelatin is liquefied at 35°–37°. Then the flasks are shaken so as to disseminate the germs throughout the medium. The gelatin is allowed to set again, and after an incubation of 30 days the colonies are counted.

Preserving Streptococci Cultures.*—Dr. J. Petruschky records the fact that he has kept two cultures of Streptococcus for six months, without any loss of virulence, and this was done by merely keeping the tubes in an ice safe.

ABEL, R., & A. DRÄER—**Das Hühnerei als Kulturmedium für Choleravibrionen.** (Fowl's Eggs as Culture Media for Cholera-vibrios.) *Zeitschr. f. Hygiene*, XIX. (1895) pp. 61–74.

AUSSET, E.—**De l'influence de la température dans l'analyse bactériologique des eaux.** (The influence of Temperature in the Bacteriological Examination of Water.) *Compt. Rend. Soc. Biol.*, 1895, No. 3, pp. 58–9.

BALL, M. V.—**A new Culture Medium for the Bacillus of Diphtheria and other Bacteria.** *Med. News*, 1894, p. 581.

BONHOFF—**Untersuchungen über Giftbildung verschiedener Vibrionen in Hühnereiern.** (Investigations into the formation of Poisons by various Vibrios in Hen's Eggs.) *Arch. f. Hygiene*, XXII. (1895) p. 351.

FROTHINGHAM, L.—**Laboratory Guide for the Bacteriologist.** Philadelphia, 1895, 8vo, 61 pp.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 551–2.

Kiefer—**Zur Kultur des Gonococcus Neisser.** (Cultivation of *G. neisseri.*) *Berl. Klin. Wochenschr.*, 1895, pp. 332–4.

Novy, F. G.—**Directions for Laboratory Works in Bacteriology, for the use of the Medical Class in the University of Michigan.** Ann Arbor, 1894, 8vo, 209 pp.

Van Ermengem, E., & E. Sugg—**Recherches sur la valeur de la formaline à titre de désinfectant.** (The Value of Formalin as Disinfectant.) *Arch. de Pharmacodynamie*, I. fasc. 2, 3.

Whipple, G. C.—**A Standard Unit of Size for Micro-organisms.** *Amer. Mon. Micr. Journ.*, 1894, pp. 377–81.

(2) Preparing Objects.

New Method of Studying Cell Motion.*—Dr. C. Lennard describes a method of studying cell motion which consists in the making of a consecutive series of instantaneous photomicrographs of the same microscopic field taken at definite intervals, and the comparative study of the series. The author's first series exhibits the amœboid motion of the white blood-corpuscles, and the change in shape and motion with relation to the surrounding stationary and identical folds is well marked. The second series shows the path of the white blood-corpuscle in forcing its way through a mass of red adherent blood-corpuscles. The third series is said to be of marked interest, a white has seized on a red corpuscle, and a series of photomicrographs shows that it has dragged it through a considerable distance in a field which is proved to be stationary and identical in all the photomicrographs. The fourth series shows motion in a red blood-corpuscle; the fifth and sixth show the passage of the red blood-corpuscle from a capillary in which blood is in motion, and from one in which the blood is at rest. The seventh series shows a capillary; along the inner surface of the wall of this there may be seen white corpuscles in which the series indicates movement.

Experiments on Frogs' Eggs.†—Mr. T. H. Morgan, in his experiments on the blastomeres of the Frog's egg, followed in general the directions given by Roux, but some eggs were turned after the operation so that the white pole was upwards. As the membrane was pierced, the egg could easily be turned into any desired position, and it would, in most cases, hold this position until subsequent cleavages had taken place. The eggs after the operation were placed on a piece of moistened glass and kept for ten hours under a bell-jar in a saturated atmosphere. If, immediately after the operation, the eggs be simply thrown into a dish of water, they assume all possible positions with respect to the vertical, and tend to hold that position through subsequent stages of development.

Study of Necturus maculatus.‡—Mr. B. F. Kingsbury, in his examination of the histological structure of the intestine of this Amphibian, found that the best way to harden the tissues was to use mercuric chloride, picric alcohol, or Ehrlich's fluid. The first of these was made by adding a saturated solution of mercuric chloride to normal salt solution. The tissue was hardened in this for 1–12 hours and then

* Proc. Acad. Nat. Sci. Philad., 1895, pp. 38 and 9.
† Anat. Anzeig., x. (1895) pp. 623 and 4.
‡ Proc. Amer. Micr. Soc., xvi. (1894) pp. 43–5.

thoroughly washed for 12–24 hours in 67 per cent. alcohol to which a little gum camphor was added to hasten the removal of the mercuric chloride; so long as tincture of iodine is decolorised when added to the alcohol, the washing should be continued; unless the chloride is entirely washed out, crystals will form in the specimen. For the outlines and relations of cells Ehrlich's fluid gave good results, but for details of structure was generally found to be inferior.

The castor-thyme method introduced by Fish was employed in sectioning. The object was imbedded in collodion. The hardened tissue was dehydrated for 12–24 hours in 95 per cent. alcohol, placed in 2 per cent. collodion for 1 day, 3 per cent. collodion for 1 day, and 5 per cent. collodion for 1 day. The collodion was then hardened in chloroform for 1–3 hours and cleared in a mixture of castor oil and three parts of red oil of thyme. When transferred to the slide the superfluous oil was absorbed and the collodion melted with equal parts of alcohol and ether. The Ehrlich-Biondi stain gave excellent results, especially in a study of glands and leucocytes, because of its high selective power. The best results with a nuclear stain were found by the use of an aqueous solution of hæmatoxylin.

Amitosis in Ovaries of Hemiptera.*—Herr F. Preusse fixed in concentrated cold sublimate (5–10 minutes) or chrom-osmio-acetic acid, after Flemming and Carnoy, or Kleinenberg's picro-sulphuric; and stained most successfully with hæmatoxylin.

Histology of Trematodes.†—Dr. A. Schuberg, in his investigation into the histology of Trematoda, made use of the method of methylen-blue staining, and prepared sections from carefully preserved material. In his staining experiments he washed out the flukes from a still warm liver by means of a fine brush, and conveyed them at once into a methylen-blue solution (1/3–1/4 per cent. methylen-blue plus 0·75 per cent. salt solution), which was warmed to about the temperature of the body, the solution being kept warm; the objects were left in it for 4–5 hours or longer. The best results, i.e. a staining of as many of the nervous elements as possible, were obtained with animals which were just beginning to die. For control observations he made use of sections. For the investigation of nervous elements he recommends the osmic acid-acetic method of v. Mährenthal. The fresh flukes were killed in a 1 per cent. solution of osmic acid, which must be contained under a cover-glass supported by a wax foot, so that the animals may be kept well flattened out. After the removal of the cover-glass they were left for 6–12 hours in the osmic acid, so that it should completely penetrate them. They were then brought directly into the acetic acid, washed with water, and imbedded in paraffin. As all the tissues blacken completely, the sections must not be too thick.

Investigation of Gyrodactylus.‡—To fix these parasites Dr. L. Kathariner made use of cold sublimate solution or of a solution as hot as 50°. This was succeeded by chrom-acetic acid and osmic acid, while borax-carmine and hæmatoxylin were the staining reagents. Control

* Zeitschr. f. wiss. Zool., lix. (1895) pp. 305–49 (2 pls.).
† Arbeit. Zool. Zoot. Inst. Würzburg, x. (1895) pp. 168–70.
‡ Tom. cit., p. 128.

observations were in many cases effected by the investigation of the living animal.

Division of Ceratium.*—Herr R. Lauterborn preserved his specimens in Flemming's mixture, picrosulphuric acid, 45 per cent. iodine-alcohol, &c. But the first was best. In it the specimens were left for 10 minutes and then washed. Treatment with gradations of alcohol followed. For staining, Delafield's hæmatoxylin gave clearest results for the chromatin of the nucleus. Paraffin sections were also cut for the study of the centrosomes, Heidenhain's method of staining being followed.

Study of Sporozoa.—Mr. J. Jackson Clarke † confirms the statement of Wolters, that Flemming's fluid does not give good results with Gregarines. He adopted a method which he found most satisfactory, not only for Gregarines but for *Coccidium oviforme*, and for animal tissues in general. Small portions of the tissue are placed for 24 hours in Foà's reagent, which is a mixture of equal parts of a saturated solution of corrosive sublimate in normal saline solution, and a 5 per cent. solution of bichromate of potassium or Müller's fluid. The material is then transferred for a day to running water and afterwards placed on successive days in 30, 60, and 90 per cent. alcohol. After this they are placed in absolute, and after saturation with chloroform are imbedded in paraffin. Care must be taken that the bath does not reach a temperature higher than 50°. The sections were cut with a Minot's microtome, and fixed on the slide with albumen and glycerin. They were stained with Ehrlich's acid hæmatoxylin diluted with distilled water, and when they had assumed a brownish-pink colour were transferred to a bath of tepid tap water and left for at least two hours. Then for two or three minutes they were stained with a solution of Grübler's water-soluble eosin, dehydrated, cleared by xylol and mounted in the usual way. The last mentioned solution was obtained by dropping a few drops of a strong alcoholic solution into a watch-glass filled with distilled water.

Mr. G. Eisen,‡ in his investigations of the life history of *Spermatobium*, found that the following method was superior to any other. The hosts were stained *in toto* in very weak Delafield's hæmatoxylin, or in Ehrlich's ammonia hæmatoxylin. After hardening and sectioning in paraffin the slide fixing consisted simply of distilled water or of formalin and gelatin (1/2 per cent.) in water. This fixing is used as follows:—(1) Cover the space of the entire glass on the slide with several drops of the fixing so that the sections will float; warm gently over a plate until the paraffin becomes slightly transparent, but not so long that it begins to melt; let the fixing harden in the air during at least four hours, or better during the night; the paraffin should be dissolved in pure turpentine or xylol; when the latter is at last removed by alcohol the slides are stained by a saturated solution of orange G in 33 per cent. alcohol. Attention is called to the very great advantages of gum Thus in xylol as a mounting medium, for it gives images which are far superior to those found with Canada balsam or dammar.

* Zeitschr. f. wiss. Zool., lix. (1895) pp. 167–90 (2 pls.).
† Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 287–8.
‡ Proc. Cal. Acad. Sci., v. (1895) pp. 4 and 5.

Demonstrating the Tubercle Bacillus in the Sputum.*—M. J. Amann gives the result of a 12 years' experience of examining for tubercle bacilli in the sputum. All the sputum should be tested, and it is made homogeneous either by squeezing it between two ground-glass plates or by sedimentation. The former method requires no explanation; with regard to sedimentation, the author points out that any chemical or physical means which are detrimental to the tinctorial properties of the bacilli should never be adopted, and his method for treating the mass is to place it in a glass vessel holding about 100 ccm. 2–4 volumes of distilled water are then poured over it so that the vessel is about half full. 1 ccm. of chloroform and some clean lead shot are then put in, and the vessel having been tightly plugged is shaken up for some minutes. The fluid is then placed in a conical wine-glass, or better still in a U-shaped glass tube, the bottom of which is narrowed to 2 mm., so that it resembles somewhat a Geissler's burette. 2 ccm. of phenol-fuchsin solution are then added and the apparatus shaken. The top is closed with a perforated caoutchouc plug, through the aperture of which is inserted a balloon syringe. After standing for 24–48 hours the sediment will have deposited, the supernatant fluid being quite clear. The bulb is then squeezed and the sediment flows out into a receptacle placed to receive it. The sediment can then be examined for epithelium or elastic fibres as well as for bacilli. The sedimentary sputum is next spread on slides, and when dry fixed either by heat or by immersion in equal volumes of ether and absolute alcohol, the latter process being preferred as it removes the fatty particles.

For staining the preparations (already partially coloured) use phenol-fuchsin 1 grm., fuchsin 5 grm., 90 per cent. carbolic acid, and 95 ccm. hot distilled water. A few drops of this solution are poured on the slide, which is then heated till it vaporises over a spirit-lamp. The preparation is decolorised as follows:—It is first treated with 20 per cent. picro-sulphuric acid for 1/2–1 minute and then washed thoroughly in running water. It is next treated with the special solution, 15 grm. fluorescëin, 15 grm. methylen-blue, 500 ccm. absolute alcohol, until the sputum is of a pale greenish-yellow colour. The next step is to stain the preparation with malachite-green in dilute aqueous solution, and this done it is dried at a temperature of 60–80°. While it is still warm cedar oil is dropped over one or two spots, and when cold the preparation is examined without the interposition of a cover-glass, though of course it can be mounted in the usual way.

(3) Cutting, including Imbedding and Microtomes.

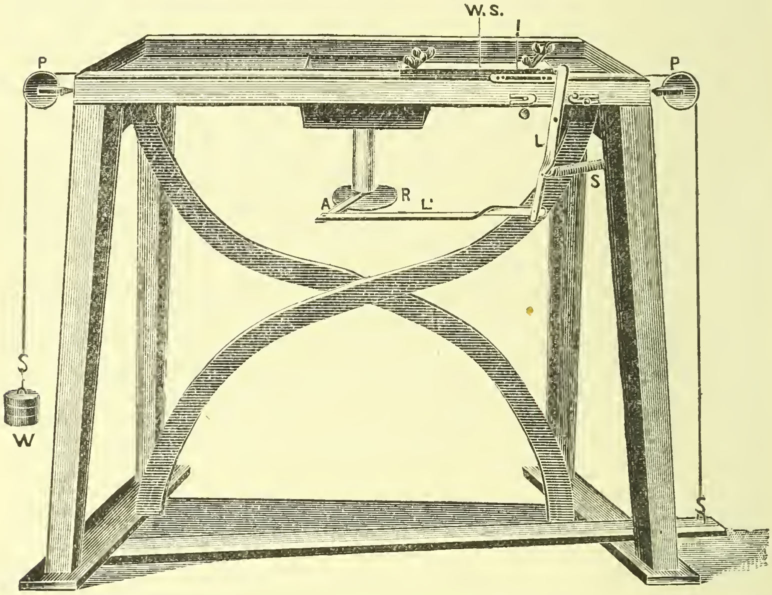
Microtome for Cutting Sections under Spirit.—Alexander Bruce, M.D., F.R.C.P.E., Lecturer on Pathology, Surgeons' Hall, Edinburgh, writes:—Most microscopists who have had occasion to use a sliding microtome to cut sections from tissues imbedded in celloidin have been met by several difficulties in their work. Among them may be mentioned:—(1) Friction of the cut section against the blade. This is obviated fairly well in the case of small sections by dropping spirit on the blade; but when the sections are of considerable size it is very

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 513–22.

difficult to bathe the knife with sufficient spirit to prevent them from tearing. (2) The vibration in the unsupported end of the blade. (3) The fact that, in most cases, a change in the obliquity of the edge of the blade, which may become necessary during cutting, is always accompanied by a change in its plane, and therefore by the loss of several sections. (4) The difficulty of adjusting the tissue to be cut to any desired plane.

I have devised an instrument to meet these difficulties so that it is possible—(1) to cut sections with a knife completely under spirit; (2) to support the knife by both ends; (3) to change the cutting edge of the knife to any obliquity desired without altering its plane; (4) to allow of ready adjustment of the tissue by means of a simple mechanism

Fig. 77.



Microtome seen from the side.

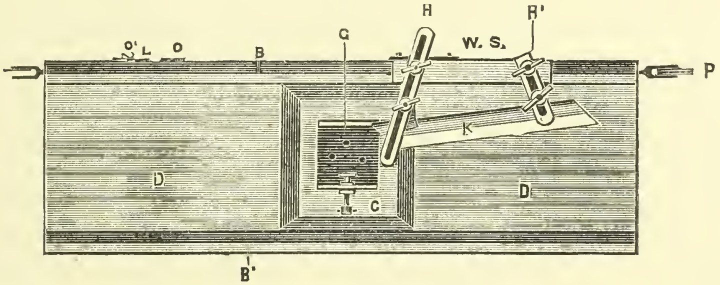
for holding the block of wood on which the tissue is mounted, and of its easy orientation by means of a ball-and-socket joint.

The instrument consists (figs. 77 and 78) essentially of the following parts:—(1) A long shallow trough (D D, fig. 78) for holding spirit. (2) A wedge slide W S, which moves along a groove (B, fig. 78) on one side of the trough, and supports the knife K by two horizontal arms H H. (3) A screw mechanism G passing through the centre of the trough for carrying and raising the tissue that is to be cut. (4) A treadle-arrangement (fig. 77) automatically raising the section.

The trough D is 36 in. long, 8 in. broad, and 1 in. deep. In the centre is a well C, 7 in. square and $2\frac{1}{2}$ in. deep. To the middle of the floor of this well is attached the apparatus G for raising the tissue to be cut. The object of the well is to give greater depth for the tissue than is possible with the shallow trough, and, at the same time, to economise spirit. The sides of the trough have two perfectly parallel wedge-shaped grooves for carrying the wedge-slides. The object of the double groove was to enable the knife, in cutting large sections, to be supported at both ends and from both sides of the trough; but since the instrument has been in use it has been found that the knife can be perfectly well supported from one wedge-slide alone. The ends of the trough are closed with a thin layer of oak.

The trough is made of cast iron in a single casting, and the grooves in the sides are planed by a planing machine. The wedge-slide W S is 10 inches long, and is made of cast-iron. The sliding surfaces have been grooved so as to diminish friction in working. To the upper surface two long lever-arms H H, made of gun-metal, can be fixed. Those are slotted throughout almost their entire length, so as to allow the knife to be placed at any desired degree of obliquity to the piece of tissue to be

FIG. 78.



Microtome seen from above.

cut. This adjustment can be effected with the greatest readiness, and the plane of the knife is thereby scarcely, if at all, altered.

The knife K is hollow ground. Its blade is 12 in. long and $1\frac{3}{4}$ in. broad. Its ends have been cut obliquely so as to allow the point of the blade to come nearer the margin of the trough than would have been possible had the ends been rectangular. This is especially desirable when very large sections are to be cut. The knife can be fixed by a simple adjustable apparatus to the slotted arms (fig. 78).

The screw for raising the object has forty turns to the inch. To its upper extremity is attached a ball-and-socket arrangement, into the former of which is screwed the clamp for holding the tissue. A special arrangement is provided for screwing the socket on to the ball to any desired degree of tightness. It is not difficult to screw the socket up so that it should be just so loose that the clamp can be easily moved into any desired position, and yet so tight that it shall retain that position during the process of cutting.

The screw is raised by means of a toothed wheel (R, fig. 77) at its lower end, and this wheel, again, is turned by means of an arrangement of levers thrown into action by the impact of the wedge-slide at the end of its back stroke (L L′, fig. 77). This wheel has about 120 teeth in its circumference.

The wedge-slide is drawn backwards by a treadle T worked by the foot, acting through a cord which passes round a pulley P at one end of the trough. It is drawn forward by a cord and weight W attached to the opposite end of the wedge-slide and acting on a pulley P at the other end of the trough. The rate of movement of the slide is controlled partly by the amount of the weight attached to the cord, and partly by the foot hindering the rise of the treadle. The mechanism for raising the section is so arranged that the screw is rotated throughout the desired distance when the knife is at the end of its return journey and just in position to commence the cutting movement. When the wedge-slide is pulled backwards it strikes the upper end of a vertical lever arm L, which moves on a fulcrum fixed slightly below the side of the trough.

The other end of the lever moves forward a horizontal rod L, which is attached to an arm A moving round the centre of the toothed wheel. This arm bears a ratchet which carries the wheel round through the desired distance. This distance again is regulated by the travel of the lever-arm, the wheel being the further carried round the greater the movement of the lever, and *vice versa*. The movements of the arm can be easily and finely adjusted by two small slotted bars O O′, attached by butterfly screws to the side of the trough. When the knife moves away from the lever, its lower end, and with it the rod and ratchet, are drawn back by a spring attached to the leg of the instrument. The ratchet is thus ready to move round the wheel when next the wedge-slide strikes the lever. The general arrangement of the mechanism is seen in fig. 77.

The operator sits or stands at the side of the trough opposite to the groove in which the wedge-slide acts. He thus has both hands free for the manipulation of the sections.

The instrument is made by Mr. Alexander Frazer, 22 Teviot Place, Edinburgh. It is already in use in my laboratory, Surgeons' Hall, Edinburgh, and in the Universities of Edinburgh, Aberdeen, Dublin, and in Queen's College, Belfast.

Method for Marking Small Objects in Paraffin Imbedding.*—It is often difficult, says Herr M. Samter, to discover the whereabouts of a small colourless object when imbedded in paraffin; but this may be surmounted by the following device. Paraffin is easily stained red by merely rubbing alkanin into it when melted. The object having been saturated with this red paraffin, is then imbedded in colourless paraffin through which its position is easily discernible.

Collodium as a Material for Imbedding.†—Prof. G. F. Atkinson describes in detail the best method of preparing the various stages in the life-history of Ferns, and of using collodium as the imbedding-material for sections made with the microtome.

* Zeitschr. f. wiss. Mikr., xi. (1895) pp. 469–71.

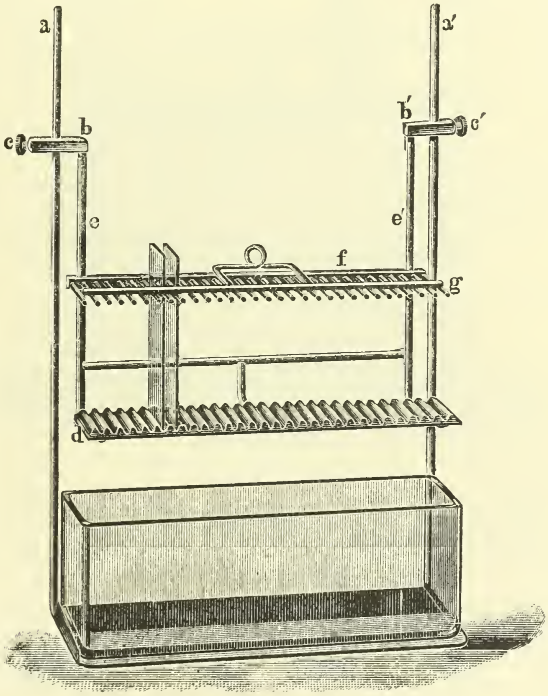
† 'The Study of the Biology of Ferns, &c.,' New York, 1894, 134 pp. and 163 figs. See Bot. Centralbl., lxi. (1895) p. 95.

(4) Staining and Injecting.

Slight Modification of Golgi's Method.*—Prof. A. S. Dogiel has endeavoured to get over the well-known difficulty that blood-vessels and the ducts of glands are apt to be impregnated as well as the nerves in using Golgi's method. He injects at the outset with a saturated solution of Berlin-blue and gelatin, cools the subject in snow for 20–30 minutes, cuts off suitable portions, and treats with Golgi's bichromate of potash solution or with Ramon y Cajal's osmio-bichromic mixture. The ordinary procedure follows, or a red injection may be used, with subsequent treatment in the osmio-bichromic mixture. The injection-colours last for some time and obviate confusion.

Apparatus for Staining Serial Sections.†—Herr R. Borrmann has devised an apparatus for the convenient and rapid staining and further

Fig. 79.

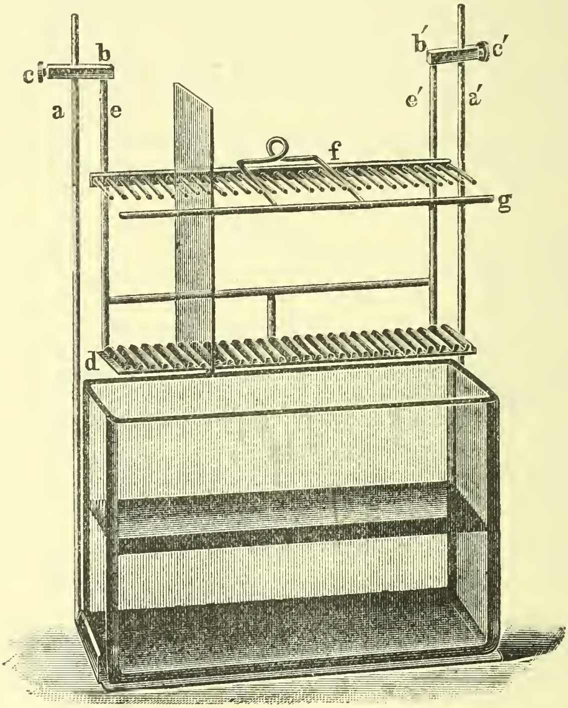


manipulation of serial sections. It consists (figs. 79 and 80) of a base to support a glass rectangular vessel in which the various fluids are placed. From the base proceed two metal uprights a, a', to which are fixed by means of screws c c' the tray d, supported by means of the pieces

* Anat. Anzeig., x. (1895) pp. 555–7.
† Zeitschr. f. wiss. Mikr., xi. (1895) pp. 459–64 (2 figs.).

b b' and *e e'*. The tray is grooved to prevent the slides touching at the bottom, while at the top is a toothed rackwork *f g*, much like a scullery plate rack. The method of using the apparatus is obvious from the illustration. The material of which the apparatus is made is brass, and

Fig. 80.



back to back it will hold sixty slides. The chief measurements are as follows:—Bottom 16 by 6 cm.; uprights, 25 cm.; tray, 15 by 3·5 m. Of course the measurements vary with the size of the slides, as may be seen by comparing the two illustrations.

Staining the Plasma-sheath of Anthrax.*—Herr F. Lüpke recommends a freshly prepared 0·2 per cent. solution of gentian-violet for staining anthrax, and makes this by taking a drop of a 10 per cent. alcoholic solution of gentian-violet and adding it to 50 drops of sterile water. The cover-glass preparation is then heated until the fluid begins to vaporise, after which it is washed with water.

Demonstrating the Nerve-fibres of the Vertebrate Heart.†—In studying the innervation of the vertebrate heart Drs. J. F. Hymans and

* Deutsch. Tierärztl. Wochenschr., 1895, p. 23. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 683.

† Arch. de Biol., xiii. (1895) pp. 619–70 (25 photo plates).

L. Demoor followed Golgi's method, though they took full advantage of the modifications suggested or introduced by other workers with the same procedure, such as Ramon y Cajal and Kallius. No details of the technique are given. They mention that the photographs, which are numerous and excellent, were taken on isochromatic plates with the oxyhydrogen light.

Demonstrating the Parasites of Artificial Carcinoma.* — Prof. F. Sanfelice placed the pieces removed from the dog and fowl in alcohol, and when hard stained them *in toto* with lithium-carmine. The pieces were then treated with acid alcohol and absolute alcohol, imbedded in paraffin, and sectioned. The sections were stuck on with albumen and freed from paraffin with xylol, washed with absolute alcohol, and then placed in Ehrlich's fluid for 5–10 minutes. On removal they were bathed in distilled water, to which a few drops of 0·5 per cent. oxalic acid had been added. The excess of acid was next removed by washing with distilled water. The sections were dehydrated in absolute alcohol and mounted in xylol-balsam. By this method the parasites are stained violet and the tissues red. Another method by which good results were obtained was, after sticking the sections on slides with albumen, to immerse the preparations in a mixture of equal parts of a 1 per cent. aqueous solution of safranin and a 1 per cent. aquoso-alcoholic solution of malachite-green for 10–20 minutes. The preparations were, after washing in distilled water, placed in 0·5 per cent. oxalic acid for 2–3 minutes, and then in absolute alcohol until they no longer gave off any colour, whereupon they were mounted in xylol-balsam. By this method the parasites became green and the tissue elements red.

HESSERT, W.—**A Simple Stain for Ciliated Bacteria.**
Chicago Med. Recorder, 1894, pp. 240–2.

(5) Mounting, including Slides, Preservative Fluids, &c.

New Method for Securing Paraffin Sections to the Slide or Cover-glass.†—Miss Agnes M. Claypole finds that "Among the many steps to be taken in making microscopical preparations, that of securing the sections to the slide may seem of minor importance, yet the possibility of ultimate successful results depends largely on the complete reliance to be placed upon the process by which this step is accomplished. Especially is this true of serial sectioning when the disarrangement of the sections renders the slide almost worthless. In Lee's compilation of microscopical methods, 'The Microtomist's Vade-Mecum,' there are about a dozen different processes given for fixing paraffin sections to the slide. These processes fall into two natural divisions, those fitted for material stained *in toto*, and those fitted for sections to be stained on the slide. Of those belonging to the second group, only a few admit of the use of both watery and alcoholic stains, and in most of them heat is an essential part of the process.

Many of the methods involve a previous coating of the slide with a substance that has to dry and be again moistened before the sections can be arranged upon it, such as collodion, shellac, or a gum preparation.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 631.
† Proc. Amer. Micr. Soc., xvi. (1894) pp. 65-7.

Some are useful for temporary slides, while in others the intricacy of the process greatly increases the chance of error, and adds to the time required for the work.

There are no methods given in Lee's work of an earlier date than 1880. One of the oldest is the shellac method, now no longer used. Schällibaum's collodion also is best fitted for bulk-stained objects. A slide is coated with a thin even layer of one part of collodion to three or four volumes of clove or lavender oil. The sections are arranged and the slides heated over a water-bath for five to ten minutes, or over a lamp for a shorter time, till the oil has evaporated. Gage and Summers use a pure collodion coat on the slide which is rendered adhesive by clove oil or ether-alcohol. There are many gum methods, but some forbid the use of watery fluids, and others are not fitted for alkaline stains.

Lee recommends Mayer's albumen for use with sections that have to be stained on the slide, and says that he has found it to be absolutely reliable. There is no need to describe so well known a method, the principle is the coagulation of a thin layer of albumen by the use of heat. It is just at this point that the element of uncertainty comes into the process; much heat will injure the tissue, and in avoiding this danger there is a great probability of applying too little heat to coagulate the albumen.

Among other methods given by Lee is one recommended by Strasser.* It consists of coating the slides thinly and evenly with a mixture of two parts of collodion with one of castor oil—the percentage of the collodion is not given. Sections are arranged on those prepared slides and coated with a thicker solution—collodion concentratum duplex, 2–3 parts; castor oil, 2 parts; no warming is required, but the slide is put direct into a bath of turpentine for two to ten hours to dissolve out the paraffin.

While working during the past year with serial sections, great trouble was experienced with Mayer's albumen method, and after some experimentation, the following plan was adopted. A layer of Mayer's albumen was spread on the slide and the sections arranged. Then a wash of $\frac{3}{4}$ per cent. collodion was spread over the surface evenly with a camel's hair brush. This coat is allowed to dry, which takes place in about one minute, but a longer time does no harm; practically, one slide dries while the next is being prepared. During the drying many small air bubbles appear, the presence of which indicates the right degree of dryness; these do not cause any inconvenience, as they disappear during the subsequent processes. When dry the slide is put, *without heating*, into a jar of xylol or benzin for half an hour or more, to dissolve the paraffin. A stay of several hours in the liquid will not injure the tissue. The paraffin may be removed in three to five minutes by constantly moving the slide in the benzin. The benzin or xylol is removed by 95 per cent. alcohol, and the sections are then stained and mounted as desired.

It was found best to have the liquid for removing the paraffin as fresh as possible, or else the thin film of collodion retained a sufficient amount of it to render the surface greasy; benzin was tried, and proved

* Zeitschr. f. wiss. Mikr., iv. I. (1887) p. 45.

in every way as satisfactory as xylol. Owing to its cheapness it is possible to use benzin in much larger quantities than xylol, and the requisite degree of freshness is easily obtained.

Many slides were prepared without the preliminary coating with albumen, and in all cases the collodion coat was sufficient to keep the sections fastened to the slide, but owing to the well-known uncertainty in making a film of collodion adhere to glass, the albumen was used as a safeguard against failure, the alcohol in the collodion serving to coagulate the albumen. Different per cent. solutions of collodion were tried, and mixtures varying in the proportions of ether and alcohol. No difference was found in the results given by the various mixtures, but the 3/4 per cent. solution was the most satisfactory.

The chief advantage of this method is that it dispenses with the need for an alcohol lamp; an important, and, in the hands of the inexperienced, a somewhat dangerous adjunct of the laboratory is thus removed from constant use. The greatest disadvantage is that, as in all collodion methods, the collodion is liable to take the stain and refuse to give up the colour to treatment. Practically, however, in using the ordinary hæmatoxylins, eosin, picric alcohol, &c., there is no difficulty; it is only with the stronger stains that trouble is found. The use of this thin coat of collodion is a simple and effective method for general histological purposes."

Preparing Liquidambar for Mounting.*—Prof. H. G. Piffard prepares liquidambar for mounting in the following manner. A pound of the crude gum (an exudation from *Liquidambar styraciflua* L.) is liquefied in a water-bath, and then filtered through a Plantamour's funnel lined with two or three thicknesses of cheese cloth. When cold, one pound of xylol is added. The bottle containing the mixture should be shaken several times daily for at least two weeks. It is then filtered two or three times through absorbent cotton or Swedish paper. The thin transparent filtrate is next inspissated at a gentle heat until it has the consistence of molasses. Two parts of this should be mixed with three parts of monobromid of naphthalin and heated gently. The result is a clear amber-coloured fluid, the refractive index of which should be brought to 1·625 by the addition of either of the ingredients as may be required. Preparations mounted in this medium are quite permanent.

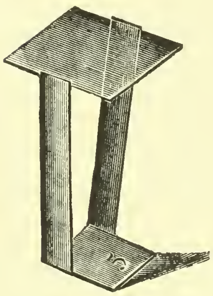
Zenker's Fluid as a Fixative.†—Dr. A. Mercier records his experience of this fluid, the formula for which is as follows:—Sublimate, 5·0; bichromate of potash, 2·5; sulphate of soda, 1; acetic acid, 5·0; distilled water, 100·0. The acetic acid should be added to the rest of the fluid just before using, 10 ccm. to 200 ccm. of the mixture, and a large quantity is to be used, about fifty times the bulk of the piece or organ. The objects used were fowls' embryos from the second to the seventh day, organs of some mammals (cats, bats, rabbits), and worms, young frogs, and salamanders. The smaller objects were immersed for 24 hours, the larger for 48 hours. They were then washed for 6 hours in running water; then 6 hours in 50 per cent. spirit, changed thrice; then 6 hours in 70 per cent. spirit, once changed; then 2–3 days in 90 per cent.

* Med. Record N.Y., May 4, 1895, p. 547.
† Zeitschr. f. wiss. Mikr., xi. (1895) pp. 471–8.

spirit, changed twice or thrice. After this, for 10–15 days in 90 per cent. spirit, containing 1/2–3/4 per cent. tincture of iodine some tincture being occasionally added. Finally, in 90 per cent. spirit until all the iodine was removed. After this the objects were immersed in absolute alcohol, or stained *en masse*, or soaked in chloroform, &c., preparatory to imbedding for sectioning. The results from this method of fixing are said to be very satisfactory, and the staining with most dyes very good.

Simple Cover-glass Holder.* — Dr. O. Zoth shows how a simple cover-glass holder can be made from a strip of brass or platinum foil. The strip of foil, 7 cm. long and 4 mm. broad, widens out to 1 cm. sq. in the centre (see fig. 81) where it is bent twice almost at right angles, and the free ends are provided with two grooves cut by means of a file. The thickness of the foil should be from 0·6 to 0·3 mm., so that it can be easily cut with an ordinary pair of scissors.

Fig. 81.



(6) Miscellaneous.

Improvements in Microscopical Technique.† —Prof. H. G. Piffard discusses some of the improvements in microscopical technique, among which he mentions the use of the electric light supplied from the street main. In order to use this it is necessary to employ a Carpenter's rheostat, which not only effects a uniform resistance and voltage, but affords critical illumination. The author has had made for him lenses specially corrected for the D line of the spectrum, and these are advantageous both in visual and photomicrographic work. The usefulness of monobromide of naphthalin as an immersion medium is referred to, and the author has had constructed for him, by H. R. Spencer of Buffalo, a monobromide immersion lens which works most satisfactorily, and also an achromatic condenser with N.A. 1·40, at about half the cost of English condensers. After showing the advantages to be derived from using lenses and condensers of high aperture, the author proceeds to discuss various mounting media, the preference being given to liquidambar, the formula for which we give elsewhere. Clarifying media, such as the essential oils, are next referred to, and the important fact is pointed out that what is sold as oil of origanum is not such, but in all probability red oil of thyme. The author advises a thorough re-study of our clearing media.

Gaseous Formic Aldehyde for Disinfecting Purposes.‡—MM. R. Cambier and A. Brochet report the results obtained by using their apparatus for disinfecting places with gaseous formic aldehyde. The experiments were of two kinds, theoretical and practical, the former carried on under laboratory conditions, the latter in a room of 75 cubic metres (5 m. × 5 m. × 3 m., with two doors and three windows). In

* Zeitschr. f. wiss. Mikr., xi. (1894) p. 149.
† Medical Record N.Y., 1895, pp. 545–9.
‡ Ann. de Microgr., vii. (1895) pp. 89–102.

the laboratory series, where the vessels could be hermetically closed, the results were eminently satisfactory, and much like those seen in the testimonials of a new antiseptic; all the germs were destroyed. Although not obtaining absolutely perfect results in disinfecting the room, the value of the method was sufficiently demonstrated, for dust in layers of 1 cm. thick, placed in little pots at various heights in a cupboard, was found perfectly sterilised in 20 hours.

Optimum Temperature for Incubation.*—Mr. Féré comes to the conclusion that 38° is the temperature at which the smallest number of abnormal developments takes place during the first few days of incubation of hens' eggs. By exposing eggs to fumes of alcohol the author finds that injurious effects are overcome afterwards in a large percentage of cases if the eggs are incubated at 38° rather than any other.

Apparatus for making Gaseous Formic Aldehyde.†—MM. R. Cambier and A. Brochet have constructed an apparatus for making gaseous formic aldehyde, the object of which is to disinfect rooms, &c., by diffusing therein a definite quantity of this vapour. Its construction is based on the incomplete oxidation of methylic alcohol in contact with air and incandescent platinum, $CH_3OH + O = H_2O + CH_2O$. It is composed of a copper vessel to hold the spirit, on which are screwed a number of burners. Each of the burners is composed of a metal tube containing a cotton or asbestos wick, and is surmounted by a cone of platinum wirework, fixed by means of a mica ring. The quantity of air is regulated by a device similar to that of a Bunsen's burner, and the draught kept up by a long glass chimney.

To set the apparatus going, the level of the spirit in the burners must first be adjusted to 1 cm. below the upper edge of the tube, and the holes in the regulator closed. The platinum case is then made red-hot by applying a match to it, the chimney is then put on and the regulator-holes opened.

The best temperature for the platinum is when it is cherry-red; if the flame be too lively the spirit undergoes total conversion into H_2O and CO_2; if too dull, CO as well as CH_2O is produced. It is advisable to avoid the production of CO, for though it is not found in quantity sufficient to be lethal, yet the blood-spectrum shows the characteristic absorption change. With eight burners 800–1000 grm. of spirit can be converted per hour.

* Journn. de l'Anat., July 1894. See Amer. Natural., xxix. (1895) p. 62.
† Ann. de Micrographie, vi. (1894) pp. 539–42 (2 figs.).

PROCEEDINGS OF THE SOCIETY.

Meeting of 19th June, 1895, at 20 Hanover Square, W.
E. M. Nelson, Esq., Vice-President, in the Chair.

The **Minutes** of the Meeting of 15th May last were read and confirmed, and were signed by the Chairman.

The following **Donation** was reported, and the thanks of the Society were given to the donor.

From

J. Pereira, Lectures on Polarised Light (8vo, London, 1843) .. *Mr. W. H. Brown*

Messrs. Watson and Sons exhibited a simple Centering Underfitting for use with any ordinary Student's Microscope. It was well known that very few instruments of this class did centre accurately, and the fitting exhibited was a contrivance for providing a means of accurate centering at a small expense to such Microscopes.

The Chairman thought this was a very good thing indeed, and one which he was extremely glad to welcome, for he had long felt that the most elementary student's Microscope should have some kind of centering gear fitted to the substage condenser. The one before them met the two essential requirements of efficiency and cheapness.

The Chairman exhibited a new low-power lens by Zeiss, which he thought would be found very acceptable. It was the first of its kind made in Germany, for hitherto all German low powers had consisted of single combinations, except one made by Seibert of 36 mm. Zeiss had now remedied this by making one with optical index of 31, which so far as he had yet tried it gave very excellent results.

He also brought another lens for exhibition which was not exactly microscopical, but was such a new advance in optics that it was not possible yet to tell how it might affect the construction of Microscope lenses intended for photography. This was an ordinary photographic camera lens which consisted of two symmetrical, but uncorrected lenses; its chemical focus was therefore not coincident with its visual focus. It was $8\frac{1}{2}$ in. in focus, and it covered a half plate sharply to the edge. In fact, it was the most anastigmatic lens he had ever seen.

A few years ago a lens capable of taking pictures that size would have cost 8*l.* or 9*l.*, whereas this cost only 25*s.*, with an iris diaphragm included. The point was, Could this principle be applied to Microscope objectives? The method of working of this lens was very simple. The visual rays were first focused in the ordinary manner, the lens was then pushed nearer the ground glass by means of the bayonet-shaped slot in the mount, and then the photograph was taken.

He further brought an improved form of his little reflector lamp, exhibited at a former meeting of the Society; it had now been achromatised, and was found to act remarkably well.

Mr. C. Beck inquired if these photographic lenses were single uncorrected lenses, or were they not the same as the periscope introduced by Steinheil in 1865? He should have thought—looking at them casually—that it had an aperture of $f/16$, and was nothing more than two uncorrected meniscus lenses. In what way was it corrected for aberration?

Mr. J. E. Ingpen was glad to hear that Zeiss had taken to making low-power objectives again. When Prof. Abbe was over here the first time he brought with him an objective of 32 mm. which was an extremely good one, and showed a distinct advance upon much work done at that date. Zeiss's firm went back however to their 24 mm., but he was very pleased to find they were again making a low power, having come back to their right mind.

The Chairman said that the photographic lens was not corrected at all, but he thought there must be some difference in the glasses, because he found that the correction for astigmatism was perfect. It worked at F/13, and he found he could take instantaneous views with it, outside, quite perfectly. He had not taken it to pieces to see what the combination might consist of, but so far as he could judge by reflection, the lenses were single.

Mr. Beck said it would be a rather curious optical problem if with such a construction the lens was corrected. Of course, it would be understood at once that a photographic lens always had a very great advantage over a microscopic objective, because it had to produce an image which was much smaller than the original, whereas a lens for the Microscope had to produce a magnified image, and the correction was necessarily of a more accurate character.

On the motion of Prof. F. J. Bell, a vote of thanks was passed to Mr. E. M. Nelson for bringing to the meeting these very interesting exhibits.

Mr. W. C. Bosanquet read a paper on *Nyctotherus ovalis*, a parasite of the Cockroach, illustrating the subject by a diagram upon the black board.

The Chairman said he was glad to welcome on that occasion the presence of a new worker amongst them in that room, and moved a hearty vote of thanks to Mr. Bosanquet, which was carried unanimously.

Dr. Bruce's paper, "On a new Microtome for cutting sections in spirit," was read to the meeting, in the absence of the author, by Mr. Karop (see p. 487).

Mr. G. C. Karop said that by reading a technical description it was hardly possible at once to grasp all the features of an instrument such as this, but so far as he could judge there was not any special novelty about it. As regarded the cutting of sections under spirit, this had been done long ago by Katsch of Munich, and others. Supporting the knife at both ends had also been done before, but, as indeed the author admitted towards the end of his paper, this was really quite unnecessary except in the case of very large sections. The idea of changing the obliquity of the knife as desired was also an old contrivance. As a combination machine, this might probably be found a very useful instrument, though there were very few points about it which could be claimed as really new.

Mr. Beck remarked that the ball-and-socket joint was not by any means new, the Bausch and Lomb Company having made it in America long ago. As a combination instrument it might have its merits, but he thought that every individual feature had been accomplished before.

On the motion of the Chairman, a vote of thanks to Dr. Bruce was unanimously passed.

Prof. Bell regretted that they had been disappointed as to the attendance at the meeting of Prof. Farmer, who it was expected would have been present that evening to give them his views upon certain questions which arose at their last meeting, as to the conclusions arrived at by Miss Sargant in her paper then read before the Society. Prof. Farmer on that occasion controverted some of Miss Sargant's opinions, and it had been arranged that he should come and state his own ideas more fully on the present occasion. Unfortunately he was not present, and there was nothing further upon the Agenda paper to occupy the time which had been reserved for the purpose of the expected discussion.

The Chairman said that the Library would close on August 12th, and reopen on September 9th; he then announced the adjournment of the Meeting to October 16th, and wished the Fellows present a pleasant vacation.

The following Instruments, Objects, &c., were exhibited:—

Mr. E. M. Nelson:—A Low-power Objective by Zeiss; a Photographic Lens; and a Reflector Lamp.

Messrs. Watson:—A Centering Underfitting for Student's Microscope.

New Fellows:—The following was elected an *Ordinary* Fellow:—
Mr. Laurence Miles.

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

OCTOBER 1895.

TRANSACTIONS OF THE SOCIETY.

XII.—*On the Division of the Chromosomes in the First Mitosis in the Pollen-Mother-Cell of Lilium.*

By Prof. J. Bretland Farmer, M.A.

(Communicated by Prof. F. Jeffrey Bell, M.A., Sec. R.M.S.)

(*Read* 16*th October*, 1895.)

Plate X.

In a paper read before the Society on May 15th of this year,* Miss Sargant discusses the origin of the peculiar appearances presented by the chromosomes in *Lilium Martagon* during the first (heterotype) mitosis in the pollen-mother-cell. She deals especially with the question as to how the shape of the daughter-chromosomes in the diaster stage is derived from that of the mother-chromosome, and endeavours to explain the curious forms exhibited at that time as

EXPLANATION OF PLATE X.

[E signifies in all cases the ends of the elliptical chromosome, or the free ends when the primary fission is complete.]

Fig. 1.—Diagram of a nucleus with four chromosomes illustrating some of the more common forms of these structures.
„ 2.—The common mode of attachment of the "ring"-chromosome to the spindle fibres.
„ 3.—Some common forms of chromosomes seen from the pole when in the aster stage. S A, spindle axis.
„ 4.—Later stage of fig. 2.
„ 5.—Still later stage, in profile.
„ 6.—The same, in front view.
„ 7.—Front view of a chromosome dividing to give rise to the daughter-chromosomes.
„ 8.—Another mode of attachment of the ring-chromosome to the spindle. There is no bending, and the chromosome is attached near one end.
„ 9, 10, 11.—Chromosomes whose limbs have crossed over each other.
„ 12.—An unusual form, where the longitudinal halves of the chromosomes have become twice twisted.
„ 13.—Later stage of 12.

* See *ante*, p. 283.

the result of an upcurving of the outer ends of the divergent halves of the mother-chromosomes. But I have been myself led to a different conclusion, as the result of my own studies on this plant, and a comparison of it with other species of *Lilium*. The main assumption which underlies Miss Sargant's argument seems to be that the original chromosome splits longitudinally, and that the two halves then diverge as simple bars. These may subsequently become bent, but the curved form is of secondary importance. She further implicitly concludes that the relative lengths of the divergent ends and the as yet unsplit portion (of the original chromosome) will furnish a criterion of the age, or stage of development, to which that body may have attained. I think that the assumption as to the mode of splitting and also the conclusion as to the age need proof, and I further believe that, as a matter of fact, the whole process really takes place in a manner other than that which has hitherto been considered to be the mode.

If the genesis and early steps in the development of the chromosomes from the resting nucleus be followed out, the process will be found to be as follows, though variations from the normal type frequently occur.

1. *Normal type.*—As the linin framework of the nucleus becomes more prominent, it shortens and thickens, and the tangled skeinwork becomes more and more unravelled. Chromatin appears in it, but is not uniformly distributed. As the nucleus proceeds through its changes, the linin thread flattens, and the chromatin is especially abundant at its edges; furthermore, at certain entire transverse areas it is nearly absent. These spots mark the places where the original filament will split transversely into its twelve segments. Along with these changes the linin is seen to split longitudinally along its middle line, from which the chromatin is nearly or quite absent. This is the longitudinal fission referred to by authors. Now it has always been assumed that the remaining steps in the formation of the daughter-chromosomes, which arise by the separation of the longitudinal halves, consist in their *simple* divergence, though only after a somewhat considerable interval of time. This, however, seldom corresponds with the true state of the matter. A certain number of the twelve chromosomes (formed by the *transverse* breaking up of the filament, as above described) are still seen to be completely split horizontally. Many of them, however, are only cleft along the middle, and are closed at one or both ends, thus forming closed links, or ellipses —the closed rings of Flemming's figures.

As the process of mitosis progresses, the twelve segments are seen to be distributed just within the wall of the nucleus, and to assume, in many cases, a curved form. They then, almost suddenly, retreat to the equatorial plane of the nucleus, and this happens concomitantly with the formation of the achromatic spindle. At this stage the number of ellipse-shaped chromosomes is relatively *increased*, and I regard this as the result of the fusion at the ends, of a number of those in which the longitudinal fission had extended throughout their entire length. Each chromosome now bends over on itself, so as to place its originally distant ends into close apposition. This and the following stages can easily be understood by bending an elliptical hoop of wire in the corresponding fashion. The bending takes place in such a way that the approximated ends are directed radially outwards to the periphery of the spindle, and thus each chromosome appears split almost, but *not quite*, to its central end, with the peripheral limbs diverging. The divergence of the limbs may be quite obliterated, if the bending on itself of the chromosome is very complete, as the slit then becomes indistinguishable. I may remark that Guignard * seems to have seen this figure, without, however, having appreciated its real significance. At any rate it is a very common one, and no one can have looked at one of these nuclei at this stage without having noticed it. The general effect is that of a Y, with the limbs directed *outwards* and in the *plane of the equator*, at right angles to the direction of the spindle.

It is obvious that these divergent limbs can hardly represent the longitudinal halves of a chromosome, since, in order to assume their proper position on the spindle, the chromosome as a whole would have, first to rotate on its axis through 90°, and next to twist round in the radial plane of the spindle through 180°, in order to bring the vertical bar of the Y outwards, and the limbs to lie on the spindle fibres. This difficulty seems to have escaped Guignard, who, in fig. 14,† indicates a split at right angles to that shown in fig. 13, though he seems to regard the two as identical. The vertical part of the Y consists then of two approximated loops, which represent the middle portions respectively of each of the longer sides of the ellipse, and they now commence to divaricate along the spindle fibres, forming the well-known divergent bars of the dividing chromosome. When the process is nearly complete a "split" appears in each, which is identical with the one previously described by me.‡

The split does not extend to the extreme end of the diverging daughter-chromosome, but it *is* of course continuous through the humped projection at the middle, and represents simply the reopening of the original chromosome ring. Finally a split appears *across* the hump, and the separation of the two daughter-chromosomes is then complete ; each opens out to form a V, and retreats to the poles, with its free ends still directed to the equator. Very often the line of separation across the hump appears before the ring has opened out again, or the two events may happen simultaneously. The appearance presented by the chromosome just before the final separation of its

* "Nouvelles Études sur la Fécondation," Ann. Sci. Nat. Bot., 7e sér. xiv. (1891) pl. 10, fig. 13. Compare also pl. 13, fig. 52. † Op. cit.

‡ "Über Kerntheilung in *Lilium*-Antheren besonders in Bezug auf die Centrosomen-Frage," Flora, 1895, Heft 1.

component halves thus corresponds to fig. 51 in Miss Sargant's paper, though it is obvious that our interpretations differ widely.

2. Variations may occur, and of these it is impossible to mention more than a very few. The most frequent one is that in which the young mother-chromosome does not form a completely closed ring after the longitudinal fission has occurred. When it is closed at *one* but not at both ends, the free limbs often cross each other, and according as they do this more or less so will the further development of the chromosome be affected. If they scarcely cross, or do not do so at all, they *may* go through the same series of metamorphoses as have already been described. More often, however, the whole chromosome comes to be attached to the spindle by one of its ends, and most frequently by the end at which the two halves are free. The respective halves then diverge a little above the actual end of the chromosome, and so the incurved figure shown in Miss Sargant's fig. 49 is produced. In those cases where the original chromosome was attached to the spindle fibres at the middle of its length, the figure represented by Miss Sargant in her fig. 51 might probably occur, though I cannot accept the conjectured sequence of events as suggested in the text. Whether such a figure as that of 51 would be produced would, I think, depend on the *original* position of the chromosome on the spindle, and I have seen no evidence to suppose that such a form as that represented in fig. 49 would ever pass into that shown in fig. 50 or 51. The relative length of the incurving portions which *subsequently separate* bears no constant relation to the common undivided portion, and therefore I cannot admit that any conclusions, based on this relation, as to the age of the chromosome, are valid.

In those cases where the free ends of the longitudinally split chromosome cross each other to a large extent, the body commonly becomes attached to the spindle at the point of crossing. As the ends are already curving outwards, this peculiarity becomes accentuated as the division of the chromosome proceeds, and in this way many of the forms with outcurving limbs (see fig. 48, *c* in Miss Sargant's paper) may be accounted for. That this is really the case may be easily decided, as one limb may be seen to be actually lying *across* the other until quite late in the entire process. This particular type often gives rise to very singular forms: sometimes the daughter-chromosome remains nearly straight along the spindle, and the two are still attached to one another by a knot-like swelling at the middle. When this gives way very late, the phenomenon is seen of a chromatic thread extending through the whole length of the spindle from pole to pole. These figures are, however, rare.

From what has been said it will be obvious that, in the heterotype as well as in the homotype form of division we have a longitudinal fission of the mother-chromosome, but that in the former the process is greatly complicated. I may mention that in some Liverworts which I am at present investigating, the homotype division may be more complex than usual, and even approximate to the heterotype in character.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, Etc.

*Including Original Communications from Fellows and Others.**

ZOOLOGY.

VERTEBRATA:—Embryology, Histology, and General.

a. Embryology.†

Early Stages in the Development of Vertebrates.‡—Herr B. Lwoff has a somewhat lengthy memoir on the formation of the primary germinal layers, and on the origin of the notochord and mesoderm in Vertebrata. His investigations have led him to conclusions which in many points contradict many embryological theories which are current to-day. He finds that the differentiation of the primary germinal layers is very various in various Vertebrates, and the history cannot be compressed into one general scheme. Thus, in *Amphioxus*, the smaller ectodermal cells can be distinguished from the larger endodermal cells in the blastula stage. The typical condition in the process of differentiation of the primary germinal layers in holoblastic eggs is this—that the endodermal elements are surrounded by the ectodermal elements; but this final result may be obtained in various ways. In meroblastic eggs, where the primitive conditions are altered, cleavage is effected on one side, and there is partial or unilateral delamination. In *Amphioxus* the endoderm is formed by invagination, but in other Vertebrates there is no invagination at all. There may be epiboly, delamination, or partial delamination. The foundations of the notochord and of the mesoderm are due partly to cleavage from the ectoderm, partly to the growing round of the ectodermal cells, which form a thickening. A typical condition in the development of Vertebrates is the formation of a continuous plate of cells, partly by infolding, and partly by cleavage

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, &c., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development and Reproduction, and allied subjects.

‡ Bull. Soc. Imp. Moscou, 1894, pp. 57–137, 160–256 (6 pls.).

of the dorsal ectoderm. The dorsal plate, when formed, gives rise to the typical organs of the Vertebrata. Attention is particularly called to the fact that in all Vertebrates the notochord and the axial mesoderm primitively formed a continuous *Anlage*, which only secondarily breaks up into the median notochord and the lateral mesodermal plates. The author thinks that this result is of great importance for the comprehension of the mode of origin of the notochord and of the axial mesoderm. In comparing the mode of formation of the mesoderm in Vertebrates, one finds that there are only two points of constant occurrence. The first is that, as already said, the notochord and the axial mesoderm arise from a continuous *Anlage*, and the second is that the mesoderm is always a continuous structure which owes its origin to the elements of the two primary germinal layers. This leads the author to deny the homology of the mesoderm as a germinal layer through the whole series of Vertebrata; for example, the mesoderm of *Amphioxus* cannot be homologous with the mesoderm of Amphibians, for in the former it is axial only, and not peripheral.

Phylogenesis of the Amnion.*—Prof. A. A. W. Hubrecht has published a general essay on the phylogenesis of the amnion and the meaning of the trophoblast. Rejecting all previous explanations of the phylogenetic origin of the amnion as being unsatisfactory, he suggests that it is very probable that the Protamniota were viviparous Amphibia in which the pseudomeroblastic germinal vesicle arose by a collection of fluid between the cells of the hypoblast. If this be so the germinal vesicle of Monodelphous Mammals corresponds to a stage which is phylogenetically older than that of the Sauropsida. He suggests that the amnion in this primitive stage began to be formed from the covering layer of the Amphibian epiblast. In the further development of arrangements to allow of osmotic exchange between the vessels of the embryo and the mother, a closed trophoblast arose; this invested both the embryo and the amniotic vesicle. This was effected in such a way as to give opportunity for the allantois to develope in various directions; on this hypothesis the trophoblast is homologous to the covering layer of the Amphibian epiblast. The actual separation of the internal lining of the amnion from a trophoblast layer several cells thick occurs at the present day in the Hedgehog, and a similar but shortened process obtains in *Pteropus* and *Cavia*. In the mouse and some other rodents the amnion arises by the formation of folds in epiblastic cell layers, and here both the embryo and the amnion lie within the trophoblast. Several series are described, and it is pointed out that a sharp separation between the embryonic shield and the trophoblast is the primitive condition. Both amnion and trophoblast are therefore closely allied in their phylogenesis, and both are to be regarded as products formed by separation from the outer epiblast layer. In the Sauropsida the trophoblast is much less active than in Mammals, in consequence of the formation of an egg shell. The polyphyletic derivation of the three sub-classes of Mammals, which is a necessary supposition for the hypothesis here developed, is made probable by the palæontological results of the last decade, indeed, may be said to be almost definitely established.

* 'Phylogenesis of the Amnion,' Amsterdam, 1895, large 8vo, 66 pp. and 4 pls.

Development of Oviducts in Man.*—Dr. P. Wendeler traces the development of the oviducts from their beginning in the fifth week of embryonic life. The material for the formation of the Müllerian ducts is the cœlomic (archinephric) epithelium. The tube grows backwards between the Wolffian duct and the thickened superficial epithelium of the Wolffian body. Its growth depends mainly on the multiplication of cells in the solid point. Neither the cell material of the Wolffian duct nor the superficial epithelium or formative cells of the Wolffian body have any share. Dr. Wendeler traces the differentiation of the ducts to the end of fœtal life, and describes the descensus ovariorum and the origin of the coils.

Development of Oculomotor and Trigeminal Nerves.†—Prof. G. Chiarugi has worked chiefly with embryos of the guinea-pig. He notes that in embryos of 3–3·6 mm. there are two primitive branches of the fifth—an ophthalmic and a mandibular, and that there is an intimate connection at this stage between the fifth nerve and the ectoderm. The latter is for a time in direct contact with the ganglion, but mesenchyme is eventually interposed. In embryos of 4·7 mm. a maxillary branch has been derived from the mandibular, and there is a distinct ophthalmic ganglion (not to be confused with the ciliary) which soon fuses with the ganglion of the fifth, forming a conical bud from whose apex the permanent ophthalmic branch arises. No primitive connection between the third nerve and the ophthalmic of the fifth was observed.

At a stage when the ophthalmic ganglion has fused with that of the trigeminal, and the ophthalmic branch has acquired a fibrillar structure, some ciliary filaments—proximal and distal—are seen arising from the ventral margin of the ophthalmic branch.

The youngest embryos in which an oculomotor was seen measured 4·5 mm. A rudimentary ganglion on the root of this nerve is distinct, and does not seem to be derivable from the passage of nerve elements from the fifth. Along the oculomotor, between the nerve fibrils, there are scattered nuclei, most difficult to interpret. These and the origin of the ciliary ganglion, the author discusses, but all so tersely that one would prefer to wait for his completed memoir.

Theories of Dentition.‡—Dr. W. Kükenthal agrees with Schwalbe's general conclusion that the diphyodont condition of Mammals is inherited from Reptilian ancestors, from the polyphyodont state. He argues against Leche's view that there are in Mammals four sets of teeth,—(1) The oldest, quite functionless, only hinted at in the embryos of the lowest Mammals; (2) the second, or milk-set, functional; (3) the replacement-set, a new acquisition; and (4) a fourth set of prospective importance.

Kükenthal reasserts his own conclusions:—(1) In all Mammals there are originally two sets, of which the second typically replaces the first. Both sets and the succession are inherited from ancestral forms. Hints of two other lost sets may be seen in embryos. (2) With increased specialisation the polyphyodont state has been replaced by a

* Arch. f. Mikr. Anat., xlv. (1895) pp. 167–99 (3 pls., 1 fig.).
† Monitore Zool. Ital., v. (1894) pp. 275–80.
‡ Anat. Anzeig., x. (1895) pp. 653–9.

diphyodont state, the more anterior teeth being always most affected. (3) In the lower Mammals the first set is still dominant; in the higher, the second. (4) The number of sets has been reduced in proportion as individual teeth have been specialised.

He rejects Leche's idea that the replacement-set is a new acquisition, notes Schwalbe's corroboration of the theory of fusion, and criticises Hoffmann for combating this without sufficient consideration.

Development of Teeth in Ruminants.*—Herr A. Hoffmann has studied the development of the sheep's teeth, with particular reference to the crown-cement. Some of his results are the following:—From palæontological as well as embryological evidence, it is plain that the fourth tooth on the lower jaw is a canine which has become like an incisor. In the region of these teeth, the lower jaw is separated from the lower lip by a deep groove, the lip-groove. The same is to be seen above and below in the region of the back teeth, but on the upper jaw in front, where teeth are absent, the groove though present is less distinctly developed. The lip-groove is suppressed in proportion to the suppression of teeth.

The development of the lower front teeth occurs from in front backwards; the dental ridge is continued uniformly over the region of the most anterior premolar, which does not develop; in the upper dental ridge there are no rudiments of the lost incisors; the replacement-ridge in the region of the permanent premolars, is differentiated from behind forwards, and the same is true of the rudiments of all the back teeth.

Of the insunk epithelium only the high cylindrical cells of the stratum mucosum which lie directly on the papilla can be regarded as equivalent to the enamel organ of lower Vertebrates. It is developed exclusively from the lingual fold of the dental ridge. The formation of the crown-cement in Ruminants occurs without the intervention of a cartilage-stage, by the direct ossification of the layer of the tooth-sac overlying the enamel surface. The main condition of its development is that the production of enamel come to an end a sufficiently long period before the emergence of the teeth, and in Ruminants there is a characteristic hastening of degeneration in the enamel organ and a characteristically rich vascularity in the tooth-sac.

The molars are ontogenetically equivalent to teeth of the first set. In all cases they arise from a perfectly simple single papilla, which secondarily becomes complicated. There is no fusion of the rudiments of several series. Of reduction first affecting the milk-series there is no evidence.

Reduction first affects the second series, and this may lead to a stronger development of the corresponding teeth in the first series. Hence the strength, persistence, and differentiation of those teeth, such as the molars of Placentals, which have no successors.

Experimental Embryology.†—Prof. O. Hertwig has made further experiments with the ova of *Rana esculenta* and *R. fusca*, subjecting them to the influence of salt solutions. The addition of a little salt (·1–·6 per cent.) results in the production of what may be called

* Zeitschr. f. wiss. Zool., lviii. (1894) pp. 566–617 (1 pl.).
† Arch. f. Mikr. Anat., xliv. (1895) pp. 285–344 (3 pls.).

monstrosities. Even a solution of ·1 per cent. has a marked influence. The ovum is unequally affected, the vegetative half being more inhibited and injured than the animal half, probably because less protoplasmic.

The process of gastrulation is modified, approaching that in meroblastic ova. There is a disproportionate increase of the dorsal organs, a longitudinal growth of the embryo, at the expense of the region adjacent to the blastopore ring, the cellular material being moved forwards and towards the median plane. Hertwig has observed three modes of gastrulation in frog-ova, and is convinced that the disposal of cell-material is determined in the course of the developmental process, according to the various conditions, and that the mosaic theory is thereby proved false. Another effect of the chemical stimulus of the salt is anencephaly and associated hemicrania, the cerebral plate being at an early stage inhibited from closing into a tube.

It is hardly necessary to say that Hertwig maintains that external conditions have a direct influence, and are more than mere stimuli. External and internal conditions combine to give the result. He criticises Weismann's position, and argues for Epigenesis.

Grafting Amphibia.*—Prof. G. Born has been making some experiments on young tadpoles of various Amphibia. He was led to his experiments by the observation that when a tadpole was cut into two pieces the pieces might unite again if kept close together. He used larvæ that were ready to escape from the egg jelly or those that had just escaped. When the tail ends of two tadpoles of the edible frog are placed with the cut ends together, they unite in 24 hours quite completely, so that there is little external evidence of the line of fusion. These joined tails live for eight days and increase in length; they then degenerate and become dropsical. The anterior ends of two larvæ may be made to unite. This succeeds more readily with the younger stages. Complex unions of two larvæ may result when the cuts are not quite complete and the two pieces of each remain connected by a slender bridge of tissue. The anterior part of one larva may be united to the posterior part of another individual. Two frog larvæ may be easily united belly to belly so that a true twin is formed. It is possible to unite larvæ of different genera, and even of different families.

What is a Germinal Layer?†—Dr. F. Braem criticises the different conceptions which prevail as to the nature of a germinal layer, and traces the history of opinion in regard to this question. Pander (1817) seems to have had the physiological differences of the layers most in view; to him they were distinguished by the quality of the organs to which they gave rise. Von Baer (1828) also found the essential point of distinction in the nature of the organs which the layers form. Rathke (1829) also found the "idea" of a germinal layer in its function, in what it formed. So when Huxley (1849) compared the outer and inner layer of the Cœlenterate body with the germinal layers of higher animals, the parallel rested on physiological relations. Remak (1851–5) distinguished sensory, motor-germinative, and trophic layers, and still kept to the physiological standpoint. Allman (1853) introduced the

* JB. Schles. Ges., 1894. See Amer. Natural., xxix. (1895) pp. 590–2.
† Biol. Centralbl., xv. (1895) pp. 427–43 (2 figs.), 466–76, 491–506.

terms ectoderm and endoderm, and the very use of these led gradually to emphasis on position. The author goes on to trace the development of the planula-theory (Ray Lankester) and the gastræa-theory (Haeckel), the slow evolution of the *biogenetisches Grundgesetz* which he traces back to Aristotle, and the growth of scepticism as to the homology of the germinal layers, which had been assumed, where only analogy was evident. From the development of Bryozoa, &c., he shows how difficult it is to homologise the analogous layers throughout. He maintains that the homology of *Keimschichten* has got hopelessly mixed up with the analogy of *Keimblätter*, and that embryologists have a bad habit of shifting at random from morphological to physiological conceptions.

Relative Proportions of Yolk, Shell, and White of Egg.*—Dr. R. W. Bauer, continuing his quantitative estimates, finds that a double-yolked duck's egg has 42·554 g. of yolk, 59·06 g. of albumen, and 11·453 g. of shell. In a thrush's egg there was 2·31 g. of yolk, 4·642 of albumen, and ·999 of shell.

β. Histology.

Particular Type of Nerve-cell in the Middle Ganglionic Layer of the Bird's Retina.†—Prof. A. S. Dogiel finds, besides the large nerve-cells and amacrine cells of the middle ganglionic layer, other cells of much interest. He describes two types:—(1) Nerve-cells whose very long axis-cylinder process enters into and branches within the optic centres, in the layer of optic fibres, and (2) nerve-cells whose relatively short axis-cylinder process does not go beyond the retina, but branches on the external surface of the inner reticular layer. In many, particularly in large cells of this second type, there are two axis-cylinder processes, either both from the body of the cell, or one from a protoplasmic process, and the other from the body of the cell. The two kinds of centrifugal fibres which end in the retina come into close relations with the cells of the middle ganglionic layer; the terminal branches of the first kind of fibre surround the amacrine cells (which have no axis-cylinder process), those of the second kind of fibres form a feltwork around the protoplasmic processes of the second type of nerve-cells above described.

Retinal Cells in Eyes of Fishes.‡—The late Prof. J. A. Ryder had a note on an arrangement of the retinal cells in the eyes of Fishes which partially simulate compound eyes. He recently found that in the eye of a larval salmon there is an arrangement of the sensory cells of the retinal epithelium that is so regularly and definitely repeated throughout the whole extent of the retina as to admit of no question. The first thing that strikes the observer in examining these sections is the extraordinary regularity with which the rods and cones form a pattern. The author recognises that a comparison of these rods and cones in the retina of the Salmon cannot be exactly instituted with the cell groups in the Arthropod eye which are known as ommatidia. The regularity and repetition of the arrangement of cellular elements in the retina of a fish suggests that

* Biol. Centralbl., xv. (1895) p. 448.
† Anat. Anzeig., x. (1895) pp. 750–60 (2 figs.).
‡ Proc. Acad. Nat. Sci. Philad., 1895, pp. 161–6 (2 figs.).

it is possible that the retina of Vertebrates has been evolved by the coalescence of very small groups of sense cells that were at one time separate and simple sense organs.

Peculiar Mitosis in young Oocytes of Salamander.*—Dr. F. Meves describes peculiar mitotic processes in the oocytes of *Salamandra maculosa*, observed at the stage when aquatic life is abandoned. As the larvæ were all born in captivity, abnormal conditions may have had to do with the peculiarities.

The oogonia show a nucleus with few chromatin fragments and a very delicate, but dense linin-framework. As they become ova, a fine narrow-meshed chromatin network appears, which afterwards changes into a coarser coil. A longitudinal cleavage of the chromosomes was observed. Young oocytes, in the stage with a narrow-meshed chromatin network, exhibited a mitotic process which ends in degeneration. The chromatin network becomes a fine coil; a longitudinal splitting of chromosomes follows; the double rods (twelve) separate, shorten, thicken, may anastomose, and behave quite abnormally; the nuclear membrane disappears; only a single central point of radiating filaments is usually apparent; the chromatin elements, occupying a peripheral position, are halved transversely, and each group consists of four spherules; the elements are bent towards the centre of the radiation, and degeneration sets in.

Probably the phenomena, which are merely outlined in the above summary, represent the introductory phases of premature and abnormal directive-divisions.

Retrogression of the Karyokinetic Spindle.†—Mr. A. Bolles Lee observes that in the spermatogonia and spermatocytes of the snail the karyokinetic spindle in the "regression" is often a compact body uniting the daughter-cells. This is the "problematic body" of Platner.

The bridges may persist for several successive generations, forming a chain—the *Zellkoppel*, or intercellular ligament of Zimmermann.

It is admitted that the retrogression may take other forms, but the caution is submitted that the retrogressive stages of the spindle may be mistaken for attractive spheres, centrosomes, and even intercellular parasites.

Eosinophilous Cells of some Fishes.‡—M. J. Siawcillo has examined the eosinophilous cells of three species of fish, the gudgeon (*Gobio fluviatilis*), the Russian loach (*Cobitis fossilis*) and the skate (*Raia denticulata*). The blood was fixed by dry heat or alcohol and ether, and then stained with the triple Ehrlich solution, or with eosin (aqueous) and aqueous methylen-blue solutions. The leucocytes with large granulations were not observed in the loach. In the skate they were numerous and in this fish were observed other cells, the protoplasm of which was filled with fine needle-like crystals also staining with eosin. The eosinophilous granulations of the skate responded to all the micro-chemical tests for albumen. The fact that the skate is devoid of bone marrow and is possessed of numerous large eosinophilous cells seems to

* Anat. Anzeig., x. (1895) pp. 635–45 (5 figs.).
† La Cellule, xi. (1895) pp. 29–51 (1 pl.).
‡ Ann. Inst. Pasteur, ix. (1895) pp. 289–300 (1 colrd. pl.).

overthrow the usually accepted hypothesis that these last are derived from bone marrow. The author made some experiments to test the validity of the hypothesis put forward by Hankin, namely that these eosinophilous granules are the mother substance of alexins. It was found that the loach, which does not possess eosinophilous cells, was unaffected by subcutaneous and abdominal injections of anthrax, though if the water of the aquarium were not kept at the ordinary temperature the animals died in a few days. That the eosinophilous cells of the skate had no relation to the anthrax bacilli was shown by the fact that no changes occurred in the number or character of these cells after injection. Moreover, anthrax, when cultivated in skate's blood, notwithstanding the large proportion of eosinophilous cells, throve well and retained its virulence; inoculations of the cultures on guinea-pigs and white mice were fatal.

Changes in Nerve-cells during Functional Activity.* — Dr. G. Mann has made experiments to determine whether the functional activity of the nervous system is accompanied by demonstrable histological changes in the cells, and he finds that during rest certain chromatic materials are stored up in the nerve-cell and that these materials are used up by it during the performance of its function. Activity of nervous tissue is accompanied by an increase in size of the cells, the nuclei and nucleoli of sympathetic, ordinary motor and sensory ganglion cells. Fatigue of the nerve-cell is accompanied by shrivelling of the nucleus and probably also of the cell, and by the formation of a diffuse chromatic material in the nucleus.

γ. General.

Results of the 'Challenger' Expedition.† — A very handsome appreciation of the results of the 'Challenger' voyage is contained in an article by Dr. Anton Dohrn on the 'Challenger' expedition and the future of oceanography. Dr. Dohrn remarks that it is well worth while to seize this occasion for a few words of reflection on a scientific drama, which is equally great in all its parts and dimensions. He rejoices to see that in these days of division of labour, combination of labour takes its firm hold in the organisation of modern scientific life, and Moltke's maxim, March separately, attack jointly, proves useful in the peaceful battles of thought and science. The reports of the 'Challenger' expedition not only combine to produce results which close a splendid past, but open a future of new research. Dr. Dohrn very properly recalls the services of the late W. B. Carpenter in the inauguration of the 'Challenger' expedition. He urges with great force that the mental and intellectual productions of a nation are not to be the last nor the least in their claims on public money, and he maintains with confidence that hardly any other expense will so amply repay the budget of a nation as the funds handed over for the promotion of research, or more correctly, for the organisation of research. The last two volumes of the 'Challenger' report, which are the immediate object of Dr. Dohrn's review, are, as he points out, the work of Dr. John Murray, the true

* Journ. Anat. and Physiol., xxix. (1894) pp. 100–7 (1 pl.).
† Nature, lii. (1895) pp. 121–6.

soul of the expedition, to whom science owes a great debt of gratitude for his never-ceasing care and toil. The modest language which Dr. Murray uses with regard to the most important work of his life is quoted with high appreciation. The fact that, of the fifty volumes of the 'Challenger' reports, more than nine-tenths are purely biological leads us naturally to suppose that the future of oceanography will lie with biology and with its ways and means for increasing our knowledge. It would be of the highest advantage if one nation, or an international combination, would present biology and oceanography with a steamer expressly built for purposes of such research as the 'Challenger' performed, and it is at any rate clear that a scheme of this kind is the best way of enlarging our knowledge. In conclusion, Dr. Dohrn ventures to utter the thanks of science to the officers and men of the 'Challenger,' to the Admiralty, to the British Government and Parliament, and to the whole British nation for having set the example to the world of one of the grandest and most successful scientific expeditions that ever has been, and most likely for considerable time to come will be, started. Dr. Dohrn's enthusiastic article ought to give a new impetus to the study of the biology of the great oceans.

Cœlom, Genital Ducts, and Nephridia.*—Mr. E. S. Goodrich calls attention to a theory of the homology of the cœlom which, though gradually gaining ground abroad, has not, he thinks, received in this country the notice which it deserves. This theory is, that the cavity which we know as the cœlom in the higher Cœlomata, is represented by that of the genital follicles in the lower types of that grade; in fact, Hatschek's suggestion has now become a well-established theory. Although the theory has been, at all events, partially adopted by other writers, no one, so far as Mr. Goodrich is aware, has pushed it to its logical conclusions, and applied it to all the groups of Cœlomata. This is what he attempts to do in the present paper. We are led, it seems, to the conclusion that we have been confusing two organs of totally different origin under the one name nephridium; the one organ is the true nephridium, the other the morphological representative of the genital duct, which may be called the peritoneal funnel. It seems that, while both are present in the adult of many Worms, Rotifers, and Endoproctous Bryozoa, there are no certain traces of true nephridia in the Ectoproctous Bryozoa, the Mollusca, the Arthropoda, the Echinoderma, or the Vertebrata. In these latter groups, the peritoneal funnels, or primitive genital ducts, take on the excretory functions of the nephridia which they supersede. In briefly reviewing the various classes of the Cœlomata, the author endeavours to show that the two kinds of organ can always be distinguished. The nephridium, primitively excretory in function, is developed centripetally and quite independent of the cœlom, possesses a lumen which is developed as the hollowing out of the nephridial cells, and is generally of an intracellular character, is closed within, and may secondarily acquire an internal opening either into a blood space or into the cœlom. The second kind of organ, the peritoneal funnel, is invariably developed centrifugally as an outgrowth from the cœlomic epithelium or wall of the genital follicle,

* Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 477–510 (2 pls.).

and possesses a lumen which arises as an extension of the cœlom itself. Into the details of the various groups which he describes it is impossible for us to follow him, but we may note that he concludes in the following terms:—the cœlom can be traced from its smallest beginning as a cavity or cavities in which are developed the gonad-cells; it grows gradually in size and importance until it becomes the body-cavity in which the viscera rest; the genital ducts, with a few possible exceptions due to secondary modifications, are homologous throughout the Cœlomata; the nephridia, which have often been confused with these ducts, can always, when they occur, be distinguished from them; and finally, the cœlom may secondarily acquire a renal function, in consequence of which the peritoneal funnels supersede the nephridia proper as excretory ducts.

Variation in Animals and Plants.*—Prof. W. F. R. Weldon, as Secretary to a Committee of the Royal Society appointed to conduct a statistical inquiry into the measurable characteristics of animals and plants, has prepared the first report. In this it is pointed out that while the importance of variation as a factor in organic evolution is not seriously disputed, naturalists are not agreed as to the manner in which variation among individuals is associated with the modification of species. The original view of Darwin and Wallace was that specific modification is, at least generally, a gradual process, but of late years another view has received support from various writers. It has been assumed that the advantages or disadvantages which accompany the more frequent slight abnormalities are in themselves of necessity slight, and that the effect of such slight abnormalities may be neglected. These writers regard change in specific character as an event which occurs occasionally and by steps of considerable magnitude. Prof. Weldon, however, discusses the effect of small variations. It is further pointed out that the questions raised by the Darwinian hypothesis are purely statistical, and the statistical method is the only one at present obvious by which that hypothesis can be experimentally checked. In order to estimate the effect of small variations upon the chance of survival it is necessary to measure, first, the percentage of young animals which exhibit this variation, and secondly, the percentage of adults in which it is present. When the law of growth has been ascertained the rate of destruction may be measured, and in this way an estimate of the advantage or disadvantage of a variation may be obtained. Numerical data of the kind indicated contain all the information necessary for a knowledge of the direction and rate of evolution, and it is strongly urged that the importance of such numerical statements in testing the current theories of adaptation, &c. is great. Mr. Weldon's report on the variation in the shore-crab is noticed on another page.†

Discontinuous Variation.‡—M. H. de Vries distinguishes fluctuating, individual or continuous variation—modifying the relative number of different kinds of pangenes—from specific variation, in which the division of pangenes is qualitatively diverse. The fundamental idea of his theory of pangenesis is that the diverse hereditary qualities have materially

* Proc. Roy. Soc., lvii. (1895) pp. 379–82. † See p. 527.
‡ Arch. Néerland. Sci., xxviii. (1895) pp. 442–57 (1 pl.).

different bearers, pangenes, idioblasts, or biophors, as the hypothetical particles are variously called.

Quetelet observed (1870) that the variations of a single character are symmetrically grouped around "a centre of greatest density." Galton, Weldon, and others have increased our knowledge as to the laws of these variations, and de Vries has for years accumulated relevant facts as to *Œnothera Lamarkiana*, *Helianthus annuus*, *Coreopsis tinctoria*, *Anethum graveolens*, *Caltha palustris*, and many other flowers whose variations illustrate the phenomenon known as Galton's half curves. These he regards as indices of a discontinuous saltatory variation which itself varies continuously.

De Vries thinks he has experimental evidence to prove the transformation of a unilateral variation into a symmetrical variation. The summit of the new curve does not coincide with the normal character of the species, but depends on the novel character of the variety. Thus, in regard to the number of petals, the half curve of Galton observed in De Vries' cultures does not result from a fluctuating variation in the number, but from a brusque doubling, which again is in itself variable. The observed variation, continuous in appearance, is in reality discontinuous.

Stimuli considered in Relation to Development.* — Herr Curt Herbst distinguishes "directive stimuli"—light, gravity, chemotaxis, heat, electricity, currents, &c.—and formative stimuli, such as the contact of one body on another. He gives a valuable summary of facts, to which he has himself added, discusses the general physiology of stimulus and reaction, and applies the results to the interpretation of developmental processes. Thus he discusses the aero (oxygeno)-taxis of the segmentation cells in Arthropod ova; the chemo (tropho)-taxis of yolk-cells, the cause of the origin of Schwann's sheath and neurilemmata, the origin of connective and muscular sheaths around vessels, the origin of other connective-tissue sheaths, the origin of the Polyclad-gut, the directive stimuli in the development of freshwater Turbellarians, and so on. As a contribution to a rational ontogeny Herr Herbst's paper is of great interest and importance.

Theory of Development.†—Dr. W. Haacke, continuing his copious criticisms of modern theories of heredity and development, works out four examples to show that Weismann's theory of determinants leads to the old preformationist theory of "emboîtement"—the *Einschachtelungs-theorie*, or *Skatulations-theorie*, as Haeckel calls it. And this, somehow or other, leads to a creationist dogma, which is a *reductio ad absurdum;* Haacke is equally severe on Hertwig, who falls, he says, into the same error as Weismann, in reflecting back on the *Anlage* the high organisation of the adult.

Heredity and Development.‡—Dr. W. Haacke continues his vigorous criticisms. It is neither necessary nor justifiable to postulate a highly organised *Anlage* for a highly organised organism. The human ovum may be as low in organisation as an Amœba. Specification of cells is a function of the position which they occupy in the organism; the endo-

* Biol. Centralbl., xiv. (1894) pp. 657-66, 691-7, 727-44, 753-71, 800-10.
† Op. cit., xv. (1895) pp. 481-91. ‡ Op. cit., pp. 536-56.

derm becomes endoderm because it is invaginated, and not *vice versâ*. There is no alternative between epigenesis and the Gemmaria-theory of Haacke. Driesch's last book is criticised at some length, and then the author returns to the inheritance of acquired characters. It does not follow that this is impossible because its mechanism is not at present explicable, though the Gemmaria-theory makes the process conceivable. Direct proof is not forthcoming, and may be impossible, but indirect evidence is cumulative. On this, on amphimixis, and other problems, Haacke has much to say which is worthy of consideration.

The Essence of the Organism.*—Dr. W. Haacke criticises at great length an essay by Dr. Hans Driesch entitled 'Die Biologie als selbständige Grundwissenschaft'; and in so doing expounds his own views as to the essence of the organism. We cannot within our present limits see our way to a summary which would be just to either party, and simply notice the two complementary contributions to the philosophy of biology.

Phylogeny of an Acquired Characteristic.†—Prof. A. Hyatt has added a contribution of great length to a subject of which the literature is already more than voluminous. He commences with pointing out that the nature of the evidence afforded by fossil shells is, even at the present time, very little understood. He urges that a single shell, either of a living or a fossil form, may present accurately the general history of the development of the young, the stages of the adult, and old age. The results of heredity and of the action of endemic or traumatic diseases may also be detected, if one knows how to study and compare the remarkable and distinct series of metamorphoses displayed by this external or protective skeleton with those of congeneric forms. Limiting himself to the Cephalopodous Mollusca and using the terminology with which readers of his papers have more or less made themselves acquainted, Prof. Hyatt enters into great detail with regard to a number of fossil forms. He points out that it is impossible to disprove or prove that a character is acquired or genetic, unless it can be followed back to its origin. Until this is done one cannot assert positively that it was not potentially existent in the embryo and became apparent at the proper time in the ontogeny in accordance with genetic law. His final conclusions are that his results favour the theory of tachygenesis and diplogenesis, and are opposed to Weismann's hypothesis of the subdivision of the body into two essentially distinct kinds of plasm.

Extinction of Species.‡—Mr. C. Morris makes an attempt to solve the problem of the extinction of the great numbers of giant reptiles which disappeared at the close of the Cretaceous epoch, and the similarly sudden disappearance of a considerable number of large mammals in the early recent period, such as the Mammoth, the American Horse, and the Giant Sloths. He thinks that, looking at the matter generally, few if any species have ceased to exist in consequence of the direct assaults of other animals, for animal hostility, even when unrelenting and effective, is never governed by a fixed purpose of destruction. Hostile aggression,

* Biol. Centralbl., xiv. (1894) pp. 626–47, 666–81, 697–718.
† Proc. Amer. Phil. Soc., xxxii. (1894) [1895] pp. 349–647 (14 pls.).
‡ Proc. Acad. Nat. Sci. Philad., 1895, pp. 253–63.

while it may occasionally have been an indirect, has rarely been the direct cause of the extinction of species. It is equally doubtful if extinction has been due as a general rule to lack of suitable food. Most probably the usual causes of destruction have been adverse conditions of nature and the competition of other species in the struggle for food. Though bacteria and other disease-producing agents may at times in the past have attacked species of animals destructively, it is probable that they have played a minor part in the extinction of species. One tendency, which has particularly manifested itself in herbivorous forms and has frequently led to their destruction, is the tendency to increase in size through the double influence of abundance of food and little waste of tissue through exercise. The great Cretaceous reptiles may to some extent have been affected by this, but they could hardly have succumbed to it. What reptiles want, however, is the instinct of carefulness for their eggs, which is not much more developed in them than it is in fishes. Fish species indeed escape annihilation mainly through fecundity, but the huge Cretaceous reptiles probably laid but few eggs, and these they had to lay on land, where they were in all probability devoured by the small mammals which had then begun to appear. It is highly probable that the placental mammals who were slowly developing intelligence adopted from time to time new methods of attack, while the reptiles were very much slower in developing new methods of defence. The egg-destroying mammals had a double advantage; laying no eggs themselves and caring for their young they could only be destroyed when in the mature stage, while their assault upon their foes was by the safer and more effective process of devouring them in the egg—a method which may well have caused rapid reduction in numbers and final extinction. With regard to the more recent large mammals, while it is probable that the Glacial epoch may have had something to do with their disappearance, this is not an explanation which can be applied to the South American Horse, or to its huge contemporaries, the *Megatherium* and the like. It is suggested that some active carnivorous animal began to attack and destroy the young of the Giant Sloths in a new and covert manner which the parents were quite incapable of guarding against. With regard to the South American Horse no explanation can be suggested which appears to be satisfactory.

Study of Metamerism.*—Prof. T. H. Morgan discusses in a series of chapters the phenomena of metamerism. He deals first with typical forms of modification in Annelids; the variation in the position of the reproductive organs is next considered; thirdly, limiting himself to the anterior part of the body, he discusses the abnormalities which may be observed in it. These variations are, it is suggested, due to a regeneration in the adult of anterior metameres. A study of embryos showed that all the commoner forms of abnormalities recorded for adult forms are found also in them. Abnormalities at the posterior end are frequently found and appear to be due to the conditions acting during regeneration, and not to be in any way connected with an hereditary tendency to be more abnormal in one case than in another. That is to say, the tissues of a worm that has developed normally from the egg are

* Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 395–476 (4 pls.).

just as apt to develop irregularly in regenerating as are the tissues that have developed irregularities during embryonic growth. In fact, one might say, that the tissues inherit a strong tendency to regenerate normal metameres, but the means at command are so imperfect that abnormal results are frequent. Rightly thinking that, before any conclusion can be reached as to the value of irregularities seen on the surface, the internal organs should be examined, the author proceeded to make a study of the modifications of internal structures, and especially of the arrangement of the septa. A few have been selected for description; cases which puzzled the author himself, and which he cannot pretend to entirely explain, are some of those in which the internal and external spirals do not agree. The greater number of cases of false union seem to be due to the imperfect joining of the mesodermic blocks, while the ectodermic grooves mould themselves on the internal arrangement. An account is given of the modification in the antennæ of Arthropods. The abnormal metamerism of a locust is discussed. Before summarising and discussing his results and comparing them with those of other writers, the author gives an account of his study of colour-bands of Echinoderms, and describes his experiments on regeneration in earthworms.

Teratogenic Influence of Alcohol on Eggs.*—M. Ch. Féré has made numerous experiments as to the abnormalities produced by submitting hens' eggs to vapours or injections of alcohol and other reagents.

The experiments are thus summarised:—

Number of Eggs.	Nature of Injection.	Percentage.		
		Normal.	Undeveloped.	Monstrous.
84	Ethylic alcohol	63·09	15·47	21·43
84	Alcoholic solution of absinth ..	25	30·97	44
24	Ethylic alcohol	62·5	16·66	20·83
24	Alcoholic solution of anise ..	41·66	25	33·33
24	Alcoholic solution of absinth ..	16·66	21·43	62·5

The facts are probably of human interest in connection with heredity in the case of alcoholism and the like.

Aid to Bibliography of Zoology.†—Drs. P. Schiemenz and E. Schoebel have prepared an index to the indices of the Naples Zoological Reports for the years 1886 to 1890. For the years with which it deals this is one of the most complete subject-indices that can be imagined. There is no need to tell the worker of what great assistance it will be to him, and especially to the worker whose years are getting on and who finds that he does not easily remember the events of more recent years.

* Journ. de l'Anat. et de Physiol., xxxi. (1895) pp. 161–86.

† 'Autoren- und Sachregister zu den Zoologischen Jahresberichten für 1886–1890,' Berlin, 1895, 8vo, 365 pp.

Tunicata.

Plankton Thaliacea.* — Herr J. Reibisch reviews the work of M. P. A. Transtedt on the systematic relations of the Plankton Thaliacea, and that of C. Apstein on their distribution. Only two subgenera—*Cyclosalpa* and *Salpa*—are recognised. The genera *Jasis*, *Thalia*, and *Pegea* are based upon wholly external characters; but the species of *Salpa* s. str. may be brought together, and to them Apstein applies the title Cylindrica. In the unsymmetrical Salpæ, the individuals of the two rows are not congruent, but mirror one another as regards their musculature. Even in the symmetrical Salpæ, there is no perfect congruence, since in both rows the embryo always lies on the right. Apstein believes that the buds are at first congruent, and become secondarily unlike through their relations to the stolon.

The aggregate forms are much more numerous than the solitary forms, perhaps because each chain-individual forms only 1–5 embryos, while the solitary form gives rise only to a chain with a considerable number of individuals.

As is well known, the Salpæ are mainly confined to warm water, to near the tropics, or to such currents as the Gulf Stream. One species, *S. Hensenii*, frequents the coast; all others are pelagic. Occurrence at considerable depths is very rare.

Isolated Blastomeres in Ascidians.†—Dr. H. Driesch finds that an isolated blastomere of the egg of *Phallusia mammilata* may, as in Echinoderms, form a complete individual. Complete larvæ may arise from one of the first two cleavage cells, and are about half the normal size. The sensory and adhesive organs may be in part deficient, as is the case in larvæ reared from whole eggs when exposed to advrese circumstances. There is no semi-morula. Roux in the frog, and Chabry in the Ascidian, as well as Chun in Ctenophores, found, it will be remembered, cases where an isolated blastomere did not make a complete individual, but only a half or a partial one, but the differences in the methods employed by Chabry and Driesch are so considerable that we can scarcely expect a very close agreement in the results.

Budding in Perophora.‡—Mr. G. Lefevre has made a study of the development of the buds of this Ascidian, which was found growing luxuriantly on the wharf-piles at Beaufort, N.C. He finds that, by a peculiar process of rotation of the endodermal vesicle through a right angle, the thickened right wall of the vesicle is carried down to the ventral side of the bud-rudiment, where it forms the floor of the future pharynx. This process seems to be due to the rapid growth and flattening of the cells which compose the vesicle, except in its thickened portion. The first organ to appear is the pericardial rudiment, and it is formed from the free cells of the blood. The peribranchial sacs arise asymmetrically. No epicardium is present, so that in this respect *Perophora* differs strikingly from some other Ascidians. The endostyle appears early as a longitudinal groove in the middle of the thickened portion of the inner vesicle. From its position on the right side it is moved down to the ventral mid-line by the rotation of the vesicle. The

* Biol. Centralbl., xv. (1895) pp. 93–6.

† Arch. f. entw. Mech. d. Organismen, 1895. See Amer. Natural., xxix. (1895) pp. 500–1.

‡ Johns Hopkins Univ. Circ, xiv. (1895) pp. 75–7 (5 figs.).

common rudiment of the dorsal tube and nerve ganglion arises as a solid string of mesenchyme cells, which are closely applied to the outer surface of the inner vesicle, a little to the left of the median dorsal line. The cord acquires a lumen, which later on communicates with the pharynx. When the rotation is completed the dorsal tube lies in its definite position in the median line. The nerve ganglion is constricted off from the dorsal wall of this tube. Mr. Lefevre's study of *Botryllus* is in complete agreement with Hjort's description of the bud-development of this genus, so that scarcely a word needs to be added. Pizon's statement that the constriction of the ganglion from the dorsal tube cannot be established is directly contradicted.

INVERTEBRATA.

Locomotion of Invertebrates.*—Prof. C. Stewart devoted his presidential address for the year 1894 to an interesting account of the various organs and structures which are concerned in the locomotion of various marine Invertebrates. The method which he adopted in making his investigations was to very carefully fix the attention solely on one pair of limbs of a crab at a time, and by this means it was possible in the majority of cases to see what the rhythm was. A detailed account is given of the movements of the common shore-crab and of some of its allies. The address deals also with the movements of the hermit crab and with that of some Mollusca.

Mollusca.

Mollusca of the Bay of Bengal.†—Mr. E. A. Smith has a report on the Mollusca dredged by the 'Investigator' in the Bay of Bengal and the Arabian Sea in 1893 and 1894. He reports that the collection contains several very remarkable new forms, among which perhaps the genus *Pontiothauma* is worthy of special notice. This genus, of which an anatomical account will later on be published, appears to be allied to the Pleurotomatidæ. Its enormously expanded rostrum, with the absence of eyes, radula, and operculum, at once separate this genus from any which it approaches in shell characters. It should be added that of the two species one has eyes. The occurrence of the characteristically Japanese *Ranella perca* in the Indian Ocean, and the discovery of a British *Lucina* and an Atlantic *Poromya* are of great interest. Another instance of wide distribution is afforded by *Solenomya patagonica*.

a. Cephalopoda.

Sexual Dimorphism in Nautilus.‡—M. A. Vayssière has an interesting note on the sexual differences exhibited by this Mollusc. The opening of the shell is seen to be in some cases ovoid and conical, and in others elliptical. Observations show that all the individuals with a wide orifice to the shell are males, while those in which the opening is

* Proc. Linn. Soc. Lond., 1893–4 (1895) pp. 14–23.
† Ann. and Mag. Nat. Hist., xvi. (1895) pp. 1–19 (2 pls.).
‡ Comptes Rendus, cxx. (1895) pp. 1431–4.

compressed laterally are shells of females. Intermediate stages of the shape of the orifice probably belong to young males, or at any rate to forms in which the copulatory organ is not yet well developed. The author asks whether it is not possible to apply the results which he has obtained to fossil shells. D'Orbigny, as long ago as 1841, suggested that the differences in the shells of Ammonites might be due to differences in the sexes of the animals that occupied them. Nothing definite, however, appears to have been yet attained.

γ. Gastropoda.

Mesoderm Formation in Pulmonata.*—Mr. T. Fujita has made a study of the early stages of *Siphonaria lepida*, and publishes a preliminary notice of his results. The endo-mesodermic cell first establishes itself at the 19-cell stage. At the 27-cell stage it differentiates into an endoderm cell and the primitive mesoderm; bilateral symmetry is fully established at the 33-cell stage. The primitive mesoderm cell segments into two lateral ones. At the 38-cell stage endoderm cells formed by division of three macromeres are added to the one already present. The mesoderm begins to be formed from the two lateral primitive mesoderm cells at about the 43-cell stage.

Phylogeny of Gastropoda.†—It will suffice to call attention to a summary by Dr. J. Thiele of papers by Dall, Haller, Pelseneer, and others, which have been published during the last eight years. The student of the subject will find it convenient to consult this essay.

δ. Lamellibranchiata.

Early Stages in the Development of the Pholadidæ.‡—Mr. C. P. Sigerfoos has been employed by the U.S. Fish Commission in the study of the natural history of the ship-worms, on account of their great economical importance; a preliminary note on his investigations is now published. With regard to *Pholas* it is found that the first two planes of cleavage are meridional, and followed by an equatorial one. Segmentation is such that bilateral symmetry is not established till after the formation of the germ-layers. The endoblast cells divide into almost equal parts, and gastrulation is partly epibolic, and partly invaginate. The blastopore persists as the mouth. The first cilia are irregularly arranged; the apical cilia are very large; the embryo rotates on its long axis, in the direction of the hands of a watch. In addition to the mesoblast, as usually described, there is a second factor derived from the ectoblast after the embryo is free-swimming. A history of the egg of *Teredo norvegica* is almost exactly the same as that of *Pholas*, and the same is true of *T. fimbriata*.

Parasitism of Larva of Anodonta on the Skin of Fishes.§—Herr V. Faussek has studied the Glochidia on the fins of *Osmerus eperlanus*. During the first period of their parasitic life the larvæ obtain all their

* Zool. Mag., vii. (1895) pp. 89–93 (1 pl.).
† Biol. Centralbl., xv. (1895) pp. 220–36.
‡ Johns Hopkins Univ. Circ., xiv. (1895) pp. 78 and 9 (1 fig.).
§ Biol. Centralbl., xv. (1895) pp. 115–25 (4 figs.).

food by means of intracellular digestion, which is effected by the cells of the mantle of the embryo. Later on the mantle undergoes a metamorphosis which is a true process of regeneration, for the cells which have fulfilled their function are replaced by other new and, at first, resting cells. This replacement of cells is accompanied by a sharp change in function, for while the cells of the mantle of the embryo have a function which is unusual for ectodermal cells, namely, that of nourishing the organism and of intracellular digestion, the cells which take their place return to the normal function of the ectoderm, for they form ordinary tegumentary cells. This and other results of the author are, as he points out, of wide interest. A little reflection shows that the embryonic ectodermal cells of Mammals have the same power of taking up nutriment. The cells of the chorionic villi and the chorionic epithelium have this same phagocytic peculiarity. This striking functional resemblance between the chorionic epithelium of the mammalian embryo and the embryonic mantle of the parasitic larva of the mussel may afford a new support to the hypothesis that the embryo in viviparous animals is in the relation of a parasite to the body of its mother. Another phenomenon in the nourishment of the Glochidium, the peculiar pathological changes which are seen in the corium of the fin, may be compared with the formation of that nutritious substance (placenta), which in *Moina* serves for the nourishment of the embryos which are developed in the brood-space of the mother. Similarly the fact that in the destruction of the parasitic organism the phagocytes of the host come into action, appears to find a parallel in the developmental history of the Mammalia. If a fœtus dies in the uterus of its mother, there appear in the tissues of the former a number of small cells which are like lymph cells. These wandering cells are, the author thinks, nothing more than phagocytes, which wander into the embryo from the organism of the mother.

Bryozoa.

Bryozoa of Africa.*—Dr. M. Meissner gives us the first account of the Bryozoa of East Africa. Four species only, and those already known, appear as yet to have been discovered.

Arthropoda.

α. Insecta.

Senses of Insects.†—Prof. C. V. Riley has an exceedingly interesting article on this subject to which we can do little more than refer. The suggestion appears to be new that the highly developed and delicate antennæ of the male *Chironomus* may be likened to an external brain; its ramifying fibres corresponding to the highly complicated processes that ramify from the nerve cells in the internal brains of higher animals, and corresponding in a somewhat similar way to external impressions. The author states that he has no sympathy with that class of materialists who refuse to recognise that there may be and are subtle psychical

* 'Deutsch-Ost-Africa. IV. Die Thierwelt. Die Wirbellose Thiere,' Berlin, 1895. See Zool. Centralbl., ii. (1895) pp. 243–6.

† Nature, lii. (1895) pp. 209–12 (5 figs.).

phenomena beyond the reach of present experimental methods. The abnormality is not to be denied because it is past our limited understanding.

Spermatogenesis of Caloptenus Femur-Rubrum and Cicada Tibicen.*—Mr. E. V. Wilcox has published a detailed account of his observations on these insects.† Degenerating cells are stated to be very frequent in the testicular follicles of *Cicada*. The first sign by which he was able to recognise that a spermatogonium is becoming abnormal was a chemical change in the nucleus, the chromosomes staining more brightly than in normal cells, while the cytoplasm becomes clearer and more homogeneous. The chromosomes next become irregular in shape, lose their individuality, and fuse into a single mass. In *Cicada* there are frequently seen spermatozoa and various stages in the metamorphosis of spermatids, which are four or five times as large as the corresponding normal forms. These may be called giant spermatozoa. These, the author believes, are not functional, but that they are excluded from the developmental series and that really they come to nought. He is not aware that any one has hitherto suggested that they arise directly from spermatogonia, and *a priori* it seems quite improbable, but the author's *Cicada* preparations point very strongly to this conclusion. The whole history of spermatogenesis is so closely bound up with references to the figures as to make a detailed account of Mr. Wilcox's observations quite impossible. In the latter part of his paper he enters into a useful critical account of what has been done by his predecessors.

The Blow-Fly.‡—We can only call attention to the conclusion of the second edition of Mr. B. Thompson Lowne's well-known work on this subject, which contains a large amount of original work, as well as discussions of the results of others.

Bleeding of Coccinellidæ.§—Herr K. G. Lutz summarises what has been recorded concerning the bleeding of Coccinellidæ, and from his own observations comes to the following conclusions:—the blood issues through a cleft in the knee-joint, in the outer of the two membranes surrounding the tendons of the extensor of the tibia; the bleeding follows a strong contraction of the posterior part of the body and of the flexor of the tibia, and is voluntary; it is a means of defence, for the blood is repulsive to insectivorous animals. In *Timarcha*, *Meloë*, &c., the arrangements which secure the outflow of blood are probably the same as in Coccinellidæ.

"Petiole" of Ants.‖—M. Ch. Janet finds that the waist or petiole of *Myrmica rubra*, which consists of the fifth and sixth post-cephalic segments, has all the organs—two longitudinal tracheæ, the aorta, the gut and two gastric nerves, the nerve-cord and the musculature, &c.—in their usual relative positions.

* Bull. Mus. Comp. Zool., xxvii. (1895) pp. 1–28 (5 pls.).
† See this Journal, *ante*, p. 171.
‡ 'The Anatomy, Physiology, Morphology, and Development of the Blow-fly,' London, 1893–5, 2 vols. 8vo, 745 pp., 52 pls.
§ Zool. Anzeig., xviii. (1895) pp. 244–55 (1 fig.).
‖ Mém. Soc. Zool. France, vii. (1895) pp. 185–202 (6 figs.).

Warmth in the Wasp's Nest.*—M. Ch. Janet has an interesting note on the egg-laying of *Vespa crabro*, and on the gradual growth of the nest from the first to the fortieth day. He shows that the eggs absolutely require for their development a high temperature, and that the chief use of the gradually elaborated nest is to retain the heat.

Tibio-tarsal Comb of Ants.†—M. Ch. Janet, who, it is interesting to observe, signs himself an engineer, gives a most careful description of the tibio-tarsal comb by means of which *Myrmica rubra* and other ants clean various parts of their body, especially the antennæ. By means of the buccal organs they also remove debris from the comb. The ingenious experiments which the author has made in dusting or otherwise affecting the comb, and the precision of his descriptions deserve special notice.

Odorific Apparatus of Heteropterous Hemiptera.‡—M. J. Künckel d'Herculais has investigated the odorific apparatus of a large number of species of this group of Insects, and finds that the glands as well as their canals and orifices may be of considerable assistance in determining natural affinities of the species. Thus the young of the Capsidæ have only a single gland on the third segment. The Pentatomidæ and the Scutelleridæ have two on the fourth and fifth segments. Others have three on the third, fourth, and fifth, and others again have three tergo-abdominal glands. The fact that these glandular organs may appear indifferently on any segment in the larvæ and the nymphs, while they are placed on the metathoracic segment in each adult, leads to the conclusion that the glands are remnants of a pair of organs which primitively belonged to each one of the segments respectively.

β. Myriopoda.

Structure and Relationships of Diplopoda.§—Dr. C. Verhoeff concludes his notes on the structure and habits of Diplopoda. He has paid special attention to the intricate genital apparatus, and applies his results to a readjustment of the systematic relations of the group.

γ. Protracheata.

Reproductive Organs of Peripatus oviparus.‖—Prof. A. Dendy has a preliminary note on the results of his anatomical investigation of these organs in the egg-laying species of this interesting genus. The adult female has, in place of the usual genital papilla, a very conspicuous organ, which might be termed an ovipositor. It is capable of great extension, its surface is uniformly ornamented with minute spine-bearing papillæ, and at its apex it bears a large slit placed parallel to the long axis of the body of the animal. The oviducts are long and convoluted, and each is divided into three parts. The egg-envelope really consists of three membranes; (1) very thin and transparent, immediately sur-

* Comptes Rendus, cxx. (1895) pp. 384–6.
† Ann. Soc. Entomol. France, lxiii. (1894) pp. 691–704 (7 figs.).
‡ Comptes Rendus, cxx. (1895) pp. 1002–4.
§ Zool. Anzeig., xviii. (1895) pp. 213–26 (3 figs.), pp. 237–44.
‖ Tom. cit., pp. 264–6.

rounding the yolk; (2) a very thick membrane, which is apparently formed as a secretion in the thick-walled part of the oviduct; (3) an egg partially extruded from the greatly extended ovipositor revealed the formation of a thin transparent membrane outside the thick one.

Variety of Peripatus Novæ Zealandiæ.*—Prof. A. Dendy describes a new variety of *Peripatus Novæ Zealandiæ* from the North Island of New Zealand. The three specimens which he has seen were of remarkably large size, one, in particular, measuring $2\frac{1}{4}$ inches long, and being broad in proportion. The most remarkable peculiarity, however, lies in the fact that they all possess 16 pairs of claw-bearing legs instead of the usual 15. As no Australasian species of *Peripatus* has yet been found to vary in the number of its appendages, this is a very remarkable fact. Had it not been for the well-known variability of certain neo-tropical species in the number of their legs, Prof. Dendy would have been inclined to regard the three specimens under discussion as specifically distinct.

δ. Arachnida.

Parasitic Acarus.†—Dr. A. Gruvel describes, under the name of *Stylogamasus lampyridis*, an Acarus which he has found parasitic in large numbers on some females of *Lampyris splendidula*. Although the parasites are numerous when found, specimens of *Lampyris* infected are very rare. The author gives a preliminary account of this new parasite, of which he promises a full and illustrated description. On the whole it approaches the Gamasidæ, but differs by its styliform mandibles and its genital armature. If it is not anatomically a true parasite it is a physiological one, for if the host on which it lives be placed under conditions which are unfavourable to it, the parasite detaches itself and dies.

ε. Crustacea.

Early Crustacea.‡—Dr. H. Woodward took as the subject of his anniversary address to the Geological Society, the life-history of the Crustacea in early Palæozoic times. He comes to the conclusion that the ancient faunæ of the earth were far more wide-spread, more simple, and more uniform than are our recent faunæ, and if, as the researches of geologists seem to indicate, other sedimentary rocks exist older than the Lower Cambrian, then we may expect to gather evidence of still earlier and more simple forms of life than we meet with in the "Olenellus" zone. Dr. Woodward thinks that we are fully justified in concluding that such must actually have existed, because we find in the Lower Cambrian evidences of a quite considerable fauna belonging to several divisions, which, although lowly in themselves, are already so clearly differentiated one from the other as to prove to us that we are still, both biologically and chronologically, very far removed from the commencement of life on the earth.

Histology of Unicellular Glands.§—MM. J. Kunstler and A. Gruvel have recently made a study of the *Hipperinæ*, in which the unicellular

* Trans. N.Z. Inst., xxvii. (1894) pp. 190 and 1.
† Arch. Zool. Exper. et Gen., iii. (1895) pp. ix. and x.
‡ Nature, lii. (1895) pp. 114–8. § Comptes Rendus, cxxi. (1895) pp. 226–8.

pharyngeal glands present some very remarkable characteristics. Below the brain in the region of the mouth transverse sections show a peculiar tissue, the appearance of which directly attracts attention. This tissue is formed of cells of considerable size arranged in small groups of from three to five, and connected with one another by a fundamental connective tissue. These elements have an appearance which is not unlike that of the *Noctilucæ*. One immediately recognises a kind of hilum whence richly branched prolongations radiate in all directions. It is from this hilum that the excretory duct of the glands arises. The canal swells into a vesicle, into which there open by a very small number of pores the proximal ends of the radiating canaliculi. The small number of these orifices is due to the fact that the canaliculi open into large lacunar spaces. The radiating canals branch more or less largely, but they only extend into the clear region of the protoplasm of the cell. This protoplasm exhibits an alveolar structure. The nucleus, which is eccentric in position, is surrounded by a clear zone which varies in appearance and constitution.

Retina and Optic Ganglia in Decapoda.*—Mr. G. H. Parker, who has specially studied the eye of *Astacus*, gives a detailed account of his results. Beginning with a section on the general structure of optic stalks, he points out that the nervous organs contained within these are so complex that it is well first to consider the shape and position of the stalks themselves. The nervous structures contained within them have received such a variety of names that an accepted nomenclature for them can hardly be said to exist. In dealing with the retina Mr. Parker commences by a consideration of its form. This is by no means easy, as the extent of the retina is not only unequal in different directions, but the curvature of its outer surface also varies. Dealing next with the ommatidia he points out, as is no doubt well known, that the results of investigators are by no means in full agreement, and he ventures therefore to redescribe these organs, dealing at length however with those points only where a difference of opinion exists, or where he has gained a clearer insight into their structure. The migration of retinal pigment is next considered, and it is stated that the black pigment of the distal and proximal retinular cells is a means of controlling the amount and quality of the light that reaches the rhabdomes. The author's critical investigation of the various theories of vision results in showing that when the rhabdome is surrounded by pigment its whole length can be penetrated only by very strong light, and, secondly, they confirm the belief entertained by Müller, Grenacher, and Exner that the image in the compound eye is a single upright one for the whole retina, whose perceptive elements, the rhabdomes, receive each a single impression. This result, however, is so contrary to that obtained by many investigators that the author pursued his inquiry, and observations that he made left no doubt in his mind that when the retinal pigment in *Astacus* was adjusted for very dim light the image formed by the dioptric apparatus was a superposition one. Mr. Parker's account of the optic ganglia commences with some notes on their position, after which the topography of the ganglia is discussed in detail. As to the optic nerve,

* MT. Stat. Zool. Neapel, xii. (1895) pp. 1–73 (3 pls.).

the relation of its fibres to ganglionic cells is not easily determined, and in addition to the fibres, which are truly optic, there are eight or ten which are motor and a few special sensory fibres which resemble the nervi nervorum. Although the author's observations are not as yet numerous, he thinks that a comparison of the optic ganglia in various Crustacea shows that the type represented by the optic ganglia in *Branchipus* is essentially Entomostracan, while that represented in *Astacus* is peculiar to the Malacostraca. It is of interest to observe that the optic ganglia in Hexapods are almost identical in their structural features with those of *Astacus*. After a discussion of the growth of retina, ganglia, and optic nerves, the author concludes with some remarks on the derivation of the ommatidia. The simplest and the most complex types are, without doubt, genetically connected, and it is probable that the simplest type is a primitive one, from which the other has been derived. The numerical relation of the cells indicates the way in which this derivation can have been accomplished. A cone composed of two cells can be easily converted into one formed of four, and the simplest group of five undifferentiated retinular cells could be differentiated, and division give rise to the two distal and eight proximal retinular cells of the more complex type. The simplest type of ommatidium appears to have been derived from a cluster of cells in a continuous unfolded epithelium, and by a process of cell-division and differentiation. The simpler type of ommatidium has given rise to the more complex.

Conjugation of Cambarus.*—Mr. E. A. Andrews finds that there are important differences between the American crayfish *Cambarus* and the European *Astacus*. Certain structures hitherto known only as specific and generic characters are necessary accessory reproductive organs. In confinement *C. affinis* conjugated in November, and in February, March, and April. The process lasts several hours. During it the male exhibits great skill and is visibly excited, while the female shows scarcely any evidence of excitement. The sperm is introduced into the cavity in the annulus, which thus serves as a sperm receptacle. As in the American lobster the well-known hook on the ischipodite on the third walking leg of the male is used to firmly attach the male to the female. There is no wide distribution of sperm as has been described for *Astacus*. It is all placed in the annulus. The oviducts of the female are not concerned in the process of conjugation. For further details of the process the author's own account must be consulted.

Observations on Carcinus Mænas.†—Prof. Weldon, as Secretary of the Royal Society's Committee on the measurable characteristics of plants and animals,‡ made an attempt to measure the death rate due to the selective destruction of *C. mænas* with respect to two particular dimensions. About 7000 females varying in length from 7 to 13·95 mm. were chosen at random except as regards their size, and two dimensions were measured in each. The results were then compared with those of the corresponding measurements made upon 1000 adult females taken from the same locality (Plymouth Sound). The results of Prof.

* Zool. Anzeig., xviii. (1895) pp. 284–5.
† Proc. Roy. Soc., lvii. (1895) pp. 360–79. ‡ See *ante*, p. 514.

Weldon's observations are discussed by him in detail. In concluding his paper, to which we must refer the student, the author points out that the advantage of eliminating from the problem of evolution ideas which must often, from the nature of the case, rest chiefly upon guesswork, need hardly be insisted on.

Central Nervous System of Shore-Crab.*—Herr A. Bethe, using his new modification of Ehrlich's methylen-blue method (methylen-blue-molybdate), has studied the histology of the central nervous system of *Carcinus mænas.* He describes the ventral cord, its neuropil or *Punktsubstanz*, its motor elements, its sensory elements, and its association-elements, of which he distinguishes ten types. The brain, with its six ganglion masses, the optic nerve with nine types of fibres, the tegumentary nerve, the antennary nerves I. and II., the oculomotor, and the anterior median nerves, are then described. Eight types of association-elements connect the parts of the brain, three types connect cells in the brain with the ventral cord, and four types connect cells in the ventral cord with the brain. But the intricate nature of the investigation demands reference to the original and its figures.

Freshwater Schizopod from Tasmania.†—Mr. G. M. Thomson describes a remarkable and apparently archaic Schizopod, which he has had the good fortune to discover in Tasmania, and of which he has already published a short preliminary account. This creature, which he now calls *Anaspides Tasmaniæ*, is regarded by him as being the type not only of a new genus, but of a new family of Schizopods. Owing to its long isolation it has undergone very profound modification. The *Anaspididæ*, of which it is the sole representative, may be defined as a family of the Schizopoda in which the carapace is wanting; the cephalon and all the segments of the body distinct; maxillipeds and succeeding seven pairs of limbs uniform in general structure, adapted for walking, furnished with external lamellar branchiæ; no egg pouch (?); pleopoda with well-developed natatory exapodites; endopodites of first and second pleopoda specially modified in the males as copulatory appendages; uropoda normal; auditory organ in the base of the first pair of antennæ. Nothing is known as to its development. After giving a detailed account of its external form and a discussion of its anatomy, Mr. Thomson points out that *Anaspides* is manifestly a Schizopod shrimp, but its greatly generalised characters, and its remarkable habitat in a pool near the summit of Mount Wellington, that is at a height of over 4000 feet, indicate that it is a survival of a very old type. The most conspicuous external features are the want of a carapace and the plate-like character of the gills. No other Thoracostracous crustacean is known in which the adult has absolutely no trace of a carapace. In general appearance the new genus is most like the members of the family Euphausiidæ, although indeed the points of dissimilarity are numerous enough. The alimentary canal shows a much simpler structure than prevails in any other described Schizopod. The liver is unique in its structure, and the whole alimentary canal bears a closer resemblance to that of the lower Amphipoda than to that of any of the higher forms of Crustacea. This is

* Arch. f. Mikr. Anat., xliv. (1895) pp. 579–622 (3 figs.).
† Trans. Linn. Soc., vi. (1895) pp. 285–302 (3 pls.).

probably another survival of a primitive type of structure. The circulatory apparatus is very elementary, and it is only in the Stomatopoda that there is any approach to such a primitive form as the simple tube of this remarkable genus. Mr. Thomson has attempted to arrive at some conclusion as to the length of time during which *Anaspides* has been isolated, and he thinks it probable that its separation from some marine form occurred at a period shortly after the eruption of diabase greenstone, which, if Mesozoic at all, must be referred to the beginning of that period. It was found associated with an Isopod of a very old and greatly generalised type, while the very vegetation on the summit of Mount Wellington suggests the antiquity of the region.

Bosminopsis.*—Under the name of *B. deitersi* g. and sp. n., M. J. Richard describes a South American Cladoceran; this makes the second genus to be found in the family Bosminidæ. The justification for the creation of a new genus is to be found in the structure of the anterior antennæ, and the number of joints in the posterior antennæ, in the structure of the post-abdomen, &c.

Processes of Maturation.† — Dr. V. Häcker gives a particular account of the processes of maturation in *Canthocamptus staphylinus* Jur., and compares the maturation in Invertebrates with that in Vertebrates. Constancy in the number of chromosomes throughout successive mitoses is usually secured by the fact that before the distribution of the elements to the two daughter nuclei the number is doubled by longitudinal splitting. But in the second division of the maturation process (in Arthropods and the salamander) there is a reduction in the number of chromosomes, the doubling and longitudinal splitting being suppressed. The first division in maturation occurs in the "plurivalent" fashion characteristic of reproductive cells, that is each pair of neighbour-elements remain at first in close union (vom Rath, Hæcker, Rückert). This "pseudo-reduction" implies a suppression of the last transverse division.

Copepoda of the Rhætikon Alps.‡—Dr. O. Schmeil has investigated the Copepods collected by Prof. Zschokke from the Alpine lakes of the Rhætikon. He describes *Diaptomus denticornis* Wierzejski, *D. bacillifer* Koelbel, *Cyclops albidus* Jurine, *C. vernalis* Fischer, *C. strenuus* Fischer, *C. serrulatus* Fisher, *Canthocamptus rhæticus* sp. n., *C. zschokkei* sp. n., and *C. cuspidatus* sp. n. In the Calanidæ a red colour is characteristic, due, as Prof. Zopf has shown, to two carotin-pigments.

Appendages of Copepoda and Cirripedia.§—Prof. C. Claus has been able to show that the two maxillipedes of Copepods are not the inner and outer branches of a single (fifth) appendage, but represent the fifth and sixth appendages which have lost their exopodites. In the larvæ of Cirripedia there is a displacement of the fifth pair, corresponding to the anterior maxillipedes of Copepods. The fifth pair appear medianly in the same transverse plane as the fourth or maxillary appendages. The sixth pair, corresponding to the second maxillipedes, become the first of the six pairs of curled feet.

* Bull. Soc. Zool. France, xx. (1895) pp. 96–8 (3 figs.).
† Arch. f. Mikr. Anat., xlv. (1895) pp. 200–73 (4 pls.).
‡ Abh. Nat. Ges. Halle, xix. (1893) pp. 1–40 (4 pls.).
§ Arbeit. Zool. Inst. Univ. Wien, xi. (1895) pp. 49–64 (1 pl.).

Fertilisation of Cyclops.*—Herr J. Rückert describes the phenomena of fertilisation in *Cyclops strenuus* Fisch. There are three opinions in the field as regards the origin of the centrosomes and spheres of the first cleavage spindle:—(1) That both centrosomes come from the spermatozoon, but some who accept this derive the spheres from the ovum; (2) that the centrosomes have a paternal and maternal origin, and Fol's quadrille is corroborated by several; (3) that in different cases they differ in their origin, they may be maternal or paternal, or both.

In *Cyclops*, the second directive spindle has a tangential position, and the second polar nucleus remains in the ovum; it is drawn inwards, and is subsequently seen inside one of the blastomeres. Neither polar bodies nor germinal vesicle show centrosomes, attraction-spheres, or rays. The sperm-nucleus has an irregular sphere, but no visible centrosome. The first sphere buds off a second. The spheres of the first cleavage nucleus are derived solely from those of the sperm-nucleus, and the position of the latter, to which the female pronucleus adapts itself, determines the direction of the first cleavage.

Revivification of Dried Copepods and Copepod Ova.†—Prof. C. Claus reviews the literature on this subject, and, having experimented with mud 10 years old, shows that species of *Diaptomus*, like Phyllopods and Ostracods, survive desiccation in the ovum stage, while species of *Cyclops* survive only in the Cyclopid stages and as adult sexual forms. In *Diaptomus* there is a hard ovarian sac which forms a protective capsule, while that of Cyclopidæ is delicate. The same paper contains a discussion of *Mikrocyclops diaphanus* Fisch, which is equivalent to *M. minutus* Claus.

Freshwater Ostracoda.‡—Prof. C. Claus describes the internal structure of *Cypris* and other Ostracods. He first discusses the alimentary canal and excretory organs. *Inter alia* he notices that in the secretory activity of the mid-gut, it seems normal that the stumps of the cells which have liberated the secretion-products should themselves regenerate. The shell-gland, which seems to correspond to the antennary gland of other forms, is minutely described, as also the maxillary gland. The nervous system shows a pyriform brain, a broad subœsophageal ganglion (mandibular and maxillary), and a nerve-chain whose halves are in part distinctly separate. As many as six pairs of ganglia are recognisable. The complex musculature is briefly described. There seem to be no blood-corpuscles, a fact which may be associated with the minuteness of the body. In Cytheridæ and Cypridæ the dorsal vessel and heart are also absent, and respiratory appendages are only known in the Cypridinid genera *Asterope* and *Monopia*.

Systematic Position of Trilobites.§—Mr. H. M. Bernard calls attention to the recent papers by Dr. C. E. Beecher on the appendages and structure of *Triarthrus*. The metastoma, now revealed for the first time, exhibits the first stages of the modification which leads to the arrangement which obtains in *Apus*. The position of the labium in

* Anat. Anzeig., x. (1895) pp. 708–25 (8 figs.).
† Arbeit. Zool. Inst. Univ. Wien, xi. (1895) pp. 1–12 (2 pls.).
‡ Tom. cit., pp. 17–48 (5 pls.).
§ Quart. Journ. Geol. Soc., li. (1895) pp. 352–9 (1 fig.).

front of, or at least in a line with, the jaw-pieces of the second pair of appendages is a very primitive feature retained by *Triarthrus*; while in *Apus*, and still more in *Limulus*, there is much greater specialization; in fact, we can trace through these three genera the greater modification of the labium from its primitive condition as a ridge-like posterior border of the mouth, such as the "bent annelid" theory demands, into the pair of specialized and enigmatical lobes found in *Limulus*. The original similarity of the limbs of the head and of the trunk, which the annelidan theory demands, is still found in *Triarthrus*. In fact, *Triarthrus* represents the primitive type of mouth-formula. A study of the appendages of the trunk shows that the Trilobites, as exemplified by *Triarthrus*, in spite of their extremely primitive mouth-formula, do not stand in the direct line of descent of the Crustacea, but are lateral offshoots, specialised for a creeping manner of life. Mr. Bernard urges that the discovery of tufts of setæ on the limbs of *Triarthrus* at practically the very spot where, in *Apus*, he assumed their former presence, may be fairly claimed as one more slight confirmation of his general argument. Summing up the new and important facts described by Dr. Beecher with the known conditions of *Apus*, we find that the Crustacea can now be linked, step by step, with the Chætopod Annelids, while the line of development is practically that which the author sketched in his former paper.* We are now in a position to supplement that scheme by additional details which bring it still closer to the actual order. These points the author briefly indicates.

Annulata.

Tube-forming Habits of Panthalis œrstedi.†—Mr. A. T. Watson gives an interesting account of his observations on the formation of these tubes. They were first observed in dredging off the Isle of Man. A number of long, curious, soft muddy masses were brought to the surface, and as nothing was known about them they were described as "mud-sausages." Many of those that are dredged are empty, but others are inhabited and the most frequent tenant is a *Panthalis*. The question to decide first of all was whether the *Panthalis* was the fabricator of the tubes or simply a tenant. The genus in question is one of the Acoëtidæ, all the members of which are rare. The author describes how, in the laboratory at Port Erin, he made observations on this worm and was able to see how the tube was made. The mucus-like threads which form the bases of the tubes are derived from glands which exist in all the parapodia of the worm except the anterior eight pairs.

Javan Perichætidæ.‡—Dr. W. B. Benham gives an account of three species from Java which are nearly allied to one another and to others previously recorded from the same island. It appears that Dr. Benham is inclined to lay considerable stress on the colour and dimensions of the worms in question, for in our endemic forms these characters are very constant. We have yet to learn how far the size of the prostate and of the diverticula of the spermathecæ are liable to variation, either in relation to functional activity or to other circumstances.

* See this Journal, 1894, p. 562.
† Trans. Liverpool Biol. Soc., ix. (1895) pp. 169–88 (2 pls.).
‡ Ann. and Mag. Nat. Hist., xvi. (1895) pp. 40–51 (1 pl.).

Perichætæ from the Eastern Archipelago.*—Mr. F. E. Beddard and Miss S. N. Fedarb describe some new species of *Perichæta* from the East, which were collected by Mr. Everett some months ago. These new species of the genus come from Borneo and Palawan. In addition to these Mr. Everett found *Pontoscolex corethrurus* and *Megascolex armatus*, both of which are widely distributed forms.

Breeding Habits of Earthworms.†—Mr. E. A. Andrews has made a study of the small earthworm *Allolobophora fœtida*, and finds that it conjugates beneath the surface and cannot therefore be directly observed. Momentary immersion in boiling corrosive sublimate preserves the conjugating individuals in the natural position, and a study of this shows that the process is essentially the same as in *Lumbricus*, but the union is much firmer and more intimate. We may hold that the spermatophores in terrestrial Oligochætes are not of the importance they are elsewhere, but that they are to a large extent accidental results of secretions taking place during conjugation.

Enchytræidæ.‡—Prof. J. Nusbaum finds that the nuclei which Ude described on the walls of the heart-like swellings of Enchytræidæ are true cells, as may be well seen in some species of *Fridericia*. They are bound to the wall, but move backwards and forwards in the blood stream, and probably correspond to blood cells. As Ude noted, no free blood cells are known. Nusbaum confirms R. Hesse's observation that the blood sinus, from which the dorsal vessel arises, and which Michaelsen regarded as a cleft between the wall of the gut and the muscular layer, has in *Fridericia Ratzelii*, &c., a very distinct lining epithelium. The so-called "heart-body" in the dorsal vessel of some Enchytræidæ (e. g. *Mesenchytræus*) is probably of the same nature as the above-mentioned blood cells. The author describes *Fridericia oligosetosa* sp. n. and *F. bichæta* sp. n. (subspecies *typica*), and compares them with other forms.

Ganglia of the Ventral Nerve-chain of Leeches.§—MM. C. Simon and G. Thiry have re-investigated this subject, which has been discussed by so many previous writers, because they find that the ideas of these various authors vary so much among themselves. The recent methods of staining nerve-fibres have been of considerable assistance to them in their studies. In the face of the very divergent statements which have been made by their predecessors, they find it difficult to speak with confidence on many points. Two, however, they regard as well established. There are fibres which arise from the commissures and traverse the ganglion without stopping in it. These fibres pass out by the posterior commissure. Other fibres curve outwards to pass out by the lateral nerves. The authors enter at length into a detailed account of the somewhat complicated course taken by the nerve-fibres. One matter of interest may be mentioned. Between the points of emergence and the lateral nerves there are two multipolar cells, one dorsal and the other ventral. The constituents are placed in such a way that one of

* Ann. and Mag. Nat. Hist., xvi. (1895) pp. 69–73.
† Johns Hopkins Univ. Circ., xiv. (1895) p. 74.
‡ Biol. Centralbl., xv. (1895) pp. 25–31.
§ Journ. Anat. et Physiol., xxxi. (1895) pp. 237–49 (1 pl.).

the prolongations passes into one of the lateral nerves, while the others extend to the dorsal and ventral surfaces of the ganglion.

Nemathelminthes.

New Gordius from China.*—Prof. L. Camerano describes a new species of Gordiid from China, to which he gives the name of *Chordodes moutoni*. It is distinguished from all allied species by its coloration, by the formation of the hinder extremity of the male, and by the general plan of the structure of the cuticle.

New Filaria from Natal.†—Prof. G. Neumann describes a new Filarian found in *Python natalensis*, which has some affinities to *F. medinensis*. The new species is called *F. dahomensis*; like its ally it lives in the connective-tissue near the skin, and the differences between the two are simply specific. The point of greatest interest is the discovery of the male of this new species, as the female of the other is alone known. It is probable that in both cases the male is exceedingly short-lived.

Filaria papillosa.‡—Herr C. Deupser made some experiments with a view to ascertain if embryos of *Filaria papillosa* isolated from living worms could be cultivated. The experiments were negative. The author found several times in horse's blood small filarioid wormlets which in size and shape resembled the embryo of *F. papillosa*. This discovery suggested the notion of keeping the embryos in horse's blood, and as they survived for 36 hours, it seemed probable that *F. papillosa* might pass its first transition stage in the blood. Pregnant female worms were then introduced into the abdominal cavity of rabbits, and numerous examinations of the blood showed the presence of the embryos in the circulation. *Filaria papillosa* therefore behaves as do *F. Bancrofti* of man and *F. attenuata* and *tricuspis* of birds. The earliest time the embryos were detected in the blood was 34 hours, and the latest 31 days. The further fate of the hæmatozoa was not ascertained.

Trichina Migration.§—Herr A. Geisse experimented on cats and rabbits with the view of ascertaining if Cerfontaine's statements as to the migration of *Trichina* were well founded. Pieces of intestine with the mesentery were spread out under the Microscope and numerous sections examined. The author's observations did not confirm those of Cerfontaine, who stated that the adult female *Trichina* migrated from the intestine to the mesenteric glands by way of the lymphatic vessels, and there brought her embryos into the world. *Trichinæ* seem to prefer to stay in the lumina of the intestinal follicles, and hence are able to resist the action of purgative and anthelminthic remedies. The *Trichina* embryos are disseminated over the body, principally through the intermediation of the vascular system, and to a lesser degree by direct migration through the peritoneal sac and the circumjacent cellular tissue.

* Bull. Soc. Zool. France, xx. (1895) pp. 99 and 100.
† Tom. cit., pp. 123–7 (5 figs.).
‡ Inaug. Diss. Breslau, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 910–1.
§ Inaug. Diss. Kiel, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 912.

Trichinosis in the Dog.*—Two small dogs were fed on the flesh of a trichinous pig, and both took the disease; one dog, says Herr Dlugay, became restless on the third week and was attacked with cramps, later on becoming quite palsied in the hind-quarters. The temperature was 39°·4. From the corners of the eyes exuded a purulent secretion, and at the beginning of the illness there were bloody motions. The animal was poisoned. At the post-mortem examination no striking lesions were found, but on microscopical examination of the muscles numerous *Trichinæ* were detected. The second, an older dog, recovered.

Development of Strongylus paradoxus.†—Herr Hs. Spemann corroborates, in regard to this species, the results which Boveri reached in his study of *Ascaris megalocephala*. Of this, however, the full account has not yet appeared.

Influence of Cold on Maturation and Fertilisation.‡—Dr. L. Sala has published a full account of his experiments as to the influence of cold on the maturation and fertilisation of the ova of *Ascaris megalocephala*, a preliminary notice of which we have already summarised.

Cold may render polyspermy possible, or prevent any fertilisation; the yolk-substance is changed as its staining reactions show; the formation of the vitelline membrane is inhibited; the disposition and number of chromatin-elements is altered, and so on. There is certainly an ovum-centrosome, which is, however, modified before the process of maturation. Both the directive spindles and the first cleavage spindle are markedly modified from the normal.

Classification of Acanthocephali.§—Dr. O. Hamann divides the Acanthocephali into three families. The first is that of the *Echinorhynchidæ*, which contains most species; the second is that of the *Gigantorhynchidæ*, which contains three large annulate species, and perhaps also *E. gigas*; the third family, or that of the *Neorhynchidæ*, consists as yet of two species, which are remarkable for retaining some of their embryonic characters, while the larvæ are provided with generative organs.

Two new Chætognaths.‖—Mr. F. S. Conant describes two new Chætognaths which he calls *Spadella schizoptera* and *Sagitta hispida*, from Bimini, one of the Bahama Islands. He points out that with regard to the classification of the Chætognaths the new species of *Spadella* presents this difficulty that it has the fins of one genus with the morphological characteristics of the other. By the systems of Langerhans or Hertwig it would, on the strength of a single external resemblance, be separated from its nearest allies, but the system of Grassi, while keeping it in the same genus as its fellows, would reverse the usual name of that genus and call it *Sagitta*.

* Berl. Tierärztl. Wochenschr., 1894, No. 21. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 911–2.
† Zool. Jahrb. Abth. Anat. Ontog., viii. (1895) pp. 301–17 (3 pls.).
‡ Arch. f. Mikr. Anat., xliv. (1895) pp. 422–98 (5 pls.).
§ 'Die Nemathelminthen,' Jena, 1895. See Zool. Centralbl., ii. (1895) pp. 238–40.
‖ Johns Hopkins Univ. Circ., xiv. (1895) pp. 77–81 (2 figs.).

Platyhelminthes.

New Zealand Land Planarians.*—Prof. A. Dendy appears to have been already very successful in his investigation of the Land Planarians of New Zealand, for whereas only three Land Planarians have as yet been recorded from New Zealand he has, by the assistance of many friends, been able to bring the total number of species found in New Zealand up to twenty. Of these twelve appear to be new to science, eighteen belong to the genus *Geoplana*, one to *Rhynchodemus*, and one to *Bipalium*. As to the last it need hardly be said that it is our old friend *B. kewense*. Seventeen of the whole number may be safely considered to be indigenous. One, *G. sanguinea*, is identical with a very common Australian species, and another differs very slightly from a common Australian form. As to the rest they appear to be peculiar to New Zealand, though some of them very nearly resemble Australian species, and it must be a matter of opinion whether the slight differences that exist are sufficient to justify specific separation.

New Zealand Land Nemertine.†—Prof. A. Dendy adds one to the already known five species of Land Nemertines. It will be remembered that four years ago he discovered one (*Geonemertes australiensis*) in Victoria. The new species *G. novæ zealandiæ* has a considerable resemblance to the Australian form in general anatomical features, but by its possession of four eyes only, and by the characteristic arrangement of alternate light and dark bands on the dorsal surface it was clearly seen to be specifically distinct.

Musculature and Sensory Cells of Trematodes.‡—Herren F. Blochmann and H. Bettendorf have investigated the muscular and sensory organs of these worms, with the aid of the more recent methods of staining. They commence with a short account of the simpler condition of things which may be found in the Turbellaria. For example, in *Gunda ulvæ*, every muscular fibre is connected with its myoblast by a long fine protoplasmic process. The myoblasts also give rise to one or two fibres which pass down and come into connection with nerve-trunks; at least what is seen in tapeworms and flukes may lead us to conclude that it is so, but the fact is that this connection has not yet been observed in any Turbellarian. In the Trematoda the condition of things is somewhat more complicated, as the myoblasts ordinarily give rise, not to one, but to several muscular fibres; their connection with nerve-trunks has been distinctly observed. The bodies which the authors here describe as myoblasts are the large cells which have long been known to be scattered in the substance of the body of Trematodes, and which have been explained in various ways. The large cells which are found in the sucker are also myoblasts. It is further to be noted that although the authors have prepared numerous sections from very various forms, they have never yet observed one myoblast trespass on the area of another. Sensory cells of the kind already found in various Cestodes have been discovered in the fluke by the use of Golgi's method. They are found over the whole extent of the body, but, as may be supposed,

* Trans. N.Z. Inst., xxvii. (1894) pp. 177–89. † Tom. cit., pp. 191–4.
‡ Biol. Centralbl., xv. (1895) pp. 216–9 (5 figs.).

they are most numerous in the suckers. A cell placed at some distance from the surface sends out a fibril to the cuticle, which passes into a pyriform space in that layer, and ends with a plate shaped like the head of a nail. The authors frequently observed that a small tuft was placed on the terminal vesicle. Free nerve-endings have not been certainly observed in Trematodes. The methylen-blue method shows that two kinds of nerve-trunks enter into each sucker, one sensory and one motor. The former consists of the central processes of the sensory cells, while the latter is connected with a nerve-plexus which lies in the musculature of the sucker.

Aspidogaster conchicola.*—Mr. J. Stafford has a preliminary notice of his researches on the structure and development of this worm. Cross-sections of the adult show that a transverse muscular system separates the intestine and some of the organs of the generative system above from the large vessels of the excretory system, the lateral nerves, and the hermaphrodite organs below. At the posterior end of the intestine this septum thins out. On each side in the ventral sucker there is a longitudinal nerve with a collateral plexus, the whole of which is in communication with the marginal sense-organs by means of thick lateral branches. The funnel organ, which recent observers have been unable to find, is, the author states, easily distinguished by a practised eye. Some corrections are made in the homologies of parts of the generative apparatus. The penis is stated to be a highly complex organ, the structure of which led Voeltzkow into numerous errors, but the details of the structure cannot be clearly explained unless illustrated by drawings.

Anthocotyle.†—M. P. Cerfontaine has made, under the direction of Prof. Van Beneden, a close study of this fish parasite. He describes in detail the organs of adhesion, which appear to be of remarkable complexity. Owing apparently to the large size of the first pair of adhesive organs the digestive apparatus is found to ramify in its valves. Of the other organs of the body most attention is paid to the female reproductive organs. The author's review of the characters of this form convince him that Van Beneden and Hesse were fully justified in forming a new genus for its reception.

Action of Methylen-blue on the Body.‡—Dr. G. Brandès injected sodium chloride solution of methylen-blue into a frog's stomach, and killed the frog after a few days. Mouth-cavity and intestine were distinctly, in part intensely, coloured, but the gullet and stomach were unaffected. Small forms of *Distomum* in the small intestine were slightly coloured in their seminal vesicles, but those in the lung, and *Echinorhynchi* in the small intestine were unaffected.

A living *Distomum ovocaudatum*, under the tongue, was unaffected, except along certain subcuticular lines, forming incomplete rings anteriorly, and four longitudinal bands posteriorly. On these last a distinct cross striping was discernible, and beneath the groups of fibres lay a large darkly coloured cell whose processes ran to the fibres. It

* Zool. Anzeig., xviii. (1895) pp. 282–4.
† Bull. Acad. Roy. Belge, lxv. (1895) pp. 510–27 (1 pl.).
‡ Abh. Nat. Gesellsch. Halle, xix. (1893) pp. 81–2.

seems to be a case of peripheral ganglion cells having protoplasmic connections with muscular elements.

Free Nerve-endings and Sensory Cells in Cestodes.*—Prof. F. Blochmann and Herr Zernecke find an unexpectedly rich development of free nerve-endings and sense-cells in tapeworms, comparable to those described by Lenhossék, Retzius, Smirnow, and Langdon in earthworms and other forms. The material used consisted of *Cysticercus cellulosæ*, *Tænia serrata*, *T. cucumerina*, *T. echinococcus*, &c., and especially *Ligula monogramma* and *L. digramma*. The methylen-blue and the chrome-silver methods were used.

The results show that there is a richly developed nerve-plexus beneath the "subcuticular" layer, and that in the "subcuticular" layer there are numerous sensory cells and free nerve-endings. It follows from this that the cuticle is a true cuticle, and that the so-called "subcuticular layer is the epithelium.

Cestode of Hyas aranea.†—M. A. Vaullegeard finds that the Cestode parasitic in a number of crabs and formerly called by him *Cænomorphus joyeuxii* is the larva of the Cestode known as *Tetrarhynchus ruficollis*, and found in *Mustelus vulgaris* and *Acanthias vulgaris*. A detailed account of the anatomy and of the mechanism of the proboscis, as well as of the structure of the excretory system, is given.

Tænia solium in North America.‡—Dr. C. W. Stiles again calls attention to the rarity of this tape-worm in North America. He suggests, though it is doubtful if everybody will agree with him, that the relative immunity of Americans is explained by the better methods which they adopt in the care of the pig. His other explanation that the anti-hygienic habit of heating uncooked pork as practised in Germany does not obtain in America, is a more acceptable reason.

Cysticerci in Subcutaneous Tissue.§—Dr. Kudriascheff describes a case in which several tumours about the size of peas were present in the subcutaneous tissue of different parts of the body. After removal they were found to be cysticerci.

Spread of Echinococcus Disease.‖—By collecting a large number of statistics relative to the existence and distribution of hydatids, Herr Peiper has been able to show, as far as Germany is concerned, that the frequency with which people inhabiting certain districts are affected with echinococcus disease is in direct relation to the extent of this disease in domestic animals. Some of the author's statistics are striking; for example, it was found that in the Greifswald district 64·58 per cent. cattle, 51·02 per cent. sheep, and 4·93 per cent. pigs were affected with echinococci, while in the Regenwalde district the figures were 2·06 per cent., 2·21 per cent., and 0·82 per cent. respectively. The

* Biol. Centralbl., xv. (1895) pp. 14–25 (4 figs.).
† Bull. Soc. Linn. Normand., vii. (1894) pp. 23–6; viii. pp. 112–43 (1 pl.) See Zool. Centralbl., ii. (1895) p. 238.
‡ Bull. Soc. Zool. France, xx. (1895) pp. 127–31.
§ Wratsch, 1893, No. 34. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 681.
‖ Stuttgart, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 680–1.

number of animals in these two districts is very much the same. In the latter district *Echinococci* in man are almost unknown, while in Upper Pomerania the disease is quite frequent. Of the 150 cases collected by the author 67·33 per cent. were in the liver, 10·6 per cent. in the lungs, 4 per cent. in the spleen, 6 per cent. in skin and muscles, 4·6 per cent. in the kidneys, and 6·6 per cent. in abdominal cavity and pelvic organs.

Echinococcus of the Orbit.*—Dr. Rabbinowitsch narrates a case in which the eye was dislocated upwards and inwards owing to the presence of a tumour, and was so proptosed that it could not be covered with the lids even with great exertion. In consequence of its rapid growth the tumour was supposed to be a malignant neoplasm. At the operation it was found to be an *Echinococcus* bladder which extended as far as the foramen opticum.

Rotifera.

Floscularia Hoodi.†—Mr. J. Hood supplements Dr. Robinson's original description of this rare species. Owing to the exceptional transparency of the creature's large head the true rotatory organ may be seen with greater facility than in any other species. It appears to be the most interesting and the most hardy of all members of its genus, but it should be supplied daily with a change of water taken from an aquarium where there is an ample supply of food in the form of living Infusorians.

Pedalion mira.‡—Prof. C. Claus has some notes on this interesting form, which occurred among other Rotifers revivified from dried mud. Its springing movements suggested the nauplius of *Cyclops*. Daday was mistaken in identifying *Pedalion mira* Hudson with the insufficiently described *Hexarthra polyptera* of Schmarda; thus the six appendage-like processes of *Hexarthra* were said to be all ventral, while in *Pedalion* two unpaired processes arise between the dorsal and ventral surface, and the four others form a shorter dorsal, and a longer ventral pair. Moreover, *Hexarthra* is without the two posterior finger-like knobs with terminal cilia. These were also absent in *Pedalion fennicum* Levander, with which Schmarda's species, if incorrectly described as to the position of its six processes, may perhaps be identical.

Prof. Claus notes some detailed differences between his observations and those of Daday and Levander, but agrees emphatically with the latter that *Pedalion* is a true Rotifer, and that its suggestion of Arthropod characters, exaggerated by some, is merely the result of convergence.

Echinoderma.

Starfishes of the 'Vettor-Pisani' Expedition.§—Dr. F. Leipoldt has a somewhat lengthy memoir on the starfishes collected by this expedition during the years 1882–5. Eleven families, with 17 genera and 28 species, are represented in the collection, and of these two alone

* Centralbl. f. Prakt. Augenheilkunde, 1894, p. 355. See Centralbl. f. Bakteriol. u. Parasitenk., 1[te] Abt., xvii. (1895) p. 679.
† Internat. Journ. Micr. and Nat. Sci., v. (1895) pp. 291–5 (1 pl.).
‡ Arbeit. Zool. Inst. Univ. Wien, xi. (1895) pp. 13–6.
§ Zeitschr. f. wiss. Zool., lix. (1895) pp. 543–644 (2 pls.).

appear to be new. Owing to the condition of the preserved specimens the author is in many cases able to add to our knowledge of forms already described. Three species of the genus *Heliaster* were collected. A number of species described by Perrier and Sladen, or accepted by them, are grouped together under the head of *Asterias sulcifera*, and it is possible that others ought to be united with them. Having had before him 81 examples of what he calls *Asterias rugispina* of Stimpson, the author again has a synonymy of very considerable length. A considerable addition is made to our knowledge of *Cribrella hyadesi*. *Echinaster panamensis* is a new species from the Gulf of Panama. It has a remarkable similarity in external appearance to the *Mithrodia victoriæ* described by Bell from the Atlantic Ocean. The characters of *Poraniopsis echinasteroides*, first described by Perrier from Cape Horn, are discussed in detail. The wide distribution of *Asterina stellifer*, which is only known as a littoral form, is perhaps due to the fact that it also occupies the deeper and therefore the colder layers of the Atlantic Ocean. With regard to the genus *Cycethra* of Bell which either contains a single species *C. simplex* Bell, of great variability, or a very large number of closely allied species, the author's three specimens do not permit of his saying much; however, he states that these three do not exactly agree with any of the forms described by Bell, Sladen, or Perrier. The author suggests that a study should be made of the influence of growth on the external configuration of the body of these starfishes, and that the possibility of the differences being sexual should also be borne in mind. *Luidia magellanica* is a new species described from a single example taken in the Straits of Magellan.

Starfishes from the Red Sea.*—Dr. F. Leipoldt in an appendix to his paper noted in the preceding paragraph, has a short report on starfishes collected by Sig. F. Orsini in the Red Sea. Nine species in all were taken, of which one, *Astropecten orsinii*, is new. *A. acanthifera* and *Ogmaster capella* are for the first time described from the Red Sea, the latter being hitherto known only from China and Japan.

Cœlentera.

Anatomy of Alcyonium digitatum.†—Prof. S. J. Hickson has made a fresh study of the anatomy of this common zoophyte of our own coasts, which, though not of a kind to lend itself easily to an abstract, is a very valuable addition to our knowledge of the animal.

Mesoglœa of Alcyonium digitatum.‡—Mr. W. L. Brown has a note on the chemical constitution of this layer. He finds it is chiefly composed of a hyalogen, a class of bodies so widely found among invertebrate skeletal structures and characterised by its insolubility and its conversion by various reagents into a soluble substance, hyalin. Prior to the conversion of this hyalogen into hyalin the mesoglœa will yield a mucin. The mesoglœa also contains a small amount of an insoluble albuminoid body, the nature of which was not determined. It does not contain gelatin or nucleo-albumen.

* Zeitschr. f. wiss. Zool., lix. (1895) pp. 644–54.
† Quart. Journ. Micr. Sci., xxxvii. (1895) pp. 343–88 (4 pls.).
‡ Tom. cit., pp. 389–93.

Sarcodictyon catenata.*—Prof. W. A. Herdman has a note on the yellow variety of this species. From the numerous specimens that he has been able to dredge off Port Erin he now knows of three coloured varieties. One is the red form with red spicules in the stolon and lower part of the polyp; the second is the bright yellow form with yellow spicules in the stolon and lower part of the polyp; while the third or pale-yellow form has colourless spicules throughout the colony. All of these Sarcodictyons have the polyps in single file, but any of them may exceptionally have the polyps grouped in little clumps. There is, therefore, no reason for distinguishing *S. agglomerata* from *S. catenata*. In conclusion the author makes a few remarks in regard to the genus itself. He thinks that *S. catenata* should be kept separate from *Clavularia*, and that there is at present no evidence that there is any other species of the genus than it.

Alcyonaceæ from Ternate.†—Herr A. Schenk gives an account of the Xeniidæ collected by Prof. Kükenthal. Of the genus *Xenia* six species have as yet been described, and to these he adds no less than eight new species, promising at a later time to give a full description of them. He finds that it is possible to divide the genus into three sub-genera: (1) Xeniidæ with long pinnules all along the tentacle; (2) Xeniidæ with short wart-like pinnules at the base of each tentacle, and longer ones at the upper end; (3) forms with short pinnules only.

Origin of Bell-Nucleus of Physalia.‡—Mr. Seitaro Goto calls special attention to the formation of the bell-nucleus in this jelly-fish by the wandering-in of interstitial cells from the ectoderm. He thinks that *Physalia* presents an intermediate stage between those forms in which the bell-nucleus is formed as a solid mass of cells from the ectoderm, and such as *Coryne pusilla* in which cells appear to migrate singly into the endoderm and there form the bell-nucleus afterwards.

Protoplasmic Connection of Lasso-cells in Physalia.§—Mr. S. Goto has discovered that the lasso-cells of this jelly fish have a protoplasmic connection with one another. He finds that the facts now known afford a sufficient clue to the mechanism by which a large number of lasso-cells are discharged simultaneously. For, the connection of the ganglionic cells with one another as well as with the lasso-cells being proved, we have only to assume the transmission of impulses from one ganglionic cell to another, in order that a simultaneous discharge of numerous lasso-cells should take place. His own observations justify us in supposing that the protoplasmic connection among lasso-cells subsists to the last, and furnishes the passage for the direct transmission of impulse from one cell to another.

Mode of Growth and Development of Diplograptus.||—Mr. R. Ruedemann finds that *Diplograptus pristis* and *D. pristiniformis*, which were hitherto known to grow only in single stipes, have been growing in compound colonial stocks. The virgulæ are joined to a central con-

* Trans. Liverpool Biol. Soc., ix. (1895) pp. 163–8 (1 pl.).
† Zool. Anzeig., xviii. (1895) pp. 270–4.
‡ Johns Hopkins Univ. Circ., xiv. (1895) p. 80 (1 fig.).
§ Op. cit., xix. (1895) p. 80.
|| Amer. Journ. Sci., xlix. (1895) pp. 453–5 (5 figs.).

necting stem. The funicle is enclosed in a thick chitinous capsule, which is identical with the so-called central disc of the compound fronds of numerous Monograptidæ. The central disc is surrounded by a verticil of oval capsules, which number from four to eight, and probably still more. The vesicles appear to have been organs of reproduction comparable with the gonangia of recent Hydrozoa. The author thinks that the colonial stock was carried by a large air-bladder, to the under side of which the funicle was attached. By the possession of a pneumatocyst and the arrangement of the reproductive organs at the bases of the stipes, the colonial stocks of *Diplograptus* have a general similarity to those of certain Siphonophora, while the chitinous structure of the hydrothecæ and gonangia can only be referred to the Sertularians. "It thus becomes evident that the genus *Diplograptus*, like so many Palæozoic fossils, has the combined properties of different groups, thus giving valuable hints in regard to the common ancestors of these groups."

Grafting Experiments on Hydra.*—Herr G. Wetzel has made numerous extraordinary experiments with *Hydra*, e. g. grafting the head of one on the foot of another, and the net result is a demonstration of the strong tendency to restore the normal forms. The fusion of two grafted forms, even if their poles be reversed, is remarkable, but the subsequent regenerative processes corroborate the theory of definite polarities.

Sub-epithelial Nerve-plexus of Ctenophora.†—Herr A. Bethe has made a fresh examination of the nerve-plexus which has been the subject of so much controversy. He substantiates in almost all details the conclusions of R. Hertwig, and expresses his opinion that the nerve-plexuses as seen in Ctenophores present us with one of the oldest and most primitive forms of the nervous system, and that isolated nerve-paths are a later acquisition.

Porifera.

Two new Hexactinellida.‡—Dr. I. Ijima describes what appears to be a new species of *Euplectella* from Sagami Bay. *E. marshalli*, as the new species is called, has a body of the shape of a lamp chimney, and may be provided with prominences which give a very corrugated appearance to it. In its spicules it appears to closely resemble *E. oweni*. A new species of *Hyalonema*, which is called *H. ovatum*, is also described from Sagami Bay. It would appear that this species has been confounded with young specimens of *H. apertum*.

Protozoa.

Recent Theories on Cell Nuclei.§—Dr. A. Labbé reviews the recent theories in which the nucleus of the Protozoa is homologised with that of the cells of the Metazoa. With the exception of the Sporozoa, the Protozoa differ most importantly from the Metazoa in that the nuclear membrane persists during mitosis. Critically revising the work of

* Arch. f. Mikr. Anat., xlv. (1895) pp. 273–94 (1 pl.).
† Biol. Centralbl., xv. (1895) pp. 140–5 (2 figs.).
‡ Zool. Mag., vii. (1895) pp. 93–6.
§ Arch. Zool. Expér. et Gén., iii. (1895) pp. x.–xiv.

various writers Dr. Labbé concludes that in any case we must consider that, in almost all Protozoa, the nucleus, either in a state of repose or in one of division, is the homologue of the nucleus of the Metazoa, and that it is only in the ciliated Infusoria that we find two nuclei which are functionally different. The division of the organ and of the nuclear functions in the Ciliata appears to Dr. Labbé to be an abnormal phenomenon of a physiological nature which cannot be resolved merely by morphological factors.

Thermotropism of Protozoa.*—Herr M. Mendelsohn has experimented with *Paramæcium aurelia* and *Euglena viridis*. The Infusorians (*Paramæcium*) move at once in the tube from an end at 38° C. to the other end at 26° C. But there are limits; thus a temperature of 25° was preferred to 10°. The optimum is between 24° and 28°; to temperatures under 24° the Infusorians are positively thermotropic, above 28° negatively. The optimum may be changed gradually to 30°–32° C. In a tube 10 cm. long the difference of the poles must be at least 3° if the thermotropic movements are to be observed.

Marine Protozoa of Roscoff.†—Dr. A. Labbé has a short note on the Protozoic fauna of Roscoff, which appears to be peculiarly rich. In the aquarium, the water of which seems to be extremely favourable to ciliated Infusoria and to Acinetans, a large number of Cothurnidæ were observed. One species, *C. spinosa*, appears to be new, and is remarkable for the spines set at regular distances which it carries on its test. Rhizopods are extremely numerous and Foraminifera very abundant. Of *Amœba* there were several species.

Foraminifera from the Arabian Sea.‡—Mr. F. Chapman, whose papers are well known to readers of this Journal, has a report on some Foraminifera obtained from the Arabian Sea. The depths at which the soundings were obtained did not exceed 1238 fathoms, but no record was, unfortunately, kept of the depths at which the several soundings were dredged. A striking feature of the foraminiferal fauna of the Arabian Sea is the presence therein of a number of forms from marine clay-beds of late Pliocene age, on the northern coast of Kar Nicobar. There are altogether eight species new to the list of recent Foraminifera, which have formerly been regarded as fossil; besides these there are two new species and three new varieties. The report is on the lines to which Mr. Chapman has accustomed us, and in it there are enumerated 277 species.

Paulinella.§—Herr R. Lauterborn describes under the name of *P. chromatophora* a new genus and species of shell-bearing Rhizopods from fresh water, distinguished by containing bluish-green chromatophores. The shell of this form is siliceous, rounded behind, somewhat tapering anteriorly, and having a neck-like process by which the protoplasm can escape to form pseudopodia. This shell is in life hyaline and transparent, but becomes of a feeble brown colour in dead examples. The protoplasmic contents do not completely fill the shell, but are

* Biol. Centralbl., xv. (1895) pp. 556–7; Arch. Gesammte Physiol., lx.
† Arch. Zool. Expér. et Gén., iii. (1895) pp. xiv. and xv.
‡ Proc. Zool. Soc. Lond., 1895, pp. 4–55 (1 pl.).
§ Zeitschr. f. wiss. Zool., lix. (1895) pp. 537–44 (1 pl.).

separated from it at the sides by a more or less large space. No differentiation into ecto- and endoplasm could be detected. The nucleus is of some size, and rounded in form. Of all the contents of the protoplasm the most remarkable are the large chromatophore-like structures of bluish-green colour which were found in every example that was examined. Under a high power these chromatophores, if they may so be called, are found to have the bluish-green colouring matter chiefly in the peripheral layer. In discussing the significance of these bodies the author suggests that perhaps after all the difference between a symbiotic alga, vegetating in the protoplasm, and a chromatophore is not so very considerable, and he leaves to the future to settle the exact nature of these bodies. Although he has no doubt that the bluish-green contents of *Paulinella* do play the part of true chromatophores, that is to say, do nourish the rhizopod body by the products of their assimilation, there is nothing of importance to be said with regard to the mode of reproduction. This new form was found at Neuhoven on the Altrhein. There seems to be no doubt that it belongs to the Euglyphinæ.

New Coccidium.*—Dr. A. Labbé describes a new genus of Oligosporous Coccidia under the name of *Bananella lacazei*. It was found in the intestine of *Lithobius forficatus*, where it appears to be rather rare. The author gives a short description of its characters and life-history, and comes to the conclusion that it is intermediate between *Coccidium* and *Cyclospora*.

Protozoa in a Liver Abscess.†—Dr. Berndt records a case of subdiaphragmatic abscess which developed towards the end of an attack of enteric fever. Besides white and red corpuscles, fat droplets, fat crystals, and bacteria, the pus contained peculiar pale bodies, which could be separated into two groups. The one was oval or reniform, with nucleus and nucleolus and simple contour; the other organism was doubly contoured and the parenchyma seemed to be divided up into sections by bright bands traversing the interior. Under the Microscope active and passive movements were observed. Only a short time ago Grimm recorded a similar case in which Protozoa were found in the abscesses of lungs and liver.

Eozoon.‡—Prof. T. G. Bonney gives an account of the mode of occurrence of *Eozoon canadense* at Côte St. Pierre, which he has investigated personally. The facts to which he confines himself are such as must be taken account of in framing any theory as to the origin of *Eozoon*. For himself they offer a choice between two interpretations only; the structure is either a record of an organism, or a very peculiar and exceptional condition of a pyroxene marble of Laurentian age, which is not a result of contact metamorphism in the ordinary sense of the term.

* Arch. Zool. Expér., iii. (1895) pp. xv. and xvi.

† Deutsche Zeitschr. f. Chirurgie, xl. (1894) Nos. 1 and 2. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 673–4.

‡ Geol. Mag., ii. (1895) pp. 292–9 (2 figs.).

BOTANY.

A. GENERAL, including the Anatomy and Physiology of the Phanerogamia.

a. Anatomy.

(1) Cell-structure and Protoplasm.

Energy of Living Protoplasm.*—Herr O. Loew gives a detailed synopsis of the present state of our knowledge of the formation, composition, structure, and functions of protoplasm in living cells, both in non-chlorophyllous and in chlorophyllous plants. He calculates that some microbes may produce a trillion of cells from a single one in the course of 24 hours. A great number of details are given with regard to the nutritive properties for bacteria of different organic substances; these are classified under four heads:—those which are good, moderate, and bad sources of carbon, and those from which bacteria are unable to obtain any carbon. In the albumen of chlorophyllous plants, neither the nitrogen nor the sulphur is combined with oxygen; a reduction of the nitrates and sulphates must, therefore, have taken place, as in the lower fungi. Asparagin is one of the most widely distributed of the intermediate substances in the production of protoplasm. As a rule it increases in the seedling with the decrease of the carbohydrates. The access of air is indispensable for the formation of asparagin and of protoplasm, but not for the action of peptonising ferments.

Structure of Cellulose and Chitin.†—As the result of a very careful study of the minute structure of cellulose and chitin, Herr O. Bütschli comes to the following conclusions:—The honeycomb structure observed in protoplasm may occur also in crystallisable substances. He was unable absolutely to determine whether the structure of the cell-membrane is reticulate, or whether it results from a peculiar combination of small particles or globulites. It is possible for both structures to occur in the same substance, as he demonstrated experimentally. The honeycomb-like structure may disappear on drying, from the coalescence of the walls of the meshes; but the meshes appear again at the same spots when water again reaches them. The suggestion is made of a possible new theory of swelling independent of the micellar hypothesis.

(2) Other Cell-contents (including Secretions).

Proteids of Wheat.‡—Miss M. O'Brien has studied the disposition and the function of the aleurone-grains in wheat. She supports the theory of Weyl that gluten is formed by the action of a ferment on the myosin which is the chief proteid of wheat. The aleurone-grains do

* Bull. Imp. Univ. Tokyo, 1894, pp. 43–67. See Bot. Centralbl., lxii. (1895) p. 347.

† Verhandl. Naturhist. Ver. Heidelberg, 1894, 63 pp. and 2 pls. See Bot. Centralbl., lxii. (1895) p. 387.

‡ Ann. Bot., ix. (1895) pp. 171–226. Cf. this Journal, 1892, p. 809; 1894, p. 78.

not, in the Gramineæ, present that degree of differentiation in which the mineral matters are sharply separated off as a globoid from the proteid constituents of the grain; only the membrane is here differentiated. The authoress advocates the view of there being one mother-substance in flour which readily undergoes hydration, giving rise to gluten.

Mineral Food-materials of Plants.—A fresh series of experiments confirms Dr. H. Molisch* in his previous view that iron is an essential constituent of the food of the lower fungi, and that it cannot be replaced by cobalt, nickel, or manganese. In opposition to the statement of Nägeli, he finds that magnesium is also indispensable, and cannot be replaced by calcium, barium, strontium, zinc, or cadmium. Cadmium salts, even in very dilute solutions, are poisonous to fungi. The only element with which fungi can dispense, and which is essential to the higher plants, is calcium.

Dr. W. Benecke † arrives generally at the same results as Molisch, especially with regard to *Penicillium glaucum* and *Aspergillus niger*. Magnesium is indispensable to their growth, and cannot be replaced by strontium. As a general result from these experiments, sulphur, phosphorus, potassium, magnesium, and iron are indispensable to all plants, and calcium also to green plants.

Quantity of Soluble Substances contained in Plants.‡—According to M. E. Gain the quantity of soluble substances contained in the water present in the tissues of plants increases with that of the water absorbed from the soil; the different tissues presenting very important differences in this respect. The distribution of these substances varies according as the plant is growing in a moist or in a dry soil. The amount is larger in the parts near the summit of the plant than in the base of the stem or in the root.

Fatigue-substances.§—Herr G. Jaeger claims priority over Reinitzer in the discovery of the fatigue-substances of plants, which are thrown off as excretory products, and which act prejudicially on the life of the plant.

(3) Structure of Tissues.

Process of Splitting in Anomalous Climbing Stems.‖—Herr H. Schenck contests the theory of Gilg that the splitting of the xylem in leaves (*Mendoncia* and *Afromendoncia*) is due to the penetration of secondary tissue derived from the cambium zone. He maintains his previous view that the dilatation-parenchyme has been formed on the spot where it exists. These conclusions are founded on observations made on species of Acanthaceæ, Cæsalpinieæ, Convolvulaceæ, Bignoniaceæ, and Malpighiaceæ.

* SB. Vers. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 167.

† Ber. Deutsch. Bot. Gesell., xii. (1894) Gen.-Vers.-Heft, pp. 105–17.

‡ Bull. Soc. Bot. France, xlii. (1895) pp. 53–67.

§ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 70–2. Cf. this Journal, 1894, p. 361.

‖ Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 581–612 (2 pls.). Cf. this Journal, 1893, p. 351; 1894, p. 221.

Anatomy, Morphology and Biology of Cactaceæ.*—Mr. W. F. Ganong enters into further details respecting the structure of this order, which is phylogenetically very new and is practically entirely American, consisting of about 1000 badly defined species, grouped in about 20 worse defined genera. The special characteristics of the tissues are a strong cuticle, thick epiderm, perfect cork, sunken stomates, collenchymatous hypoderm, deep palisade-layers, great development of pith and cortex, which consist of large round pitted water-storing cells, often containing mucilage, and a generally simple fibro-vascular system, the xylem-portion composed of annular and spiral tracheids, often collected into gland-like masses, the whole system conforming closely to the external form and following its morphological changes.

Comparative Anatomy of the Dilleniaceæ.†—Herr H. Steppuhn enters into detail as to the structure of the vegetative organs in this order, and their value for the purpose of classifying the genera. The anatomical structure is remarkably constant throughout the order, and shows a close affinity with the Ranunculaceæ. Some species, which are aquatic climbers, are characterized by having vessels of enormous size.

Anatomy of Cyperaceæ.‡—Herr M. Rikli has investigated the anatomical structure of the stem and leaf in 24 genera of Cyperaceæ belonging to the Scirpoideæ. He lays great stress, both from a structural and from a systematic point of view, on the presence or absence of an inner parenchyme-sheath to the vascular bundles; this sheath consists of a single chlorophyllous layer of assimilating cells within the protecting sheath of the bundle. When this layer is present, the outer non-chlorophyllous parenchyme-sheath is nearly always wanting. The author proposes to divide the Scirpoideæ into two suborders, the Chlorocyperaceæ and the Eucyperaceæ, dependent on the presence or absence of this sheath. The three large genera *Scirpus*, *Cyperus*, and *Heleocharis* must each be divided into two, according as the species possess or are destitute of this sheath; all the remaining genera fall into one or other of the suborders. The stem and leaf are not sharply distinguished from one another in the Cyperaceæ, the two organs being connected by a series of intermediate structures. The Chlorocyperaceæ have two kinds of vascular bundle, with round and with oval transverse section, the two kinds differing also in their anatomical structure.

(4) Structure of Organs.

Amphicarpy of Fleurya.§—In a species of Urticaceæ from forests in western tropical Africa, *Fleurya podocarpa*, Herr A. Engler describes the phenomenon of amphicarpy. The plant bears two kinds of fruit, the one ripening beneath, the other above the surface of the soil, but differs from all other known geocarpic and amphicarpic species in having only unisexual flowers. The subterranean female flowers differ

* Bot. Gazette, xx. (1895) pp. 129–38, 213–21 (2 pls.). Cf. this Journal, *ante*, p. 69.
† Bot. Centralbl., lxii. (1895) pp. 337–42, 369–78, 401–13 (2 pls.)
‡ Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxvii. (1895) pp. 485–580 (2 pls.).
§ SB. K. Preuss. Akad. Wiss. Berlin, 1895, pp. 57–66 (1 pl.).

but little from the aerial ones; they are apparently fertilised by pollen from the aerial male inflorescences, which must be carried by worms or grubs or other animals to the humus which abounds in the soil in which the female flowers are imbedded.

Abnormal Ovules of Begonia.*—M. P. Vuillemin describes a specimen of *Begonia erecta*, in which the ovules are transformed into organs, the upper part of which has the colour and structure of petals, the lower part the essential structure of a carpel. He suggests two interpretations:—(1) that the placenta is an integral portion of the carpellary leaf, the leaves which have taken the place of ovules being inserted on other leaves; (2) that the placenta interposed between the carpel and the ovule is a special formation of the flower, not possessing the definite characters of either axis or appendage. Either theory negatives the idea that there is any essential distinction between axial and appendicular organs, since one kind may pass into the other by insensible gradations. If the first explanation is the true one, the leaf may sometimes have an axial, sometimes an appendicular character.

Dimorphism in the Seeds of Coffea arabica.†—Herr T. F. Hanausek calls attention to a variation in the structure of coffee-seeds, the embryo being found sometimes to the right, sometimes to the left, of the longitudinal furrow in the endosperm. As a rule, all the seeds in the same fruit belong to the same variety. It is not uncommon to find in the same seed two embryos and two well-developed endosperms.

Anomalous Production of a Tendril.‡—Dr. F. Noll describes a specimen of *Tropæolum aduncum*, in which one of the leaves was replaced by a tendril endowed with active circumnutation. In the allied *T. tricolorum* similar tendrils are formed normally. Dr. Noll regards this circumstance as indisputable evidence that the formation of the abnormal tendril is not a phenomenon of retrogression; and that the tendril is derived by modification from the leaf, not the leaf from the tendril.

Leaf-sheath of Casuarineæ.§—Dr. F. Morini describes what he terms the "connective tissue" intercalated between the teeth of the leaf-sheath of *Casuarina*. The leaf-sheath itself retains, in its general characters, the structure of the costæ of the internodes. At the base of the depression between each pair of teeth is the connective-tissue, consisting of a membrane of a light green colour, traversed transversely by curved fibres with their convexity directed downwards. Its function is unquestionably that of increasing the stability of the sheath. It is in direct connection with the sclerenchyme of the internodes; on each side of it is a band of chlorophyllous tissue provided with stomates; two of these bands advance into each sheath-tooth or rudimentary leaf.

Leaf-glands of Ipomæa.‖—Miss M. F. Ewart describes the peculiar glands found at the apex of the petiole, immediately beneath the lamina,

* Bull. Soc. Bot. France, xlii. (1895) pp. 143–50.
† Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 73–8 (1 pl.).
‡ SB. Niederhein. Gesell. Nat. u. Heilkunde, Bonn, Jan. 14, 1895. See Bot. Centralbl., lxii. (1895) p. 315.
§ Malpighia, ix. (1895) pp. 204–19 (1 pl.).
‖ Ann. Bot., ix. (1895) pp. 275–88 (1 pl.).

in *Ipomæa paniculata.* They closely resemble in structure the glands of the pitcher of various species of *Nepenthes.* On each side of the petiole is a depression which is covered by a thin colourless saccharine fluid secreted by a gland hidden within the tissue of the leaf. In the centre of the depression rises a small papilla, at the apex of which is a wide mouth, from which the secretion of the gland is poured over the surrounding concave surface.

β. Physiology.

(1) Reproduction and Embryology.

Chalazogamy of the Birch.*—Dr. S. Nawaschin gives a detailed account of the structure of the sexual organs in *Betula*, and of the mode of impregnation of the ovule. He regards chalazogamy as one of the intermediate stages between the intercellular growth of the pollen-tube in the gymnospermous ovary, and its free growth through the cavity of the ovary in Angiosperms. The first adaptation to the penetration of the pollen-tube through the chalaza lies in the formation of lateral ovules. In plants with a single terminal ovule chalazogamy is impossible.

The author traces the development of the typical angiospermous ovary through the following stages:—(1) An open ovary as in Coniferæ, with central ovule consisting of nothing but nucellus; (2) closing of the mouth of the ovary (unknown); (3) the ovule clothes itself with an integument, as in *Juglans* and *Myrica*, porogamy; (4) central placenta with two naked ovules, *Loranthus;* (5) *Alnus;* (6) *Betula;* (7) *Ulmus*, an intermediate condition between porogamy and chalazogamy; (8) Typical Angiosperms. In the development of Dicotyledons two lines of descent have manifested themselves:—one, the ACROSPERMÆ, begins with a simple porogamous mode of impregnation; while the other series, the PLEUROSPERMÆ, have begun with chalazogamy, becoming afterwards porogamous. The apetalous Dicotyledons are probably descended from the Coniferæ; the Casuarineæ from the Gnetaceæ; the Monocotyledons from the Cycadeæ.

Embryo-sac of Aster.†—Mr. C. J. Chamberlain has carefully examined the structure of the embryo-sac of *Aster Novæ-Angliæ.* The mature sac is very elongated, and is surrounded by a strongly differentiated layer of tapetal cells. The embryonic vesicles fill up about one-sixth of the sac, the oosphere, which is pear-shaped or perfectly globular, occupying from one-half to four-fifths of its diameter. It contains a large vacuole, below which is the nucleus. The two synergids generally fill the entire diameter of the sac; their nuclei vary in position. The endosperm-nucleus lies just below the oosphere; it is very large, and has a large dense nucleole. The antipodals are invested with membranes, and vary greatly in number, from three to as many as thirteen, formed from the first cell by cell-division; they frequently contain a large number of nuclei. In the lowest of the antipodal cells the author has frequently found a structure closely resembling an oosphere. He regards this

* Mém. Acad. Sci. St. Pétersbourg, xlii. (1894). See Bot. Centralbl., lxii. (1895) p. 324. Cf. this Journal, 1894, p. 707.

† Bot. Gazette, xx. (1895) pp. 205–12 (2 pls.). Cf. this Journal, 1893, p. 352.

observation as confirming Strasburger's view that the antipodal cells are homologous with the endosperm of Gymnosperms.

Sexual Organs of Convolvulus arvensis.*—Dr. K. Schilberszky calls attention to the heterandry of this plant; a considerable number of flowers have stamens smaller than the ordinary size. This is not the result of degeneration, since the two forms of flower may be found on the same plant. The shorter stamens have sepia-brown instead of white or light violet anthers. The micrandrous flowers were found to be invariably infested by a parasitic fungus which the author names *Thecaphora Convolvuli;* and the parasite is present not only in the expanded but also in the unopened flowers. The suggested genus *Pantocsekia* is probably only a *Convolvulus* in which further degeneration, both of the stamens and of the corolla, has been caused by the attacks of a *Thecaphora.*

(2) Nutrition and Growth (including Germination, and Movements of Fluids).

Abnormal Germination.—Herr A. Winkler † has collected together all the examples known of abnormal modes of germination. Cotyledons are wanting in *Ranunculus Ficaria*, *Corydalis Bulbocampnos*, and *Cuscuta;* while *Ranunculus glacialis* and *Carum Bulbocastanum* have only one cotyledon. Subterranean germination takes place in a number of plants. In others either the cotyledons themselves or their pedicels form a sheath which encloses the growing point; while a coalescence of the lamina of the cotyledons takes place also in *Æsculus Hippocastanum. Ceratophyllum*, and all species of *Linum* except *L. flavum*, have apparently four cotyledons. A number of examples are also recorded of deviations from the ordinary form of cotyledons, of inequality in the size of the two cotyledons, and of abnormalities in the development of the seedling.

Dr. F. Tognini ‡ describes an instance of abnormal germination in the sweet chestnut, where the radicle, instead of emerging from the apex of the fruit, had pierced the comparatively firm wall of the pericarp at a point about two-thirds of the distance from the apex. There was no irregularity in the ovary, nor in the structure of the radicle.

Distribution of Leguminosæ.§—Herr J. Buchwald describes the means of distribution of the Leguminosæ of Tropical Africa in connection with their geographical area and the nature of their habitat. In those species which are dependent for the distribution of the seeds on the elastic rupture of the pod, the seeds cannot be carried to any great distance, and these species are mostly endemic. The wind acts as agent for the carriage of the fruit of a number of species, though not, in the case of the Leguminosæ, of the seeds by themselves. Animals, especially birds, also take their part in the distribution.

Influence of Climatic Conditions on the Growth of Fir.‖—M. E. Mer has studied the effect on the pine-forests in the Vosges of the very

* Bot. Centralbl., lxii. (1895) pp. 342-6.
† Verhandl. Bot. Ver. Prov. Brandenburg, xxxvi. (1895) pp. 125-40.
‡ Malpighia, ix. (1895) pp. 117-8 (1 fig.).
§ Bot. Jahrb. (Engler), xix. (1894) pp. 494-561. See Bot. Centralbl., lxii. (1895) p. 239.
‖ Journ. de Bot. (Morot), ix. (1895) pp. 178-80, 202-6, 222-8, 229-33, 247-55.

dry summer of 1893. The result was a general retardation of growth, especially in the spots most exposed to the sun; this retardation was exhibited in a diminution, both of the diameter of the trunk and of the length of the shoots; the breadth of the woody layer formed during that summer was not above from two-thirds to three-fourths of the average. As a general rule the upper part of the trunk appeared to be the portion least affected, this being the region where the starch produced in the leaves is first consumed.

Ascent of Sap.*—Herr E. Askenasy comes to the same general conclusions as Dixon and Joly with regard to the cause of the ascent of sap in trees, attributing it to the effect of transpiration in the leaves. The drawing force is carried from above downwards by the cohesion of the particles of water in the conducting paths, and by the adhesion of the water to the walls of the vessels.

(3) Irritability.

Irritability of Water-plants.†—Prof. M. Möbius has investigated the sensitiveness to light of some aquatic plants, especially of *Ceratophyllum demersum.* If shoots which swim erect in the water remain in the dark for some days, the internodes lengthen considerably, and the leaves, which are normally directed upwards, droop, as also do the lateral branches. The elongation does not take place, as is the case under similar circumstances with land-plants, chiefly in the apical region beneath the terminal bud, but mainly in the older internodes; and this is effected by a lengthening of the cells in that region. Further observations showed that these movements are not geotropic or chemotropic, but entirely heliotropic. The plant exhibits a moderate positive heliotropism; but, in the absence of light, peculiar movements take place which originate in the primary axis. Darkness appears to exercise a directly irritating effect on the plant.

Very similar results were obtained with *Myriophyllum;* and a similar elongation of the cells of the internodes in darkness takes place in *Elodea canadensis.* In other water-plants—*Ranunculus, Naias, Cabomba*—no such phenomena were observed. The author compares these results with earlier observations on *Callitriche* and *Chara.* In *Elodea canadensis* darkness has a remarkable effect in promoting the formation of roots.

The phenomena above described differ in some respects from all others hitherto observed in the vegetable kingdom, and deserve further investigation. The author speaks of it as a kind of position-paralysis (*Lagestarre*).

Heliotropism.‡—Herr J. Wiesner replies to several points in Rothert's recent publications on this subject, and points out that his own observations and conclusions have, in several instances, been seriously misrepresented by that writer.

* Verhandl. Naturh.-med. Ver. Heidelberg, v. (1895) 23 pp. See Bot. Centralbl. lxii. (1895) p. 237. Cf. this Journal, *ante*, p. 335.
† Biol. Centralbl., xv. (1895) pp. 1–14, 33–44 (8 figs.).
‡ Bot. Ztg., lii. (1895) 2te Abt., pp. 1–13. Cf. this Journal, *ante*, pp. 73, 75.

(4) Chemical Changes (including Respiration and Fermentation).

Germination of Oleaginous Seeds.*—According to M. Leclerc du Sablon, the reserve-substances of oily seeds, whether stored up in the embryo or in the endosperm, are chiefly oil and aleurone; starch is but rarely found. In all the species examined the proportion of oil decreases regularly during the period of germination. By the action of a diastase the oil is transformed into fatty acids without any separation of glycerin. During germination these fatty acids, instead of accumulating, are themselves transformed into carbohydates, especially into those belonging to the group of saccharoses. The saccharose is again converted, by the action of a diastase, into glucose, which is assimilated directly by the plant. Starch is also temporarily present as an intermediate product between oil and glucose. Starch and oil, as reserve-substances, give rise to the same assimilable products during the germination of the seed.

B. CRYPTOGAMIA.

Cryptogamia Vascularia.

Metamorphosis of the Sporophyll.†—Herr H. Glück argues against the theory of Prantl and Bower,‡ that the green leaf in Vascular Cryptogams is derived from the sporophyll by sterilisation of the tissues. He adduces a large variety of facts and observations in support of the view that the fern-leaf cannot have sprung from a sporangiferous structure, and that the sporogone of mosses does not correspond to any stage in the development of ferns.

The fertile fern-leaf may present three degrees of development as compared with the sterile leaf, viz.:—(1) The structure of the two may be the same, as in many Polypodiaceæ; (2) the sporophyll may differ from the foliage leaf only in the presence of special organs for the protection of the sporanges; (3) the sporophyll may differ from the foliage leaf in its morphological and anatomical structure. The various forms of the apparatus for protecting the sporanges—hairs, indusium, pits, the recurring of the margin of the frond—are described in great detail in the various orders of Vascular Cryptogams.

The changes which have taken place in the conversion of a sterile leaf into a sporophyll are various. The lamina has frequently become shorter and narrower; it may also be more deeply divided. The spongy parenchyme frequently disappears more or less completely; and the number of stomates is always less. The stalk of the leaf often becomes longer when it is converted into a sporophyll, and the position of the lamina more erect. In the Equisetaceæ, Marsileaceæ, and Salviniaceæ, the metamorphosis has proceeded much further than in ferns.

Prof. F. O. Bower § replies to Glück's criticism, and charges him with having in several instances misrepresented his statements. Especially he disclaims having anywhere suggested that the Lycopodiaceæ are descended from the Equisetaceæ.

* Rev. Gén. de Bot. (Bonnier), vii. (1895) pp. 145–65, 205–15, 258–69. Cf. this Journal, *ante*, p. 75. † Flora, lxxx. (1895) pp. 303–87 (1 pl. and 40 figs.).
‡ Cf. this Journal, *ante*, p. 75. § Tom. cit., pp. 487–8.

Conducting System of the Stem of Osmunda.*—Herr P. Zenetti describes in detail the structure of the fibrovascular system in the stem of *Osmunda regalis*, and of its passage into the leaf-stalk. It consists of a central cylinder with a central pith, which puts out radiating branches, by which the xylem is broken up into a number of sections of various form. These rays do not proceed beyond the xylem-ring. The sieve-portion and the succeeding layers surround, in the form of continuous concentric zones, the ring formed by the detached portions of xylem. In the angles of the central cylinder are the horse-shoe-shaped xylem-bundles which give off their outer bows to the leaf-bundle. This latter is concentric (not collateral, as described by de Bary and Schwendener). The phloem-elements are inserted both above and below the insertion of the xylem-elements, and completely envelope them.

The structure of the vascular system of *Osmunda* corresponds to nothing else that is now found among either mature Phanerogams or Vascular Cryptogams. It represents an archaic form, such as is still general in young seedlings, from which all the higher types are derived through several lines of descent, and closely resembles that of fossil Osmundaceæ and Lepidodendreæ.

Mycorhiza of Botrychium.†—Herr A. Y. Grevillius has examined the root-system of twelve species of *Botrychium*, belonging to all the different types, and has found it in all cases infested with mycorhiza-hyphæ. These do not make their appearance in the youngest portion of the system, but only in the older parts, and especially where there are large accumulations of starch. In *B. virginianum* root-shoots were observed similar to those previously described in *Ophioglossum vulgatum.*

Muscineæ.

New Genera of Musci.—Under the name *Diaphanodon thuidioides* g. et sp. n., MM. F. Renauld and J. Cardot ‡ describe a new moss from the Himalayas. The following is the diagnosis of the genus:—Habitus thuidioideus. Folia papillosa, costata, caulina et ramea heteromorpha; vaginula glabra; calyptra cucullata, nuda; capsula breviter exserta, globosa, exannulata; peristomium duplex; exostomii dentes 16, pallidi, pellucidi, læves v. sublæves, intus tenere trabeculati; endostomium e 16 ciliis tenerrimis cum dentibus alternantibus compositum.

A new genus of Archidiaceæ, *Ephemeridium*, is described by M. N. C. Kindberg,§ with the following characters:—Calyptra covering at least one-third of the capsule, bell-shaped, torn, papillose; leaves papillose-thorny on both sides, and on the vein on the under side; spores warty.

Opening of the Capsule of Calymperes.‖—According to Herr P. Dusén the calyptra does not become detached from the capsule in this genus of mosses, the opercule being firmly fixed by it. When the weather is dry, the capsule contracts when ripe, causing the opercule to become detached and the calyptra to split longitudinally. In moist weather the opercule prevents the escape of the spores.

* Bot. Ztg., liii. (1895) 1te Abt., pp. 53–78 (1 pl. and 3 figs.).
† Flora, lxxx. (1895) pp. 445–53.
‡ Rev. Bryol., xxii. (1895) pp. 33–4. § Tom. cit., p. 23.
‖ Bot. Notiser, 1895, p. 41 (1 fig.). See Hedwigia, xxxiv. (1895) Rep., p. 95.

Algæ.

Absorption of Light by Marine Algæ.*—Prof. N. Wille has previously noticed the occurrence of chromatophores deeply imbedded in the tissue of brown and red algæ, and has now made a number of observations as to the penetration and absorption of light. He gives a table showing his results, and suggests that the deep chromatophores represent a secondary internal assimilating system utilising the CO_2 of respiration.

New Genera of Algæ.†—Mr. E. A. L. Batters describes three new genera of marine algæ from the south coast of England.

Hymenoclodium (Florideæ). Fronds minute, adhering by the entire under surface; branches opposite, frequently anastomosing, united by a hyaline membrane into a pseudo-parenchymatous expansion; tetraspores cruciate, formed from the cells of the main stem. Founded on *Callithamnion serpens* Crn.

Buffhamia. Fronds simple, cylindrical, solid, composed of an inner layer of large angular roundish colourless cells, and a cortical layer of closely packed small coloured cells, from which at maturity arise short jointed assimilating filaments or paraphyses, plurilocular sporanges, and colourless hairs; sporanges linear-oblong, with obtuse or slightly pointed apices, stalked; unilocular sporanges unknown. Epiphytic on *Castagnea Griffithsiana.*

For this genus the author proposes to establish a new family of Phæosporeæ, BUFFHAMIACEÆ, nearly resembling the Chordariaceæ in its mature state, but showing, in its earlier stages, a closer relationship with the Asperococcaceæ, or, through *Myriotrichia densa*, with the Myriotrichaceæ.

Tellamia (Chlorophyceæ). Thallus minute, yellowish or brownish green or clear grass-green, composed of radiating branched jointed threads, with tun-shaped or oval cells, constricted at the joints. Filaments at first rolled up into an almost spherical ball, spreading out afterwards and branching in all directions; propagation by zoospores formed in slightly enlarged cells. Two species growing on the periostracum of the yellow periwinkle, *Littorina obtusata.*

Cystocarp of Rhodomelaceæ.‡—Mr. R. W. Phillips describes the structure and development of the cystocarp in several species of *Rhodomela* and *Polysiphonia.* In all the species examined the fifth and last-formed pericentral cell of the procarp gives rise to three branches:—(*a*) a 4-celled lateral carpogonial branch; (*b*) a 2-celled lateral sterile branch; (*c*) a 1-celled inferior sterile branch. After fertilisation, there is great uniformity in the processes up to the formation of the carpospores. The carpogonial branch is first thrown off; the 2-celled lateral sterile branch again branches and becomes 4-celled; a cell is added to the 1-celled inferior branch; the fifth pericentral cell, now the auxiliary cell, shuts off a superior sporogenous cell; and the central cell finally gives off laterally 2 cells, from which about 12 paranematal filaments are derived, converging to the pore, and forming an imperfect lining.

* Biol. Centralbl., xv. (1895) pp. 529–36.
† Ann. Bot., ix. (1895) pp. 168–9, 307–21 (1 pl.).
‡ Tom. cit., pp. 290–305 (1 pl.).

In the mode of formation of the spores the species examined present considerable differences. The process which has been described as taking place in *Chondria tenuissima* differs from that detailed above in several important particulars, especially in the wholesale conjugation before spore-formation, and in the subsequent differentiation of a sporogenous portion from the resulting mass.

Pleurocladia.—Prof. N. Wille* has investigated the structure of the freshwater alga *Pleurocladia lacustris* belonging to the Phæosporeæ. It has the appearance of a brown velvety coating on water-plants, each separate filament being enclosed in mucilage. The erect filaments spring from a basal disc, composed of primary filaments coalescent into a pseudo-parenchymatous layer. Both kinds of sporange were observed, growing on the same individual; the unilocular are pear-shaped, the plurilocular filiform; the biciliated swarmspores escape from terminal openings; both kinds of sporange are often proliferous. Long trichomes proceed from the erect filaments of the thallus, resembling those of the Ectocarpaceæ; the apical growth of these hairs soon ceases, their further elongation being effected by basal growth. The systematic position of *Pleurocladia* is clearly in the Ectocarpaceæ near to *Streblonema*.

Herr H. Klebahn † confirms, in essential points, the observations of Wille. Each cell of the vegetative filaments contains a parietal golden-brown chromophore, resembling in colour those of diatoms. The nucleus is minute, and is usually in contact with the cell-wall; the cells of the hairs are colourless. The nearly ripe sporanges contain a large number of chromophores and nuclei. When mature the entire contents of the sporange assume an amœba-like movement, and escape through the apical pore enclosed in mucilage. Each cell of the plurilocular sporanges produces only a single swarmspore, which is probably a gamete. The author was able to follow out the germination of the spores and the further development of the new individuals.

Structure of Spirotænia.‡—Dr. J. Lütkemüller has studied the structure of this genus of desmids, especially in relation to the spiral bands. He does not advocate the division of the genus into two; but arranges the species in two sub-genera, in one of which the chlorophores are central or axile, in the other parietal; this classification nearly corresponds to that into species with one and species with more than one spiral band. Nine out of the 14 known species (including one new one) can be disposed of in this way, the others being either doubtful, or species in which the arrangement of the spiral bands has not been accurately described. The species of *Spirotænia* show but little variation in the structure of the cell-wall or jelly; in the mode of cell-division, which is oblique, in contrast to that of all other desmids; or, as far as is known, in the formation of the zygotes.

Development of the Sexual Organs of Vaucheria.§—Prof. F. Oltmanns has followed out, in all its stages, the development of the antherids and oogones of several species of *Vaucheria*, especially *V. clavata*, *fluitans*, and *aversa*. The antherozoids agree with those of *Volvox*,

* Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 106–12 (1 pl.).
† Tom. cit., pp. 93–106 (1 pl.).
‡ Oesterr. Bot. Zeitschr., xlv. (1895) pp. 1–6, 51–7, 88–94 (2 pls.). Cf. this Journal, 1894, p. 90.
§ Flora, lxxx. (1895) pp. 388–420 (5 pls.).

mosses, and ferns, in the large nucleus, and the small amount present of cytoplasm and chloroplasts. The young oogones contain a large number of nuclei, distributed nearly uniformly. A portion of the protoplasm subsequently retreats into the supporting filament, carrying with it the chlorophyll-bodies and nearly all the nuclei. Only a single nucleus, the future oosphere, remains in the oogone, which then becomes shut off by a septum. The protoplasm, which is ejected when the oogone opens, contains no nuclei, and cannot be regarded as a directing sphere; its purpose appears to be merely the forcing open of the cell.

Abnormal Vaucheria.*—Miss M. A. Nichols records examples of abnormal fruiting in *Vaucheria geminata* var. *racemosa,* in which (1) the oogones are absorbed, leaving stump-like protuberances on the fertile branch; (2) the oogones are prolonged into vegetative filaments; (3) fully developed antherids were produced in places normally occupied by oogones.

Bryopsis.†—Miss E. S. Barton describes a new species of *Bryopsis* from British Kaffraria, *B. Flanagani;* also a peculiarity in the mode of growth of *B. cupressina* from the Cape, in which the hapters of different specimens interlace with one another, causing the younger plants to cling to the stem of older ones, and giving the species an appearance of branching.

Cohn's Hæmatochrome.‡—Dr. W. Zopf has studied the pigment of *Hæmatococcus pluvialis*, which Cohn described as hæmatochrome. Besides chlorophyll, there is in this alga a red carotin with one absorption band, and a yellow carotin with two absorption bands. The yellow carotin is characteristic of *Trentepohlia Iolithus*, and was lumped by Cohn along with the red carotin. Zopf rigidly distinguishes the two, and calls the yellow eucarotin. Apart from this, the paper also contains numerous important notes on pigments.

Fungi.

Astreptonema, a new Genus of Saprolegniaceæ.§—Under the name *Astreptonema longispora* g. et sp. n., Herr P. Hauptfleisch describes a parasitic fungus found in the rectum of *Gammarus locusta.* The life-history is but imperfectly known, but the following diagnosis is given:—Thallus non racemosus; una tantummodo ovospora in ovogonio nata, quasi explens ovogonium; ovosporæ plurium nuclearum, oblongæ, $2 \cdot 26 \times 7$–$10\ \mu$; ovogonia terminalia, semper simplici serie adnexa aliud alii, non transfusa. Sporangia incognita; antheridia desunt.

Diseases of Plants caused by Cryptogamic Parasites.‖—Herr R. von Tubeuf has recently brought out a work which is intended as an introduction to the study of parasitic fungi, Mucedineæ, Schizomycetes, and algæ, and also as a guide to the prevention and treatment of the diseases of cultivated plants. The work is essentially a phytopathological mycology. It is well got up, and is divided into a general and

* Bot. Gazette, xx. (1895) pp. 269–71 (1 pl.).
† Journ. of Bot., xxxiii. (1895) pp. 161–2 (1 pl.).
‡ Biol. Centrabl., xv. (1895) pp. 417–27.
§ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 83–8 (1 pl.).
‖ 'Pflanzenkrankheiten durch kryptogame Parasiten verursacht,' Berlin, 600 pp. and 306 figs. See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 510–1.

special part, and is adorned with 306 illustrations, partly woodcuts and partly photographs.

Conversion of Aspergillus Oryzæ into a Saccharomycete.*—By making cultivations of Tane-Koji, Mr. J. J. Juhler found it to consist of the spores of three different kinds of fungus, a white mould resembling the *Amylomyces Rouxii* described by Calmette, a species of *Mucor*, and an *Aspergillus* which is undoubtedly the *Aspergillus Oryzæ* described by Cohn. Cultivations on suitable substrata soon showed that *Aspergillus Oryzæ* rapidly saccharised starch. Experiments were then made to determine on what substrata and under what conditions the diastatic ferment was best produced from *A. Oryzæ*; and it was found that there was a close connection between it and the formation of the mycele, and that it was dependent upon the rapidity of growth. The germination and development of the fungus was followed on various substrata and under various conditions, and it was found that when the temperature was suitable, and the supply of air copious, the ripe conids developed a mycele. If, however, the medium contained much starch, so that it came under the influence of the diastatic ferment, it was saccharised and became fluid, the conids sank down in the fluid—thus becoming excluded from access of air—and their appearance gradually changed (always supposing that the other conditions remained favourable). Instead of being round with rough surface, they became longish with smooth surface; while before they were quite opaque, they now became quite transparent in all the transition stages; instead of being conids, which grew and thrived as such, they became yeast fungi, having all the characteristics peculiar to Saccharomycetes.

The author's experiments to reconvert the new formed yeast cells into *Aspergillus* failed, but he expresses the hope that he will ere long succeed.

Composition of the Spores of Penicillium glaucum.†—The earlier researches of Herr E. Cramer showed that *Penicillium* spores contain a large amount of dry substance, and that in dry air they give off all their water, recovering it again in moist. The analysis recently made by the author shows that the dry substance of *P. glaucum* spores has the following composition:—N-substances (= albumen) 28·44 per cent.; ether extract 7·34; alcohol extract 30·46; starch 17·00; cellulose 11·13; ash 1·91; residue 3·72. Those carbohydrates which are inverted by dilute H_2SO_4 are reckoned as starch. The alcoholic extract is strongly hygroscopic.

Fungus growing in a Solution of Copper.‡—Under the name *Penicillium cupricum* M. L. Trabut describes a mould-fungus, closely resembling *P. glaucum*, which he found flourishing in a 9·5 per cent. solution of cupric sulphate.

Biological Status of Lichens.§—Mr. A. Schneider strongly supports Reinke's view that Lichens cannot be regarded as a group of

* Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 326–9. Cf. this Journal, *ante*, p. 343.

† Arch. f. Hygiene, xx. (1894) pp. 197–205. See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) p. 499.

‡ Bull. Soc. Bot. France, xlii. (1895) pp. 33–4.

§ Bull. Torrey Bot. Club, xxii. (1895) pp. 189–98. Cf. this Journal, *ante*, p. 82.

Fungi, but that they form an autonomous group, with a phylogeny of its own, intermediate between Algæ and Fungi. Their mode of multiplication by means of soredes is quite peculiar to the group. The prototype of Lichens is probably to be found in the so-called "pseudo-lichens" found on rocks, tree-trunks, &c., in which *Protococcus* is the algal element.

Infection of Uredineæ.*—Prof. E. Fischer establishes several new instances of the occurrence of "species sorores" † in the Uredineæ:—*Æcidium Leucanthemi*, parasitic on *Chrysanthemum Leucanthemum*, the *Puccinia*-form of which infests *Carex montana*. The *Puccinia* from the same host may be made also to infect *Centaurea montana* and *C. Scabiosa*. *Uromyces Cacaliæ* is not, as has sometimes been stated, a *Uromycopsis*.

Herr P. Magnus ‡ puts a somewhat different interpretation on the facts observed by Fischer, regarding them as an illustration of the phenomenon of "habit-races" (*Gewohnheitsracen*) rather than of "species sorores."

Polymorphism of Sporotrichum.§—In the course of its development *Sporotrichum Vellereum* takes, according to M. E. Boulanger, two distinct forms,—an aggregated form, in which it is identical with *Graphium*, and a perfect ascogenous form identical with *Chætomium*. The former of these results from the coalescence of sporiferous branches in the filamentous or *Sporotrichum* form. The *Graphium* and *Chætomium* forms do not pass directly one into the other, but both have a tendency to revert to the *Sporotrichum* form, on which one or other of the two other forms then appears, according to the conditions of growth.

Spermogones of Puccinia suaveolens.‖—Mr. D. A. Boyd points out that the spermogones of this fungus, parasitic on *Cnicus arvensis*, are fragrant with the odour of the evening primrose, and are probably useful in attracting insects to the plant.

Sclerotes on Prunus Padus and Pyrus Aucuparia.¶—M. M. Woronin states that *Sclerotinia Padi* and *S. Aucupariæ*, which form sclerotes respectively on the bird-cherry and mountain-ash, are so similar that they must almost be regarded as varieties of the same species. When the conids fall on the stigma they coalesce, and put out a single thick germinating tube, a result of this coalescence, which passes down the style till it reaches an ovule. He proposes to classify *Sclerotiniæ* under three heads:—(1) Those which pass through their course of development on the same plant, and which form both conids and asci (*S. Padi*, *S. urnula*, &c.); (2) Those which pass through their development on the same plant, but do not produce conids (*S. Betulæ*); (3) Those which produce conids and asci on different host-plants, or are heterœcious (*S. heteroica*, *S. Rhododendri*, &c.).

Mycorhiza of Thismia.**—In *Thismia Aseroe*, a saprophytic plant from Malaya, belonging to the Burmanniaceæ, Mr. P. Groom records

* SB. Naturf. Gesell. Bern, May 25, 1895. See Bot. Centralbl., lxii. (1895) p. 380.
† Cf. this Journal, 1894, p. 603.
‡ Bot. Centralbl., lxiii. (1895) pp. 39–42.
§ Rev. Gén. de Bot. (Bonnier), vii. (1895) pp. 97–102, 166–71 (4 pls.).
‖ Trans. Nat. Hist. Soc. Glasgow, iv. (1894) pp. 145–6.
¶ Mém. Acad. Imp. Sci. St. Pétersbourg, 1895 (1 pl.). See Hedwigia, xxxiv. (1895) Rep., p. 91.
** Ann. Bot., ix. (1895) pp. 338–61 (2 pls.).

the constant presence of endophytic mycorhizal filaments in the leafless axial structures. These hyphæ do not enter a cell until the latter has finished dividing and already possesses a nucleus clothed with a distinct permanent membrane. In the mediocortex, the hypha, having reached the nucleus, forms a local pear-like or oval swelling against it. In the epidermal cells, on the other hand, the hypha runs straight through the middle of the cell, and does not undergo local hypertrophy. In the excortical and limiting layers the behaviour of the hyphæ is intermediate between those of the sheath and those of the mediocortex. The determining influence in the direction taken by the hypha is apparently its chemotropism; and the hyphæ appear to derive nutriment from the cell rather than to convey nutriment to it. The nucleus of the cell is the centre of the metabolic changes on which the hyphæ depend for their nutrition. The excortical hyphæ act as haustoria for the benefit of cells lying outside them. The author contests Frank's view of the analogy of the part played by an endotrophic mycorhiza with the digestion of captured insects by an insectivorous plant.

Cladosporium and Dematium.*—According to Sig. A. N. Berlese, *Cladosporium herbarum* is a derivative form of *Hormodendron cladosporioides* which has lost its power of branching and of forming conids. It consists of a mass of nearly related forms which differ in their pycnid-stage. *Dematium pullulans* does not belong to the same cycle of development.

Hymenium of Marasmius.†—M. J. de Seynes describes a peculiarity in the structure of the hymenium in an African species of *Marasmius*. The production of basids is suppressed; but both the ordinary cells of the hymenium and the fusiform cystids produce wart-like or cylindrical appendages at their apex. The hymenium, in fact, exhibits a tendency to revert to the condition of a simple epidermal layer of cells, a tendency which may be compared with that of certain Hymenomycetes to produce conids on the hymenium.

New Genera of Phalloideæ.‡—In addition to a number of new species, Herr A. Möller describes the following new genera of Phalloideæ from Brazil.

Protubera, a nearly hypogæan genus resembling *Clathrus* in some respects, but representing the lowest type of the Clathreæ, and marking the transition to the Hymenogastreæ through *Hysterangium*.

Blumenavia has a receptacle resembling that of *Laternea*, but the branches are furnished with membranous wing-like appendages which bear the glebe; and the genus therefore differs from other genera of Clathreæ in the glebe not being seated immediately on the receptacle, but on the outer side of its lobes.

Aporophallus is distinguished by the glebe stretching above the apex of the receptacle in an unbroken cap. It marks the transition from the Phalleæ to the Hymenogastreæ.

In *Itajahya* the plates of the trama on which the glebe is placed

* Bull. Soc. Mycol. France, 1895, p. 34 (1 pl.). See Hedwigia, xxxiv. (1895) Rep., p. 92.

† Comptes Rendus, cxx. (1895) pp. 763–5.

‡ Bot. Mittheil. aus d. Tropen (Schimper), 1895, 152 pp. and 8 pls. See Bot. Centralbl., lxii. (1895) p. 173.

remain after the latter has dropped off, giving the fungus a perruque-like appearance. The apex is covered by a small torn pseudo-parenchymatous cap.

Clathrus chrysomycelinus sp. n. permeates rotten wood with its golden yellow mycele. *Dictyophora phalloidea* is distinguished from other Phalloideæ by the possession of a reticulate veil, the growth of which is so rapid that it can be watched with the naked eye.

The author does not regard the Clathreæ and the Phalleæ as being nearly related; the two are probably descended from the Hymenogastreæ by two distinct lines of descent. *Dictyophora* appears to mark the highest development of the Phalleæ.

Oidium albicans, a Pathogenic Fungus.*—MM. Charrin and Ostrowsky describe a human subject in which this fungus appears as a pathogenic agent. A series of pathological processes are induced by it comparable to those due to bacteria, but presenting important differences.

Trichophyton tonsurans Cultures.†—*Herpes tonsurans* cultures usually exhibit, says Herr Winternitz, the following characteristics. Aerial growth is often absent or is the consequence of special conditions. On the ordinary media there is only a scanty development of conids. An important property of the fungus consists in its penetrating into the medium, and in most substrata of forming all shades of colour from pale red to dark violet. The development of pigment is dependent on the access of air. The optimum temperature is 31°–33°; at 18°–21° and at 37° the cultivation flasks are, especially on poor media, sterile, or show only an extremely slight development. When the medium is richer, and especially when containing pepton, the growth even at unfavourable temperatures is better than on poorer media at 37°. Inoculations on healthy skin were made from agar cultures. In the three cases infected *Herpes tonsurans* appeared on the eighth day. Two of these healed spontaneously at the end of the third week, while the third case, which attained a diameter of $5\frac{1}{2}$ cm., lasted about three months.

Pathogenic Action of Blastomycetes.‡—Some months ago Prof. F. Sanfelice made a preliminary communication relative to a pathogenic blastomycete which morphologically resembled the so-called coccidia of cancer. Pure cultivations of this species, when inoculated on guinea-pigs, were found to cause primary and secondary growths, and the results of inoculating a bitch and a cock, the former in the dugs, the latter in the comb, are now given. Four months after infection, the tumours were examined; and in the case of the bitch there was a primary mammary growth with secondary deposits in lymphatic glands and elsewhere (intestines, kidney, spleen), sections of which presented appearances resembling the histological characters of carcinoma. In the cells lying in the peripheral portions of the growths, parasitic cell inclusions, pushing the nucleus of the tissue cell aside, were found. The infection of the cock's comb caused a large growth to arise, and when examined

* Comptes Rendus, cxx. (1895) pp. 1234–6.

† Ber. IV. Kongress Deutsch. Dermat. Gesellsch., Breslau, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 904–5.

‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 625–34.

after removal, fresh specimens revealed the presence of numerous free parasites. Sections showed that the yeast-cells formed a mass in the centre of the tumour; most of the parasites were degenerated, only a few staining well. It does not appear that there were any secondary deposits in the bird. Neither in the dog nor in the cock were there any appearances of inflammation in or around the tumours. The parasites resemble in appearance the cancer bodies depicted by Soudakewitsch and others; that is to say, the bodies are invested by a highly refracting membrane, usually having a double contour and containing a hyaline protoplasm, with one or more central or excentric refracting granules.

Micro-organism of Cancer.*—Dr. J. Braithwaite describes a Hyphomycete which he has found in epitheliomata of ear, uterus, breast, lip, and penis. The life of the fungus consists of four stages: (1) spores, (2) zygospores, (3) spore-masses and spore-bags, (4) mycele which is emitted from the ruptured spore-bags. The mycele gives origin to the spores. Sections of the different tumours were treated with liquor potassæ and then mounted in Farrant's medium. Attempts at staining rendered the parasite almost invisible; but owing to its great refractive power the fine colourless mycele was easily distinguished.

Parasites of Adeno-carcinoma.†—Dr. D. B. Roncali describes the appearances found in a case of *Adeno-carcinoma* of the ovary (infectious papilloma). In the cells of this neoplasm there occur with some frequency bodies, mostly round, invested in a definite membrane which may be doubly contoured. This capsule encloses protoplasm which is generally homogeneous and highly refractive. Sometimes the protoplasm contains chromatin and may be highly coloured. The protoplasm may be in the centre or even excentric. The bodies multiply by budding. The parasite is said to be of vegetable origin and to be a yeast.

Protophyta.

α. Schizophyceæ.

Vegetation of Hot Springs.‡—Dr. L. Buscalioni has examined the scum (*muffe*) found on the surface of the hot springs of Valdieri in Piedmont, and finds it to consist of the following organisms:—*Anabæna bullosa;* one of the sulphur-bacteria; *Leptothrix Valdevia*, which forms the larger part of the scum; a *Mastigocladus;* and *Hapalosiphon laminosus*, belonging to the Nostocaceæ. The author discusses at great length the complicated synonymy of these various organisms; and the relationship of those belonging to Valdieri with those found in other hot springs, and comes to the conclusion that the theory of Hansgirg with regard to the polymorphism of the lower algæ must, in their case, be accepted with caution.

Spring Vegetation in the Lake of Plön.§—Dr. O. Zacharias notes that while in the winter months *Melosira distans* var. *lævissima* is almost alone in the water of the lake, other species begin to occur in February,

* Lancet, 1895, i. pp. 1636–8 (3 figs.).
† Ann. de Microgr., vii. (1895) pp. 145–57 (1 pl. and 66 figs.).
‡ Malpighia, ix. (1895) pp. 158–84 (1 pl.).
§ Biol. Centralbl., xv. (1895) pp. 517–9.

and increase enormously in April and May. Among these spring species are *Diatoma tenue* var. *elongatum*, *Synedra delicatissima*, *Asterionella gracillima*, and *Fragilaria crotonensis;* and meantime *Melosira* wanes almost to disappearance. He gives figures showing for four months a quantitative estimate of the Plankton (after Hensen's method), as far as Bacillariaceæ and the like are concerned. The quantity of *Asterionella* increased five times in 13 days, of *Diatoma tenue* six times in 10 days. In a litre taken in the month of May from the depth of one metre there were 54,500 chains of *Diatoma tenue*, 4500 individuals of *Synedra delicatissima*, 2500 individuals of *S. longissima*, 500 individuals of *S. ulna*, 1000 bands of *Fragilaria crotonensis*, 3500 stars of *Asterionella gracillima*, 700 balls of *Uroglena volvox*, 4000 colonies of *Dinobryon stipatum*, 1500 colonies of *D. divergens*, 250 balls of *Eudorina elegans*.

Structure of Protococcoideæ.*—Prof. R. Chodat has further studied the structure of *Golenkinia*, which has a parietal chromatophore and an amyliferous pyrenoid. It is reproduced by hemizoospores, spores, and autospores, and it occurs also in a palmelloid condition, in which it gives birth to four ciliated zoospores. Another new genus of Protococcaceæ is described, *Tetraceras* (afterwards changed to *Lagerheimia* †), reproduced by autospores which form small colonies of 4 or 8 individuals, and occurring also in a palmelloid condition which produces fusiform zoospores. It is probably a condition of *Scenedesmus*.

In another paper ‡ M. Chodat describes the mode of formation of the spores of *Raphidium Braunii*, and the structure of *Actinastrum*, and proposes another new genus of Protococcaceæ, *Tetrastrum*, allied to *Lagerheimia*.

M. Chodat § further confirms his previous statement that *Pleurococcus vulgaris* occurs in the following conditions,—unicellular, pleurococcus, stichococcus, cystococcus, and microthamnion. The last is a branched filamentous form.

Genera of Diatoms.—M. J. Tempère ‖ completes his revision of the genera of diatoms with a few additional names, and appends the following diagnosis of the new genus *Cleveia* Pant. :—Frustulis convexis, a latere primario visis late lanceolatis, cum structura striata asymmetrica ornatis; a latere secundario maxime convexo-rectis cum structura medio biserialiter punctatis et ad latera cum loculamentis alternate majoribus et minoribus vestitis.

Dr. H. Van Heurck ¶ gives a synopsis of all known genera of diatoms, recent and fossil, 191 in number.

Reproduction of Diatoms.**—Mr. J. N. Coombe gives a careful *resumé* of the observations and theories of various observers on this subject. His own observations confirm the statement that in several species of diatoms, both marine and freshwater, the endochrome breaks up, under certain conditions, usually of deficient nutrition, into globular

* Arch. Sci. Phys. et Nat., xxxii. (1894). Cf. this Journal, *ante*, p. 212.
† La Nuova Notarisia, vi. (1895) pp. 86–90 (12 figs.).
‡ Bull. Herb. Boissier, iii. (1895) pp. 109–14 (2 figs.).
§ Arch. Sci. Phys. et Nat., xxxiii. (1895) pp. 196–7.
‖ Le Diatomiste, ii. (1895) p. 162. Cf. this Journal, 1893, p. 672.
¶ Tom. cit., pp. 180–6. ** Tom. cit., pp. 152–9, 165–80 (4 pls.).

spore-like bodies. At the same time similar bodies which have been detected within the frustules of diatoms have undoubtedly frequently been of a parasitic nature.

Endochrome of Diatoms.*—Mr. H. W. Shrubsole thus describes the changes which take place in the endochrome of *Pleurosigma angulatum* in the course of its development. At first, in the young frustule the endochrome is distributed uniformly in the cell without presenting any lacunæ or solution of continuity. It divides, and appears to become denser in contracting, the contraction continuing until two narrow sometimes sinuous bands are formed, running parallel to the longitudinal axis of the diatom, and sometimes joining at their extremities. These bands then divide in the middle, and the nucleus, itself divided, appears to be absorbed by each of the two or of the four masses thus formed. At the extremities of these masses, small rounded bodies of a dark colour then commence to show themselves, until all the endochrome within the frustule has thus become broken up. A little later a thin transparent membrane is formed round each of these dark bodies, which detaches itself slightly from the margin, and this transparent protoplasm continues to develope until a kind of lobe is produced, bearing a strong resemblance to an amœba. These amœba-like bodies then assume a more definite form, develope cilia, and display rapid movements. Whether they are in reality parasitic organisms the author leaves undetermined.

Sporulation and Division in Melosira.†—Count Abbé F. Castracane records another example, observed by him, of the formation of spores, and of fission, in two distinct forms of *Melosira varians*. The origin of a chain of frustules appears to be a spherical frustule formed from a spore, the chain of intermediate frustules resulting from the division of this one; the series terminates, and again commences with a hemispherical valve.

Chætoceras, and Peragalla g. n.‡—Herr F. Schütt describes 26 new species of *Chætoceras*, mostly from the Baltic; also a new genus of diatoms, *Peragalla*, allied to *Attheya*, and forming an interesting link between the Chætocereæ and the Rhizosolenieæ. The structure of the body is that of *Dactyliosolen*, while the valves resemble altogether those of *Chætoceras*. The cells have an elongated cylindrical form, with intermediate bands forming interrupted rings; each valve is provided with two long hollow horns, which are themselves often spiny or thorny.

Schmidt's Atlas der Diatomaceen-Kunde.—Heft 50 of this work (Pls. 197–200) contains illustrations of the genera *Cocconeis*, *Achnanthidium*, *Terpsinoe*, *Pleurodesmium*, and *Anaulus*.

Structure of Cyanophyceæ.§—Prof. R. Chodat has examined the structure of *Chroococcus turgidus*, and differs in several points from the conclusions of Palla, Zukal, and others. The so-called "central body"

* Le Diatomiste, ii. (1895) pp. 149–50.
† Atti Accad. Pontif. Nuovi Lincei, xlviii. (1895) 4 pp.
‡ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 35–48 (2 pls.).
§ Arch. Sci. Phys. et Nat., xxxii. (1894) pp. 637–44. Cf. this Journal, *ante*, p. 213.

results, according to him, from a vacuolisation of the central region, and does not differ in any essential respect from the rest of the protoplasm; it is often as strongly coloured as the peripheral protoplasm. Mucilages, soluble starches, and cyanophycin may appear in all parts of the protoplasts, though they are liable to accumulate especially in the central portion. This first division-wall of *Chroococcus turgidus* is protoplasmic and coloured.

Prof. R. Chodat and Mdme. Balicka * have continued their investigations of the cell-contents of *Tolypothrix*, *Rivularia*, *Oscillatoria*, and *Stigonema*. In no case were there found any granulations incapable of staining, with the exception of vacuoles. In the first-named three genera these granulations always occupy the central region, and the peripheral zone to a less degree; in *Stigonema* they are equally distributed over the whole cell. The cell-wall cannot be distinctly differentiated from its contents.

Protoplasts of Cyanophyceæ.†—Herr G. Nadson adopts Bütschli's view of the honeycomb structure of the protoplast of the Cyanophyceæ, not only of the green peripheral layer, but also of the central body; the meshes are filled with phycochrome-chlorophyll. The central body is not sharply differentiated. Among the cell-contents of the Cyanophyceæ are three kinds of granular structure:—(1) chromatin-grains, corresponding to the red granules of Bütschli, the *Schleimkugeln* of Palla, and partially to those of Schmitz, and to a portion of the cyanophycin-grains of Hieronymus; (2) protoplasmic microsomes; (3) reserve-granules, which occur only in the peripheral layer, corresponding to the cyanophycin-grains of Borzì and Palla, and to a portion of those of Hieronymus; they perform the function of the starch in the higher plants. In cell-division, the whole of the protoplasm becomes constricted into two halves. The central body of the Cyanophyceæ corresponds in many respects to the nucleus of higher plants.

The protoplasm of the larger bacteria agrees in structure with that of the Cyanophyceæ; in most of the smaller ones there is, on the contrary, no differentiation into central body and peripheral protoplasm. For the protoplast of the Cyanophyceæ and Schizomycetes the author proposes the term *archiplast.*

Calothrix producing Spores.‡—M. M. Gomont has found, in a marsh in France, growing attached to a *Cladophora*, a *Calothrix* which he names *C. stagnalis* sp. n. It is characterised by the production of spores, always at the base of the trichome, not in chains, but singly or less often in pairs, one superposed on the other. The sporiferous branches present the appearance of a *Glœotrichia.*

Stigonema.§—Dr. G. Hieronymus discusses the distinctions and the synonymy of the species described by authors of this genus of Sirosiphoneæ, especially in reference to the species *S. ocellatum*, *panniforme*, *tomentosum*, and *minutum*. A new species, *S. Glaziovii*, is established.

* Arch. Sci. Phys. et Nat., xxxiii. (1895) pp. 206–8.
† Scripta Botanica, iv. (1895) 76 pp. and 2 pls. See Hedwigia, xxxiv. (1895) Rep., p. 46. Cf. this Journal, *ante*, p. 213.
‡ Journ. de Bot. (Morot), ix. (1895) pp. 197–202 (2 figs.).
§ Hedwigia, xxxiv. (1895) pp. 154–72.

β. Schizomycetes.

New System of Classifying Bacteria.*—Herr W. Migula suggests the following classification into Families and Genera.

I. Fam. Coccaceæ Zopf. (Mig.). Cells spherical; dividing in one, two, or three dimensions of space; endospore formation rare.

Flagella absent	Cells dividing in one direction	1. *Streptococcus* Zopf.
	Cells dividing in two directions	2. *Micrococcus* Cohn.
	Cells dividing in three directions	3. *Sarcina* Goods.
Flagella present	Cells dividing in two directions	4. *Planococcus* g. n.
	Cells dividing in three directions	5. *Planosarcina* g. n.

II. Fam. Bacteriaceæ Zopf. (Mig.). Cells straight, cylindrical, length variable; never bent. Dividing in one direction only.

Flagella absent	.. ..	6. *Bacterium* Cohn.
Flagella present	Distributed over the whole body	7. *Bacillus* Cohn.
	Polar	8. *Pseudomonas* g. n.

III. Fam. Spirillaceæ (Mig.). Cells with one or more spiral turns, dividing in one direction only.

Cells inflexible	Flagella absent	9. *Spirosoma* g. n.
	Polar flagella 1, rarely 2–3	10. *Microspira* Schroet. (Mig.)
	5–20 flagella in polar bundles	11. *Spirillum* Ehrenbg.
Cells flexible, serpentine	Organs of motion unknown, but (?) undulating membrane.	12. *Spirochæte* Ehrenbg.

IV. Fam. Chlamydobacteriaceæ fam. n. Forms with very different kinds of development, but all characterised by a firm investment or sheath which surrounds the cells joined into branched or unbranched filaments.

Cells without sulphur granules	Cells divide in one direction only	Filaments unbranched	13. *Streptothrix* Cohn.
		Pseudodichotomous branching; vegetative propagation by polar-flagellated swarm-cells.	14. *Cladothrix* Cohn, including *Sphærotilus* and *Actinomyces*.
	Cells divide in all three directions	Cells at first dividing in one direction only, but afterwards in three; the division products round themselves off and become reproductive cells.	15. *Crenothrix* Cohn.
		Filaments, at first unbranched, presenting a bond of union between the cells. Certain cells may grow through the investment, thus causing branching.	16. *Phragmidiothrix* Engl.
Cells with sulphur granules.		Filaments unbranched. Dividing in one direction.	17. *Thiothrix* Winogr.

V. Fam. Beggiatoaceæ. Sheathless filaments. Division in one direction; movement by means of undulating membrane. Cells with sulphur granules. 18. *Beggiatoa* Trev.

* Arb. Bact. Inst. Grossherz. Hochschule zu Karlsruhe, 1895, pt. ii. See Centralbl. f. Bakteriol, u. Parasitenk., 2te Abt., 1895, p. 406.

Conditions affecting Bacterial Life in Thames Water.*—Dr. E. Frankland, who has for many years busied himself with the investigation of the waters supplied to Londoners, has, since May 1892, been making monthly determinations of the number of bacteria capable of development on a peptone-gelatin plate in a given volume of Thames water, collected at the intakes of the metropolitan water companies at Hampton. The number of microbes per ccm. of water varied during this time between 631 and 56,630. As a rule, the highest numbers were found in winter, or when the temperature of the water was low, and the lowest in summer, or when the temperature was high. The author comes to the conclusion that his comparisons demonstrate that the number of microbes in Thames water depends upon the rate of flow of the river, or, in other words, upon the rainfall, and but slightly, if at all, upon either the presence or absence of sunshine or high or low temperature. Without denying that the researches of Marshall Ward prove that sunlight is a powerful germicide, Dr. Frankland thinks that it is probable that its potency in this respect is greatly diminished, if not entirely annulled, when the solar rays have to pass through a stratum of water, even of comparatively small thickness, before they reach the living organisms.

Extracellular Destruction of Bacteria.†—In his sixth memoir on Immunity, M. E. Metschnikoff deals with the extracellular destruction of bacteria in the organism, a doctrine put forward by R. Pfeiffer, who found that cholera vibrios disappear when injected into the peritoneal sac. The inference from this observation is that now there was no need to ascribe to phagocytes a microbicidal power; for the vibrios disappear through the direct influence of the exudation, the destruction being proportional to the immunity of the animal. The author defends his position with numerous experiments and verbal arguments, his main conclusions being that the extracellular destruction of vibrios in the peritoneal sac is not to be ascribed to an endothelial or other secretion, but to a bactericidal manifestation of the liquid discharged by leucocytes attacked or broken up during the phase of phagolysis. The Pfeiffer phenomenon and also phagolysis disappear if the leucocytes be reinforced by a previous injection of bouillon; the animal is then able to free itself of the vibrios by an intense phagocytic action; and, taken altogether, the cholera peritonitis of guinea-pigs is a well-marked example of phagocytosis.

The animal organism, under the influence of preventive serum, gets rid of the cholera vibrios more often by the aid of a typical phagocytosis than by means of an extracellular destruction. The Pfeiffer phenomenon occurs only in those cases where the vibrios penetrate into a medium which already contains a sufficient number of leucocytes, and only in those animals the leucocytic products of which possess a considerable bactericidal force. The injection of the red bacillus of Kiel is not followed by the Pfeiffer phenomenon; after a period of hypoleucocytosis and transient phagolysis, hyperleucocytosis and well-marked phagocytosis set in. The Pfeiffer phenomenon is only an episode in the struggle of the organism carried on by its amœboid cells, and is not a phagocytic

* Proc. Roy. Soc. Lond., lvii. (1895) pp. 439–50.
† Ann. Inst. Pasteur, ix. (1895) pp. 433–61 (1 pl.).

action strictly speaking, but rather a phagolytic process whereby the vibrios are destroyed.

Resistance of Spores of Bacteria to High Temperatures.*—Dr. P. Miquel and M. E. Lattraye, who have made a large number of experiments as to the resistance offered by spores of bacteria to moist heat above 100° C., find that in some exceptional cases a temperature of 100° cannot be relied on to sterilise nutritive media containing micro-organisms from the earth, air, or water, unless the temperature be kept up for five hours or more. This is not only not practical, but causes changes in the gelatin. Recourse should be had to cold-sterilising, by means of the porcelain bougie, or to heat of 110° for a quarter of an hour. The method of sterilising by discontinuous heating is based on an inexact theoretical conception; for to sterilise discontinuously at 100° requires almost the same time that one continuous heating does. If at below 100°, e.g. at 60°, 70°, 80°, media have been successfully sterilised by discontinuous heating, this has been due to the fact that they do not contain spores of those bacteria which do not resist a temperature of 70°–80°. In disinfecting by high-pressure steam it is better to prolong the action to twenty minutes, and to slightly exceed 110°, as germs are more resistant to mere steam than when immersed in water or any cultivation medium.

Influence of High Temperature on Bacillus mesentericus vulgatus.†—The results of the observations of Dr. A. Wroblewski on *Bacillus mesentericus vulgatus*, when exposed to high temperatures, show that this bacterium is completely or almost completely killed off if the medium be heated thrice for 20 minutes each time to a temperature of 80°, with pauses of 12 hours at 38°–40°. Little effect is produced if the temperature be slowly raised, and practically none at all if the medium be suddenly cooled.

Bactericidal Effect of Silver Salts.‡—Dr. H. Kionka reports on the work which has been done by Behring, Schäffer, Meyer and others as to the disinfecting value or bactericidal influence of solutions of certain silver salts—Argentum-casein, silver nitrates, and Argentum-amin. The effect seems to be generally inhibitive to the life of bacteria, as many different kinds were experimented with; but it is strongest against *Gonococcus*. The poisonous effect of the silver is slight, as the doses used in practice are very small. In penetrating power the salts are effective in the order mentioned above.

Bacteria of the Leguminosæ-Tubercles.§—According to Herr M. Gonnermann, the root-tubercles of Leguminosæ are not formed by a single species of bacterium, the kind varying according to the local position and the nature of the ground in which they are cultivated. The "sprout forms" which arise in the plant as the result of symbiotic and parasitic conditions, and which later break up into separate bacilli on

* Ann. de Microgr., vii. (1895) pp. 205–18.
† Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 419–22.
‡ Biol. Centralbl., xv. (1895) pp. 519–26.
§ Landwirthsch. Jahrb., xxiii. (1894) pp. 649–71. See Bot. Centralbl., lxii. (1895) p. 260.

the opening of the tubercle, may be cultivated as such in artificial nutrient soil. When the tubercle breaks up, these return to the soil, form spores, and enter the plant again in the spring as bacilli.

Pleomorphism of the Tubercle Bacillus.*—Dr. H. Bruns has observed in two cultures of tubercle bacillus appearances which are indicative of pleomorphism, and he gives eight figures descriptive of the aspect presented by the micro-organism in one preparation. The appearances depicted represent the tubercle bacillus as usually seen, long filaments of variable thickness, filaments exhibiting well marked branchings, the branches coming off at right angles from their parent stem, and others showing club-shaped swellings and bulgings. In many of the rodlets the bulgings were terminal or central, and both from their position and appearance suggested the notion of being spores. The spore notion was supported by the fact that they gave the Neisser spore reaction; though, on the other hand, cultures containing these spore-like bodies were killed by heating them for 10 minutes to 80°.

The cultures were 5–6 months old and of human origin. They were kept constantly at a temperature ranging from 37°–37°·5, and this of itself precludes the objection of the appearances being due to degeneration. The macroscopical appearances of the cultures were exactly like the ordinary growths of tubercle, and it is worthy of remark that several other cultures kept under the same conditions, and presumably of the same origin, did not present pleomorphic appearances.

Bacteria of the Healthy Eye.†—Dr. Lachowicz examined 63 healthy conjunctivas (32 persons), and only in 19 eyes (4 double and 11 single) were bacteria found. In 11 persons they were cocci; in 4, bacilli. The organisms cultivated were *Staphylococcus pyogenes albus*, *Micrococcus candicans*, *Streptococcus pyogenes*, *Sarcina lutea*, *Micrococcus coronatus*, *Bac. sporiferus* Bujwid, *Bac. fluorescens putidus*, *Bac. xerosis conjunctivæ*, *Micrococcus cereus albus*.

In order to test the influence of these organisms on the healthy human eye, the author inoculated his own conjunctiva, having first ascertained that it was sterile, with the species mentioned except *Str. pyogenes*, *B. xerosis conjunctivæ*, *Sarcina lutea*. The results were quite negative.

Green-producing Chromogenic Micro-organisms in Wool.‡—Prof. T. P. Anderson Stuart had submitted to him a parcel of wool with green patches. On submitting this wool to microscopical examination, little, highly refracting bodies were seen on the surface of the hair. Suspecting that they were micro-organisms of some sort, Prof. Stuart set about cultivating them, if possible. After some time he succeeded in obtaining an abundant crop of an organism which tinted the culture medium with the exact colour of the wool, could be transferred from one artificial culture medium to another, and to normal wool itself. It everywhere provides the same beautiful green pigment. The organism is a *Bacillus*, and there were found associated with it varying quantities of a *Streptococcus* and a large *Coccus*. It is the *Bacillus* which produces

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 817–26 (8 figs.).
† Arch. f. Augenheilkunde, xxx. (1895) p. 256.
‡ Proc. Roy. Soc. N. S. Wales, 1895, pp. 320–2.

the pigment; it is actively mobile, aerobic, and liquefying, and measures about 1 μ in length. To prove that this *Bacillus* is the real cause of the green coloration in the wool submitted to him, normal wool from the fleece was inoculated with pure cultures from the tube, and in about a fortnight a characteristic colour made its appearance. All the specimens of green wool had a very characteristic odour, reminding one of the smell of woollen garments that have been put away in a wardrobe in a damp state. This smell is present likewise in the cultures, and even in the alcoholic solutions of the pigment. The pigments are two in number: one blue, soluble in chloroform, the other light green or yellow, soluble in ether. The growth of the organism does not appear to injure the staple; it grows upon the strands, and possibly on the abundant organic and foreign matter found in all fleeces. As shown by the sample examined, about half of its weight is lost when wool is scoured. As to the origin of the organism there can be little doubt; it is a saprophyte distributed more or less abundantly all over the world, and there is little cause for wonder that, having entered the fleece, and finding there moisture, warmth, food, and shelter in the dust and dirt already referred to, it should grow and multiply.

Anaerobiosis and the Treatment of Wounds.*—In the course of some remarks on anaerobiosis Dr. E. Braatz mentions that pathogenic bacteria are potential anaerobes, and that in virtue of this faculty they flourish in abscess cavities and in the discharges of wounds from which air is excluded. Hence the open treatment of infected wounds is indicated. Experiments showing the beneficial effect of free aeration were made with the tetanus bacillus in fluid sugar-gelatin. By passing filtered air through tubes inoculated with tetanus it was shown that these remained perfectly clear, while the control cultures exhibited copious growth.

The author then relates some experiments made with mica plates for the purpose of excluding air. The bacteria used were *Bacillus pyocyaneus*, *Staphylococcus pyogenes aureus*, and anthrax, and these were cultivated on agar in capsules. On the surface bits of mica plates were scattered irregularly. Beneath these pieces of mica, most of which were triangular, no growth occurred, and this result is ascribed by the author to the exclusion of air from pressure by the mica.

Effect of Kidney Extract in Cultivation Media.†—Dr. O. Henssen, who has made a series of experiments as to the effect of kidney extract, in the fresh and boiled condition, when added to nutrient media, finds that the fresh juice of the kidneys of healthy Carnivora, Herbivora, and Omnivora possesses an inhibitory influence on the growth of certain Schizomycetes, which is expressed more or less markedly in the different species. The influence is most striking in diphtheria, cholera, and typhoid, and in these instances this action is all the more remarkable as renal affections are frequent in these diseases. The influence on anthrax, glanders and *Bact. coli* was less unfavourable. The growth of *B. coli* in fresh kidney juice is considerably better than that of the typhoid bacillus, a discovery which may possibly possess some diagnostic value.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 737–42 (1 pl.).
† Tom. cit., pp. 401–11.

The inhibitory influence of fresh kidney juice is not only entirely removed by boiling, but media prepared with the boiled juice are extremely favourable cultivation media for Schizomycetes. Media made with boiled pig's kidney juice are quite inhibitory to the growth of anthrax; but with this exception the behaviour of the kidneys of the three species examined was approximately equal.

Infectiousness of Milk.*—Mr. C. H. Ernst made a series of experiments to ascertain if the milk of tuberculous cows contained tubercle bacilli; only tuberculous cows free from affection of the udder were employed.

Series I. Samples of milk and cream were tested for two years. Of 121 samples from 36 cows, 19 gave positive results (12 different cows). Twenty out of the 36 were killed, and careful examination showed that they were free from udder disease.

Series II. (*a*) Inoculation of 88 guinea-pigs with milk from 15 different cows: 12 guinea-pigs became tuberculous. (*b*) Of 90 rabbits, only 6 became affected.

Series III. Feeding experiments. Milk given to young rabbits, pigs and calves. The animals were killed after 6 months. Results, 2 out of 48 rabbits; 5 out of 12 pigs; 8 out of 21 calves.

During the experiments 19 calves were born of tuberculous cows. These were all slaughtered within 6 days of birth, but none gave any evidence of tubercle. These results therefore exclude direct inheritance.

Bacteria in the Intestinal Contents of New-born Infants.†—Dr. Schild has examined the intestinal contents of new-born infants, and also determined the paths whereby the bacteria gain access to the intestine. He finds that the intestine of the infant is sterile, and that infection first occurs 10–17 hours after birth; that the infection is independent of food, but is influenced by the prevailing temperature, occurring more quickly in summer than in winter. The infection takes place through the oral or anal opening. The author's experiments further show that some of the bacteria are derived from water, and others from air. Thus in children as in adults, an infection may occur per anum, and the appearance of bacteria in the intestine cannot be prevented even when the children receive only sterilised food. Before any food had been taken, the author isolated seven species of bacteria, some of which were peptonising.

Cream Ripening with Bacillus No. 41.‡—Prof. H. W. Conn describes an organism obtained from milk coming from Uruguay, S.A., which has a remarkable effect on butter. It is a diplobacillus $1 \cdot 1\ \mu$ by $0 \cdot 7\ \mu$, or when growing on potato a little larger. It does not form spores and is motionless. Optimum temperature about 23°, but will grow, though less readily, in culture oven, as the author says. Grows well on agar and gelatin, forming white uncharacteristic colonies and overlay. On

* 'Result of Investigations made for Trustees of Massachusetts Society for promoting Agriculture,' Boston, 1895, 17 plates. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 650–1.

† Zeitschr. f. Hygiène, xix. (1895) No. 1. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 648.

‡ Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 385–92.

potato the growth is thick, white or whitish-yellow to brown; bouillon becomes turbid, a heavy scum forms, and in five days a sediment. With milk no visible effect for a long time; during first three days there is slight acidity, but no curdling, and a pleasant aromatic odour, which afterwards changes to that of cheese, is developed. After several weeks the milk becomes slightly brownish and translucent.

Cultivations have been used in more than 100 creameries with very favourable results on the butter, the quality and buttery flavour (grass flavour) of which is improved in the summer and produced also during the winter. The influence of the cultures on cream seems to increase until the third or fourth week, when it rapidly deteriorates, and a new culture must be used. *Bacillus No.* 41 is not only remarkable for producing the desired aroma and augmenting the quality of butter, but it actually destroys many injurious organisms which chance to be in the cream.

Bacillus No. 41 differs from the other bacteria used in cream ripening in two important respects: (1) It is not an essentially souring organism, though it adds the desirable flavour. (2) No previous treatment of the cream is needed to obtain good results.

Mixed Infection in Diphtheria.*—In an examination of eleven cases, Dr. J. Bernheim found that the diphtheria bacillus was always accompanied by *Streptococcus*, and sometimes also by *Staphylococcus*. Numerous cultivations on media with and without the metabolic products of these organisms were made, but the most interesting result was that which showed the increased virulence of the symbiosis of the *Streptococci* and the diphtheria bacilli. Very similar results were obtained by Dr. F. Reiche, who examined 42 bodies dead of diphtheria. In 64 per cent., *Streptococci* and *Staphylococci* were present; in 45 per cent., *Streptococci* only. Dr. Ricker found in the placenta and the liver of the fœtus of a woman who died of diphtheria *Streptococcus* in almost pure cultivation.

Morphological Peculiarity of Diphtheria Bacillus.†—Herr C. Fränkel pointed out some time ago that in fresh cultures of diphtheria on Löffler's blood serum, branchings of some of the bacteria were occasionally to be detected. It has been recently found that the surest way to obtain cultures with branched forms is to cultivate the diphtheria bacilli on the surface of hard-boiled egg. When the diphtheria bacillus is inoculated on slices of eggs which have been boiled for 15–20 minutes there appears a yellowish-white dry tuft, which on microscopical examination shows very large forms, "a sort of giant growth," so that the club-shaped swellings are the more striking.

In order to demonstrate these branchings microscopically it is necessary to adopt an unusually careful procedure. The tufts of bacteria are to be rubbed up into a suspension with distilled water on a slide. A small quantity of Löffler's or Ziehl's solution is then added, and, the cover-glass having been imposed, any excess of fluid is removed with blotting-paper. If the preparation is to be kept, it must be ringed round with wax.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 416–9.

† Hygièn. Rundschau, 1895, No. 8. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 896–7.

Water Bacteria resembling the Bacilli of Typhoid.*—Dr. A. del Rio cultivated from Spree and Havel water three species of bacteria, the colonies of which had considerable resemblance to those of *Bact. coli* and the bacillus of typhoid. The first was a short plump bacillus without movement, and usually occurring in pairs. On ordinary media it throve well at the room temperature, but at 37° C. its growth was weaker. The second was a slender bacillus endowed with lively movements which only grew well at the room temperature. The third was a medium sized coccus, occurring singly or in short chains, and this grew well at the room temperature, but less well when incubated. The differentiation of these organisms from the typhoid bacillus, and from *Bact. coli commune*, was found to be difficult on gelatin plates; but by transferring the gelatin colonies to saccharated media in fermentation flasks they were easily distinguished. When the flasks were kept at the room temperature, development occurred only in those parts of the medium to which there was free access of oxygen. When the flasks were incubated no growth took place. Under both these conditions the opposite occurs with *B. coli commune* and with the typhoid bacillus.

Bacteriology of Gastric Fermentation.†—Dr. J. Kaufmann describes a case in which, notwithstanding the presence of free hydrochloric acid in increased quantity at the height of digestion, a bacterial fermentation took place. Bacteriological examination of the gastric contents was conducted on acid 2 per cent. agar plates at 37°, and eight different microbes were isolated; (1) yellow *Sarcina;* (2) white yeast; (3) *Micrococcus aurantiacus;* (4) *Staphylococcus cereus albus;* (5) *Bacillus subtilis;* (6) *B. ramosus;* (7) thick short bacillus; (8) short rodlet resembling *coli commune.*

The presence of most of the foregoing organisms is not considered surprising, but that of the rodlet resembling *coli commune* is so, for the author was able to show that it could not exist in normal gastric juice with free HCl.

An explanation on the vague basis of the existence of atony of the stomach and a "circulus vitiosus" is then given.

Present Position of the Bacteriology of Cholera.‡—During the past few years, study of the cholera question has taught us, says Dr. M. Gruber, that the problem of the ætiology of cholera is not so simple as it first appeared. Though there is no doubt that the cases of Asiatic cholera are characterised by the presence of the comma bacillus in the dejecta, and that these vibrios are at least participators in the production of the disease, yet a something else is necessary, a something which influences either the production or the absorption of the poison. Perhaps this may be another germ which has hitherto escaped observation. A special difficulty arises from the resemblance between the cholera vibrio and the numerous other vibrios, both as to their cultivation characters and their microscopical appearance; and according to the author, many

* Arch. f. Hygiène, xxii. (1895) p. 91. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 528.

† Berlin. Klin. Wochenschr., 1895, Nos. 6 and 7. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 647–8.

‡ Münch. Med. Wochenschr., 1895, Nos. 13 and 14. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 762–3.

of the criteria, such as the number of flagella, the form and appearance of the young colonies, or the cholera red reaction have no specific value, and are only to be regarded as group characters. The experiments on man and animals show that the cholera vibrios are capable of producing the disease provided the other unknown conditions are present, and they further seem to show that the disease is rather an infection than an intoxication. There is no reason to suppose that the poison secreted by the cholera vibrio is specifically different from poisons formed by other bacteria; and as to its exact nature we are still in the dark. After pointing out that experiments on animals have quite failed from a diagnostic point of view, the author sums up by affirming that the present position of the bacteriology of cholera is that we know with certainty that the vibrios occurring in the cholera process call forth the morbid phenomena, but that we cannot diagnose these vibrios as a definite species with certainty. No definite opinion can be expressed as to whether in all true cholera cases, the vibrios belong to one or to several species, nor whether they are different from our endemic vibrios or are identical with them.

Behaviour of Cholera Bacilli in Aerobic and Anaerobic Cultures.*—Dr. Hellin made cultures of cholera bacilli in litmus whey (10 ccm. each) and incubated them for 5–8 days at 37°. The now red cultures required 0·7–0·8 ccm. of a 1/10 soda solution to restore the original colour. The cholera bacilli therefore form acid which, expressed in terms of the standard soda solution, is equivalent to 7 or 8 per cent. In the experiments a blue scum, 2–3 mm. thick, formed on the surface of the litmus whey, beneath this there was a layer of red fluid, while lower still the fluid was quite decolorised. The upper blue layer showed that the cholera bacilli made the medium alkaline, and as the scum cut off access of air to the parts below, there was in the same test-tube an aerobic and an anaerobic cultivation. There was no difference in the reaction after a stay of 10 days in the thermostat. When the cultures were placed in a Buchner's apparatus for breeding anaerobes all the whey turned red, but no scum membrane was formed; hence it follows that the different reactions in the first case depended on the presence or absence of air. Cholera bacilli are accordingly formers of acid and alkali, the latter corresponding to oxidation, the former to reduction. In the human alimentary canal, the cholera bacteria, when oxygen is excluded, form acid, and at the same time exert a reducing action.

The author further states that in the presence or absence of oxygen, cholera bacilli form nitrous acid in the course of a few hours if 0·01 grm. $NaNO_3$ and 1 per cent peptone be added to the medium. In 28 hours 5 mg. of nitrite were demonstrated. The quantity of nitrous acid formed is greater, if the nitrate be added after the bacteria have started growing, than if put in before the inoculation.

By introducing 0·01 cm. nitrate and cholera bacilli into an egg, it was determined that in one day 1 mg. N_2O_3 was formed, in 2 days 2 mg., and 5 days 4 mg. A comparison of egg and bouillon cultures showed

* Arch. f. Hygiène, xxi. (1894) p. 308. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 764–5.

that in the former, after 3 days, 5–6 mg. of N_2O_3 were present; in the latter, after 16 hours 4 mg., and after 40 hours 1 cg. In an anaerobic culture 16 hours old, 0·75 mg. nitrite was formed; in another 16 hours old, 2·5 mg., and after 42 hours 4·5 mg. When bouillon was rendered strongly alkaline with Na_2CO_3, the quantity of acid formed in anaerobic cultures was found to exceed that of aerobic cultures.

Toxicity and Virulence of Cholera Vibrios.*—For studying the relations between the toxicity and virulence of cholera vibrios, Freiherr von Dungern used (1) a culture, isolated from a cholera case from the last epidemic in East Prussia, the virulence of which may be expressed by saying that 1/8 loopful (1/4 mgrm.) of a 20 hours old agar culture killed a guinea-pig of 200 grm., and another (2) which had been continuously cultivated for eight years in the Institute, and which was originally obtained from Calcutta. The virulence of the latter was almost entirely lost, for when 10–20 mgrm. of the culture were injected into the peritoneal sac of a guinea-pig, almost all the organisms were killed off. The two cultures were made in exactly the same way, all the usual precautions were carefully observed; and although the animals did not react exactly alike, yet it was clearly determined that the toxicity of the two cultures, so different in their virulence, was very much the same; even injections into the blood stream led to the same result.

Ætiology of Dysentery.†—In a preliminary communication on the results of the examination of 62 cases of acute dysentery, Prof. A. Celli and Dr. R. Fiocca state that amœbæ, and especially *Amœba coli*, cannot be the direct cause of this disease on the following grounds:—(1) There are cases of epidemic, endemic, and sporadic dysentery without any amœbæ. (2) By inoculating with dysenteric fæces, or with cultures containing amœbæ and bacteria, an amœba-free dysentery can be induced; and if the amœbæ be killed a dysentery can be excited by inoculating with the bacteria and their poisons. (3) Amœbæ are found in quite healthy intestines (*A. coli*, *guttula*, *oblonga*, *spinosa*, *diaphana*, *vermicularis*, and *reticularis*). (4) In dysenteric dejecta *Bacterium coli commune* is constantly found, ordinarily in company with a typhoid-like transition variety; frequently with Streptococci and sometimes with a Proteus. (5) Dysentery may be artificially induced by means of *B. coli com.* or two other species, and it seems possible that the combined action of two or more organisms on the intestines, by altering the environment, converts *B. coli com.* into the variety *Bact. coli dysenteriæ*, which retains its specific potentiality through a series of animals. This variety is distinguished by excreting a toxin capable of setting up a typical dysentery.

Immigration of Bacteria into Cysticerci.‡—Though bacteria cannot penetrate the walls of the echinococcus bladder, they may, according to the observation of M. C. Frenkel, pass into *Cysticercus pisciformis*. A small quantity of a sterilised culture of *Staphylococcus citreus* was subcutaneously injected into a rabbit, and later on an attenuated culture

* Zeitschr. f. Hygiène u. Infektionskrankheiten, xx. p. 147. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 893-4.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 309–10.

‡ Compt. Rend. Soc. Biol., 1894, No. 30. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 910.

into an ear vein. After death a cysticercus with yellow contents was found, and these consisted of the injected microbes.

Bacillus tracheiphilus sp. n.*—Dr. E. F. Smith describes a micro-organism which he has found to be the cause of withering of various Cucurbitaceæ. The bacillus is of variable length, the average size being $0 \cdot 5$–$0 \cdot 7$ μ. When young it exhibits lively movements. It possesses a capsule visible both in stained and unstained preparations. Spores were not observed either in the natural or in the cultivated condition. The bacillus does not stain well with most anilin dyes, though phenol-fuchsin is best. Both the capsule and the flagella are stainable. The number of flagella appears to be variable. In sections of plants it was difficult to demonstrate the bacilli *in situ* owing to the tissues being more retentive of the stain than the organisms. This difficulty was overcome by immersing the sections in strong aqueous solution of tannin for 10–15 minutes, and after washing in water, staining with aqueous solution of gentian-violet. On treating the sections with alcohol the colour was extracted from the tissue, but not from the bacilli. The bacillus was cultivated on the ordinary media, but best on potato, and in bouillon with pepton. Gelatin is not liquefied. The organism preferred alkaline to acid media, and though aerobic was found to be a potential anaerobe. It was very sensitive to heat and dry air, and maintained its vitality for about three weeks as a rule, though sometimes a few living bacilli were found in four months old cultures. Transfer experiments from plant to plant were successful in reproducing the disease in healthy plants, and the same result was obtained from pure cultivations.

Bacillus anthracis claviformis.†—MM. A. Chauveau and C. Phisalix describe a modified form of anthrax under the title *Bacillus anthracis claviformis*, which differs materially, morphologically and physiologically, from its pathogenic progenitor. The ancestor of the new variety came of a race with a fixed virulence equal to killing the adult mouse, but unequal to killing a guinea-pig, and was obtained from bouillon cultures, inoculated from the lymphatic glands nearest the wound and from the internal viscera. Microscopical examination showed the bouillon growth to be composed of bacilli $0 \cdot 5$–2 μ long, with rounded ends. There was no tendency to form filaments. Most of the bacilli had an oval spore at one end, thus imparting to the rodlet a nail-like or bell-clapper appearance. The spore, which is highly refractive and resists a temperature of 70°, is easily stained. Numerous cultivations showed that succeeding generations retained the acquired morphological characters.

The physiological characters of the new variety differ materially from those of *B. anthracis*; it is quite devoid of virulence, for it does not kill even a young mouse. It retains some toxic properties, for its injection in large doses is followed by a rise of temperature. The new race possesses the vaccinating property in a trivial degree only. Attempts to restore the virulence to the bacillus failed, and the authors consider that the new race is not an example of common polymorphism, but of a real specific transformation.

* Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 364–73.
† Comptes Rendus, cxx. (1895) pp. 801–7 (1 fig.).

Bacterium Chauvæi.*—Drs. G. P. Piana and B. Galli-Valerio describe a variety of *Bacterium Chauvæi* which was obtained from the muscles and lungs of a cow dead of symptomatic anthrax. It is a very small bacillus, mobile, highly refractive, and easily stainable. The spores and the usual forms of *B. Chauvæi* were never observed, and this bacillus varied not only in size but also in shape (cocci, small and thin bacilli, and thick swollen cells, a few having spores). The virus, which is but little resistant to heat, was more active than that of the normal breed. The diminished resistance of the virus is probably due to the infrequency of the spores. Phagocytosis is a marked phenomenon, and especially so in the more resistant animals. The incorporated bacilli are always small, and devoid of spores or strongly coloured corpuscles.

Bacillus suitable for exterminating Mice.†—Herr S. S. Mereshkowsky isolated from *Spermophilus musicus* a bacillus which was found to be suitable for the destruction of field and house mice. The bacterium was found both in viscera and in the blood. On microscopical examination of bouillon cultures the bacillus appears to have much resemblance in size and movements to Lœffler's mouse typhoid bacillus. In meat-pepton-bouillon at 37°·5 there is clouding, followed by the formation of a white scum which breaks up when shaken. It develops a characteristic odour resembling that of freshly voided horse-urine when cultivated in large bulk of bouillon. It does not liquefy gelatin, and the colonies on plates are circular and brownish. It does not develop gas on saccharated media, and on agar and potato exhibits no special peculiarity. Its growth is suspended when oxygen is excluded, but it retains its vitality nevertheless. Spore-formation was not observed.

This microbe is fatal to squirrels, as well as to the marmot and mice. The results of the field experiments are promised shortly.

Bacillus piscicidus agilis.‡—Mdme. Siebe-Schoumoff isolated from the bodies of dead and dying fish a short mobile rodlet which in young cultures was short and thick ($1–1\cdot5\ \mu \times 0\cdot5–0\cdot8\ \mu$) and in old long and thin ($2–3\cdot5\ \mu \times 0\cdot3–0\cdot5\ \mu$). *Bacillus piscicidus agilis* is mobile, a potential anaerobe, liquefies gelatin, grows on all media, and is killed off at a temperature of 60°–70°. This bacillus is pathogenic both after subcutaneous and gastric infection to warm- and cold-blooded animals. The extract from infected fish, boiled for half an hour, when injected into guinea-pigs, was fatal to half the number, while cultivations from the fluid were negative.

Towards the end of 1893, the authoress had the opportunity of examining the stools of six persons suffering from fish poisoning with cholera-like symptoms. In two cases which succumbed *B. piscicidus agilis* as well as comma bacilli were found.

Micrococcus Sornthalii.§—Prof. L. Adametz describes a coccus which he isolated from milk. The isodiametric cells measure 0·0007 mm. These occur singly, in pairs or short chains. In old cultures large cells resembling yeast-cells, oval in shape and having 2–3 times

* Ann. Inst. Pasteur, ix. (1895) pp. 256–64 (3 figs.).
† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 742–56.
‡ C.R. Soc. Med. Russes, Dec. 1894. See Ann. de Microgr., vii. (1895) pp. 231–2.
§ Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 465–73 (1 pl.).

the normal diameter, are found. On milk-sugar gelatin the colonies are round, characterised by concentric circles, white at first, but later becoming brown in centre. When inoculated in sterilized milk at 28°–30° coagulation sets in from 30–36 hours, the casein at first separating in flakes, forming later on a consistent or homogeneous mass. The reaction of the milk is markedly acid, caused by the presence of lactic acid. The action of the organism on cheese was tested by making hard and soft cheese from milk infected with *M. Sornthalii;* as soon as the temperature rose to 17°–20° the cheeses exhibited fermentation phenomena, and numerous bubbles and cavities appeared.

Pyobacterium Fischeri.*—Dr. H. Küttner describes a pyogenic organism isolated from an abscess in the abdominal wall. Though much resembling *B. coli commune*, it is distinguished therefrom by a number of characters. It is slimmer, grows more slowly, the colonies are pure white, and the movements lively. It coagulates milk, though slowly, ferments sugar solutions, and forms acid in meat solutions. One special characteristic is its power of forming in liquid media nitrous acid as well as indol, a property which has hitherto been only observed in vibrios and a few other organisms. Experiments on animals showed that *Pyobacterium Fischeri* is a pure pyogenic organism and is pathogenic to mice, guinea-pigs, rabbits, and pigeons. When introduced into serous cavities and into the circulation the animals soon die of septicæmia. On intramuscular or subcutaneous injection it leads to suppuration, and the formation of crusts of matter which recall the croupous or diphtheritic processes. In large doses death results from septicæmia before pus can form, but in small ones the disease is slow and abscesses form.

Immigration of Cholera Vibrios into Hens' Eggs.†—The results of Herr Wilm's experiments on the immigration of cholera vibrios into hens' eggs are that the vibrios are able to pass through the shell into the egg, taking at least 15–16 hours to do so: the immigration is all the more certain and the greater, the less the infecting material be exposed to drying, and the fresher and fuller of vibrios it is.

Besides the cholera vibrio other bacteria, e. g. *Bacterium coli commune* and some water bacteria, can pass through egg-shell. Eggs containing cholera vibrios retain for about four or five days their normal character; they then become cloudy and begin to smell of sulphuretted hydrogen. Cholera may be acquired by eating infected eggs, and the disease transferred by means of infected shells on which the vibrios are viable for 4–5 days. Eggs boiled longer than two minutes are not poisonous. The virulence of the cholera vibrios is increased in eggs.

Decomposition of Hen's Egg by Vibrios.‡—For studying the decomposition products of the egg, Herr Grigoriew used *Vibrio choleræ asiaticæ*, *V. Metschnikovi*, *V. Deneke*, *V. aquatilis*, and *V. Finkler-Prior.* The yolk of eggs inoculated with the cholera vibrio became green in

* Zeitschr. f. Hygiène, xix. p. 263. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 760–1.

† Arch. f. Hygiène, xxiii. (1895) pp. 145–69. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 892.

‡ Arch. f. Hygiène, xxi. (1894) p. 142. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 885–7.

5–7 days, and later on firm, the white being liquefied. Acetate of lead papers demonstrated the development of sulphuretted hydrogen, and the reaction of the medium became faintly acid. In 3½–4 weeks the vibrios were dead. *V. Metschnikovi* behaved in much the same way, but the other spirilla did not grow well or develope H_2S in the eggs.

From the albumen infected by the different species of *Spirilla*, injections were made into the peritoneal sacs of guinea-pigs, each receiving 0·5–5 ccm. of cultures 1–2 weeks old. *V. choleræ* and *V. Metschnikovi* set up well-marked toxic phenomena; but though the others induced pathological symptoms the animals recovered.

The toxines were separated from the eggs by precipitation with alcohol and extracting them from the dried precipitate with water. The aqueous extract was repeatedly treated with alcohol-ether, then with ether only, and finally dried in a vacuum-exsiccator. The cholera and *Metschnikovi* toxines were pale brown and easily soluble in water; they gave the biuret and xantho-protein reactions, a red colour with Millon's reagent, and on the whole behaved chemically like peptones. The phenomena excited by the injection of these aqueous extracts were very similar, except that that from *V. Metschnikovi* was more rapid and stronger in its action. Injection of the albumen itself was followed more rapidly by morbid phenomena than when the aqueous extract was used. An effective toxin was also obtained from *V. Finkler-Prior*, while the products of *V. Deneke* and *aquatilis* were but little toxic.

Cholera Vibrio and Hens' Eggs.*—The results obtained by Herr W. Dönitz from cultivating the cholera vibrio on hens' eggs were chiefly that, when alone, these organisms do not form sulphuretted hydrogen in quantity perceptible to the smell or demonstrable by means of lead paper; and also that the hens' egg is a very unsuitable medium for pure cultures of bacteria. The eggs used were as fresh as possible; for the ordinary bought eggs almost invariably contained germs which produced sulphuretted hydrogen. Formalin was tried as a disinfectant, but it was found that when it had been used too long the eggs became useless as nutrient media, nor is it to be recommended as a preservative, for when opened the egg sets to a glassy mass.

Formation of Poisonous Substances by Vibrios in Hens' Eggs.†—Herr Bonhoff has cultivated *Vibrio danubicus, berolinensis*, and Dunbar in hens' eggs for the purpose of determining whether poisonous substances were formed in the cultivation medium, and if so whether these substances were protective against intra-peritoneal inoculation of cholera. In the result the author found that all these vibrios had the same action on the egg-albumen, and that watery extracts of alcoholic precipitates of these eggs contained the same poisonous substances, but not in the same quantity; a well-marked immunity which lasted for 15–36 days against intraperitoneal injection of living cholera vibrios was obtained from the egg extractives. Hence it appears to be probable that the toxic substances formed by vibrios in egg-albumen are identical.

* Zeitschr. f. Hygiène u. Infektions., xx. p. 31. See Centralbl. f Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 892–3.
† Arch. f. Hygiène, xxii. (1895) pp. 351–91.

Association of the Pneumococcus with Staphylococcus pyogenes aureus.*—M. Mosny finds that the coalition of *Staphylococcus pyogenes aureus* with *Bac. pneumoniæ* serves to render the action of the latter much more virulent. When 0·5 ccm. of a culture of *Bac. pneumoniæ* was intravenously injected into a rabbit the animals died in 5 days, while they survived after subcutaneous injection. When the two organisms co-operated the virulence of *Pneumococcus* was much increased, the animals dying in from one to three days. *Bac. pneumoniæ* was always found in the heart's blood, but *St. py. aureus* never. The latter was, however, found in miliary abscesses of the kidney, which were constantly present, and at the inoculation site. It seems probable that the increased virulence is due rather to the poison than to the organism itself. When *Pneumococcus* was cultivated on sterilized *Staphylococcus* cultures its virulence was also increased.

Bacteriological Examination of Edinger's Rhodanates.†—Dr. A. Müller has submitted some of the rhodanates to a bacteriological examination in order to test if they were possessed of any disinfecting power. This power suggested itself on account of the suspected affinity of these bodies with those substances produced by the human body which protect against or prevent disease. The three bodies tested were chinolinbenzyl rhodanate, oxychinolinmethyl rhodanate, and chinolin rhodanate, and the bacteria used were *Staphylococcus aureus*, *Bacillus diphtheriæ*, and *Vibrio choleræ asiaticæ*. The experiments showed that these bodies are possessed of a certain amount of bactericidal influence and disinfecting power, and this the author considers is some support to the theory of self-purification.

Urethritis caused by Bacillus coli communis.‡—Herren N. R. C. A. van der Pluym and C. H. ter Laag record a case in which a specific urethritis was caused by *B. coli communis*. Examination of the discharge failed to reveal any gonococci, but instead there were numerous bacilli with rounded ends, most of them being within the pus-cells. Cultivations were made on gelatin and agar plates. The colonies which developed on the agar were both superficial and deep. In both cases the bacilli were alike, and consisted of longer and shorter rodlets. The organism was further cultivated on gelatin and agar (tubes), on potato, and in bouillon. In media containing grape or milk sugar there was copious disengagement of gas. The organism was pathogenic to mice, the spleen being much enlarged. Inoculated in the cornea it produced suppurative keratitis. The authors identify the organism with *Bacillus coli communis*.

Bacillus typhosus in Urine of Enteric Fever Patients.§—Prof. A. E. Wright and Dr. D. Semple find that the bacillus of typhoid fever is easily detected by bacteriological examination of the urine of enteric fever patients. In one case the *Bacillus typhosus* was also isolated from the blood obtained by puncturing the "spots." These facts go far to support the authors' contention that typhoid fever is a septicæmia and

* La Semaine Méd., 1895, No. 1. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 761.
† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 705–10.
‡ Tom. cit., pp. 233–5 (1 pl.). § Lancet, 1895, ii. pp. 196–9.

not an intoxication as some suppose. The intoxication theory cannot, however, have a very strong basis, as the presence of *Bac. typhosus* in the spleen and mesenteric glands is universally admitted. From actual observation it has been determined that the specific organism of enteric fever is absent from the stools during the course of the fever, and this absence is confirmed by the fact that *Bac. coli communis*, when put in competition with *Bac. typhosus*, soon overcomes the latter.

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MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

New Preparation Microscope.†—Drs. H. Braus and L. Drüner have devised a new form of preparation Microscope which has been made for them by the firm of Zeiss.

The first instrument made is represented in fig. 82. For base it

FIG. 82.

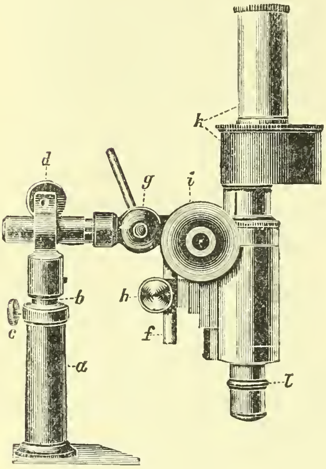
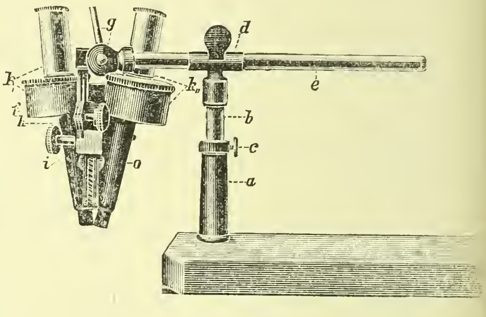


FIG. 83.



has a heavy rectangular metal plate (see fig. 82). Screwed into this is a hollow upright *a* in which a metal rod *b*, 13 cm. long, slides vertically, and can be clamped at any height by means of the screw *c*. This rod carries a socket, with clamping screw *d*, which clasps a second horizontal rod *e* (compare fig. 83), 28 cm. long, with the end of which a short metal rod *f* is connected by means of the joint *g*. The optical instrument is attached to the rod *f* by a second clamping socket *h*.

The Microscope consists of a short body-tube (9 cm.) provided with a rack and pinion *i*. The inversion of the image is effected by an inverting eye-piece *k*.

The instrument has the following advantages over the Brücke lens :—

(1) A fine and certain adjustment by the pinion which is in close proximity to the hand.

(2) The coarse-adjustment is possible in all directions after loosening the fixing screws.

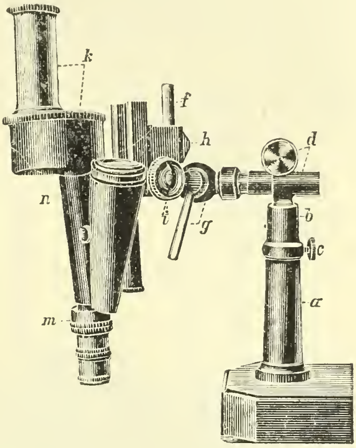
* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Jena. Zeitschr. f. Naturw., xxix. (1895) pp. 435–42.

(3) The rotation about the axis of the vertical rod *b* allows the instrument to be moved aside for the purpose of observing the preparation with the naked eye.

(4) The length of the tube causes the head to be at a greater and more convenient distance from the preparation.

FIG. 84.



Instead of the monocular Microscope, the authors have used with much more advantage a binocular of the form shown in fig. 83. The two tubes, converging on a point about ·25 cm. from the eye of the observer, are cast in one piece out of aluminium bronze. The two objectives have a special holder so that they can be adjusted to suit a difference in the eyes. The binocular can if necessary be converted into a monocular by removing the two objectives and attaching another by means of the connecting piece *m*, as seen in fig. 84. The axis of the single tube *n* is then adjusted parallel to the rack by means of a rotating disc.

(3) Illuminating and other Apparatus.

New Hot-Stage with Regulation for Constant Temperature.*—Dr. W. Behrens has devised a hot-stage in which the regulation of the temperature depends upon an entirely new principle.

The new stage consists of a metal box (fig. 85) which can be firmly screwed to the Microscope stage by the two clamping screws *k*. In the cover in the centre is a hole through which the objective projects. On one side of this is a narrow slit closed by a glass plate through which can be seen the thermometer *t* placed in the interior of the box, while at *c* and *b* are openings closed by metal caps.

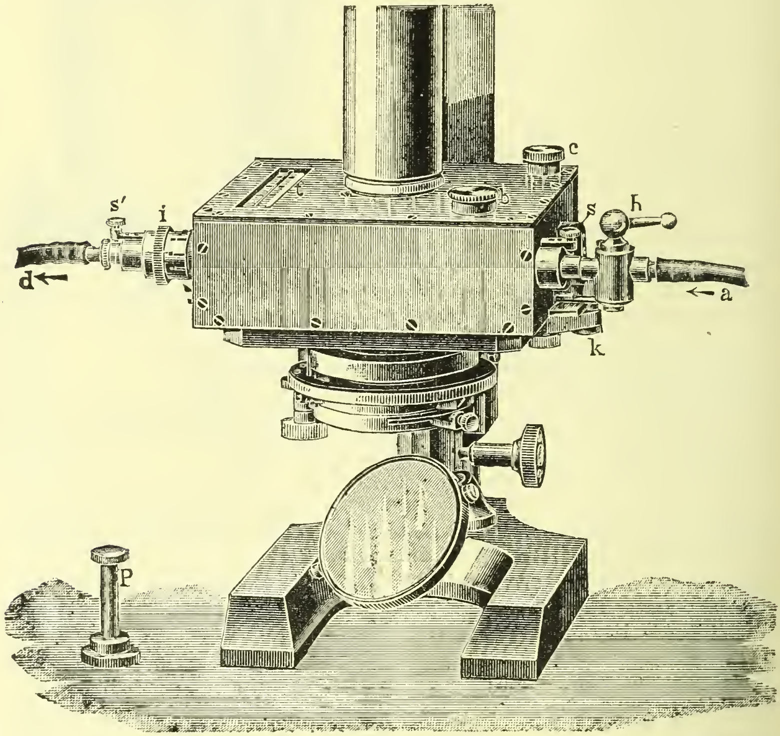
The base-plate has a sufficiently broad piece cut out of it, so that it only rests upon the Microscope stage at the front and back, and leaves a hollow space in the middle in which the preparation can be inserted. On the left side face of the box is the inlet tube *a* provided with a cock *h*, and opposite to it on the right-hand side is the exit tube *d*. Both tubes are movable inwards and can be fixed in position by the clamping screws *s* and *s'*. The exit tube possesses also an adjusting arrangement *i* with a division like the correction arrangement on objective-systems.

The method of using the apparatus in order to obtain a constant temperature is simple. The reservoir B (fig. 86) which is supplied with water by the funnel D is connected by the bent glass tube E and indiarubber tubing F with the inlet tube *a*. A piece of tubing G of convenient length is attached to the exit tube *d* for carrying off the water which has passed through the apparatus. The cock *h* is opened and water

* Zeitschr. f. wiss. Mikr., xii. (1895) pp. 1–15 (4 figs.).

drawn from B into A by sucking at G; *h* is then closed and the box A is filled with water at the ordinary temperature through the opening *c*. The cap *c* is then screwed on and the water in B is heated by the Bunsen H to 60°–70°, as registered by the thermometer T. The cock *h* is again opened a little so that the water only flows from the exit tube drop by drop, and the apparatus is allowed to gradually get warm up to a temperature about 2° higher than the temperature required. The cock *h* is then fully opened and at the same time the tube *d* is pressed so far inwards that the outflowing water only falls drop by drop. The

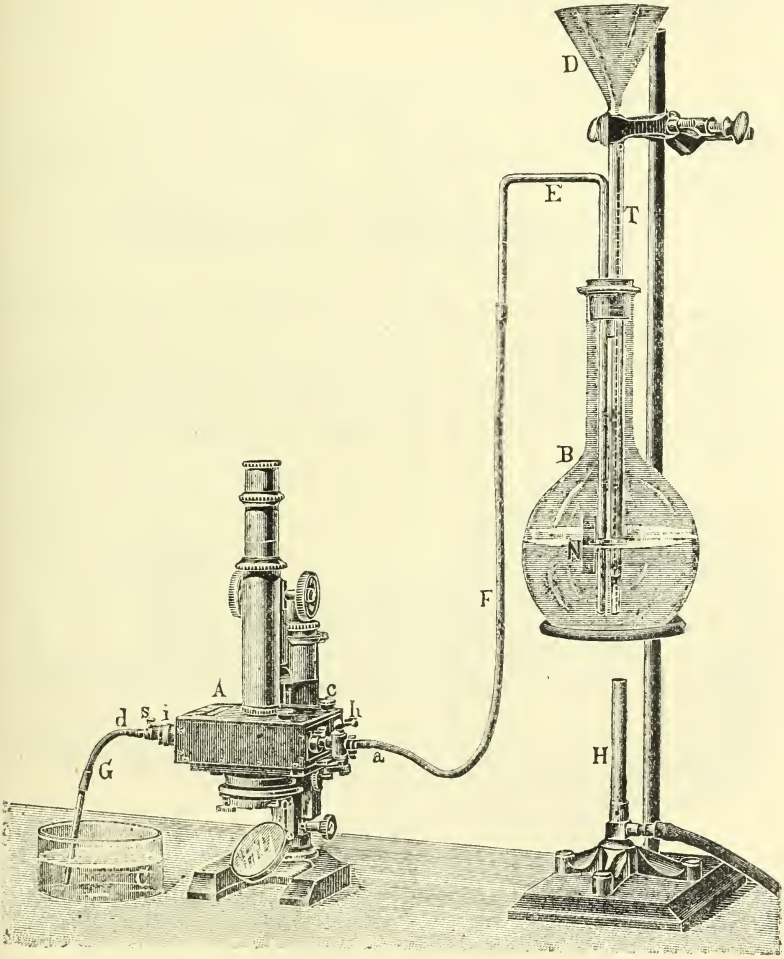
Fig. 85.



clamping screw *s*′ is then fixed and the apparatus left to itself for a short time and the rise or fall in temperature noted. The tube *d* is then moved either way through definite intervals until the desired constancy of temperature is obtained.

The means by which this constancy of temperature is obtained appear somewhat complicated. Within the box A, opposite the inlet tube *a* (fig. 87), lies a metal cylinder *g*. In the bottom of this is the socket *l* into which the tube *a* passes. In front the cylinder *g* narrows down to the tube *m* in which is a freely movable piston *k*. The piston-rod *o* terminates in a flat plate *p* which lies exactly opposite to the exit tube d. The whole arrangement is fastened in the partition wall n which divides the front part of the hot-stage into two parts. The cylinder g is filled with air. As this air expands or contracts on heating or cooling, so does the piston k move forward or backwards. When the piston has moved forward a certain distance its plate p comes in

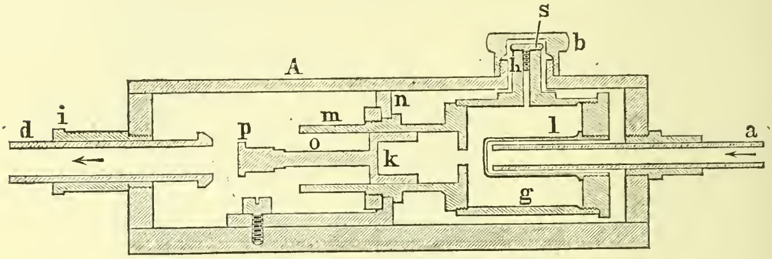
FIG. 86.



contact with the end of the exit tube d and closes it. In that case no water can flow out, and consequently no more hot water can enter. The apparatus then cools by radiation, the volume of air in g diminishes, the piston is drawn back, d opens and water again flows in until the piston once more closes d and so on. In actual practice d is never completely closed, but a continual stream of water passes through the apparatus with a varying rate of flow.

The dimensions of the apparatus are such that for a range of temperature from + 20° C. to + 60° C. the displacement of the piston amounts to 25 mm. For a very exact adjustment of temperature many slight movements of the tube are necessary. An adjusting arrangement

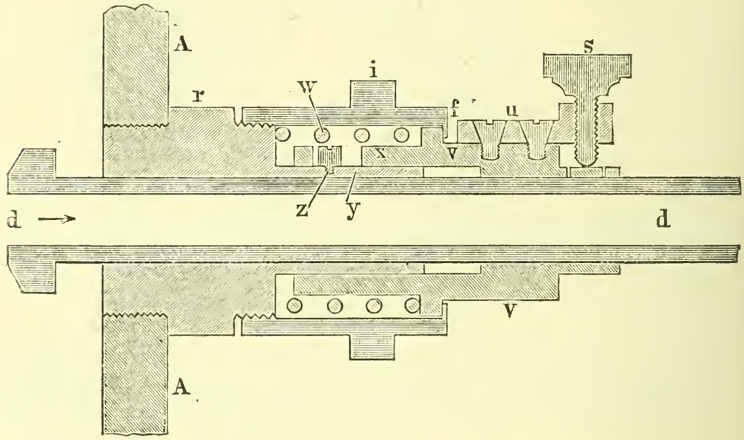
Fig. 87.



is therefore brought on the tube *d*, on the division of which, displacements of 0·025 mm. can be read directly. This adjusting arrangement is seen in fig. 88.

By loosening the clamping screw *s'*, the tube *d* is freely movable in the metal piece *r*, which has a screw thread on its exterior in which the corresponding screw of the divided head *i* engages. The projecting

Fig. 88.



ring *f* fits over a corresponding ring on the piece *v* which carries the screw *s'* for clamping the tube *d*. Between *r* and *v* is a spiral spring *w* which presses *v* forwards when the divided head *i* is turned. The tube *y* is a prolongation of *r*, and the tube *x* a prolongation of *v*. These two tubes are connected together by the small screw *z*. By means of the clamping screw *s'*, *d* is rigidly connected with *v* and shares in the movements which are communicated to the latter by means of the divided head *i*. Since the volume of the air in the cylinder *g* depends not only on the temperature but also on the pressure, it is necessary in order to keep a constant temperature that the level of the water in the reservoir should be kept fairly constant.

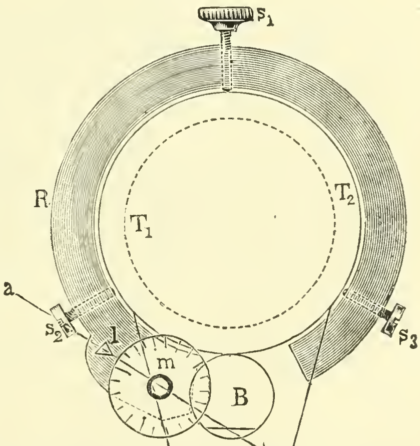
The preparation beneath the hot-stage will have a lower temperature than the stage itself. This difference must be determined for different temperatures of the stage by means of a thermometer occupying the position of the preparation. At 30° the difference amounted to 1°·5, and at 60° to 3°.

For the perfect air-tight closing of the cylinder *g*, the piston must be oiled. This oiling can be effected through the neck *h* after removing the cap *b* (fig. 87) and unscrewing the screw *s*. For working at a temperature of 50° the reclosing of *h* by the screw *s* can be done at the ordinary temperature, but for work at a temperature of 60° the cylinder must first be cooled to + 10° before closing *h*.

Auxiliary Apparatus for the Adjustment with Immersion Objectives.*—Herr A. van Delden describes a simple arrangement which in difficult cases renders the adjustment with immersion objectives quick and safe.

Round the outer tube T_2 (fig. 89) is fastened by means of the three screws s_1, s_2, and s_3, a strong ring which rests above against the edge of the spring socket in which the inner tube slides. As seen in the figure, the ring is cut through to allow room for the rack B. Through the broader end thus obtained passes a micrometer screw *m* which is provided with a divided head and long vertical index I (fig. 90). The head has a diameter of about 1 cm., and is divided into 20 divisions. The pitch of the screw is 0·5 mm., and the number of revolutions can be read directly on the vertical index which is divided into half millimetres.

FIG. 89.



By estimating the tenth of a division on the head, differences up to 0·0025 mm. can be measured. The micrometer screw moves parallel to the rack B, and presses against the column A which is moved by the micrometer screw of the stand (figs. 90 and 91). The apparatus is used in the following way:—Adjustment is first made on a clearly coloured preparation with a fairly strong dry system (e. g. Zeiss D to F), the screw *m* is then turned until it rests on the

* Zeitschr. f. wiss. Mikr., xii. (1895) pp. 15–18 (3 figs.).

column A, and a reading of its position is taken on the divided head and index.

The dry system is then replaced by the immersion system and as sharp as possible an adjustment is made by means of the coarse-adjustment. The screw *m* is then turned until it again rests on the column A.

A second reading is taken on the divided head and index, and once for all the difference D is noted between the position of the micrometer screw *m* in the adjustment with the dry system and in the adjustment with the immersion system. In the observation of any preparation

Fig. 90.

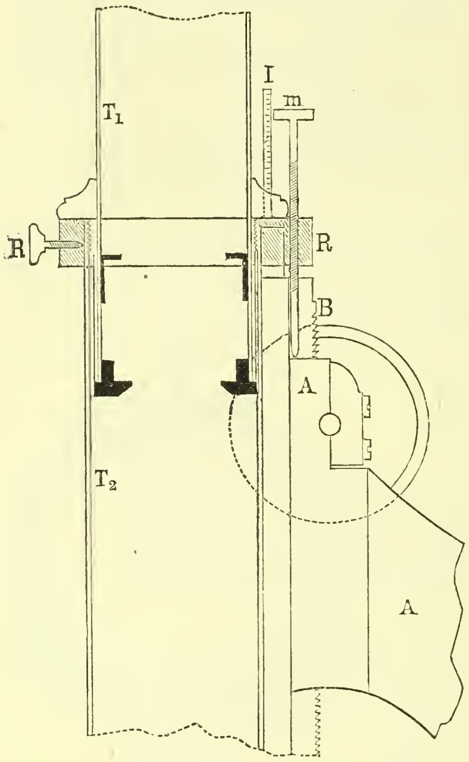
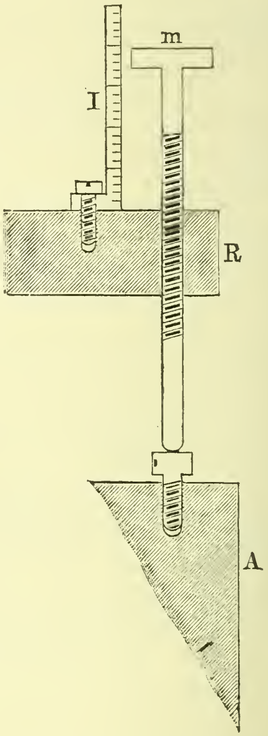


Fig. 91.



with the immersion system, adjustment is first made with the dry system, the screw *m* is turned until it touches the column, the body-tube is raised and *m* again turned through an amount equal to the difference D previously determined. The dry system is then replaced by the immersion system and the body-tube lowered by the coarse-adjustment until the micrometer screw *m* touches the column A. For the perfectly sharp adjustment only a very slight movement of the ordinary micrometer screw of the stand will then be required. The apparatus is easily detachable from the stand, when not required.

New Object-Finder.*—Herr R. Fuess has devised a new arrangement for re-finding interesting parts in microscopic objects. The apparatus, represented in natural size in fig. 92, is connected with the objective-changer shown in fig. 93. By its means a circle can be drawn with a diamond point on the cover-glass round any desired part of the object.

To the piece Z, which by its upper conical part is clamped to the objective-holder, is screwed the socket H. In this fits the spring cylinder C which is pressed downwards by the spring S, and carries at

FIG. 92.

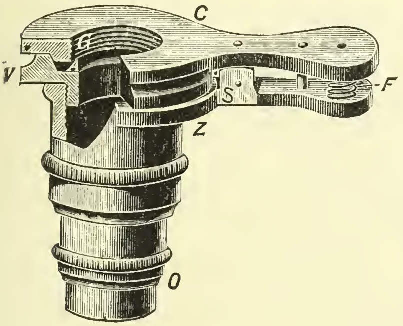
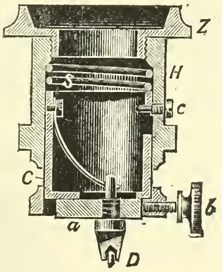


FIG. 93.



its lower end the sliding piece *a*, provided with the diamond point D and adjustable in position within a few millimetres. The eccentric position of the diamond point necessary for the production of circles with different radii is effected by the screw *b* and the counter-spring F.

The little screw *c* prevents the falling out or rotation of the cylinder C.

In the use of the apparatus, after the desired part of the object has been found by observation, the objective is removed and the apparatus clamped to the objective-changer in its place; the body-tube is then lowered until the diamond-point comes in contact with the cover-glass. The circular line can then be drawn in two ways, either: (1) by rotating the stage, or (2) by rotating the small apparatus in its socket H between the finger and thumb.

The apparatus has the further advantage that by its means lines can be drawn at regular intervals in the case of Microscopes provided with a mechanical stage.

Use of Coloured Light in Microscopy.†—Dr. A. M. Edwards considers that microscopists have not sufficiently appreciated the fact that the clearness with which an object can be seen depends much more upon the character than upon the intensity of the illumination. "Colour is vastly more important than brilliancy." The author gives an account of some experiments which he made on two objectives, 1/5, as long ago as in 1865. With one of these, on *Amphipleura*, Cuba, only lines could

* Neues Jahrb. f. Mineralogie, 1895, (1)2 pp., 2 figs.
† English Mechanic, lxi. (1895) pp. 529–30.

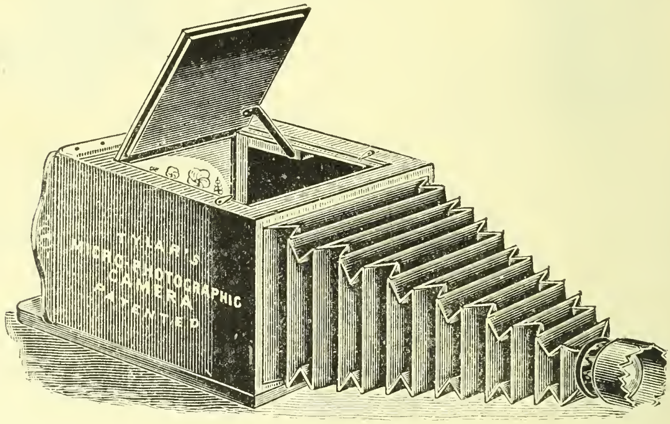
be seen when a blue glass was interposed. With the other, lines could be seen under ordinary conditions, but they disappeared when a yellow glass was interposed or when petroleum light was used instead of daylight. With light which had passed through a flint glass prism, the objectives resolved in the blue but not in any other part of the spectrum. In the blue of the spectrum the author could resolve with a 1/5 what could only be resolved by a 1/15 in ordinary light.

As the result of experiments carried on for several years up to the present time, the author makes use of a slide of mica coloured blue with anilin blue which he places in the path of the illuminating beam of light for the Microscope.

(4) Photomicrography.

Tylar's Photomicrographic Camera.*—The author of this little pamphlet of eight pages gives detailed instructions for beginners in the use of the photomicrographic camera which he has devised. The apparatus (fig. 94) may be described as an elementary low-power photo-

Fig. 94.



micrographic camera. According to the author's instructions it is intended to be used with the Microscope from which the *eye-piece has been removed!* It is also essential that the whole apparatus should be firmly clamped to the table, and this would almost necessitate the use of the photomicrographic board. This point, however, is not mentioned by the author, so that "the initial outlay of 27*s.* 6*d.*" does not include an essential part.

The table of exposures for different objectives given by the author is of little use, since the magnification is not stated, and the limits from 3 to 45 seconds are too wide; but the advice which follows is so good that it may be quoted at full:—

"I personally advise the waste of the first plate in obtaining an approximate guide for the exposure of the rest of the plates, and proceed

* W. Tylar, 'The Art of Photographing Microscopic Objects,' Birmingham, sm. 8vo (n.d.).

thus:—Place the dark slide in position in the camera, taking care before withdrawing the shutter to cut off the light entering the instrument by placing a portion of blackened card between the object and the lens. Now, instead of pulling the shutter out the whole distance, only pull it out 1 inch and expose 3 seconds; replace the card, draw out the shutter another inch and expose 6 seconds; again replace the card and draw out the shutter 1 inch, exposing 6 seconds; once more repeat the foregoing, again giving 3 seconds only. On developing you will find four ranges of exposures, the last inch having received 3 seconds, the next to it 9 seconds, the next to that 15, and the next, being the first portion exposed, 18 seconds.

"When we develop this plate we shall be able to tell at a glance which part of the plate has had the nearest to the correct exposure, and shall know how to act with the next."

(5) Microscopical Optics and Manipulation.

Relation of Aperture to the Determination of Minute Structure.*—Mr. C. F. Cox gives vent to some rather heretical remarks concerning the Abbe diffraction theory. The central idea of Prof. Abbe's theory is that in order to obtain a true image of an object, all light-rays from the object must be gathered up by the objective and recombined at its back. The finer the details of structure in the object the greater the dispersion, so that in order to admit all the rays, the aperture of the objective must be proportionately widened. Our finest optical combinations, however, fall far short of an ideal performance in this respect, and, according to Prof. Abbe, no known method of construction can produce an objective capable of giving a true image of details of structure which are closer to each other than within 1/2500 in. It is also the teaching of Prof. Abbe that strictly similar images cannot be expected, except with *central* illumination with a narrow incident pencil.

The author asks why, if the above statements are true, microscopists continue to use high-power objectives or buy wide-angled substage condensers? He considers that the reason is that they do not really believe the statements; and though they go on repeating the orthodox creed, they qualify it by some secret mental reservation. He confesses that he himself is one of the heretics who still places more or less reliance upon what is seen through the modern high-power objective. Referring to Prof. Abbe's experiments to prove that the diffraction-spectra are necessary to the formation of the image, he points out that a progressive reduction of aperture should result in wider and wider divergence from faithfulness in the image, and states that experience does not confirm this inference. In proof of this point he refers to a set of photographs of the Abbe diffraction-plate made by Mr. T. F. Smith, showing the effect of using successively a stop with a 1/12-in., a 1/20-in., and a 1/32-in. opening. Other photographs by Mr. Smith of diatom valves showing the fibrillar structure are also referred to. Photographs of the same diatom valves taken first with an old-time water-immersion 1/12, and then with a recent oil-immersion apochromatic 1/12, were wholly in favour of the wider-angled glass, but the author considers that

* Journ. New York Micr. Soc., xi. (1895) pp. 74–85.

this result is due as much to the elimination of spherical and chromatic aberrations in the new objectives as to the mere increase in numerical aperture. The author's position appears to be that an objective with perfect correction will always give truthful images of structures, but that one with narrow aperture will only reveal the coarser structure, while one with wider aperture will correctly image the finer as well as the coarser parts of the structure up to a limit depending on this aperture.

Limit of Microscopical Vision.*—Dr. A. C. Stokes makes some "dogmatic statements" on the limit of the resolving power of the Microscope. The greatest number of lines ever seen through a Microscope is about 120,000 to the inch. The greatest number photographed by Van Heurck with the 1/10 in. objective, 1·63 N.A., using monochromatic blue sunlight, is 127,500 to the inch. This is about the number of the longitudinal lines on *Amphipleura pellucida*. Dr. A. Fock † states that the best Microscopes can resolve, with central illumination, 63,750 divisions to the inch; with oblique illumination 125,000 to the inch; and with the aid of photography 300,000; and these limits are probably too high. The theoretical limit is of course higher. According to Van Heurck's calculation a diamond objective, 2·50 N.A., would theoretically resolve with central illumination and white light 120,000 lines to the inch, with blue light 130,000 to the inch, and by photography 159,000 to the inch; while with oblique light these numbers would be about doubled.

(6) Miscellaneous.

Introduction to the Study of Rocks under the Microscope.‡—This text-book "is intended as a guide to the study of rocks in thin slices" under the Microscope, and, as such, should be of interest to those microscopists who do not wish to restrict their observations to the organic world.

A short introductory chapter contains a few notes on the optical properties of minerals, with instructions on the measurement of extinction angles, observation of the interference colours, pleochroism, &c.; but no systematic account is given of the various physical and chemical methods for the determination of minerals. For these the reader is referred to standard works on the subject. The introduction is therefore followed at once by the systematic description of the various rock types, treated for the most part under the three headings: Constituent minerals; Structure; Leading types. The massive igneous rocks are divided by the author into plutonic, intrusive, and volcanic; and under each of these heads the families are taken in order of increasing basicity.

The sedimentary rocks are dealt with under the four groups: Arenaceous, Argillaceous, Calcareous, and Pyroclastic. This portion of the book will supply a real want, since in most previous text-books on petrology the massive igneous rocks have alone been considered, e.g. we still wait for the second part of Teall's 'British Petrography.'

Finally the metamorphic rocks are treated under the two divisions of thermal and dynamic metamorphism.

* The Observer, vi. (1895) Pract. Micros., pp. 97–100.

† See this Journal, 1894, p. 395.

‡ A. Harker, 'Petrology for Students,' Cambridge, 1895, 306 pp., 75 figs.

Brownian Movement.*—M. C. Maltezos adds a note to his memoir on the Brownian movement which appeared in the 'Annales de Chimie et de Physique' for April 1894. In that memoir he states that if the superficial tension is the same round a corpuscle in suspension, its effect will be nil. But this state of equilibrium ceases and the Brownian movement commences in the following cases:—(1) When the body has not the same superficial density throughout its surface; and (2) when the liquid near the body is not pure.

The author refers to a paper by J. A. Bliss † which has caused him to slightly modify his views. In that paper is described a series of observations made in order to discover the causes of the phenomenon of flocculation, i. e. the aggregation into flocks of finely suspended matter in water on the addition of a few drops of acid or solutions of different salts. The phenomenon of flocculation explains the observation made by Stanley Jevons that the Brownian movement is almost stopped by the addition of saline or acid solutions. The author, however, in his observations found that after the addition of the saline solution particles form flocks when they are near to each other, and cease to show the Brownian movement when many unite together; but there are others which simply enlarge themselves and continue to move. This latter phenomenon was explained by the existence, as revealed by a higher power, of finer particles near the larger ones.

As the result of his observations the author concludes that the Brownian movement is a phenomenon of capillarity. For a particle suspended in a liquid he considers the two cases: (1) When the particle is near the bottom of the vessel or near another particle; (2) when it is suspended in the middle of the liquid.

(1) When the particle is near the bottom it is in a liquid which is not homogeneous, for quite near the wall and the bodies supported by it is a capillary liquid atmosphere. As the attraction solid-liquid and wall-liquid is greater (in pure water) than the attraction liquid-liquid and wall-solid, the potential energy is a minimum; if the distance of the particle from the bottom is smaller than the sum of the two radii of molecular action (wall-liquid and particle-liquid), repulsions will result and the Brownian movement will be produced.

The same thing should take place when the particle is near another in the middle of the liquid.

(2) When the particle is far from the walls and other particles, if the liquid were quite homogeneous around it, the particle would not present the Brownian movement; but if the liquid were not homogeneous either by reason of its salinity, or of the presence of the immersed objective, or of the superficial non-homogeneity of the solid, the difference of the superficial tension which would result would suffice to push the solid in one direction or another, i. e. to communicate to it the Brownian movement.

Micrographic Analysis.‡—Prof. W. C. Roberts-Austen gives an account of a new branch of investigation, "micro-metallography," or the application of the Microscope to the study of the composition of samples of metals such as iron and steel. Dr. Sorby, in 1864, was one of the first to attempt to develop a method of investigating samples of

* Comptes Rendus, cxxi. (1895) pp. 303–5.

† Physical Rev., ii. (1895) No. 11.

‡ Nature, xlii. (1895) pp. 367–9.

iron and steel by examining polished sections under the Microscope. The progress which has been made in micro-metallography since that time is well shown in a recently published monograph by M. F. Osmond.* The author explains how the polished section of steel is treated with suitable reagents in order to reveal the five main constituents. He shows how complicated is the structure of ordinary steel, and points out that although a micro-section of a mass of steel closely resembles a rock-section, yet its investigation under the Microscope is rendered much more difficult by reason of the various allotropic forms in which iron itself can occur. Diagrams are given showing the effects of annealing steel. The author considers that the method of microscopic analysis is capable of wide application in metallurgy, and that it should take its place in the ordinary routine of every steelworks laboratory.

The late Frederic Kitton, Hon. F.R.M.S.—We regret to have to record the death, on 22nd July last, of Mr. Frederic Kitton, one of our Honorary Fellows since 1876.

He was the son of Samuel Kitton, and was born at Cambridge on 24th April, 1827. Although placed in business at Norwich before he was 20 years of age, mercantile pursuits were most uncongenial to him, and his natural inclination was in the direction of science, especially the study of the Diatomaceæ, in which he soon distinguished himself.

The following is a list of Mr. Kitton's contributions to the Transactions of the Society:—

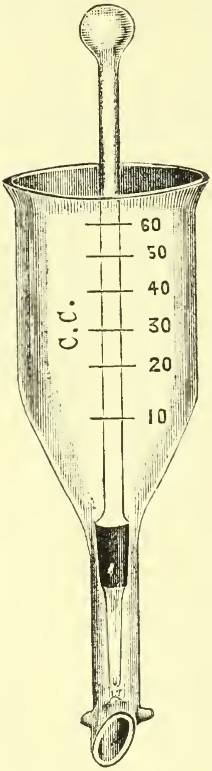
1873. Prof. Smith's Conspectus of the Diatomaceæ. (Monthly Micr. Journ., ix. pp. 165-7.)
Remarks on *Aulacodiscus formosus*, *Omphalopelta versicolor*, &c., with Description of a New Species of *Navicula*. (Op. cit., x. pp. 6–9, pl. xxi.)
Description of some New Species of Diatomaceæ. (Op. cit., pp. 205-7, pl. xxxviii.)
1874. New Diatoms. (Op. cit., xii. pp. 218–20, pls. lxxxi. and lxxxii.)
1875. Number of Striæ on the Diatoms of Möller's Probe-Platte (Op. cit., xiv. pp. 45-6.)
1876. Diatomaceæ in Slides of Sta. Monica Deposits. (Op. c., xvi. p. 232.)
1877. An Essay on the Classification of the Diatomaceæ. By P. Pettit. Translated by F. Kitton. (Op. cit., xviii. pp. 10–14, 65–77, pls. clxxxvii. and clxxxviii.)
New Diatoms from Honduras. Described by A. Grunow. With Notes by F. Kitton. (Tom. cit., pp. 165–86, pls. cxciii.–cxcvi.)
1878. On some New Genera and Species of Diatomaceæ. By P. Pettit. Translated by F. Kitton. (Journ. R. Micr. Soc., 1878, pp. 237–45, pls. xiv. and xv.)
1879. The Thallus of the Diatomaceæ. (Op. cit., 1879, pp. 38–40.)
New Species and Varieties of Diatomaceæ from the Caspian Sea. By A. Grunow. Translated with Additional Notes by F. Kitton. (Tom. cit., pp. 677–91, pl. xxi.)
1881. The Diatoms of the London Clay. By W. H. Shrubsole. With a List of Species, and Remarks. By F. Kitton. (Op. cit., pp. 381–7, pl. v.)

* Bull. de la Soc. d'Encouragement, x. (1895) p. 480.

Professor Lovèn.—We have lost a notable name from our list of Honorary Fellows by the death of Prof. Sven Lovèn, who died late in August at the age of 86. Prof. Lovèn was one of those early zoologists who did not limit themselves to one small branch of the animal kingdom, nor was he of that type of zoologist who confines himself to adult forms. What is now known as the larva of *Polygordius* was discovered by Lovèn in 1842, and that Lovènian larva, as it is often called, has been perhaps the subject of as interesting speculations and studies as any. In later years Prof. Lovèn confined himself to the study of Echinoderms, in the investigation of which he was the recognised head and master, and all students of the subject who had the great good fortune to enjoy his personal acquaintance feel a regret for the loss of a friend as well as of a great man of science.

Louis Pasteur.—Great and severe as have been the losses of late in the list of the Honorary Fellows of this Society, a blow greater than all fell on us on September 28th, when one of the greatest geniuses that ever lived, and the greatest benefactor of mankind and of animals, died near Paris. Since the death of Darwin there has been no more energetic or powerful intellectual force in the world than that of the great Frenchman, who, it may be said, more than once in his life suffered severe attacks of disease as a result of his arduous labours for mankind. Commencing as a chemist, and making a considerable reputation as a chemist, Pasteur devoted the latter half of his life to the investigation of biological problems. If it cannot be said—and indeed it cannot be said—that he solved the problem of the origin of life, yet he was one of those who brought us nearer to its solution when, by his exquisite experiments, he dealt the final blow at the doctrine of spontaneous generation. No question, perhaps, has excited the interest of men of all degrees and of all ages as much as the phenomena of fermentation. It was left for Pasteur to give a complete explanation and to show that the theories of the chemist, represented by no less a man than Liebig, were utterly erroneous. The discovery of the principle of vital action in fermentation led Pasteur to discuss at large the question of the origins of epidemic diseases in man and animals, and gave rise to one of the most fertile ideas of modern times, that of preventive medicine. It was one of the first results of his discoveries that Sir Joseph Lister was put in the way of making those experiments on antiseptic surgery which have revolutionised the practice of the surgeon and abated the pains of the patient. To his own countrymen, in three remarkable particulars, Pasteur's investigations have resulted in wealth so extensive that Prof. Tyndall was led to say that the discoveries of Pasteur alone would suffice to pay the ransom required by Germany. Sent by the French Government to investigate the diseases of silkworms, he restored the fortunes of the silk industries of Southern France. Led to investigate the fermentation of beer, he discovered a method of making pure yeast on a large scale; this completely altered the beer industry. The manufacture of the wines of Bordeaux, which had often been uncertain and unequal, was, by the teaching that he was able to give to the wine manufacturer, brought to a high state of improvement. Turning to the cattle of the field, he discovered a method by which that scourge, anthrax, could be successfully combated, and a commission sent to inquire into the results of his methods found that the cattle which he rendered immune did not die; while those which he had not touched died from this fell disease. So successful were his experiments on anthrax, that he turned his attention to what is perhaps the most dreaded of all human diseases, and he was successful in discovering a method by which hydrophobia could be almost always successfully combated. These are some of the greatest benefits which this great man bestowed not only on France, but on the world; and richer as mankind is by his life's work, the poorer do we feel it to-day to be by his death.

Fig. 95.



Professor Ryder.—Although Prof. J. A. Ryder was not an Honorary Fellow of this Society, his name has been so frequently of late years mentioned in our abstracts that it is only right that we should express our regret at the death of this distinguished embryologist at the early age of 43. Ryder began to make himself known to biologists when he was embryologist to the United States Fish Commission. In 1886 he became Professor of Comparative Embryology at the University of Pennsylvania. The origin of sex, heredity and variation, the evolution of the skeleton, and special subjects, as dynamics in evolution, and the mechanical genesis of the scales of fishes, were some of the many subjects on which he laboured, and on which he published results of great importance.

β. Technique.*

(1) Collecting Objects, including Culture Processes.

Apparatus for Drawing off 10 ccm. of Nutrient Medium.†—The apparatus devised by Dr. K. Knauss for removing 10 ccm. of gelatin or bouillon is a cylindrical funnel (fig. 95). The upper part of the outflow tube is closed by a ground glass rod which projects some few cm. above the top of the funnel, ending in a sort of round handle. The cylindrical part of the funnel is graduated in 10 ccm.'s from 10–60 ccm.

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 878–9 (1 fig.).

The method of using the apparatus merely consists in raising the glass rod so that 10 ccm. escape, and then lowering it. The end of the pipe is cut off obliquely, and is surrounded by four glass knobs which are intended to prevent the inside of the test-tube, where the cotton-wool plug is to be placed, from becoming contaminated, as it otherwise so frequently is.

Method for Inoculating Agar on Blood-serum.*—Dr. S. Grosglik has found that test-tubes containing agar or blood-serum can be easily and successfully inoculated by making use of the condensation water. A drop of the fluid to be examined is first inoculated in tubes containing sterilised water, bouillon, or liquid gelatin, and these tubes are then well shaken. From these tubes the condensation water of the culture-tubes is in its turn inoculated, and then allowed to run over the surface of the medium. Should the fluid to be examined contain a large number of organisms, the original source must be diluted several times in the usual way before the culture-tube is inoculated. For this procedure the culture-tubes should be wide, and if the condensation water have evaporated, it may be replaced by sterile water. In this way colonies suitable for making pure cultivations can be easily obtained in 24 hours.

Sterilising Blood-serum by means of Porcelain Bougie Filters.†—Dr. P. Miquel, having recently been obliged to prepare large quantities of blood-serum for the bacteriological diagnosis of diphtheria, has found that the porcelain bougie filter satisfactorily disposes of all germs in this fluid, provided that it be free from blood-corpuscles. Filtration is rapidly accomplished, especially at a temperature of 40°–50°.

Cultivation Medium for the Gonococcus.‡—Herr Kiefer recommends the following medium for cultivating gonococcus:—Ascitic fluid which has been filtered and distributed into test-tubes is discontinuously sterilised at 62°. An equal bulk of agar (1/4 of a test-tube) of the following composition is then added:—3·5 per cent. agar, 5 per cent. pepton, 2 per cent. glycerin, 0·5 per cent. salt, and the mixed contents of each tube are poured into a Petri's capsule. It sets in about a minute, and is then ready for use. The cultivation should be carried on at a temperature of 35°·8–36°.

Bacteriological Examination of Diphtheritic Membrane.§—According to Herr Jakowski, the solution recommended by Roux for staining diphtheria bacilli has no advantage over that of Löffler, and the author never succeeded in staining these organisms by Gram's method. It is also recommended to use three or four test-tubes for inoculations, as the bacilli may develop in pure cultivation in the third, and almost invariably in the fourth.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 826–9.
† Ann. de Microgr., vii. (1895) pp. 261–5.
‡ Berlin. Klin. Wochenschr., 1895, No. 15. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) p. 847.
§ Gazeta lekarska, 1894, p. 1878. See Centralbl. f. Bakteriol. u. Parasitenk. 1te Abt., xvii. (1895) pp. 897–8.

Indol Reaction in Diphtheria Cultures.*—MM. Palmyrsky and Orlowsky find that old diphtheria cultures (three weeks) give the cholera-red reaction with hydrochloric and sulphuric acids. Young cultures do not give the cholera-red reaction. For the reaction to succeed, the presence of indol and of nitrites is necessary. In young cultures the latter are absent or in such small quantities that, notwithstanding the presence of indol, the reaction fails.

Colour Reaction of Nitrous Acid on Cultivations of Cholera and other Bacteria.†—While the indol reaction is common to many bacteria and is therefore not a specific test, yet according to M. Lounkewitsch the Griess-Islovay reagent possesses the special power of detecting 1 per million of nitrous acid by staining the medium a deep red. The reagent is composed of 0·10 grm. naphthylamin in 20 grm. distilled water and 0·5 grm. sulphanilic acid in 150 grm. acetic acid. The desired effect is produced by adding to the culture one-fifth of its volume of the reagent. The colour is produced with cholera cultures 6–24 hours old, or with cultures of *Vibrio metschnikovi* 24–48 hours old. The reagent also produces the colour with the coli bacillus and the bacillus of mouse typhoid, but not with the bacillus of Eberth or with the vibrios Finkler-Prior, Müller, Deneke. The reaction recommended by the author and called by him the nitrous acid reaction to distinguish it from the red indol reaction of Bujwid and Dunham, has the following advantages. It may be obtained with cultures 6, 12, 24 hours old, while the indol reaction cannot before 24–48 hours. It manifests itself in a few seconds, while the indol reaction does not appear till after two or more hours. It can be used with both pepton and gelatin cultures. The colour is deep and bright, while that of the indol is quite pale. The cholera red reaction is unable to distinguish the vibrios Finkler-Prior, Deneke, &c., from the cholera vibrio, while the Griess-Islovay reagent can.

Simple Method of Isolating Acid-producing Bacteria.‡—In the study of the bacteriology of milk it is often desirable, says Prof. H. W. Conn, to obtain all the acid organisms separate from the alkaline producing species, and this may be done as follows:—An ordinary beef-pepton-gelatin solution is made to which is added 3 per cent. milk-sugar and enough normal litmus solution to give a deep purplish colour. Plates are then made in the ordinary manner. Wherever an acid organism is present it produces acid from the milk-sugar, and the acid turns the litmus red. The result is that after a day or two the plates begin to be dotted over with little red spots, and these when isolated are the acid-producing organisms.

Cultivating Crenothrix polyspora on Solid Media.§—Herr Rössler succeeded in cultivating *Crenothrix polyspora* on pieces of brick sterilised by heat. To the water was added some sulphate of iron, as the fungus only thrives in ferruginous waters. After some time at the room

* Medycyna, 1895. See Ann. de Microgr., vii. (1895) p. 268.
† Wratsch, 1895, No. 1. See Ann. de Microgr., vii. (1895) pp. 267–8.
‡ Micr. Bull., xii. (1895) p. 4.
§ Arch. d. Pharmacie, ccxxxiii. (1895) p. 189. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 25.

perature, the pieces of brick were completely grown over by the *Crenothrix*.

Tree-stems as Filters.*—The discovery made by Pfitzer that sea-water could be deprived of its salts and rendered drinkable by filtering it through tree-stems has been tested by Herr Wilm on tree-stems of various kinds of wood of 1–0·5 m. long. and 0·4–0·5 m. in circumference. The stems were connected with an air-pump by means of lead tubing. The permeability of the different woods was very unequal, and only a pressure of 3–5 atmospheres could be used, for with more the bark cracked and the water spurted out. The filtered sea water was at first yellowish and opalescent, afterwards becoming bright and clear. It tasted salty from the beginning. The yellow colour was due to the wood juices, which gave the Trommer reaction for sugar. The amount of salt in the first litres was somewhat less than in non-filtered water, though soon it attained the same concentration. The experiments showed that only very large stems could produce salt-free water. As the procedure was tedious and expensive, it cannot be used for practical purposes, because the stems must be large and their bark must be unimpaired, and even then they only deliver salt-free water in small quantities for a comparatively short time, soon getting blocked up and grown up with bacteria.

The suitability of tree-stems for filtering off bacteria was also examined into. Ordinary tap-water was forced through stems of fixed size for 4–5 hours, the water being examined bacteriologically both before and after the experiment. For the first 2–3 days the water was germ-free, but ultimately it came to contain more than the unfiltered. Stems sterilised by forcing boiling water through lost the power of filtering altogether.

Microscopical Plate Counting.†—According to Herr Neisser, plate colonies are best counted in the following ways:—(1) Thinly sown plates of pure cultures (less than 600 colonies) are better counted with an ordinary hand lens than with the Microscope. (2) Thickly sown plates (especially water) should be counted with the Microscope. (3) Mixed plates should always be counted with the Microscope on account of the presence of very small colonies.

Quick Method of Filtering Blood-Serum.‡—Drs. G. Campbell and A. D. Ghiselin, while disclaiming any originality for their idea, describe a new filter which answers every purpose, and which can be readily prepared at a moderate price. The filter proper is on the principle of a single bougie water filter sufficiently strengthened to allow the safe use of a high pressure, and so arranged that a sterilised flask may be attached to the bougie in such a manner that the filtrate undergoes no risk of contamination. To the filter is connected a drum filled with liquefied carbon dioxide, such as is used in charging soda-water. The drum consists of an iron cylinder 4 ft. long by 4 in. diameter. To the upper

* Hygien. Rundschau, 1895, pp. 445–50. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt, xviii. (1895) pp. 26–7.

† Zeitschr. f. Hygiene, xx. pp. 119–45. See Centralbl. f. Bakteriol. u. Parasitenk., xviii. (1895) p. 25.

‡ Bull. Johns-Hopkins Hospital, vi. (1895) pp. 91–3 (3 figs.).

end of this cylinder there is fixed a safety valve, and also a valve by which the pressure can be turned on. To this valve is attached a very thick-walled rubber hose. The method of using the filter is as follows:— A rubber-stoppered flask having two tubes passing through the stopper is the vessel used for collecting the filtrate. One tube is short and has its upper end enlarged and loosely packed with cotton. To the outer end of the long tube is attached a piece of best hose about 2 ft. long, divided in the middle, and having the two pieces joined by a glass nozzle. Further details are given concerning this apparatus, and it is stated that the serum prepared by it is perfectly clear, coagulates at exactly the same temperature as unfiltered serum, and the filtration does not appear to have any appreciable effect on any toxin or anti-toxin that may be present. The authors state that 1000 ccm. of such serum can be filtered in five minutes.

(2) Preparing Objects.

Study of Cleavage Cells.*—It is pointed out that the principle of Roux's method is very simple, but the experiments require to be carried out with care. That observer found that the best material for observation was obtained from newly captured frogs at the beginning of the normal period of spawning. The phenomena of cytotropism are seen most readily between cells which are separated from the egg by cutting or tearing in an indifferent fluid, such as the white of a hen's egg or a 0·5 per cent. salt solution. For the experiments 5 to 10 ccm. of freshly prepared white of egg is required each day. This is prepared by filtering through a wad of cotton, and the preparation must be perfectly clear. The egg in the morula or blastula stage is first stripped of its gelatinous envelope and placed on a circular glass plate about 3 cm. in diameter. It is then covered with about five drops of the prepared white of egg, and torn open with two dissecting needles. The circular plate is next placed in a round glass dish with a rim 1 cm. high, containing 10 to 15 drops of water. The purpose of the dish with water is to check the evaporation of the medium in which the egg lies, and thus to guard as far as possible against concentration of and currents in the medium. These protected cells may be kept alive in a suitable medium for one or two days. The preparation should be immediately examined with a low objective. The examination of isolated cells in an uncovered medium has the advantage that we can easily change the position of the cells with needles or other means, but it is necessary to check results by examining preparations covered with a slip. The cover-slip for this purpose must be large enough for at least two of the wax feet, which should be 0·75 mm. high, supporting it, to fall on dry points of the object-plate.

Examination of Retina of Birds.†—Prof. A. S. Dogiel used 1/10–1/16 per cent. solution of methylen-blue in studying the retina of pigeon, fowl, falcon, owl, and other birds, and was thereby able to demonstrate clearly the ending of the centrifugal fibres and their relation to the cells of the middle ganglionic layer.

* Arch. f. Entw. Mech. d. Organismen, i. pp. 44–8. See Amer. Natural., xxix. (1895) pp. 511–12. † Arch. f. Mikr. Anat., xliv. (1895) pp. 622–48 (2 pls.).

Preparation of Retinal Cells of Fishes.* — Prof. J. A. Ryder described a method which leaves but little to be desired for clearness and histological differentiation with sharpness of detail. Specimens which had been splendidly fixed and preserved were stained *in toto* in an alcoholic solution of hæmatoxylin, and differentiated *in toto* in a 1 per cent. solution of potassium bichromate.

Study of Spermatogenesis.†—Mr. E. V. Wilcox describes his method of preparing the testes of *Cicada* and *Caloptenus*. The testes of the former were killed in Müller's fluid; those of the latter either in hot water, in hot or cold corrosive sublimate, or in chrom-osmic-acetic mixture. Some of the testicular follicles of *Cicada* were stained in Grenacher's alcoholic borax-carmine, others according to Bizzozero's modification of Gram's method. Good results were obtained by double staining with safranin and victoria-green. Crystals of the latter were dissolved in absolute alcohol or in clove oil. The sections were first stained in safranin for from 10–15 minutes; the excess of staining was quickly washed off in 90 per cent. alcohol, and then a very strong solution of victoria-green in absolute alcohol was applied for one to two minutes. Excess of green was washed out with absolute alcohol. The *Caloptenus* material was all stained on the slide, and good results were obtained with the safranin and victoria-green method.

Cytoplasm and achromatic nuclear parts were stained green, the chromosomes, nucleolus, and centrosomes red. The safranin and green method was the only one by which the archoplasm was made distinct. If Henneguy's method be used the safranin must not be too much washed out or the sharpness of outlines will be lost. It is best to wash out the mordant very thoroughly before using the stain, for the potassic permanganate makes a precipitate with the safranin which renders the section so muddy as to be nearly useless. The best results were obtained by the use of Heidenhain's method, and the so-called black process proved more serviceable than the blue. For either process the sections should be very thin. They must be firmly affixed to the slide, for the washing is best done by a stream of tap-water allowed to run over it. Three washings are necessary, each of which should be thorough. Simple immersion in water does not do as well.

Investigation of Mesoglœa of Alcyonium digitatum.‡—Mr. W. L. Brown on putting to himself the question whether this mesoglœa contains nucleo-albumen, reflected that, thanks to the method recently introduced by Lilienfeld and Monti, the examination of this question micro-chemically is quite feasible. Specimens hardened in osmic acid were cut with a freezing microtome, then washed thoroughly and placed in a solution of ammonium molybdate. After being washed for a few seconds in a mixture of ether (9 parts) and water (1 part) they were put into a 20 per cent. ethereal solution of pyrogallic acid. The cells in such specimens were seen under the Microscope to be stained black, but the mesoglœa was not.

Demonstrating Tubercle Bacilli in Sputum.§ — Dr. S. Stirling praises Von Ketel's method for detecting tubercle bacilli in sputum, a

* Proc. Acad. Nat. Sci. Philad., 1895, p. 161.
† Bull. Mus. Comp. Zool., xxvii. (1895) pp. 3–5.
‡ Quart. Journ. Micr. Sci., xxxvii. (1895) p. 393.
§ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abth., xvii. (1895) pp. 874–8.

method which fulfils several essential requirements, i. e. it is easily carried out, it is not injurious physically or chemically to the material to be examined, it is quite safe, and the microscopical picture excellent. The method consists in putting 10 ccm. water, 6 ccm. carbolic acid, and 10–15 ccm. of the sputum into a bottle capable of holding 100 ccm. The mixture is thoroughly shaken, 100 ccm. of water are added, and having been shaken up again is poured into a conical glass vessel. In from 12 hours to a few days the sediment is examined. The sediment is obtained by pouring off the supernatant fluid and removing the deposit with a pipette. Cover-glass preparations will stain easily with a simple alcoholic solution of fuchsin, though, of course, the phenol-fuchsin may be used.

The method is applicable to discharges and fluids of all kinds, e. g. milk, urine, fæces, and is specially suited for staining the preparations by Czaplewski's method.

Pancreatin-digestion of Sputum for Demonstrating Tubercle Bacilli.*—Equal quantities of sputum and warm water alkalinised with soda are, after having been thoroughly mixed with 0·1–1·0 grm. of pancreatin, placed in an incubator, and in 2–3 hours 0·1–1·0 grm. of pure carbolic acid are added to prevent decomposition. As soon as a sediment has formed the supernatant fluid is removed and fresh alkalinised water added and the mixture incubated anew. The process may be repeated again in order to diminish the bulk of the sediment, and then the deposit is dried on filter-paper and examined. In 24 hours, says Dr. Spengler, the amount of sediment is, as a rule, so small that only a few cover-glasses are required for its examination.

The process does not impair the stainability of the tubercle bacilli unless the digestion of the sputum have been carried on too long.

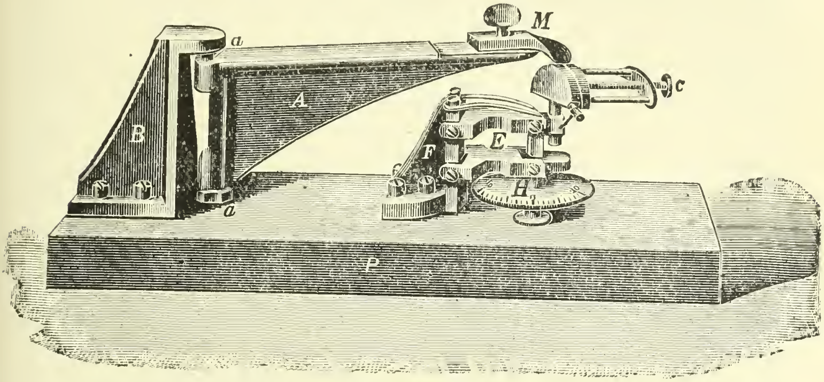
(3) Cutting, including Imbedding and Microtomes.

Novelties in Microtomes.†—Herr B. Pensky gives an account of recent improvements in and new forms of microtomes. Amongst instruments which have been already described in this Journal, he mentions Strasser's ribbon microtome for serial sections,‡ in which the sections are made to adhere to a paper band; Jung's microtomes; § the "Cambridge rocking microtome"; Minot's microtome; ‖ the Reinhold-Giltay microtome; ¶ and the Reichert large microtome for brain sections.** Besides these he describes the Fromme microtome (seen in fig. 96), in which the difficulty of production of an exact prismatic slide-way for the knife is obviated by attaching it to the end of a strong arm movable about a vertical axis. The heavy iron base-plate P carries the block B, to which is hinged the arm A, which turns about the point *a a* and carries at its end the knife M. The raising of the object is effected by a micrometer screw with a divided scale H, the movement of which is transferred to the clamp *c* by a parallelogram guide E attached to the upright F.

* Deutsche Med. Wochenschr., 1895, No. 15. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 807–8.
† Zeitschr. f. Instrumentenk., xv. (1895) pp. 14–22.
‡ See this Journal, 1891, p. 281, and 1892, p. 703. § Op. cit., 1893, p. 264.
‖ Tom. cit., p. 265. ¶ Tom. cit., p. 706. ** Op. cit., 1894, p. 636.

Amongst accessories of the microtome, Mayer and Schoebel's apparatus for raising the object is described. This (fig. 97) consists of a clamping ring R, which, by means of the screw k, is fastened to the cylinder c carrying the object, and is prevented from turning by the pin S, which projects into the block K. The raising is effected by hand

FIG. 96.



by means of the bent lever, whose shorter arm is set beneath the ring R. The Borgert arrangement for raising the object * is also mentioned. The Fromme apparatus for the adjustment of the object is seen in fig. 98. The rod Z serves for attaching the holder to the microtome, and carries at its upper end a ball R, which is enclosed by a spherical cap of the plate A and clamped by the screw c. The upper plate B can be rotated

FIG. 97.

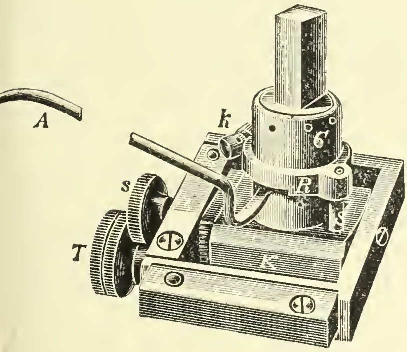
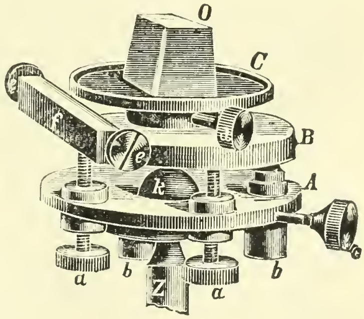


FIG. 98.



about two axes at right angles by means of the screws a and counter-springs b. The plate C is clamped on a pin projecting from the plate B by the screw d, and carries the paraffin block O. For celloidin preparations a boxwood plate can replace the metal plate C. On the plate B is a projecting piece, against the edge f of which the celloidin block

* See this Journal, 1893, p. 801.

is pressed by the screw *s* of the clamp, after the clamp has been attached by means of the screws *e*. The double knife made by Walb,* and the section-stretcher of Prof. Born,† are also described.

Electrical Phenomena of Paraffin Sections.‡—Dr. G. C. van Walsem directs attention to certain electrical phenomena which occur when making paraffin ribbon sections. Occasionally, when the strip of section is being removed from the band, it is strongly attracted to any larger object, such as the microtome itself, the table, or the hand of the manipulator. The strip may stick or be damaged. This undesirable manifestation of electricity is not derived from the paraffin but is the consequence of the fixation or hardening, especially with Müller's fluid or by Deiter's method. The presence of electricity was demonstrated by means of the gold-leaf electroscope, which also showed that it is negative in quality. It is probably of frictional and not of chemical origin. The electrical phenomena are easily dissipated by the presence of moderate heat; and prevented by exposing the piece to be sectioned to the air of the room for about half an hour previously.

(4) Staining and Injecting.

Study of Eye of Decapods.§—Mr. G. H. Parker found that the rapid Golgi method, as described by Kölliker, yielded good results when applied to the optic organs of the Crayfish, especially when the preparations, after having once passed through the silver bath, were again put into the solution of osmic acid and potassic bichromate, and then impregnated with silver. A third or even a fourth application of the silver solution often seemed advantageous. On the whole, better results were obtained from material imbedded in paraffin than from that in celloidin. In employing methylen-blue the author followed the general directions given by Retzius. The ganglia must be carefully removed and studied at once, as, soon after the death of the animal, the sharply differentiated blue stain begins to disappear. The author found that the methods of Retzius made it almost impossible to determine the precise location of a ganglionic cell, or the exact direction taken by its nerve-fibre. Since, however, these demonstrations were necessary, he attempted to devise a process for making sections from material stained in this way. In one, an account of which has already appeared, the tissues of the ganglion were fixed and the colour rendered permanent by means of watery corrosive sublimate. The second, or newer method, essentially resembles the first, but the following steps are necessary in employing it. The ganglia, after being freed from the surrounding tissue, must be first put into an aqueous solution of sublimate, then successively into 30, 50, 70, and 95 per cent. of alcohol, each grade, of course, containing its proper proportion of sublimate. The material was allowed to remain in each of these fluids for about a quarter of an hour. From 95 per cent. alcohol it must be transferred for an hour to absolute alcohol containing 8 per cent. sublimate, then for another hour to a mixture of one part of this alcohol to one part xylol, and finally to pure xylol. In this last the preparation may stay indefinitely. Mr. Parker has found a great advantage from the

* See this Journal, 1894, p. 403. † Tom. cit., p. 132.
‡ Anat. Anzeig., xi. (1895) pp. 41–3.
§ MT. Zool. Stat. Neapel, xii. (1895) pp. 3–7.

use of the method of Vom Rath, in which the tissue is fixed in a solution of osmic, acetic, and picric acids, and platinic chloride, and afterwards reduced in crude pyroligneous acid. It is stated that this method presents the double advantage of being unfailing in its results, and of yielding preparations which are remarkably clear and trustworthy. The author has improved his depigmenting fluid (0·1 per cent. aqueous solution of potassic hydrate) by using as a fixative for the sections a mixture of the fixatives of Schällibaum and Mayer. When small drops of each of these fluids are thoroughly mixed on a slide a whitish sticky paste results, which, even in extremely small amounts, resists the loosening action of both potash and absolnte alcohol. The number of retinal elements was determined by counting the corneal facets. The author describes in detail the method by which he effected it. In justification of its use he points out that the difference between the estimated and the actual number did not differ by as much as 1 per cent.

Fixing and Staining Nervous Tissue to Demonstrate Changes in the Cells.*—Dr. G. Mann uses the following fluid for fixing nervous tissue:—Saturated solution of $HgCl_2$ in 3/4 per cent. NaCl, 100 ccm.; picric acid, 1 gr.; tannin, 1 gr.; or simply a saturated solution of $HgCl_2$ in 3/4 per cent. $NaCl_2$.

Various stains were used, and the following procedure is given in detail when methyl-blue is used. The ganglia were fixed in $HgCl_2$ and imbedded in paraffin. The sections were stuck to the slide by the author's albumen method, and after removal of the paraffin immersed in the following solution:—1 per cent. methyl-blue (water-soluble) 35 ccm., 1 per cent. eosin (water-soluble) 45 ccm., H_2O 100 ccm. (1) Stain for 24 hours. (2) Remove superfluous stain with water. (3) Dehydrate in absolute alcohol. (4) Place slide in glass vessel containing absolute alcohol 30 ccm. and 1 per cent. NaHO 4 drops, and leave until the dark-blue section has become reddish (1–5 minutes). (5) Wash out all traces of soda with absolute alcohol. (6) Immerse sections in tap-water, and when the bluish-red clouds are no longer given off, transfer to water acidulated with 2–3 drops of acetic acid for 3 minutes. (7) Dehydrate with absolute alcohol and mount in turpentine balsam. If the sections be still too blue, the process must be repeated.

Methylen-blue Staining Granules of Pneumonia and Anthrax.†—Dr. N. Pane describes certain granules occurring in cells taken from the blood, spleen, and bone-marrow of rabbits infected with pneumonia and anthrax. These granules stain well with aqueous methylen-blue solution (1 : 800), and are usually of a decided blue or of a slightly different tone from the rest of the preparation (metachromatism). Similar preparations taken from healthy animals do not exhibit these granules.

After pointing out that these granules resemble those of "Mastzellen," the author negatives their identity by showing that the two sets of granules differ in their receptivity for methylen-blue and dahlia, and in their resistance to a temperature of 70°–75°. Preparations made from spleen-pulp indicated that the "methylen-blue" granules had a

* Journ. Anat. and Physiol., xxix. (1894) pp. 100–7.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 789–94 (3 colrd. figs.).

bacterial origin, all stages of conversion of the bacteria into granules being demonstrable.

New Methylen-blue Method.*—Herr A. Bethe has hit upon ammonium molybdate as a suitable substance to combine with the tetramethyldiamidothiodiphenylamin of methylen-blue in order to obtain a less soluble salt than in the ordinary method. Moreover, hyperosmic acid acting on the methylen-blue molybdate in the presence of excess of ammonium molybdate forms a combination darker blue in colour, insoluble in alcohol even after weeks, and with other advantages. For Vertebrates, Bethe recommends the following mixture:—Ammonia molybdate 1 gr., distilled water 10 ccm., peroxide of hydrogen 1 ccm.; hydrochloric acid 1 drop; for Invertebrates, half the quantity of peroxide of hydrogen, and no hydrochloric acid. He gives full details as to the employment of his new method, which has yielded highly satisfactory results.

Modification of Gram's Method: Staining with Thionin.†—After pointing out that the staining of microbes is effected indirectly, as by the Ehrlich and Gram methods, and directly, as by the methylen-blue, with tannin and other methods, M. Nicolle describes a modification of Gram for which the following reagents are necessary:—

Gentian-violet.—Saturated solution of gentian-violet in 95° alcohol, 10 ccm.; 1 per cent. phenol in H_2O, 100 ccm.

Eosin.—Saturated solution of eosin in 95° alcohol, 50 ccm.; alcohol 95°, 100 ccm.

Fuchsin.—Saturated solution of fuchsin in 95° alcohol, 5 ccm.; H_2O, 100 ccm.

Orth's Carmine.—To the carmine one-sixth alcohol at 95° is added in order to prevent the sections from becoming separated from the slide.

Picric Acid Alcohol.—Just sufficient picric acid is added to 95° spirit as will impart a very pale yellowish tint.

Gram's Iodine.—Iodine, 1 grm.; iodide of potassium, 2 grm.; H_2O, 200 grm.

Absolute alcohol to which one-third and one-sixth of aceton have been added.

Absolute alcohol.

Alcohol at 95°.

Alcohol and ether in equal parts.

Xylol. Xylol balsam.

To stain cover-glass preparations of a culture, the film is fixed in alcohol-ether and then treated for 4–6 seconds with the phenol gentian-violet, after which it is immersed in the iodine, renewed once or twice, and next placed in the one-third alcohol-aceton.

If a pathological product, it may be double-stained by passing the cover-glass through the eosin solution after decolorising in alcohol-aceton. Should the pathological product contain an organism stainable by Gram and another decolorised thereby, the alcoholic solution of fuchsin should be used instead of the eosin.

Sections may be triple-stained by combining the action of carmine,

* Arch. f. Mikr. Anat., xliv. (1895) pp. 579–622 (3 pls.).
† Ann. Inst. Pasteur, ix. (1895) pp. 664–70.

picric acid, and gentian-violet. After removing the paraffin by means of xylol and the latter with alcohol, the preparation is to be immersed in the alcoholic Orth's carmine for a quarter of an hour. After washing in water it is transferred for 6 seconds to the gentian-violet solution and then to the iodine solution. After decolorising in alcohol-aceton (1/3) the preparation is passed rapidly through the picric acid-alcohol, and having been dehydrated in absolute alcohol and cleared up in xylol is mounted in balsam.

The direct method, while applicable to all micro-organisms, should be reserved for those decolorised by Ehrlich or Gram. The necessary reagents are:—Phenol-thionin (saturated solution of thionin in 50° alcohol, 10 ccm.; phenol in H_2O 1 per cent., 100 ccm.); phenol-gentian-violet; alcoholic solution of eosin; alcohol-aceton; absolute alcohol; ether-alcohol, equal volumes; xylol and balsam. Thionin or "violet de Lauth" belongs to the same group as the methylen or toluidin blues, and owing to its slight solubility in absolute alcohol is especially suitable for staining organisms decolorised by Gram.

For cover-glass preparations the thionin or gentian-violet solution may be used, and the eosin employed as a contrast stain in certain cases. For sections the thionin solutions should only be used.

In conclusion, the author says that by adding eosin to Gram's iodine a double staining is effected. Iodine, 1 grm.; iodide of potassium, 2 grm.; saturated solution of aqueous eosin in alcohol at 90°, 20 ccm.; H_2O, 200 ccm.

Methyl-blue and Methylen-blue.*—What follows may be news to some of our readers. "The names of these two substances resemble each other so closely as to cause a greal deal of confusion, especially when an effort is made to abbreviate. We have taken the trouble to get authoritative definitions of these two forms from E. Merck (Darmstadt and New York), and Dr. Grübler (Leipsic).

Methyl-blue is the sodium salt of tri-phenyl-para-rosanilin-sulphonic acid. It is also known as methyl-blue, M.B.I., for cotton. It is a dark-blue powder, forming a blue solution in water, and is used mostly for histological work.

Methylen-blue is a salt of tetra-methylthionin, the double chloride with zinc being the form usually met with, though a simple hydrochlorate, free from zinc, is also in the market, and this is what is supplied when 'chemically pure' is specified. It is used principally for staining in microscopic work, a very extensive use being as a contrast or ground stain for tubercle bacillus, the latter being stained with fuchsin (magenta)."

(5) Mounting, including Slides, Preservative Fluids, &c.

Formol.†—M. R. Blanchard has a note on this fluid, of which we have heard so much of late. He has himself been using it for leeches. He finds that after a year there is but the faintest alteration in the delicate coloration of these worms. M. Joubin has preserved in it various Cephalopods, and they have retained the same appearance as they have in the living state.

* Micr. Bulletin, xi. (1894) p. 17.
† Bull. Soc. Zool. France, xx. (1895) p. 93.

Rapid Method of Making Permanent Specimens.*—Dr. T. S. Cullen describes a rapid method of making permanent specimens from frozen sections by the use of formalin. Knowing that specimens hardened in this fluid show almost perfect preservation of the cellular structure, it occurred to him that it might be used in the preparation of frozen sections. An excellent permanent specimen may be made in the following way:—The tissue to be examined having been frozen is cut, and the sections placed in 5 per cent. watery-solution of formalin for 3–5 minutes, in 50 per cent. alcohol for 3 minutes, and in absolute for 1 minute. The tissue is now thoroughly hardened and can be treated as an ordinary section, and stained and mounted in the usual way. The blood is lost in frozen sections as a rule, but if the specimens be first fixed in formalin and then frozen, the blood is preserved, although it does not stain very distinctly. Dr. Cullen says that given a piece of tumour from the operating-room it is possible to give as definite a report in 15 minutes as one would be able to give when examining the alcoholic or Müller's fluid specimen at the expiration of two weeks.

New Use of Formic-aldehyde.†—MM. Koehler and Lumière describe a new use of formic-aldehyde as a preservative agent for the bodies of mammals. They find that, if doses varying from 50 to 150 ccm. of a one-fifth solution are injected into the digestive tube by the mouth and anus, and into the carotid of a guinea-pig, the animal may be hung up in a dry place and left in the open air for some weeks. In this condition the animal does not become in the least deformed. A specimen which had been thus treated four months earlier was, when exhibited, found to have the tissues absolutely free from putrefaction. The hairs were perfectly intact and the animal had kept its form and was found in a state of preservation which could not be obtained by any other process.

Formalin as a Fixative instead of Osmic Acid.‡—Herr A. Durig finds that formalin is more effective than osmic acid in Ramon y Cajal's method; it penetrates deeper, is more certain, and cheaper.

For fixing he used a gradation of 0·5 to 15 per cent. solution of formalin, with variable strengths of potassium bichromate, and thereafter the silver nitrate process.

Formalin as a Fixative.§—Prof. P. Lachi refers to a note by Dr. A. Durig on this subject, and points to the previously published results of experiments made with this method by Prof. Hoyer, Dell' Isola, and himself.

New Method of Preserving Large Specimens.‖—Drs. H. Brand and L. Drüner describe the method they employ in the investigation of the nervous system of fish in order to obtain a uniform condition of preservation throughout large specimens. The method consists in introducing the fixing solution through the vascular system.

The fish is chloroformed, the heart exposed and a short glass tube attached to the bulbus aortæ. The glass tube is connected by india-rubber tubing with the flask containing the preserving liquid. A second

* Bull. Johns Hopkins Hospital, vi. (1895) p. 67.
† Bibliograph. Anat., i. (1895) pp. 31 and 2.
‡ Anat. Anzeig., x. (1895) pp. 659–60. § Tom. cit., pp. 790–1.
‖ Jena. Zeitschr. f. Naturw., xxix. (1895) pp. 435–42.

flask in connection with the water supply serves to keep the constant air-pressure necessary for the injection. A manometer tube and apparatus for stopping air-bubbles must be inserted between the injection flask and the tube. Since the preserving fluid coagulates the blood, the latter must first be washed away by means of physiological salt solution. The fixing fluid is then introduced. The injection is continued until all visible parts show the change of colour resulting from the effect of the fixing fluid. This is then expelled by water, the vascular system thoroughly rinsed with alcohol, and finally the whole specimen is immersed in alcohol.

Fish treated in the above way exhibit for preparations the following advantages:—

(1) The preservation is perfectly uniform and allows of an exact histological investigation for any given part.

(2) The firmness of the tissue is perfect.

(3) By the removal of the blood the injurious saturation of the tissues with coloured matter of the blood is avoided, and the pure colour resulting from the fixing fluid is obtained.

Mounting Small Objects in Aqueous Media.* — Herr H. Reichelt says that well-dried pollen-grains, fern-seeds, fungus-spores, &c., may be mounted in aqueous media by means of the following procedure. A cover-glass is coated with a thin layer of shellac by just dropping on it some isobutyl alcoholic solution of shellac and allowing it to dry. Upon this film the objects to be mounted are arranged in any manner desired, and then the cover-glass is carefully removed to a space filled with alcohol vapour. For this an ordinary bell-jar or exsiccator answers very well; a few drops of alcohol are poured on the bottom and the preparation placed on a tripod or some convenient vessel. In a few hours the shellac layer will have softened sufficiently to fix the objects to be mounted, and on removal from the alcoholic atmosphere the shellac becomes quite firm again, so that the objects remain in their position while being mounted in watery media.

Study of the Lymphatics of the Mammary Gland.†—M. C. Regaud finds that the methods of investigation used by his predecessors are sufficient to explain the divergent results at which they have arrived. He concludes that it is of great importance to preserve the impregnated vessels in a state of distension, but under the influence of strong alcohol, which is generally used to fix pieces treated with silver injection, the impregnated canals empty themselves and contract. The author's professor, M. Renaut, has devised a method which avoids this contraction. He mixes the silver solution with picro-osmic acid, and makes injections with this mixture. The picric acid is to be employed in a saturated watery solution. It aids in fixing the tissues, and the yellow tinge which it gives to them allows the investigator to judge of the diffusion of the injected liquid. The osmic acid may be from 1 in 300 to 1 in 1000 parts. The nitrate of silver should be a weak solution only, that is, 1 in 400 or 1 in 500. The mixture of these three fluids when dissolved in distilled water leaves no precipitate, and may be preserved for

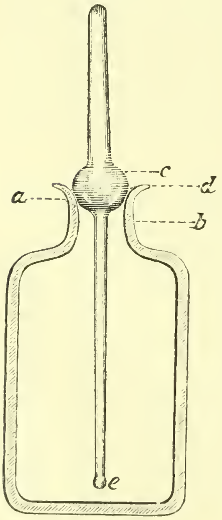
* Zeitschr. f. angewandte Mikroskopie, i. (1895) pp. 11–2.
† Journ. Anat. et Physiol., xxx. (1894) pp. 719–24.

a long time in vessels of yellow glass, although it is better that it should be made fresh before use. The injection is made either with an ordinary syringe with a fine platinum needle, or by means of an apparatus with continual pressure. When the injection is made, a cube at the centre should be marked off with a razor and placed in strong alcohol. After changing the alcohol as often as necessary, the piece should be cut into sections and these submitted to the action of acetic or formic acid, or other reagents, stained or not, and mounted in glycerin or Canada balsam. The author finds that the double action of osmic acid and nitrate of silver gives excellent preparations. The lymphatics are seen with great distinctness.

Influence of Osmic Acid on the Preservation of Nuclear Structures.*—Dr. B. Rawitz observed that the nuclei in the peripheral parts of the Salamander's testis, treated with the chrom-osmio-glacial acetic acid mixture, differed from those in the central portion. He interpreted this as a nuclear disruption due to the violent action of the osmic acid. Flemming has denied the justice of this interpretation, Rawitz maintains his position and notes the differences observable when weak and strong solutions are used. But he allows that it is still a case of opinion against opinion.

Criticism of Fixing Methods.†—Prof. A. Fischer points out some of the pitfalls of technique. Chemical reaction on the part of the tissue to be fixed, which is not always neutral or alkaline, is apt to give granular precipitates or coagulations, and these artificial products may often be mistaken for "chromatin" and other formed substances. But his cautions must be read in detail to be rightly appreciated.

Fig. 99.



(6) Miscellaneous.

New Oil-bottle.‡—Herr H. Horne has devised an oil-bottle intended for microscopical purposes and so constructed as to prevent the oil from running over. The bottle, made of glass, holds 15–20 ccm. The upper part of the neck is expanded into a funnel-shaped lip *d*. The stopper is a glass rod with a spherical expansion at the junction of the handle with the dipper. This ball *c* must be of such size and so carefully fitted that it only just rests on the junction of the lip *d* with the vertical part *b* of the neck. The dipper part of the stopper ends in a small ball *e*.

Geotropic Chamber.§—Prof. J. Sachs describes a chamber in which the geotropic phenomena in the growth of plants can be observed and recorded without being disturbed by heliotropism. The image of the growing plant is thrown on to a ruled glass plate, and observed by a telescope fixed at a distance of 3–4 m.

* Anat. Anzeig., x. (1895) pp. 777–80. † Tom. cit., pp. 769–77.
‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., i. (1895) p. 448 (1 fig.).
§ Flora, lxxx. (1895) pp. 293–302 (3 figs.).

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

DECEMBER 1895.

SUMMARY OF CURRENT RESEARCHES

Relating to Zoology and Botany (*principally Invertebrata and Cryptogamia*), Microscopy, &c., *including Original Communications from Fellows and Others.**

ZOOLOGY.

VERTEBRATA:—Embryology, Histology, and General.

a. Embryology.†

Placenta Circumvallata.‡—Dr. O. von Herff finds that the circumvallate and marginate placenta is due in part to a primarily too shallow imbedding of the ovum, and in part to inflammatory degenerative processes in the decidua, &c. Both factors usually occur together.

Evolution of Vertebral Column.§—Dr. H. Gadow has published an abstract of his conclusions on this subject. He points out that the key to the solution of the composition of the vertebral column is given by the metameric repetition of four pairs of symmetrically arranged cartilaginous elements. In the earliest primitive condition four pairs of arcualia are present, either as separate pieces, or the basidorsalia and basiventralia fuse. In the next stage the interventraliar pieces are reduced, and the other three pairs either remain separate or co-ossify. Reductions may occur further in the interventralia, basiventralia, or interdorsalia. Dr. Gadow believes that the ribs are homologous structures throughout the Vertebrata. They are lateral distal outgrowths of the original basiventralia, with which they later on form joints; they ossify independently.

Development of Hypochorda and Pancreas in Frog.‖—Dr. Ph. Stöhr finds that in *Rana temporaria* the hypochorda arises as a median thickening of the dorsal wall of the gut, being constricted off from in front

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, &c., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development and Reproduction, and allied subjects.

‡ Abh. Nat. Ges. Halle, xx. (1894) pp. 231–56 (1 pl.).

§ Proc. Roy. Soc., lviii. (1895) pp. 257–9.

‖ Verh. Anat. Ges. IX. Vers., x. (1895) pp. 176–80.

backwards, but leaving a series of bridges segmentally arranged. Cavities appear in the hypochorda, and sections show that in the anterior trunk segments the hypochorda is made up of segmental tubes which rise dorsally from the gut and then bend caudalwards. This suggests the hypothesis that the hypochorda may have arisen from the union of a series of segmental evaginations. After the cavities have appeared complete constriction from the gut occurs, the aorta arises between, and the elements atrophy, flatten, and disappear, without taking any part in forming the spleen or leucocytes.

Behind the dorsal rudiment of the pancreas there appears in the eighth myomere a second process. This is the root of the *Schwanzdarm*, and has nothing to do with the pancreas or any other organ. The author suggests that this may be the nature of the alleged fourth rudiment of the pancreas in the sturgeon, but with this von Kupffer does not agree.

Influence of Chloride of Lithium on the Development of the Eggs of the Frog and the Toad.*—Herr A. Gurwitsch finds that the influence of lithium chloride on the eggs of these two Amphibians is so similar that one description will do for them both. Comparing his results with those of Herbst on eggs of Echinoids, he comes to the conclusion that the influence of lithium salts has some connection with the reabsorption of yolk-granules in the large yolk-cells.

Development of Branchial Skeleton in Ammocœtes.†—Herr C. v. Kupffer finds that the cartilage does not arise within the mesodermic arches, nor from cells derived from these, but from and within the ectodermic epithelium which lines the whole branchial region, the branchiodermis. This raises the question of the homology between the branchial cartilages of Petromyzontidæ and the gill-arches of Amphirhini; the former are external, the latter internal. And what of the outer arches of Elasmobranchs, do they form a third category? But the chief result, that the branchial skeleton in *Ammocœtes* is cutaneous, leads to the conclusion, of which there has been recently other evidence (Goronowitsch, Platt, Klaatsch) that the *rôle* of the ectoderm has been too hastily restricted.

β. Histology.

The Cell Theory.‡—Mr. G. C. Bourne has prepared an answer to Mr. Sedgwick's article on the inadequacy of the cellular theory of development.§ He urges at the commencement that while Mr. Sedgwick asserts that there is a want of precision about the cell-phantom, there is a considerable amount of vagueness in Mr. Sedgwick's method of propounding his own views. While doing his best to understand them he asks pardon if he has misinterpreted them. He shows cause for the view that there is very slender ground for the accusations which Mr. Sedgwick levels, in an unsparing manner, against his zoological contemporaries. He urges that the phenomena to which Mr. Sedgwick draws our attention have received their due amount of recognition from

* Anat. Anzeig., xi. (1895) pp. 65–70 (5 figs.).
† Verh. Anat. Ges., ix. pp. 105–22 (7 figs.).
‡ Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 137–74.
§ See this Journal, *ante*, p. 29.

the time that the cellular structure of tissues was first studied. It is true that more recent researches have enlarged our knowledge of protoplasmic continuity, but it is still a phenomenon far from being of such universal application as to constrain us to abandon that very useful morphological concept, a cell. The study of cells has indeed in recent years been carried on by many authors with a minuteness which a short time ago was undreamt of. Nothing can be more clear than the fact that, in *Nereis* or in *Unio*, there result from the division of the ovum separate protoplasmic corpuscles, as distinct from one another as one room in a house is distinct from another. To each blastomere, it may be said in figurative language, is given material which it must place, not anywhere, but at one particular part of the edifice. The results of E. B. Wilson and others are such that it is no exaggeration to say that they effectually dispose of the idea that a syncytial theory of animal organisation is of general application; nay, more, they show that in not a few instances cells possess a morphological and physiological significance greater than was at one time supposed. Mr. Bourne thinks that the evidence is overwhelming that there are numerous cases in which there is *not* "a primitive continuity which has never been broken." Morphologists would appear to be amply justified in refusing to recognise Mr. Sedgwick's views as to the syncytial nature of animals, and there is no justification for the strong language which he uses towards them on account of their refusal. As to the fact that any reputable zoologist has stated that an organism is composed of independent and isolated units there appears to be no good evidence. Prof. Haeckel has been claimed as the author of the doctrine that an animal is a cell-republic, but, as a matter of fact, Haeckel stated this of a plant as opposed to the animal, while the researches of Mr. Walter Gardiner have shown that the statement is not true of plants. Mr. Sedgwick's critic is quite certain that the picture which he drew of the teaching given to every student of biology is a travesty of the truth. Zoologists and botanists alike have long been possessed of the truth that there is no fundamental, but only a formal distinction between unicellular and multicellular organisms. At the same time it is to be admitted that the cell theory has been very differently treated by various authors. After pointing out the now recognised importance of a nucleus to a cell, Mr. Bourne deals in a critical manner with various forms of which it is difficult to say whether or not they should be called single cells. In the cases where several nuclei are present in one mass of protoplasm it has been urged that the test of unicellularity is not the number of the nuclei, but the fact that the protoplasm is continuous. The definitions of some authors would bind us, but biologists do not want to be bound; and if we are to be free, we must, Mr. Bourne thinks, take refuge in some such lax but comprehensive statement as that of Von Sachs, namely, that cell-formation is a phenomenon very general in organic life. Even if we must regard it as only of secondary significance, it is a characteristic expression of the formative forces which reside in organic substance. The truth appears to be that the attempt to frame short concise definitions, applicable without exception to whole classes of phenomena, leads to trouble. There is no place in biology for definitions as exact and universal as those of geometry. To attempt to form definitions, to predicate the precise attributes of whole classes of phenomena, is to run counter to the very genius of the subject. For what do we mean by evolution if not that life is labile, never-resting, protean in its variety? If we are to have a definition at all, Mr. Bourne would suggest that a cell be defined as a corpuscle of protoplasm which contains a specialised element, nuclein. Cells, as thus defined, are not only of various kinds, but are variously compounded together. (1) There are those which are discrete, or corpuscles whose protoplasm is not in union with that of any other corpuscle. (2) Others are concrescent, or are corpuscles whose protoplasm is in union with that of other corpuscles. Discrete cells may be divided into those that are independent, like the uni-nuclear Protozoa, the mature ovum, or leucocytes. Coherent cells, on the other hand, are those which are in close apposition to others, but not organically in union with them, as for example, the blastomeres of many developing embryos. Concrescent cells are either continuous or conjunct. The former have the protoplasm fused but the nuclei separate, as in *Myxomycetes*, or *Opalina*, while conjunct cells are those which have a protoplasmic body of definite outline and are united among themselves by fine bonds of protoplasm. In concluding an article of great interest Mr. Bourne points out that even if the case which is based largely on the history of the development of *Peripatus* be proved to the hilt, it will after all be an isolated case of secondary significance; merely another addition to our experience of the very various phenomena displayed in organic growth. For thousands of instances point to the fact that normal growth is effected in a very different way, by mitotic division of the nucleus preceding and directing the formation of a discrete or concrescent cell-corpuscle. The recent researches of cytologists are too many, too good of their kind, and too consistent to admit of any other conclusion.

Heterotype Nuclear Divisions in Animals and Plants.*—Prof. J. B. Farmer and Mr. J. E. S. Moore have an essay on the essential similarities existing between the heterotype nuclear divisions in animals and plants. They point out that there has been little or no recognition of the fact that in one and the same species there may exist considerable range of variation, both in the actual form and in the mode of development of the individual chromosomes. They point out that this is a matter of interest, since it affords evidence of variations occurring at an especially important period in the life-history of the organism, and they suggest that it may serve to throw some further light on the essential stages in the metamorphoses through which the chromosomes individually pass. The observations here detailed have been chiefly based on a study of the spermatogenesis in *Triton* and the pollen-mother-cells of Lilies. Those who have read the recent contributions to our Transactions by Miss Sargant and Prof. Farmer will readily understand that the details given by the present authors are not amenable to condensation. The results which they have obtained from animal and plant-cells respectively agree so closely, even in the most minute details, that it seems impossible to doubt that the entire process of heterotype mitosis is essentially the same in both kingdoms. The authors, however, leave it an open question whether this identity is due to phylogenetic causes,

* Anat. Anzeig., xi. (1895) pp. 71–80 (29 figs.).

or whether it is the expression of physical forces which, at corresponding periods, operate under similar conditions.

Multiple Nuclear Division.*—Herr E. Krompecher maintains that multiple division is an undeniable normal occurrence, especially in highly nourished cells. Binary division, apparently occurring along with multiple division, is an illusion due to misinterpretation of sections; the triaster is often only the section of a 4-, 6-, or 12-division, and so on. Division may be linear (binary), in a plane surface (ternary), in three dimensions (multiple). The nucleus may divide into from two to twenty parts, but always definitely and regularly.

Accessory Nuclei in Cells of Larval Salamander.†—Dr. Hs. Rabl has observed, in various tissues (epithelial, cartilaginous, connective, &c.) of a larval salamander, the constriction of an accessory nucleus, or of several from the main nucleus. The occurrence is doubtless abnormal, but is of interest as an example of cellular variation, and in connection with amitosis.

Paranuclear Body in Blood-Cells.‡—Dr. L. Bremer describes in nucleated erythrocytes of Vertebrates the general occurrence of a paranuclear corpuscle. It is a small spherical body, lies near the nucleus from which it seems to arise, and consists of an unstainable sphere with a minute stainable centre. It occurs in Fishes, Amphibians, Reptiles, and Birds, but the author has not succeeded in detecting it in the nucleated erythrocytes of the Mammalian medulla.

Plasma-Cells.§—Prof. W. Waldeyer distinguished in 1875 a type of connective tissue-cells characterised by the abundance of protoplasm. He called these cells plasma-cells, and united them with others (in the intermediate substance of the testis, in sweat and carotid glands, in adrenals, corpus luteum, and decidua) under the category of perivascular tissue. Unna has recently applied the same term "plasma-cells" to elements which occur in many pathological processes in the skin. In what sense should the term be now used?

Waldeyer's plasma-cells correspond in staining reactions to Ehrlich's *Mastzellen*, but not to Unna's "plasma-cells," and Waldeyer proposes to give up his use of the term as applied to normal elements of connective tissue. The cells he described as "plasma-cells" are Ehrlich's *Mastzellen* and eosinophilous cells.

Eosinophilous Granulations of the Blood.‖—Herr N. Sacharoff finds that the eosinophilous granulations of the blood in Birds and Mammals always arise from the phagocytosis of nuclear elements which have fallen out of erythrocytes or hæmatoblasts. These elements consist of paranuclein (round granulations), or of degenerated nuclein (rod-like granulations).

Minute Structure of Nervous Tissue.¶—Dr. E. Rohde's general conclusions are briefly as follows:—The spongioplasm in ganglion-cells

* Verh. Anat. Ges. IX. Vers., x. (1895) pp. 52–62.
† Arch. f. Mikr. Anat., xlv. (1895) pp. 412–33 (1 pl.).
‡ Tom. cit., pp. 433–50 (1 pl., 2 figs.).
§ SB. K. Akad. Wiss. Berlin, 1895, pp. 751–8.
‖ Arch. f. Mikr. Anat., xlv. (1895) pp. 370–87 (1 pl.).
¶ Tom. cit., pp. 387–412 (1 pl., 3 figs.).

is in part coarsely fibrillar, in part finely fibrillar. The latter always forms the axis-cylinder process, but often expands from its base over the whole periphery of the ganglion-cell, which then shows a dark coarsely-fibrillar internal zone, and a clear finely-fibrillar internal zone. The ganglion-cells lie imbedded in the neuroglia, which consists of fibrils, like the coarse fibrils of the ganglion-cell's spongioplasm, and containing many nuclei. At the periphery of the ganglion-cell the neuroglia fibrils are thicker, show more nuclei, and pass continuously into the coarsely-fibrillar spongioplasm. Therefore it is concluded that the spongioplasm of the ganglion-cell is only a supporting framework, and that the really nervous substance is the enclosed hyaloplasm.

Rohde has extended his observations to Nematodes, Molluscs, Crustaceans, Insects, and Vertebrates, and has confirmed the above conclusions. In Invertebrates, from Chætopods upwards, the nerves consist of two kinds of elements. There is the *Punktsubstanz*, which appears coarsely granular or fibrillar in section, and there are more or less broad axis-cylinder processes, which consist of a very finely fibrillar axis-cylinder and a sheath coarsely fibrillar like the *Punktsubstanz*. In the lower Invertebrates the *Punktsubstanz* predominates, in the higher the axis-cylinder processes; i. e. as we ascend they become less like sympathetic and more like cerebro-spinal nerves. The general conclusion, however, is that the spongioplasm is a supporting framework, and the hyaloplasm alone nervous.

Study of Glandular Cells.*—M. J. Mouret has made a study of the activity of glandular cells, taking the pancreas as his organ for investigation. He finds that a pancreatic cell in a state of repose exhibits a zone full of large zymogenous fuchsinophilous granules and an external matrix zone. The nucleus is found at the boundary between these two zones. In addition to the granules the protoplasm is composed of two substances—one homogeneous and amorphous, and the other capable of staining by hæmatin. During secretion there is formed in the protoplasm a number of vacuoles, which contain a colourless fluid. The cell excretes its zymogenous granulations, which are dissolved in the liquid and form the pancreatic juice. The solution of the granulations may be made in the cell itself, but it more often takes place in the cavity of the secreting tube, or in the primary excretory cells. At the same time as the cell excretes its zymogenous granulations and the contents of its vacuoles, the pre-zymogenous substance, or that which is stainable by hæmatin, increases in quantity. This last gradually breaks up into fine granulations, which extend through the whole protoplasm, where they gradually grow and ripen, to become in their turn true zymogenous granulations.

A Tissue Transitional between Cartilage and Bone.†—M. J. Chatin finds that the sclerotic plates in the Gecko (*Platydactylus fascicularis* Daud.) consist of a remarkable form of cartilage, with ramified anastomosing cells, similar to that found in *Chimæra* and in the cranial cartilage of Cephalopods. It is neither hyaline nor fibro-cartilage, but is like osseous tissue arrested midway in its development.

* Journ. Anat. et Physiol., xxxi. (1895) pp. 221-36 (1 pl.).
† Comptes Rendus, cxxi. (1895) pp. 172-4.

Histogenesis of Connective Tissue.*—Prof. F. Merkel finds that in the umbilical cord the fibrils arise quite apart from the cells. In the sinews of the fingers, though the fibrils surround the cells, it seems as if a secreted substance became fibrillar. Thus, he is against the generalisation that the fibrils have a direct cellular origin.

Chemistry of the Living Cell.†—Prof. A. Gautier has written an interesting little book on the metabolism of the cell. He discusses assimilation and disassimilation, albuminoids, amides, leucomaines, ptomaines, ureids, and the like, in a terse but lucid manner. His work is more than an *aide-mémoire* to the student, it is a useful summary for the general biologist.

Morbid Histology of Rabies.‡—Drs. E. Germano and J. Capobianco find that in the spinal cord of dogs and rabbits affected with rabies there are constant anatomical changes, and that these changes, while affecting all the elements of the nervous tissue, are not uniformly distributed throughout the cord. The lesions are inflammatory in character. The nervous tissue (cells and fibres) undergoes degeneration, and may even disappear, while there is hypertrophy and hyperplasia of the neuroglia. The material used was hardened mostly in chromic solutions, rarely in sublimate. The sections were stained in various ways, but more especially by the methods of Palladino, Golgi, Marchi, and Weigert-Pal.

γ. General.

Influence of the Winter of 1894-95 on the Marine Fauna.§—M. P. Fauvel has made an investigation into the influence of the exceptional lowering of the temperature of last winter on the marine animals of the shores of France. He finds that the severe frosts at the time of low tide destroyed innumerable quantities of the animals laid bare by the sea. In the month of March numbers of dead animals were found in the clefts of the rocks and under the stones at Cherbourg and elsewhere. Enormous conger eels and other fishes were found dead or inert, paralysed by the cold. Shrimps were destroyed in such quantity that this summer only small individuals of the year could be fished. What is more remarkable, this mortality extended to a depth at which the cold could have no direct sensible action. All the dredgings made at the Marine Laboratory of Tatihou, in April and May, at depths of 15 to 25 metres, brought up nothing but dead and decomposing animals. To use the expression of the fishermen, the bottom of the sea appeared to be decaying. Whelks were either in a state of decomposition, or those which were not dead were black and uneatable. Of 1000 Pectens dredged only 200 were fit to be offered for sale. At Cancale the oyster cultivators have suffered considerable loss. Another effect of the cold has been to bring to the shore animals which are ordinarily met with only at moderate depths. For example, *Amphioxus lanceolatus* was found at Tatihou in considerable abundance on the shore, whereas as a rule it has to be dredged for ; and the same is true of various Holothurians and

* Verh. Anat. Ges. IX. Vers., x. (1895) pp. 41–4.
† 'La Chimie de la Cellule Vivante,' Paris, 1894, 12mo, 175 pp.
‡ Ann. Inst. Pasteur, ix. (1895) pp. 625–35 (1 pl.).
§ Comptes Rendus, cxxi. (1895) pp. 427–9.

of some Gephyrean worms. The spring has been marked by the extraordinary abundance of *Balanus porcatus.* Notable changes have also occurred in the Annelid fauna, and on the French coast there has been found *Ampharete grubei*, a northern species not yet met with on the coast of France; and the same is true also of other Annelids and of rare Sea-anemones. Other species have appeared much later in the year than usual.

Prof. Herdman's Address.*—Prof. Herdman, as might be expected, gave an exceedingly interesting address as President of Section D, at the last meeting of the British Association. After referring to the fact that when the British Association met last at Ipswich the field naturalists who founded and established on a firm basis British marine zoology were all at work, he is led naturally to consider the results of the 'Challenger' Expedition. He points out that Dr. John Murray's summary of the results of that historic voyage has given definiteness of scope and purpose and a tremendous impulse to that branch of science, mainly zoological, which is coming to be called Oceanography. Oceanography is the meeting-ground of most of the sciences, dealing as it does with botany and zoology, chemistry, physics, mechanics, meteorology, and geology, while it has an incalculable influence upon man, his distribution, characteristics, commerce, and economics. With some temerity, Prof. Herdman ventures to differ from Dr. Murray's generalisation that it is the mud-line, or a line at a depth of about one hundred fathoms, that is the great feeding ground, and the place where the fauna is most abundant. Murray's mud-line has, in his view, a present and a historic importance which can scarcely be surpassed in the economy of life on this globe. Prof. Herdman thinks, however, that Murray's opinion as to the distribution of animals in regard to the mud-line is not entirely in accord with the experience of specialists, and is not based upon reliable statistics. He would rather consider that there are more species and more individuals in shallower waters, and that the deep mud has a poor fauna. There can be no doubt there is a considerable amount of evidence in favour of his own and against Murray's views. After some paragraphs on Bionomics and the use of the marine laboratory, Prof. Herdman concluded with some remarks on oysters and their relation to typhoid fever.

Plankton of Deep-Water.†—MM. L. Boutan and E. P. Racovitza, using an enlarged modification of Chun's apparatus, have corroborated his results, and proved the existence of a deep-water plankton off Banyuls and Villefranche. Horizontal variations are due to currents, vertical variations to diurnal and seasonal variations of temperature. Prof. De Lacaze-Duthiers in an appended note cites the capture of ten specimens of the large carnivorous *Centrophorus granulosus* as evidence that the depths investigated are rich in life.

Proof of the Necessity for the Inheritance of Acquired Characters.‡ Dr. W. Haacke finds the necessity referred to in his conception of the organism as an equilibrated system. He finds a striking corroboration

* Nature, lii. (1895) pp. 494–501. † Comptes Rendus, cxxi. (1895) pp. 174–7.
‡ Biol. Centralbl., xv. pp. 710–12.

of his views in a recent essay by Dr. Pfeffer; the identity of argument strengthens Haacke's position. While many are puzzled to find any evidence that acquired characters *are* inherited, Haacke assures us that if we consider the organism aright we shall be convinced that they *must be.*

Heredity and Development.*—Dr. W. Haacke distinguishes pathological variations, in which organic structure has, as it were, undergone dislocation, from non-pathological variations, in which the disturbance of equilibrium is followed by an adaptive restoration. He criticises the various current conceptions of heredity—e. g. those of Haeckel, Hertwig, De Vries, Driesch, Roux, and Weismann. One of his criticisms is summed up in the sentence that, according to Weismann, heredity is the *accidental* correspondence of child to parent. He himself believes in a genetic continuity of germ-cells from generation to generation, but also in a material continuity between germ-cells and body. As the organism is a system in equilibrium, changes in the body must affect the germ-cells also. The relations of equilibrium, original and acquired, are transmitted. And these relations of equilibrium are best explained on the theory of gemmaria.

Osmotic Phenomena in Plants and Animals.†—Herr E. Overton indicates provisionally some of the more important results of his prolonged researches. He sketches the historical development of our knowledge of osmosis, from Nollet and Dutrochet to Nägeli and Pfeffer, and explains how the impermeability of protoplasm, or of the outer cytoplasmic layer, to many crystalloids is the condition of the high osmotic pressure exhibited by living cells. The tabular records of his experiments illustrate the fact that there are the same relations between osmotic pressure, volume of the solution, and molecular weight, as obtain in the case of gases. But his most important result is that all cells agree in being readily permeable by solutions of simple alcohols, ether, chloroform, simple aldehydes, acetone, and many other compounds. He indicates the application of this fact in physiology, experimental embryology, medicine, and so on, but we defer further report until the full paper is published.

Influence of the Environment.‡—M. L. Cuénot first discusses the influence of primary environmental factors—heat, light, food, &c., on organisms. A second chapter is devoted to the influence of environment on reproduction, sex, and development. He concludes with a discussion on faunistic adaptations. The book is admirably terse and clear, and is a useful appendix to Semper's 'Animal Life.'

Animals and Therapeutics.§—Prof. W. Marshall gives in his usual happy way an account of the old-fashioned uses of animals in medicine. Some of the modes of treatment have of late acquired a new interest in connection with the modern use of thyroid, pituitary, and other extracts.

* Biol. Centralbl., xv. (1895) pp. 561–71.
† Vierteljahrschr. Nat. Ges. Zürich, xl. (1895) pp. 159–201.
‡ 'L'influence du milieu sur les animaux,' Paris, 1894, 12mo, 176 pp.
§ 'Neueröffnetes, wundersames Arzenei-Kästlein darin allerlei gründliche Nachrichten wie es unsere Voreltern mit den Heilkräften der Tiere gehalten haben, zu finden sind,' Leipzig, 1894, 8vo, 127 pp.

Chromatophores of Animals.*—Mr. W. Garstang has an interesting general article on the chromatophores of animals. He defines chromatophores as pigmented cells specialised for the discharge of the chromatic function. Their evolution cannot be adequately considered, except by the comparative method, which in this case involves a survey of pigment-cells in general. In this survey special attention has been paid to two points: (1) The localisation of the pigment-cells and their relation to the germinal layers; (2) The nature of the structural modifications exhibited by pigment-cells. Although these cells are widely distributed, they attain a high elaboration of form and function in relatively few phyla. In the Animal Kingdom, the only pigment-cells distinctly specialised for chromatic purposes are those of Vertebrates, of Cephalopod and of certain Pteropod Mollusca, and of Crustacea. It would appear that there is a considerable amount of evidence in favour of the view that chromatophores in general are of ectodermal origin, whatever be their ultimate position in the body. Mr. Garstang is astonished at discovering that there is not within the whole of the existing literature a single indubitable proof of the mesodermal origin of the true chromatic cells. A classification is suggested which indicates the relation of the different kinds of chromatophore.

I. Autoplastic form, changes intrinsic.
  (1) Holoplastic, contractile as a whole,
    e. g. Ctenophora, Isopoda.
  (2) Endoplastic, inner protoplasm alone contractile,
    e. g. Vertebrata, certain Pteropods.
II. Alloplastic form, changes extrinsic,
    e. g. Cephalopoda, certain Pteropods.

Bibliography of North-American Palæontology.†—Mr. C. R. Keyes has prepared a Bibliography of North-American Palæontology for the years 1888 to 1892. In addition to an authors' list, in which a brief synopsis of the contents of each paper is given, there is a title index in which the name of each article appears under each of its leading words, and there are in addition subject entries and cross references. These are biological, geological, and geographical. It is claimed that one of the principal advantages of the present scheme is that in no case is it necessary to turn back from title to title in order to obtain a full bibliographical reference. A worker upon any systematic group of animals, a particular geological age, or a given area, finds all the articles upon the subject brought together. If this bibliography proves to be trustworthy, it will be indeed a most valuable handbook.

INVERTEBRATA.

Distribution of Aquatic Invertebrates.‡—Dr. O. E. Imhof gives a series of tables showing the distribution of "Aquatilia invertebrata" in Switzerland. He distinguishes subnival, alpine, upper forest, lower forest, and valley regions, and deals almost exclusively with Molluscs.

* Science Progress, iv. (1895) pp. 104-31.
† Bull. U.S. Geol. Survey, cxxi. (1894) 251 pp.
‡ Biol. Centralbl., xv. (1895) pp. 713-9.

Mollusca.

a. Cephalopoda.

Anatomy of Nautilus Pompilius.*—Mr. J. Graham Kerr has an exceedingly interesting essay on the anatomy of this important Cephalopod. He has been so fortunate as to be able to examine 25 specimens, a number of which, however, were young and immature. Mr. Kerr finds that the perivisceral cavity is remarkable for consisting in almost equal parts of true cœlom and hæmocœl; the latter is especially developed in the headward section of the body. The cœlom consists of two distinct chambers, genital and pericardial, separated by a perforated septum. Each of these chambers opens to the exterior by a pair of nephridia. Discussing the nature of the genital ducts, Mr. Kerr comes to the conclusion that in the Cephalopoda they represent portions of nephridia. The ovary was found to be remarkable for its extremely archaic character, that is to say, it has an ovigerous region of the cœlomic epithelium roofed in by a simple up-growth of the cœlomic wall. The ova were found to arise from syncytial masses of protoplasm. The testis also exhibits archaic characters, and is similar to the ovary in its main features. Its cavity, however, has become subdivided into numerous delicate tubes for the provision of a larger area of spermatogenic epithelium. Though the penis is said to be a paired structure, its left half is rudimentary. In contradiction to Prof. Ray Lankester, who says that no buccal nervous system has been observed in *Nautilus*, and that no enteric nervous system has been described, Mr. Kerr points out that a complicated buccal system was described and figured by Von Ihering, while at least part of an enteric system was described by Keferstein. As Von Ihering's remarks are very brief, and in the construction of his diagram a serious blunder seems to have been made, which has been perpetuated by being copied by leading text-books, the author thinks it advisable to give a short account of the buccal nervous system. The result of this description, which is commendably short, is to show that an elaborate buccal system is present in *Nautilus*. For the structure which Lankester has called the inner inferior lobe, Owen stated that the innervation was effected by a small distinct ganglion on each side. Mr. Kerr, however, finds in his specimens that the lobe is innervated, not by a pair of distinct ganglia, but by a continuous nerve-cord. Around the post-anal papilla there is a curious system of skin-glands, which appears to have escaped the notice of earlier investigators. One of the most interesting of Mr. Kerr's discoveries is a prolongation backwards of the nerve-trunk which supplies the gills. This probably represents the post-anal commissure of *Amphineura*. The pedal nature of the Cephalopod arms is discussed in some detail, and reason is given for regarding the evidence on which it rests as being on insecure foundations. It seems desirable, indeed, to abandon it for the inherently much more probable view that these structures are processes of the head region, The relationships of *Nautilus* appear to be more with the *Amphineura* than with any other group of Mollusca, and amongst these the Chitons seem to be the oldest and most primitive. Mr. Kerr quite truly says that the number of really

* Proc. Roy. Soc., 1895, pp. 664–86 (2 pls.).

important morphological features in which the Chiton resembles *Nautilus* is remarkable. These are:—(1) Bilateral symmetry; (2) general characters of the nervous system; (3) the possession of paired metamerically-arranged ctenidia, of which, in some species, there is a tendency for those at the anterior end of the body to disappear; (4) the traces of metamerism exhibited by the heart in some forms; for example, *Chiton magnificus* has four pairs of auriculo-ventricular openings. The general relations of the cœlom and nephridia are much the same in both cases, and both have eggs developed in follicles.

γ. Gastropoda.

Early Development of Limax.*—Mr. C. A. Kofoid's object in studying the development of *Limax* was a desire to add something to our knowledge of the details of molluscan embryology, many of the results of which are vague and even contradictory. *Limax* seemed, for many reasons, to be a desirable object for his investigations, as the adults are readily procurable, and an abundant supply of eggs, whose age is approximately known, can be obtained from animals kept in confinement. The absence of a large amount of yolk leaves the eggs sufficiently translucent for examination *in toto*. Discussing, first, the nomenclature of spiral cleavage, the author points out that it was necessary to introduce, as he has done lately,† a new system of nomenclature, and he gives reasons which he thinks justify him in introducing it. In a general way it may be said that *Limax* has spiral cleavage of the typical form, the spirals alternating in successive cell-generations, right spirals resulting in the even generation, and left spirals in the odd. The mesoderm is derived from the left posterior quadrant, and, as in various other forms, the first mesoblast cell is $d^{7 \cdot 2}$; and an ephemeral, recurrent cleavage cavity appears at the two-cell stage, and recurs as late as the completion of the period of gastrulation. This cavity has an excretory function, and is induced by the environment of the egg. The primary mesoblast divides bilaterally, ultimately sinks below the general level, and forms two bilaterally placed mesodermal bands extending anteriorly. The formation of these bands precedes and accompanies gastrulation. The blastopore is at first broad and shallow, but it gradually deepens at the anterior end, and disappears from the posterior margin anteriorly, forming an elliptical pit on the median ventral surface. The lateral and anterior lips of this pit grow rapidly, and there is at the same time an accumulation of mesoderm in these regions, and a general readjustment of the axes of the embryo; the opening leading into the archenteron assumes a position at what was the posterior margin of the blastopore. This remnant of the blastopore comes to lie in the anal region; the mouth breaks through at a later period upon the ventral surface of the embryo. It will be seen that the conclusions to which the author has arrived as to the fate of the blastopore in *Limax agrestis* are directly contradictory to those of Fol upon *L. maximus*, for according to him the blastopore becomes the permanent mouth. Mr. Kofoid thinks that Fol entirely overlooked the early stages in the history of the blastopore. The author deals in detail with the orientation of the embryo, critically

* Bull. Mus. Comp. Zool., xxvii. (1895) pp. 35–118 (8 pls.).
† See this Journal, 1894, p. 555.

discusses the question of cleavage, describes the formation of the mesoderm, and makes some interesting theoretical considerations based on the view that, as the matter stands now, we are compelled to deny the morphological significance of the precise method of the origin of the middle layer, if we maintain its homology even within the group of Mollusca.

δ. Lamellibranchiata.

Unionidæ of Arkansas.*—Mr. R. E. Call has made a study of the *Unionidæ* of Arkansas, with incidental reference to their distribution in the Mississipi valley. He points out that less is known about the Mollusca of this State than of any other one in the Union. He has been able to consult a number of original types with the result that he has considerably reduced the number of what he regards as good species. Not the least interesting fact connected with the study of the *Unionidæ* is the one that numerous species have been duplicated by describing the forms assumed by the sexes as of specific value. This has occurred in a number of instances, and is responsible for a considerable number of synonymic names. The author has reduced the number of species to 59, 52 of which belong to the genus *Unio*, three to *Margaritana*, and four to *Anodonta*. These molluscs are said to abound in the streams of Arkansas. Varieties of species may be relatively few, but individuals are very abundant. They are to be sought in every conceivable condition of bottom and other factors of environment.

Poisonous Mollusc.†—M. A. T. Rochebrune finds that *Spondylus americanus* emits an odour of sulphuretted hydrogen which is strong enough to disgust even a famished creature, so that it is never preyed upon for food. M. Rochebrune has isolated the toxic principle, and has obtained an olive-green extract with an acrid odour and bitter taste. Chemical reactions indicate that in this mollusc there is elaborated a product allied to ptomaines and leucomaines, and very similar to muscarine, the toxic product of the mushroom.

Bryozoa.

Mediterranean and New Zealand Reteporæ.‡—Mr. A. W. Waters points out that our knowledge of the Mediterranean *Reteporæ* is most unsatisfactory, as so many specific names have been given on account of slight differences in the nature of the reticulation. The necessity for making an entire re-examination of the group was increased upon receiving from Prof. Parona a most interesting fenestrate Bryozoan, which at the first glance seemed to belong to *Retepora*, but which is now described as *Palmicellaria parallelata*. The author doubts, however, whether it should not be made the type of a new genus. The author gives an account of the essential characters of the *Reteporæ*, and describes in detail species which have been found in the Mediterranean. The conclusion of the paper is occupied with the description of three species from New Zealand, one of which is new.

* Trans. Acad. Sci. St. Louis, vii. (1895) pp. 1–65 (21 pls.).
† Rev. Scient., June 1895. See Amer. Natural., xxix. (1895) p. 760.
‡ Journ. Linn. Soc. Lond., xxv. (1895) pp. 255–71 (2 pls.).

Australian Species of Amathia.*—Dr. P. H. MacGillivray, whose death, we regret to say, has been lately announced, and who began to write on Australian Polyzoa in 1859, has a paper on the Australian species of this genus in which he gives descriptions and figures of all (14) with which he was acquainted, and it is trusted that now Australian observers will have no difficulty in identifying their forms.

Arthropoda.

α. Insecta.

Evolution-Studies of Lepidoptera.†—Dr. T. Garbowski gives a critical summary of some recent work. He begins with E. Fischer's ‡ experiments on the influence of temperature. Out of 500 pupæ of *Vanessa io*, kept three weeks on ice, 15 turned out a new variety, *Fischeri* Stdfs.; out of another lot of 600, 50 were transitional to this new variety; out of 1000, 12 were of the *Fischeri* variety, several were transitional, and many normal. Many similar experiments were made, from the results of which Fischer argued to phylogenetic relationship, regarding the above variety, *Fischeri*, for instance, as the glacial form of *Vanessa io*.

Garbowski then gives an account of C. Schröder's § observations on the development of markings on caterpillars, and on the influence of surrounding colour on these. Schröder worked chiefly with Geometridæ, after a manner which Poulton's experiments have made familiar. The nature of the marking varied with the colour and form of the surrounding objects, but the degree of intensity in the illumination appeared to be the most important factor.

Recent Attempts to Classify Lepidoptera.§—Mr. J. W. Tutt has made an attempt to correlate the results arrived at in recent papers upon the classification of Lepidoptera. His essay takes the form of a critical notice of the work of Hampson, Comstock, Chapman, and Dyar. He finds that the results agree in one important particular, in that they substantiate the apparently sweeping innovations which Dr. Chapman made as regards the relations of various families of Lepidoptera. Probably his paper was the most severe blow which the Bombyces as a collective group ever received, whilst it has revolutionised our ideas of the Tineina. On one point all are agreed, and that is, that the *Micropterygidæ* and *Hepialidæ* come at the very bottom of the list, while these are followed by various families which have been hitherto placed high up in the scale. He compares the classifications based on pupal and larval characters with that proposed by Comstock on the presence of a jugum or frenulum, and with that on a study of the setiferous tubercules, as well as with Mr. Hampson's classification, which is based on characters derived from neuration. On the whole, it is striking how much the

* Proc. Roy. Soc. Victoria, vii. (1895) pp. 131–40 (4 pls).

† Biol. Centralbl., xv. (1895) pp. 657–72.

‡ Cited as 'Transmutation der Schmetterlinge infolge Temperaturveränderungen. Experimentelle Untersuchungen über die Phylogenese der Vanessen,' Berlin, 1895, 8vo, 36 pp.

§ Cited as 'Entwicklung der Raupenzeichnung und Abhängigkeit der letzteren von der Farbe der Umgebung,' Berlin, 1894, 8vo, 67 pp., 1 pl.

‖ Trans. Entomol. Soc. Lond., 1895, pp. 343–62.

systems of these various authors confirm one another. As Mr. Tutt states that lepidopterists have had no system of classification except a hotch-potch, it is clear that the thanks of systematic zoologists are due to the authors who have attempted a scientific classification.

Affinities of the Lepidopterous Wing.*—Mr. V. L. Kellogg discusses the relations of the wings of butterflies to those of the Trichoptera. He finds that the lines of specialization exhibited by the wings of the latter are strikingly parallel in general character with those exhibited by the Lepidoptera. A more primitive sub-equality of the wings, shown among the Lepidoptera only by the Jugatæ, is retained, but there is an obvious tendency towards a narrowing of the wings. It seems to be probable that the frenate type of wing had its origin in an earlier type which was essentially jugate, but which possessed frenulum-like structures of a character to be easily developed into the existing highly specialised frenate condition of the Noctuidæ and others.

Seasonal Dimorphism of Rhopalocera.†—Mr. C. W. Barker has some notes on the seasonal dimorphism of Rhopalocera in Natal. The seasonal variations of double or many-brooded species are found to be of a very marked character, and to modify the facies so considerably as to lead to much confusion in the determination of species and varieties. This form of variation is most marked in the Pierinæ. Two rules which generally hold good as characteristic of the changes and modifications which occur, and which serve to distinguish the dry-season form from its summer or wet-season form representatives, may be thus formulated: (1) Smaller size and a disposition to greater acuteness in the apices of the fore wings; (2) The dark markings on the upper side of the wings become contracted or even obsolete. The markings on the under side become suffused or merged in a generally duller and darker ground-colour. Practical field observations during a course of years have convinced Mr. Barker that many of the so-called species are simply seasonal varieties of one and the same butterfly; but he is unable to determine whether the modification of the facies of dry-season forms is due to protective mimicry, or whether it is the mere sympathy of organisms with their surroundings. Details are given as to a number of species, and it is urged in conclusion that the identification of species can best be aided by paying the utmost attention to dates of capture, with due regard to the character and climate of the country the butterfly may have come from. The present system of adding species to species on the mere ground of some slight modifications of the markings of the upper or under side, and sometimes on the strength of one or two examples, is most misleading.

Secretion of Potassium Hydroxide.‡—Mr. O. H. Latter has some further notes on the secretion of potassium hydroxide by *Dicranura vinula*, and similar phenomena in other Lepidoptera. He finds that the imagines of eight species secrete from the mouth an alkaline fluid on emerging from the pupa. The three species of *Dicranura* wear what is called a shield, derived from the pupa-case as they emerge, and they

* Amer. Natural., xxix, (1895) pp. 709–19 (10 figs.).
† Trans. Entomol. Soc. Lond., 1895, pp. 413–28. ‡ Tom. cit., pp. 399–412.

subsequently remove it by their legs. He finds that the strength of the solution in *D. vinula* is about 1·4 grm. of potassium hydroxide in every 100 ccm. of liquid. The mesenteron of the same species develops an anterior dorsal diverticulum for storage of the alkali during pupal life.

Scales of Lepidoptera.*—Dr. A. Spuler discusses the structure, coloration, and evolution of the scales of Lepidoptera. Throughout the whole ortho-neuropterid stem there are the same two kinds of structures—spines and scales—on the wings, and the hair-scales of Trichoptera correspond to the scales of Lepidoptera. The wing-covering in Trichoptera is phyletically the older; it is closely approached by the scales of some Psychidæ. There is a gradual series from the less differentiated families to the diurnal butterflies with parallel lateral margins and deep sinus. Not unfrequently the characters of the scales afford hints as to relationship, but they must be taken in connection with other characters. An interesting critical discussion of recent researches on the colouring of insects is included in the paper.

Guests of Ants and Termites.†—Herr E. Wasmann describes some new Brazilian forms. In his introduction he distinguishes true guests (*Myrmecoxenen*), tolerated companions (*Synœketen*), hostile intruders (*Myrmecophagen*), and parasites; and he gives some strange cases of higher animals found in association with the nests. The guests described belong to the Cicindelidæ, Carabidæ, and Staphylinidæ. Dr. Forel adds a note on three new species of Brazilian ants.

From Wasmann's abundant results we may cite the following:—There is no regular colour-resemblance between any *Eciton*-guest and its host, for the simple ocelli of *Eciton* appreciate colour but little, if at all. When the ecitophilous Staphylinids are compared with their hosts as regards form, sculpturing, hairs, and the like, three types are distinguishable. There are mimetic types, indifferent types, and protected types (*Schutzdach Typus*); the last having a covering which is not readily gripped. The small guests, approaching the size of the smallest workers among their hosts, are most readily mistaken; the larger guests show specialisations of mimicry, e.g. in having similar antennæ. Similarity of sculpturing deceives both touch and sight. In short, the peculiarities of the guests must be interpreted in the closest correlation with the peculiarities of their hosts, viz. more or less blindness, extreme fineness of touch, and wild, restless life.

Notes on Species of Melipona.‡—Dr. H. Stadelmann describes three new African species, *Melipona togoënsis* and *M. africana* (belonging to the *Trigona* group), and *M. Schmidti* (belonging to the *Tetragona* group). In the nest of the first-named there are twelve horizontal webs, each of one layer of cells, and there are spaces, possibly for storage, between the webs and the papery sheath of the nest. Another nest showed the oval honey-pots, larger than the brood-cells, but homologous with them, and containing either honey or pollen. A special tube runs as usual from the nest to the external opening. The material out of which the nest is built contains 28·66 per cent. of stuff insoluble in chloroform

* Zool. Jahrb. Abth. Anat., viii. (1895) pp. 520–43 (1 pl.).
† Verh. K. K. Zool.-Bot. Gesellsch. Wien, xlv. (1895) pp. 137–79 (7 figs.).
‡ SB. K. Akad. Wiss. Berlin, 1895, 615–23 (3 figs.).

(clay, sand, wood-particles), and 71·34 per cent. of stuff soluble in chloroform (wax mixed with resin).

Luminosity of Phosphænus hemipterus.*—Dr. C. Verhoeff finds that the larvæ as well as the nymphs and imagines (of both sexes) have a pair of luminous spots on the pleural membranes of the eighth abdominal segment. In *Lamprorhiza splendidula*, the larva, nymph, and female imago have three corresponding pairs of spots, to which a fourth and fifth pair are added in the nymph stage. The larva of *Lampyris noctiluca* agrees with that of *Phosphænus hemipterus* as regards luminous spots. In all cases, the luminosity requires to be incited by a nervous stimulus.

Mexican Jumping Bean.†—Mr. F. L. Harvey gives an account of the Mexican jumping bean which is often exposed for sale as a curiosity. Those who have seen this bean know that it is able to execute short leaps forward, or even turn over by a sideway movement. These animated curiosities are the product of the plant belonging to the Spurge family which is known as *Sebastiania bilocularis.* If some of them are put in a box and examined the following season, their movements will be found to have ceased. Small holes will be found in the seeds as though something had gnawed itself out. In the bottom of the box small moths will be found. If the beans are opened while still active, each will be found to have a larva snugly tucked away in its interior. The worms do not entirely fill the space that was occupied by the seed, and by suddenly changing their position they are able to give movement to the light seed pods which they occupy. The moth which escapes from them is known as *Graptolitha sebastianæ* of Riley.

Action of Gases on Eggs of Insects.‡—Prof. E. Perroncito and Dr. G. Bosso have experimented on the action of chlorine vapour, bromine vapour, carbon disulphide, carbonic acid, coal gas, &c., which are in various degrees injurious.

γ. Protracheata.

Peripatus insignis in Tasmania.§—Prof. Balwin Spencer was fortunate in finding 15 specimens of this species in one locality in Tasmania. One point to be noticed is the large size of the specimens as compared with those of the mainland, a feature not unfrequent in the case of other forms of life common to Tasmania and the continent. Whereas the Victorian specimens measured about 11 mm. in length and 1 in greatest breadth, the Tasmanian forms measured as much as 23, 17, and 15 mm. in length and 4 or 3 in breadth. The discovery of *P. insignis* in Tasmania is another proof of an alliance between that island and the south-eastern part of Australia.

δ. Arachnida.

Development in Spiders.‖—Dr. F. Purcel has some short notes on the development of the lungs, entapophyses, tracheæ, and genital ducts

* Ver. Nat. Ver. Rheinlande, li. (1894) pp. 208–13.
† Amer. Natural., xxix. (1895) pp. 767–9.
‡ Giorn. Med. Vet. Pratic. Torino, xliv. (1895) pp. 297–301.
§ Proc. Roy. Soc. Victoria, vii. (1895) pp. 31 and 2.
‖ Zool. Anzeig., xviii. (1895) pp. 396–400 (2 figs.).

in spiders. He points out that the significant fact that the earliest lung-leaves appear on the exposed posterior sides of the appendages before the latter have commenced to sink below the surface into the body, has hitherto escaped the notice of investigators. The presence of rudimentary genital tubes tends to show that the genital ducts had originally some other function, and the similarity of their development with that of the coxal glands in Arachnids generally indicates their nephridial origin.

New Sound-producing Organ in a Spider.*—Mr. R. I. Pocock gives a short account of a new type of sound-producing organ which he has discovered in *Cambridgea antipodiana*. Upon depressing the abdomen and looking at it from the front a large cave-like hollow may be noticed. The roof of this excavation is hairless, smooth, and horny, and is sculptured out into a series of six strong transverse ridges. The scraper that rubs against these ridges is a large heart-shaped tooth that rises from the anterior of the two sclerites which strengthen the upper surface of the pedicel. In its position and in some of the details of its structure this new organ resembles the sound-organ of the stridulating Theridiidæ (*Steatoda*). A further resemblance between this new organ and that of the genus just mentioned consists in its being confined to the male.

Spinning-glands in Phrynus.†—Mr. H. M. Bernard adds to his description of the spinning-glands in *Phrynus* an account of the so-called "penis" and of the morphology of the operculum. Two points may be noticed. The first abdominal segment has a pair of spinning-glands, and is provided with a pair of rudimentary appendages. These appear to have been retained, not only as a genital organ, but as a pair of nippers for dragging about the cocoon spun from the glands they contain. In other forms cement or spinning-glands occur on every segment, and a series may be set out in which a pair of spinning or cement glands is found on each of the first five abdominal segments. This long series of glands, with all their variations of position and specialisation, leads almost obviously to the conclusion that the common racial form of the Arachnids consisted of a number of but slightly differentiated segments, and could not have been an animal with a highly specialised segmentation, such as a *Limulus* or a Eurypterid. With the evidence before him Mr. Bernard comes to the conclusion that the genital operculum of the Pedipalpi is clearly an acquirement within the Arachnidan phylum, and is not, as Laurie claims, a primitive feature inherited from Eurypterine ancestors. Whenever among the vestiges of limbs on the abdomen we get anything more than a flat scale-like structure, it is not a leaf-like limb at all, but a typical filamentous, and sometimes jointed appendage. From this Mr. Bernard concludes that the scale-like opercula on the Arachnida have no connection whatever with the leaf-like limbs of *Limulus*. The latter are most probably persistent phyllopodan limbs, while the former are the vanishing remains of jointed filamentous limbs.

Stylogamasus lampyridis.—M. P. Mégnin and Dr. E. Trouessart ‡ separately make severe remarks on M. A. Gruvel's account of a parasite

* Ann. and Mag. Nat. Hist., xvi. (1895) pp. 230–3 (2 figs.).
† Journ. Linn. Soc., xxv. (1895) pp. 272–8 (1 pl.).
‡ Bull. Soc. Zool. France, xx. (1895) pp. 178 and 179–80.

of *Lampyris*.* M. Mégnin even doubts whether M. Gruvel has read the papers by him which the latter cites, and Dr. Trouessart is of opinion that the nymphs which M. Gruvel found belong either to the genus *Poliaspis* or *Discopoma*.

Browning of Leaves of Foliaceous Plants by Phyllocoptina.†—That diseases of leaves are caused by Gall-mites has been known to Herr D. von Schlechtendal for the past twelve years, though it is only since the beginning of this discussion that Nalepa showed that the browning was caused, not by one species of gall-mite, but that almost every tree had its own specific irritant. The disease, browning of the leaves, has recently spread rather extensively in the vicinity of Halle, and on the most important of the affected plants the author has made some observations.

(1) *Æsculus Hippocastaneum* L., browning of the leaves by *Tregonotus carinatus* Nal. Besides the gall-mites, there were frequently numerous colonies of "red spiders."

(2) *Æsculus rubicunda* Lois. was infected with *Phytopta*, not a leaf being free from mites.

(3) *Corylus Avellana* L. by *Phyllocoptes comatus* Nal.

(4) *Fraxinus excelsior* L. by *Phyllocoptes epiphyllus* Nal.

(5) *Pirus communis* and *Malus* L. by *Phyllocoptes Schlechtendali* Nal.

(6) *Prunus domestica* and *P. cerasus* L. by *Phyllocoptes Fockeni* Nalepa and Trouessart.

(7) *Rosa canina* L. by *Callyntrotus Schlechtendali* Nal.

(8) *Tilia platyphyllos* Scop. by *Phyllocoptes Balléi* Nal.

Citigrade Spiders of Russia.‡—Herr P. Schmidt discusses 58 species of Citigrade Russian spiders, of which three are new, 12 new to Russia, and some others hitherto incompletely diagnosed. In the list of 104 Russian Citigrades, 37 are only known from Russia. The Citigrade spiders are of course characteristic of flat lands, steppes, and deserts, which abound in the Russian Empire.

ε. Crustacea.

Carcinological Fauna of India.§—Dr. A. Alcock has published the first of a series of papers, in which he hopes to be able to turn to some account the mass of material accumulated by the late Prof. Wood-Mason. Commencing with the *Brachyura oxyrhyncha*, he naturally has made much use of the work of Mr. E. J. Miers, although he is not able to give his complete adherence to the classification proposed by that carcinologist. As Miers himself remarks, every reasonable gradation of form is to be seen from *Stenorhynchus* to *Pericera*, and to divide such a group into families involves, the author thinks, unnecessary and unphilosophical interference with the meaning of the term "family." He adds, and it is quite true, that nothing is gained, from the point of view of the practical systematist, by establishing families which overlap in all

* See this Journal, *ante*, p. 525.

† Zeitschr. f. Pflanzenkrankh., v. (1895) No. 1. See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 600–2.

‡ Zool. Jahrb. Abth. Syst., viii. (1895) pp. 439–84.

§ Journ. Asiatic Soc. Bengal, lxiv. (1895) pp. 157–291 (3 pls.).

directions. Mr. Alcock's work ought to prove of great value to students of this division of the Animal Kingdom.

Stalk-Eyed Crustacea of the 'Albatross.'*—Mr. W. Faxon has a report on the stalk-eyed Crustacea collected during the voyage of the 'Albatross' in 1891. After a systematic account of the species, a number of which were found for the first time by this expedition, the author proceeds to some general considerations on distribution. The route of the 'Albatross' extended over 29 degrees of latitude, and the bathymetrical range explored was very great, extending as it did to 2232 fathoms. Although there is no definite line dividing the littoral from the deeper fauna, it is convenient to consider them separately. All writers have recognised that the temperature of the sea is the chief factor which governs the distribution of marine Crustacea. It is true, as Gill well says, that the relations between the littoral marine faunæ in a longitudinal direction are traversed and complicated by relations existing in a latitudinal direction. This is due to the easy routes of migration afforded by the great coast lines and from the dispersal of the larvæ of tropical species northward and southward by the deflected equatorial currents. On the whole, however, the change of temperature has proved a barrier to the spread of tropical littoral species northward. Every summer myriads of delicate larvæ are borne on the warm bosom of the Gulf Stream to the southern shores of New England, only to perish on the approach of the northern winter. Littoral species of the cold and temperate zones have this advantage over tropical types in the matter of distribution on north and south lines, that the temperature of the sea rapidly falls in passing from the surface downward, so that even under the equator a temperate degree of heat is found at a moderate depth. Avoiding the fatal heat of the tropics certain species of the temperate zones have actually passed under the equator and invaded the opposite hemisphere. This, of course, has been already remarked by students of other groups than Crustacea.

A list is given of the similar littoral species of the Panamian and Caribbean provinces. Few of the characteristically Indo-Pacific genera are found in the Panamian province. Below the littoral zone there lies a belt extending, say from 150 to 500 fathoms, which forms a sort of debatable ground, invaded, on the one hand, by littoral types from above, and, on the other, by characteristic deep-sea forms from below.

A list of the genera found below the 500 fathom line shows the enormous, even cosmopolitan, distribution of deep-sea types and their lack of special affinity with the nearest littoral fauna. This is shown by a comparative list. Deep-sea Crustacea do not seem to be divisible into subordinate local provinces, like those of the littoral and terrestrial faunæ. It is manifestly illogical to assume, as some have done, that because a certain form is now restricted to deep water the rocks in which it occurs as a fossil were deposited at a similar depth. The surviving representatives of an ancient shallow water type may be littoral, as in the case of *Limulus*, or they may be found only in deep water, like the recent *Eryontidæ*. Some unquestionable bottom-living species at the present day have a vertical distribution of 2000 fathoms. The small

* Mem. Mus. Comp. Zool., xviii. (1895) 292 pp., 56 pls., 1 map.

number of ancient types of Crustacea preserved in the great depths of the ocean is not a subject for wonder, if we bear in mind the fact that most of the fossil Crustacea known to us are probably littoral, or from the present point of view, shallow-water forms. Changes in environment to be met and overcome by a highly specialised littoral species in adapting itself to life at great depths, are presumably as great and lead to such structural modifications as those encountered by the littoral descendants of ancient species through the vicissitudes of the shore. As an example the author instances the family *Galatheidæ*. In some instances the more primitive types of Crustacea flourish in the sub-littoral or intermediate depths, while the most highly specialised forms are more characteristic of the very shallow waters. Such is the case with the *Paguridæ*. Doubtless in certain groups of lowly organised animals many species cast in the antique mould survive in the abyssal depths of the ocean, but not highly specialised forms like the stalk-eyed Crustacea, beings endowed with visual and respiratory organs of a very perfect grade. The peculiar conditions that surround the dwellers of the deep work great structural changes; not only the visual organs become lost, but the antennæ and anterior parts of the body generally undergo changes. The purity of the water in these still regions even leads to a more or less complete disappearance of the gill-scrapers. Thus it comes about that the Crustacea living at a great depth are apt to be rather specialised types further removed from the primitive ancestral stock than are the allied species of the shore.

Taking the animal kingdom as a whole, it is probable that the archaic forms now extant in the shallow waters of the land or coast, or in the moderate depths below the strictly littoral zone, far outnumber those surviving in the extreme depths of the sea. *Heterodonta*, the Ganoid Fishes, *Limulus*, *Trigonia*, and *Lingula* are all peculiar to shallow waters; so are the *Unionidæ* of our rivers and ponds. *Nautilus* comes from very moderate depths. *Pteropoda* attain their maximum development in from 50 to 250 fathoms. The wonderful Crinoid fields lie at a depth of but 50 to 200 fathoms beneath the surface.

By Prof. Agassiz's direction coloured drawings of many of the Crustacea secured during the cruise were made, and some of them are reproduced in some of the beautiful plates which illustrate this memoir. It appears from a systematic tabulation of notes on colours that a general tendency is manifested among the Crustacea from deep water to assume red tints, which pass through various shades of pink, orange, and yellow to straw colour and ivory white.

We have indicated but some of the many interesting points which are brought out in Mr. Faxon's memoir, and we regret that our space does not enable us to deal more fully with this most interesting contribution to Carcinology.

Sensory Organs of Amphibious Decapods.*—Prof. C. W. S. Aurivillus has an interesting article on the relations of the sensory organs of amphibious Decapods to their mode of life and respiration, which we regret we have not been able to notice before. The author discusses in some detail the characters of the genera *Dotilla*, *Ocypoda*, *Gelasimus*,

* Nova Acta. Reg. Soc. Scient. Upsal., xvi. (1893) Art. No. 9, 48 pp., 3 pls.

and *Myctiris*. He then proceeds to compare these amphibious Decapods with other non-amphibious forms from the temperate seas. In comparing them with the common crab, he points out how differently the appendages are articulated to the body, and how the peculiar setæ which are found on the lower parts of the body of amphibious forms are altogether wanting in *Cancer*. There are differences also in the form of the carapace, in the meropodites of the walking feet, and in the characters of the forceps. Comparison is then instituted between the amphibious forms and *Hyas araneus*, and also *Nephrops norvegicus*. These examples of exclusively water-breathing Crustacea of various families show that the morphological peculiarities of the amphibious forms are independent of one another, but that they are due to their special modes of life. In conclusion, Prof. Aurivillus discusses in a general way the morphological peculiarities of the amphibious forms, and shows how great has been the influence of their mode of life on various parts of their bodies.

Crangonidæ.*—Mr. A. E. Ortmann has made a study of the systematic and geographical distribution of this family of Decapods, which is a true marine group characterised by the adaptation of most of its members to the cold water of the Arctic and deep-sea regions. The absence of the group from Tertiary deposits agrees with their morphological characters and their supposed recent development. The genus *Pontocaris* is, no doubt, the most primitive of the family in regard to the sculpture of the carapace, the number of gills, and the shape of the second pair of walking limbs; from it arise two divergent branches. The author gives a technical definition of the family and of the genera, together with full details as to the geographical distribution of the species. The regions of life in which Crangonidæ are found are the littoral and the abyssal. These habits admit of a universal distribution of the family, but the genera and species are more restricted. The littoral species especially are confined by barriers, and only a few species are adapted to the warmer seas. By adaptation to a cooler temperature a large number of these Crustacea are able to descend to greater depths, and, thanks to this habit, they may enter and cross the tropics in the deep sea. The species adapted to greater depths show, as is usual, a very large horizontal range. Only the true Arctic species are able to live along the most northern shores of America and Asia, and so show a circumpolar distribution. On the shores of the Atlantic and Pacific, however, nearly allied species are sometimes found. These must be derived from common ancestors living when the Arctic Ocean was not so cold as at present. Later these species retreated more southwards, and by the topical separation of their range the morphological characters would change, and distinct forms be developed. Within the limits of the Arctic region we can distinguish three sub-regions:—(1) The Arctic circumpolar. (2) The Atlantic boreal. (3) The Pacific boreal. The Arctic littoral region is the centre of origin of the family, and the centre of its development.

Otocysts of Mysis.†—Herr A. Bethe discusses these structures, which occur, as is well known, in the root of the median caudal appendages.

* Proc. Acad. Philad., pp. 173–97.
† Zool. Jahrb. Abth. Anat., viii. (1895) pp. 544–64 (1 pl.).

Unlike Hensen, who previously described the organs, Bethe finds a distinct opening in the cyst. He describes the statolith minutely, and proves the presence of calcium fluoride instead of the usual calcium carbonate. After describing the basal cushion, the sensory hairs, and the innervation, he corroborates Hensen's discovery of free sensory hairs outside the cyst. The otocyst developes as an invagination of epithelium, and its function is experimentally shown to be equilibrating, though an auditory function is not excluded.

Spermatogenesis of Telphusa.*—Dr. M. Muri describes the main stages in the spermatogenesis of this freshwater crab. He finds them closely parallel to those in *Astacus fluviatilis*, which he attributes rather to similarity of conditions than to relationship.

Luminosity of Metridia longa Lubb.†—Dr. Vanhöffen observed the luminosity on the head or neck, and on the abdomen over the furca. Sometimes the whole body seemed bluish. The living animal is colourless, excepting two moss-green spots on the posterior part of the head, and sometimes other spots at the end of the abdomen. It is therefore likely that these are the luminous glands.

Vertical Distribution of Lacustrine Crustacea.‡—Prof. O. Zacharias has paid particular attention to the autumnal distribution of *Cyclops oithonoides*. Towards autumn the vertical distribution becomes more uniform, and gradually the deeper strata show approximately the same numbers as those above. The microscopic plants of the surface are dying off, and sinking as a shower of nutritive particles, so that there is suitable food at all strata.

Independence of the Paternal and Maternal Nuclear Substance in Early Stages of Development of Cyclops.§—Herr J. Rückert maintains that in the early cleavages of *Cyclops* there is no mingling of the paternal and maternal halves of the nucleus, in at least some of the nuclei. The chromatin retains its original distribution in spite of repeated mitoses and active metabolism. The nucleus is symmetrically divisible into a paternal and a maternal half.

Zoological Position of Trilobites.‖—Mr. H. M. Bernard, who has from time to time contributed technical memoirs on the much-disputed subject of the zoological position of the Trilobites, has a more popular article in which he summarises recent facts bearing on the problem. He thinks there is now ample evidence to demonstrate once for all the affinities of the Trilobites to *Apus*, as common derivatives of an annulate ancestor from which neither is far removed.

Annulata.

Generative Organs and Products of Tomopteris.¶—Dr. J. H. Fullarton describes *Tomopteris onisciformis* Eschscholtz. The sexes are separate, the females much more numerous than the males. Testes

* Boll. Soc. Entomol. Ital., xxvi. (1895) pp. 3–10 (3 figs.).
† Zool. Anzeig., xviii. (1895) pp. 304–5.
‡ Biol. Centralbl., xv. (1895) pp. 686–8.
§ Arch. f. Mikr. Anat., xlv. (1895) pp. 339–69 (2 pls.).
‖ Science Progress, iv. (1895) pp. 33–49.
¶ Zool. Jahrb. Abth. Anat., viii. (1895) pp. 425–46 (3 pls.).

occur on the endothelium of all the parapodia which are distinctly biramose; in the mature males there are 4–5 pairs of seminal ducts, expanded into seminal vesicles, and probably modified nephridia, each with an external aperture and an opening into the body-cavity. The ovaries also occur in the forks of the lateral parapodia; the ova ripen in the body-cavity and are there fertilised. The female genital apertures are two pairs of transverse slits immediately in front of the nerves given off from the neural cord to the fourth and fifth pairs of parapodia.

Spermatogenesis of Earthworm.*—Dr. W. Voigt notices the occurrence of a distinct peritoneal membrane around the testes which Blomfield described as naked. The spermatogemmæ are first liberated in the 8-cell stage. Although the cytophore has no nucleus, and is probably not a cell, the *apparent* presence of nucleus or nuclei may sometimes be observed. The author also describes twin spermatogemmæ, and some other details.

Tasmanian Earthworms.†—Prof. Baldwin Spencer has published preliminary notes on Earthworms collected in Tasmania. The same three genera to which the Australian species are provisionally referred are all represented in Tasmania, but Prof. Spencer shows that it will be necessary to revise the classification, when the collections of Mr. Fletcher and himself are sufficiently complete and described. The zoologist just named has already described *Megascolides tasmanianus*, and to this single earthworm Prof. Spencer adds two more species of *Megascolides*, six of *Perichæta*, and ten of *Cryptodrilus*. Doubtless there must be very many yet undiscovered, especially in the well-watered valleys on the west coast of the island; but so far as is yet known the earthworm fauna of Tasmania is not so extensive as that of Victoria or New South Wales.

Regeneration in Earthworms.‡—Herr B. Friedlaender has made many experiments, the main results of which are the following:—Earthworms may regenerate not only a number of anterior or posterior segments, but supra-œsophageal ganglia and other parts of the central nervous system. The cut stumps elongate until the breach is closed; the "regeneration-tissue" consists apparently of compact masses of leucocytes into which the new growths make their way; the healing growths all show a reduced diameter, and there are frequent variations, such as a double brain, or a multiplication of Leydig's giant fibres. Apart from Leydig's fibres, which the author, as previously recorded, regards as comparable to the medullated nerve-fibres of Vertebrates, there are traces of medullary sheaths in some of the ordinary fibres of the ventral cord; in fact, no sharp line of distinction can be drawn between medullated and non-medullated fibres. Many of the earthworms were infested with a Nematode, probably *Pelodera pellio*, in the regeneration-tissue and body-cavity, while others of a different species occurred in the main ventral blood-vessel.

Distichopus.§—Mr. J. Percy Moore gives some welcome information on this genus of Enchytræid worms. The genus was first described by

* SB. Niederrhein. Ges. Bonn, 1894, pp. 76–80.
† Proc. Roy. Soc. Victoria, vii. (1895) pp. 33–54 (5 pls.).
‡ Zeitschr. f. wiss. Zool., lx. (1895) pp. 249–83 (2 pls.).
§ Amer. Natural., xxix. (1895) pp. 753–6.

Leidy, but as no information was afforded regarding its internal structure, European students have been in doubt as to where to place it. The author finds that Michaelsen was, even if by accident, right in placing *Distichopus* next to *Fridericia*. The form of the setæ is easily derived from the straight internally-hooked type of *Fridericia*, while their arrangement in bundles is even more characteristic of the Friderician plan. The post-clitellar region of the dorsal vessel, the colourless blood, the two kinds of peritoneal corpuscles, the large size and branched arrangement of the salivary glands, the simple alimentary canal, the character of the male ducts and of the nephridia, are all points which these two genera possess in common. The absence of dorsal setæ from *Distichopus* is not, in the author's opinion, any reason for regarding it as allied to *Anachæta*.

Yolk-Nucleus in Eggs of Lumbricus.*—Mr. G. N. Calkins discusses the nature of the so-called *Dotterkern*. He commences with acknowledging that a more explanatory name might be given to the yolk-nucleus, for it is not a nucleus, and the only excuse for the use of the term is the time that it has been before us. As is well known, two very divergent explanations have been given as to the origin of the yolk-nucleus, some having said that that origin is cytoplasmic, and others that it is nuclear. Mr. Calkins comes to the conclusion that in *Lumbricus* it is not only of nuclear origin, but it is derived from the chromatin; in fact, the yolk-nucleus may be said to be chromatin in the form of a mass of granules; this granular mass disintegrates, and the parts form the yolk-plates of the egg after undergoing change in their chemical composition.

Two new Lumbricidæ from North America.†—Dr. H. Ude gives short descriptions of two new species of earthworms from North America, fuller descriptions of which will be published later on. *Allolobophora Gieseleri* was found at Savannah. The dorsal vessel has five pairs of lateral hearts, and the enteric canal has in the eleventh and twelfth segments an enlargement of its wall, in the folds of which there are calcareous crystals. *Diplocardia verrucosa*, from Nebraska, has an enteric canal with a double muscular stomach.

Nemathelminthes.

New Variety of Heterodera Schachtii.‡—Dr. W. Voigt describes a dwarf variety of this common parasite, found by Mr. Percival on the roots of hops in Kent. It appears to be an instance of particular adaptation to new conditions, and there are other similar cases.

Filaria labiata.§—Dr. M. C. Francaviglia has made a detailed study of *Filaria labiata* Creplin, hitherto incompletely described. The male occurred on the pericardium, the female on the crop, of the black stork.

Strongylus subtilis.‖—Dr. A. Looss gives an account of a hitherto unknown nematode parasite found in man in Egypt. It was discovered by

* Trans. New York Acad. Sci., 1895, pp. 222–30 (5 figs.).
† Zool. Anzeig., xviii. (1895) p. 339.
‡ SB. Niederrhein. Ges. Bonn, 1894, pp. 94–7.
§ Boll. Soc. Rom. Zool., iv. (1895) pp. 93–108.
‖ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 161–9 (1 pl.).

the microscopical investigation of the contents of the intestine of corpses both in Alexandria and in Cairo. The worm is extraordinarily fine and delicate, and never more than a few individuals were found at once, the females being more common than the males. In all cases these parasites were confined to dwellers from the plains. The male has a length of from 4 to 5 mm., and the thickest part of its body has a transverse diameter of only ·07 mm. The female is from 5 to 7 mm. long, but is nowhere quite as much as ·1 of a millimetre wide. The author gives a sufficiently detailed account of the anatomy of this worm, which appears to be of no special pathological significance, as few representatives are found in any one body.

New Nematode.*—Under the name of *Strongylus affinis* M. P. Mégnin describes a new Nematode found in *Dolichotis patagonica*, where it appears to produce a true gastritis which leads to death. On the whole, the new species would appear to be closely allied to *S. strigosus*.

Nematode Larvæ.†—Dr. R. S. Bergh has made a valuable *résumé* of the recent knowledge which has been made public by Braem, Korschelt, Haecker, and Bèraneck on *Ophryotrocha* and the Nematode larvæ. These memoirs have already been noticed in this Journal, and it is sufficient to call attention to this general review of the subject.

Embryos of Anguillula stercoralis in the Blood of Man.‡—M. P. Teissier has proved the presence of these embryos in the blood of a man who had lived long in Guiana. He had suffered from anæmia, diarrhœa, and intermittent fever. Many of the Nematodes at all stages were also found in the fæces. The fever ceased as treatment lessened the vitality of the parasites, and when the fever had ceased, the embryos were found to have disappeared from the blood. The facts are of interest in connection with fevers in hot countries.

Platyhelminthes.

Dactylocotyle.§—M. P. Cerfontaine, in continuation of his studies on Trematodes,‖ gives now a monographic account of another genus of the monogenetic forms. These investigations are of some importance, as the earlier examination of Trematoda was made before there was any possibility of rendering them transparent. Four species have been studied, and a full account is given of *Octobothrium denticulatum*. Perhaps special attention may be drawn to the account of the nervous system. The genera *Dactylocotyle*, *Octobothrium*, and *Pterocotyle* appear to be synonymous, and the first of these bears the name which should stand.

Stichocotyle nephropis.¶—Mr. W. S. Nickerson found encysted in the rectal region of the American lobster the parasite which Mr. J. T. Cunningham discovered (1884) in a similar position in *Nephrops norvegicus*. Out of 100 lobsters, two were infected, one with 60–70

* Bull. Soc. Zool. France, xx. (1895) pp. 173–6 (1 fig.).
† Zool. Centralbl., ii. (1895) pp. 257–63.
‡ Comptes Rendus, cxxi. (1895) pp. 171–2.
§ Bull. Acad. Belge, lxv. (1895) pp. 913–46 (2 pls.).
‖ See this Journal, *ante*, p. 536.
¶ Zool. Jahrb. Abth. Anat., viii. (1895) pp. 447–80 (3 pls.).

worms, the other with one. The body is elongated, cylindrical, tapering posteriorly; there are 7–22 suckers in a mid-ventral row; the pharynx is of medium size, the intestine simple and tubular, extending to near the posterior end; the genital orifice is median, and ventral, in front of the anterior sucker; there are two testes, in the middle region of the body, situated dorsally, one on either side of the intestine; the ovary is nearly median, ventral to the intestine, in front of the testes, with an oviduct to the right; yolk glands lie dorsally and posteriorly, and the duct passes on the right side to the oviduct; the excretory pore is dorsal and posterior, the excretory vesicle forms two broad convoluted tubular trunks on each side of the intestine as far as the pharynx. The life-history and the adult form (perhaps in cat-fish or the like) are quite unknown.

The Diclidophorinæ.*—M. P. Cerfontaine has found on the gills of *Labrax Lupus* a new species of *Diclidophora*—*D. Labracis.* He proposes to define a sub-family Diclidophorinæ, within the family Octocotylidæ, and including *Diclidophora* (Goto), *Cyclobothrium* (Cerf.), and *Heterobothrium* (Cerf.). These are characterised by the eight cupule-like suckers, each of which has a cruciform chitinous framework at its base. In *Diclidophora*, the suckers are stalked, the anterior suckers communicate widely with the buccal cavity, the alimentary canal anastomoses posteriorly and sends a ramification towards each sucker, the genital bulb has a crown of hooks with double points, the testes lie behind the ovary which has the form of a capital N with the left side most developed, the genito-intestinal canal opens into the right branch of the intestine at the level of the anterior part of the ovary, the seminal vesicle is median in front of the ovary.

New Trematode.† — Dr. G. Brandes describes *Fridericianella ovicola* g. et sp. n., which was found on the eggs of a Brazilian fish—*Arius Commersoni* Lac.—famous for the manner in which the male hatches the eggs in his mouth. The new parasite seems to be most like *Calceostoma*, a genus of Gyrodactylidæ, but it is in some ways very distinct. It measures 4–5 mm. in length by 1–2 mm. in breadth; the anterior and posterior poles are slightly swollen, the latter bearing a terminal sucker, the former two glandular lateral pads. But most characteristic is a glandular and nervous pad projecting medianly on the right side of the body.

Echinococcus multilocularis of the Brain.‡—Dr. M. Bider describes a case of *Echinococcus multilocularis* of the brain which occurred in a butcher, 53 years old, of the canton of Thurgau. The parasite was found in the right frontal lobe. The typical membranes, hooklets, and head, which were very frequent in a cyst the size of a pea, but less so in three smaller cavities, left no doubt about the diagnosis. The multilocular character of the bladder-worm was also clearly manifested. The connection between the parasite and the blood or lymph vessels was not demonstrable. A comparison between the hooklets of the

* Bull. Acad. R. Belg., xxx. (1895) pp. 125–50 (1 pl.).
† Abh. Nat. Ges. Halle, xx. (1894) pp. 305–10 (1 pl.).
‡ Virchow's Arch. f. Pathol. Anat. u. Physiol., cxli. (1895) 27 pp., 1 pl. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 211–2.

unilocular and multilocular forms showed that there were not inconsiderable deviations from the general shape, and in special dimensions of individual parts; on the whole, however, the question remains open, whether *E. multilocularis* and *E. unilocularis* are to be regarded as bladder conditions of two different species of *Tænia* or not. The explanation of the peculiar geographical distribution of multilocular Echinococci is very difficult, for the parasite is most common where the unilocular form is a rarity. South Germany and Switzerland have produced five-sixths of all known cases of *E. multilocularis*.

Rotifera.

Cypricola parasitica.*—Dr. E. v. Daday describes an interesting new form of parasitic Rotifer under the above name. As the generic name denotes, the parasite was found on the body of a species of *Cypris*. The body of the Rotifer is undivided and unjointed, and the wheel-organ is simple. There is no foot. The covering of the body is soft. The unpaired ovary lies on the ventral surface. The genital orifice is near, but separate from, the anal, and is provided externally with a cuticular ring, and internally with several glands. The eggs are stalked. While this form appears to be parasitic it is to be remembered that it is difficult to distinguish accurately between ecto-parasitism and symbiosis.

Species-making among Rotifers.†—Herr T. Sniezek protests against a tendency to multiply prematurely the species of Rotifers. They are very variable animals, as is exceedingly well illustrated by some species of *Brachionus*, *Anuræa*, and *Notholca*. In illustration of *voreilige Species-fabrikation* he discusses Lauterborn's *Brachionus rhenanus*, Skorikow's *B. cluniorbicularis*, and France's *B. Entzii*, which he thinks have hardly even the rank of varieties.

Echinoderma.

Metamorphosis of Echinoderms.‡—Mr. H. Bury, who has for a long time been engaged in the study of the development of Echinoderms, brings together a number of facts which he thinks it is time to publish. Dealing first with Holothurians, he describes the metamorphosis of *Synapta*, the investigation of which appears to require a good deal of care and patience. Changes occur with such rapidity as to necessitate a rigorous search every day for signs of those that are impending. Development was much slowed down by keeping the larva in cold water, and in this way Mr. Bury was able to obtain all the intermediate stages without resorting to 24 hours' consecutive watching. Among true Star-fishes two very distinct types of development occur, and between them there do not appear to be any connecting links. The most marked difference lies in the behaviour of the larval oesophagus, which survives in the adult in one form, but is replaced by an entirely new one in the other.

The former includes the larva of *Asterina*, which is well known from the researches of Ludwig and MacBride. The other type, represented by *Bipinnaria asterigera*, has hitherto been but little investigated. In

* Termes. Füzetek, xvi. p. 1. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 142–3. † Biol. Centralbl., xv. (1895) pp. 602–5.
‡ Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 45–135 (7 pls.).

his studies of the internal anatomy of *Echinoids* Mr. Bury chiefly made use of *Echinus microtuberculatus*. After some account of the Ophiurids and Crinoids the author passes to the second part of his essay which deals with phylogeny. The hypotheses of preceding authors are critically discussed, and an attack is made on the almost universal method of deriving all existing forms from the Cystidea. The author thinks that if palæontologists have really proved beyond any reasonable doubt that the Echinozoa are derived from fixed forms, then ontogeny is misleading, but it is doubtful whether palæontologists have so completely established their position as to compel us to accept it. Without pursuing the subject further Mr. Bury submits that until palæontologists have produced some far more striking intermediate forms between fixed Cystids and free Echinozoa than are at present forthcoming, embryologists may be forgiven if they do not follow them. Dealing next with the bilateral ancestor, and passing on to consider the transition to radial symmetry, it is suggested that the generative organs appear to have followed the new, that is radial, symmetry at a very early period. Whether the skeleton was or was not one of the first structures to assume radial symmetry, is a question which is still too much under discussion for Mr. Bury to attempt to decide it. With regard to the origin of the Pelmatozoa Mr. Bury points out that he has good reasons for believing that the Echinozoa were never fixed by the aboral pole, and that the utmost that embryological evidence will allow of is a fixation of the bilateral ancestor by the præoral lobe. The existence of a sucker is certainly possible, though the evidence for it is weak, and the assumption of it does not appear to be necessary. It becomes therefore worth while to consider whether the supposition that the Pelmatozoa become fixed after the change of symmetry, instead of before it, is not at least as probable. Although the suggestions as to the origin of the Pelmatozoa which Mr. Bury makes are, he allows, of an extremely speculative character, and will require a great deal of evidence to support them, yet a too rigid adherence to the apparent teachings of the larva of *Antedon* is equally objectionable. It may be urged that at present we only know the development of one Pelmatozoan larva, and we have no reason for regarding this as especially primitive; on the contrary, the very early loss of bilateral symmetry in the arrangement of the body cavities, as well as the entire absence, before fixation, of either œsophagus or intestine, point most conclusively to it being a much altered form. With regard to the origin of Holothurians, the facts within our knowledge are as yet insufficient to allow us to do more than offer some cautious suggestions. Mr. Bury is inclined to the belief that this class separated off very early, perhaps even before the Pelmatozoa.

Lastly the relation of the Echinoderma to the Enteropneusta is considered, and the author claims to have established a case in favour of the homology of the dorsal sac and dorsal organ of the former with the pericardium and proboscis gland of the latter, which cannot be lightly set aside. Taking this in connection with other resemblances between the two groups we seem to have a chain of evidence of their connection which is at least as strong as that which binds together any two of the great subdivisions of the Animal Kingdom.

Excretion in Holothurians.*—M. E. Hérouard treats with some severity the recent work of E. Schultz on this subject. It is comforting however, to note that however erroneous Mr. Schultz's work may be it confirms the conclusions to which M. Hérouard has been drawn.

New Comatula.†—Mr. Jiuta Hara has found on the coast line near Misaki, Japan, a species of *Antedon* which he believes to be new and which he calls *A. macrodiscus*, belonging to the *A. milberti* group of the late P. H. Carpenter. It appears to exhibit differences from any described species which justify him in regarding it as new.

Cœlentera.

Commensalism in Madreporaria.‡—M. E. L. Bouvier commences his memoir with a note from M. Jousseaume, who collected at Aden the materials on which the work is based. This gentleman begins with referring to the error of Deshayes, who described the tube made by a worm in a coral as a new genus of mollusc. He says that he has himself found in blocks of Madreporaria worm-tubes of so great a size that he would certainly have taken them for the shell of a mollusc if he had not seen the animal. As, however, one has not always the animal to guide one, it is as well to know what are the differences between shell-tubes and worm tubes. The former are so loosely attached to their madreporic envelope that with a little patience they can always be separated from it. Those of Annelids, on the other hand, are so intimately connected by their outer layers with the madreporic mass that it is impossible to isolate them, or to obtain the smallest piece without breaking them. M. Jousseaume gives an interesting account of his experiences when collecting, and as he has been able to see the creatures alive, his opinion as to the extent of the connection between the worm and the coral is of importance. He believes that the death of one destroys for the other certain elements of vitality connected with their common life, and in this particular case he thinks that the cause is to be sought for in respiration.

M. Bouvier points out that Milne-Edwards and Haime, and not Deshayes, were the first to suppose that there was a commensalism between certain Madreporaria and Gastropod Molluscs. As is now well known, worms seize upon corals belonging to three different families, and four different species. In addition to these four now well-known forms, M. Bouvier is enabled to add a fifth—a fossil *Heteropsammia*. He comes to the conclusion that the coral and its commensal worm choose, the one for support, the other for shelter, an empty Gastropod shell. What the species of Gastropod is does not matter so long as the shell be small. The spiral tube which succeeds the shell does not belong in any way to it, but is secreted by the worm in proportion as the coral increases in size.

Two new species of commensal forms are described. One is called *Aspidosiphon heteropsammarium*, and the other *A. michelini*. The same species of coral may live commensally with either of these two species

* Bull. Soc. Zool. France, xx. (1895) pp. 161–5 (2 figs.).
† Zool. Mag., vii. (1895) pp. 115 and 116.
‡ Ann. Sci. Nat., xx. (1895) pp. 1–32 (1 pl.).

of Gephyrea. In the course of growth of the polyp and the worm the primitive shell is gradually absorbed and tubular perforations put the cavity of the tube in connection with the exterior.

Astræopora.*—Mr. H. M. Bernard has some notes on the genus *Astræopora*, as represented by the specimens in the British Museum. These specimens number altogether only 30, and may be taken to indicate the rarity of members of the genus. They fall into 14 groups, which are sufficiently distinct to rank as species, but of these 14, five only have been as yet recorded. The earliest known stage is represented by a minute plate-like growth of cœnenchymatous reticulum, not quite 3 mm. long. There is a central calicle, readily distinguished by its size, and an irregular ring of smaller daughter calicles. The whole is contained in a saucer-like epitheca, with edges bent up all round free from the substratum. Comparison with adult specimens shows that there are at least three fairly distinct methods of growth, according to which such an initial colony as that just described may develope further. Mr. Bernard has therefore divided the genus primarily according to the methods of growth. These are explanate, pulvinate, and globular. The chief characters of taxonomic value presented by the calicles are their average size, their distance from one another, the fine structure of their margins, and, when protuberant, the character of the protuberance. The most characteristic feature of the genus is afforded by the cœnenchyma. This is constructed of two elements—the costæ, which, instead of being lamellate, break up into long tapering echinulæ; the echinulæ are united with one another by regular, nearly horizontal floors. The different appearances presented by the corolla are largely due to the respective developments of these two elements. When, as in cases of rapid growth in thickness, the costal elements are most developed, the surface is highly echinulate, and the synapticular floors, on the other hand, are then often feebly developed. Again, in cases of explanate growth, the echinulæ may be feebly developed and the horizontal floors strongly. Mr. Bernard comes to the conclusion that *Astræopora* has no close relation to *Turbinaria*, and gives the reasons for his opinion. They are found indeed to differ from one another as far almost as two cœnenchymatous corals could differ, from the very outset of their respective life-histories.

Alcyonaria from Ternate.†—Herr A. Schenk continues his account of the Alcyonaria collected by Kükenthal.‡ He now describes the Clavulariidæ and the Alcyoniidæ. Three new species of *Clavularia* are described, and are called respectively *C. ternatana*, *C. inflata*, and *C. aspera*. Two already known species of *Alcyonium* are mentioned, and of *Sarcophytum* there are six new species, brief descriptions of which are given.

Gerardia.§—Mr. O. Carlgren has been so fortunate as to find spirit-preserved specimens of *Gerardia* in the museum at Stockholm. An anatomical investigation of this genus has long been ardently desired, as

* Ann. and Mag. Nat. Hist., xvi. (1895) pp. 273–81 (1 pl.).
† Zool. Anzeig., xviii. (1895) pp. 325–31.
‡ See this Journal, *ante*, p. 540.
§ Ofv. k. Vet. Akad. Förh., lii. (1895) pp. 319–34 (7 figs.).

it is now more than thirty years ago since Lacaze-Duthiers made the sole examination of its anatomy which we have. Mr. Carlgren finds that *Gerardia* is not an Antipatharian at all, but a Zoanthid, and that it closely agrees in anatomical structure with the genus *Parazoanthus*. The cœnenchym ordinarily forms a thin layer over the horny axis, being thickened at places where there are connections between the branches of the colony. The number of tentacles was found to be generally 26 or 28, though occasionally 24 were found, as in the examples investigated by Lacaze-Duthiers. The number 28 agrees with the arrangement of the septa. The ectoderm is distinct, though not as thick as the mesoglœa. In the former there are sometimes found incrustations consisting of sand-grains, sponge-spicules, Foraminifera, and the calcareous corpuscles of Gorgonids. Very rarely diatoms are found. As the mesoglœa consists of a homogeneous intermediate substance with more or less distinct connective tissue-cells, it resembles that of *Parazoanthus*. In addition there are ectodermal lacunæ and an encircling sinus in the distal part of the body. These recall the figures which Haddon and Shackelton have given of *Parazoanthus dixonii*. The circular muscles of the internal surface of the mesoglœa are feebly developed, and in the distal part there is an endodermal sphincter. In the tentacles and in the oral disc the muscles are also feebly developed. The œsophagus consists largely of supporting cells. It is continued into a conical tube which contains only the thickened part of the mesoglœa, and is only connected with the body-wall by the complete pair of directive mesenteries. The mesenteries themselves were developed as in the Zoanthids, and they agree in arrangement completely with the "macro-type." The author has not been able to find the arrangement of 24 septa described by Lacaze-Duthiers, nor are all the mesenteries complete as the figures of that author would lead us to suppose. The macro-mesenteries in the distal parts of the body are much thicker than in the more proximal, and the same appears to be true of the micro-mesenteries. Gonads were found in one individual only; they belonged to the female, and as is ordinarily the case in Zoanthids, they were developed only on the complete mesenteries. It would appear probable that not only the separate individuals in the colony are of separate sexes, but that each colony produces only male or female generative products. If this be so the genus exhibits here another point of agreement with *Parazoanthus*. Although the author speaks with reserve in consequence of the poverty of his material, he is inclined to think that the canal system is not arranged so regularly as Lacaze-Duthiers draws it. Sections of the horny skeleton show that it is made up of numerous concentric layers, but in consequence of the pressing together of the layers the arrangement is often very irregular. The small crateriform elevations figured by Lacaze-Duthiers are nothing more than small undeveloped polyps. The author gives a complete history of the views which have been held by various writers as to the systematic position of this interesting genus, and concludes with offering a diagnosis of *Gerardia* which runs as follows:—Zoantheæ with the mesenteries arranged after the macro-type form (macrocnemic Zoantheæ); sphincter diffuse, endodermal; body-wall encrusted; the ectoderm is continuous; the mesoglœa contains ectodermal canals, cell islands, and an encircling sinus. The cœnenchym secretes a strongly developed, much branched, horny skeleton. The last character is added to distinguish *Gerardia* from the genus *Parazoanthus.* The remark of Andres that the skeletal structures of *Gephyra* have no direct phylogenetic connection with the Antipatharia, but that they are dependent on physiological causes, is true also of *Gerardia.* The secretion of a more or less well developed horny lamella in the various groups of the Anthozoa is due to parallelism, and has little or nothing to do with genetic affinities.

New Rhizostomatous Medusæ.*—Mr. K. Kishinouwe describes a new species of Rhizostomatous Medusa, found near the Marine Biological Station in Mesaké. It appears to be a third species of the genus *Thysanostoma*, but it also closely resembles in general appearance the Medusæ of the genus *Crambessa.* The author agrees with Dr. von Lendenfeld that the number of marginal lobes is of little value for the determination of species; as this number varies at different stages of development, and even in different octants of one and the same individual.

Variation in Haliclystus octoradiatus.†—Mr. E. T. Browne has examined 154 specimens of this species collected at Plymouth, and found 120 to be perfectly normal and 34 to be abnormal. Some of the abnormal forms are beyond doubt good cases of congenital variation, while others are examples of imperfect regeneration of organs damaged or completely destroyed by injury. Congenital variation is usually shown by an increase or decrease in the number of organs which may either vary together or separately.

Hydroids of St. Andrews Bay.‡—The Rev. J. H. Crawford gives a list of the hydroid zoophytes now known from St. Andrews Bay. Since the first list of these animals was published by Prof. M'Intosh in 1874 several additional species have been procured. With regard to athecate forms St. Andrews with its 10 species compares unfavourably with Heligoland which has 16, and Plymouth which has 26. On the other hand, St. Andrews has 53 species of *Thecaphora*, while Heligoland has but 35, and Plymouth 36. On the whole then St. Andrews Bay takes the lead. It is possible that the poverty of *Athecata* at St. Andrews is due to insufficient search for them. Attention is drawn to the appearance in considerable numbers of *Hybocodon* in May, and *Euphysa* in August. *Steenstrupia* may yet be found if searched for at sufficient depths. The author noted it in great quantities off Shetland, after a westerly gale that stirred up the bottom. Singularly interesting and beautifully budding-forms such as *Hybocodon*, *Rathkea*, and *Codonium*, have been found.

Spitzbergen Hydroids.§—Herr G. Marktanner-Turneretscher describes the Hydroids collected by Drs. Kükenthal and Walter on their Spitzbergen expedition. The list includes the following new species:—*Laomedea* (*Gonothyrea*) *clarkii*, *Thuiaria kirchenpaueri*, *Halecium kükenthali*, and *H. septentrionale*; and the author suggests needed modifications of several genera and families.

* Zool. Mag., vii. (1895) pp. 133–6 (1 pl.).
† Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 1–8 (1 pl.).
‡ Ann. and Mag. Nat. Hist., xvi. (1895) pp. 256–62.
§ Zool. Jahrb. Abth. Syst., viii. (1895) pp. 391–438 (3 pls.).

Porifera.

Origin of Triradiate Spicules of Leucosolenia.*—Mr. E. A. Minchin found that in *Leucosolenia coriacea* the youngest spicules are surrounded by six cells which are similar, in all their characters, to the cells of the external flat epithelium of the sponge. Three cells of the external epithelium wander inwards, and give rise by division to six cells which are so arranged that three are placed more internally and three more externally. The spicule is formed by the three inner cells, a ray being formed by each. The three outer cells soon lose their rounded form, and by throwing out processes assume an amœboid appearance. The three inner cells, however, alone secrete the rays, and continue to do so until the spicule is full grown. The rays soon appear to project beyond their formative cells, but they are in reality covered by a thin layer of protoplasm. At the same time, the spicule sheath makes its appearance as a denser layer of substance between the protoplasm of the formative cell and the calcareous spicule, and it is by continued calcification of the sheath that the spicule grows. The spicule rays attain their full thickness at their bases before they reach their full length. The formative cells remain at the base until it is built up to its full thickness. Each cell then migrates along its ray towards the tip, building up the ray to its full thickness as it goes. In the fully formed ray the formative cell is found adherent to the extreme tip. Mr. Minchin points out that the origin of the spicule-forming cells from the external flat epithelium is another nail in the coffin of the so-called mesoderm. In these forms sponges are to be regarded as two-layered animals, composed of a dermal and a gastral layer. The former is differentiated into (1) an external flat contractile epithelium, the neuro-muscular system, and (2) an internal connective-tissue layer. The gastral layer consists of the collar cells, and perhaps also of the amœboid wandering cells. The history of the triradiate spicule shows that it must be regarded as having been derived from the fusion of three originally separate monactinal spicules. This supports the theory of Schulze that the triradiates of the more primitive Ascons arose as an adaptation to the structure of the sponge, and goes against Dreyer's theory that the primitive spicule of all sponges is a tetraxon, a form which he says is the direct mechanical outcome of the vesicular structure of living bodies.

Collar Cells of Heterocœla.†—Mr. G. Bidder, who prefaces his paper with a useful summary of its contents, commenced his investigations at Naples on *Leucandra aspera* and *Sycon raphanus*, on which he made feeding experiments. Observations on living cells were made chiefly on *Sycon compressum* at Plymouth. The last named species is the best suited of all known to the author for examination under high powers during life, for its collar cells are among the largest, if not as large as any known. As it appears to Mr. Bidder to be inconvenient to use names for the tissues of sponges which connote comparison with other groups of multicellular animals, he employs the following terms. An "ectocyte" is any cell forming part of the external surface of a sponge, including the afferent system of canals. A "mesocyte" is a parenchym

* Proc. Roy. Soc., lviii. (1895) pp. 204 and 5.
† Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 9–43 (1 pl.).

cell, while an "endocyte" is any cell which forms part of a surface of the central cavity of a sponge, including the efferent system of canals and the flagellate chambers. Normally, the collar cells are short and barrel-shaped with separate cylindrical collars which are never united. In certain pathological conditions, probably connected with suffocation, they elongate very greatly, diminishing in the diameter of their upper part and in some species even coming into contact. "Sollas' membrane" is always associated with great distortion of the cells. Where there is no distortion there is no membrane. The collar in *Sycon compressum* is made up of about 30 parallel rods united by a film of some other substance. The flagellum is intimately connected with the nuclear membrane. There is an interstitial substance between the body of the cells. The area inside the collar appears to be provided with a sphincter membrane.

Fossil Sponges of Flint Nodules.*—Mr. J. A. Merrill has made an investigation of the fossil sponges of the flint nodules in the lower Cretaceous of Texas. The minute structure of the Cretaceous flints of America does not seem to have been as yet studied except in a general way, and nothing whatever has been published on the microscopic organisms composing them. The flint nodules examined varied greatly in shape and size, and to some extent in hardness. The different kinds of sponges found varied so much, and were so much mixed that it is difficult to speak with certainty about the depth of the ancient Cretaceous sea. *Geodia* is fully represented, but though it, like *Stauractinella*, is a deep-sea sponge, both are also found in shallow water. The appearance of the nodules seems to indicate a very peculiar combination of circumstances which exist but once in a great cycle of changes. From its proximity to known shore lines we may judge that the formation was not in the deepest sea, but from the forms of animal life preserved in it we may conclude that it was beyond the continental shelf, or in other words, in water deep enough to secure the necessary conditions for long periods of time.

Protozoa.

Nettle-threads of Paramæcium.†—The late Prof. J. A. Ryder reviewed the conclusion of Allman, that these discharged threads are of the nature of defensive organs, and that they are not identical with the cilia which thickly clothe the organism. Allman's views have been generally accepted by naturalists. Ryder found that if a pretty strong solution of tannic acid is used the threads become entirely detached from the body of *Paramæcium*, if the reagent is allowed to act long enough. The tannic acid acts, in short, as a sort of depilatory, removing, apparently, every vestige of cilia from the creature. This singular power of tannic acid gave rise to grave suspicions as to the truth of the statement that the threads developed by tannic acid on the surface of *Paramæcium* are something different from the cilia. By his lately described method of imbedding small objects in paraffin ‡ he obtained a number of serial sections of *Paramæcium* no more than $2 \cdot 5\ \mu$

* Bull. Mus. Comp. Zool., xxxviii. (1895) pp. 1-26 (1 pl.).
† Proc. Acad. Nat. Sci. Philad., 1895, pp. 167-70.
‡ See this Journal, *ante*, p. 379.

thick. These sections so fully revealed the true structure of the ectosarc that nothing further was needed to show how completely this agrees with the view that the nettle-threads are nothing but greatly stretched cilia, that are probably extended by some physical action exerted upon them by the tannic acid that has both stretched and swollen them. The ectosarc of *Paramæcium* is composed entirely of a system of vertical rods of a plasmatic substance that stains somewhat more deeply than the endosarc. These rods compose more than four-fifths of the substance of the ectosarc and they are so closely packed together that their arrangement can very readily be made out to correspond to the origins of the cilia from the cuticle. The sections showed that, where the cuticle was intact, and where reagents like osmic acid or corrosive sublimate have provoked the discharge of the nettle-threads, there are no cilia; where, on the other hand, there has been no discharge of nettle-threads there are cilia present. No one has yet said that he has seen the threads discharged except under abnormal conditions. Mr. Ryder has watched the organisms feeding by the hour, but never once saw the slightest tendency to throw off nettle-threads except when crushed, roughly handled, or brought under the influence of reagents.

Structure and Division of Nucleus in Spirochona.*—Prof. E. G. Balbiani has studied *Spirochona gemmipara*, and has reached the following conclusions:—The chromatin and achromatin are not mingled, but may be quite separate or more frequently are so disposed that the chromatin encloses almost the whole of the achromatin. What is called the nucleolus is due to the separation, within a vacuole, of several microsomes, which usually fuse into one globule. This may be the final stage (telophasis) of a preceding division. The central globule unites the characters of nucleolus and centrosome. Like a nucleolus, it is absorbed into the achromatin substance at the end of division, and regenerates in the two daughter-nuclei; like a centrosome, it condenses substance around itself in the form of a small intranuclear attractive sphere, which does not pass into the protoplasm to act like an ordinary centrosome in division. The mixed character of this globule justifies the opinion of those who make no fundamental distinction between nucleolus and centrosome, but regard these as homologous structures varying in function according as they remain intranuclear or become intraprotoplasmic. The absence of external centrosome, and consequently the non-formation of an achromatin nuclear spindle, render nuclear division in *Spirochona* peculiar. But in the precocious disappearance of the nucleolus, in the production of uniting filaments between the two new chromatin masses, and in the formation of a rudimentary cellular plate it has the characters of a mitosis. The so-called terminal plates are accumulations of achromatin which assist in reproducing the resting nucleus. Centrosome and microcentrum are liberated microsomes of chromatin, which pass from the nucleus to play an active part in division.

Ciliated Infusorians in the Horse's Cæcum.†—Dr. A. Bundle describes these at length, viz. *Cycloposthium* (g. n.) *bipalmatum* Fiorentini, *Blepharocorys* (g. n.) *uncinata* Fiorent., *B. valvata* Fiorent., *B. jubata*

* Ann. d. Microgr., vii. (1895) pp. 289–312 (1 pl.).
† Zeitschr. f. wiss. Zool., lx. (1895) pp. 284–350 (2 pls.).

sp. n., *Paraisotricha colpoidea* Fiorent., *P. oblonga* Fiorent., *P. truncata* sp. n., *Didesmis quadrata* Fiorent., *D. ovalis* Fiorent., *Bütschlia postciliata* sp. n., *Blepharoprosthium pireum* g. et sp. n., *Blepharosphæra intestinalis* g. et sp. n., *Blepharocodon appendiculatus* g. et sp. n.

His experiments on infection show that it occurs only when the host is exclusively vegetarian, and that the parasites cannot survive or develope in a very acid medium. Therefore they must reach the cæcum in a resistant resting-stage.

He recognises four physiological groups:—parasites which do harm, parasites which help digestion, parasites which favour the multiplication of injurious bacteria, and finally commensals. Both mechanically and by physiological processes many aid in the digestion of the huge masses of vegetable food.

The Genus Multicilia.*—Herr R. Lauterborn describes *Multicilia lacustris* sp. n., a flagellate Infusorian of the sub-order Holomastigina Lauterborn. The characters of this sub-order are:—The cell is naked, with slight amœboid movements, with long cilia over its surface, without special mouth, capable of ingestion at any point by pseudopodial processes. The genus *Multicilia* Cienkowsky emend. Lauterborn, syn. *Polymastix* Gruber, is thus characterised:—The small cell (·02 – ·04 mm.) is spherical or slightly oval, without a sheath, and capable of amœboid movements; the cilia are long and scattered; there is no differentiation into ectoplasm and endoplasm; there may be one nucleus or several, of vesicular structure; there are numerous contractile vacuoles in one species; ingestion is due to the blunt pseudopodia; multiplication seems to occur by simple fission. The two known species are *Multicilia marina* Cienskowsky = *Polymastix sol* Gruber, and *Multicilia lacustris* Lauterborn.

Rhætic Foraminifera from Somerset.†—Mr. F. Chapman reports on the results of a microscopical examination of various samples of clays, argillaceous sands, and shelly limestones of Rhætic age from a quarry near Wedmore in Somerset. So far as the author is aware, no records have been published of Foraminifera having been found in strata of undoubted Rhætic age, and this paper therefore is of more than ordinary importance. Twenty-six species are recorded, a large proportion of which are new.

Structure and Multiplication of Aulacantha scolymantha Hæck.‡ Herr W. Karawaiew describes this Radiolarian. As Hertwig observed, the two membranes of the central capsule are in contact, and the operculum is also double, but no radial striation of the latter could be detected. The endoplasm under the openings is fibrillar, and besides the well-known round vacuoles, there are others canaliculate in form. Between the nucleus and the lamellæ under the operculum there is a layer of granules. The nucleus has a coarse spongy framework of chromatin, and to this are attached irregular clumps, which do not stain with safranin. They are possibly artefacts. The author discusses the nature of the phæodium, the pigment mass which lies chiefly around

* Zeitschr. f. wiss. Zool., lx. (1895) pp. 236–48 (1 pl.).
† Ann. and Mag. Nat. Hist., xvi. (1895) pp. 305–29 (2 pls.).
‡ Zool. Anzeig., xviii. (1895) pp. 286–9, 293–301 (4 figs.).

the astropyle, and contains plasmic bodies or phæodellæ. He thinks that of the various hypotheses as to their import, that is most likely which credits the phæodellæ with some part in assimilation. Before nuclear division the framework becomes finer, and a closely-wound coil is formed; the chromatin thread then divides longitudinally, and the resulting threads are seen to consist of a double row of very minute spherules; the subsequent stages on to the reconstruction of the new nuclei are very rapid, and have not been followed continuously. The division of the central capsule was frequently observed, and as many as four central capsules were sometimes seen.

Protozoa as Causes of Disease.*—Prof. G. Hauser gives a brief history of what is known in regard to Protozoa which cause disease. The discovery of the malarial plasmodia was the first decisive case in which Protozoa were proved to cause an infectious disease. The psorosperms of pébrine and the widespread Coccidia are other well-known cases. Hauser urges objections against the interpretation of tumours as infectious diseases, and distinguishes such cases as intracanalicular papilloma of the liver (due to Coccidia), or galls in plants (due to insects), from tumours proper which are due to the proliferation of somatic cells, freed from ordinary growth-conditions, and become "parasitic."

Protozoa in a Liver Abscess.†—Dr. Berndt found in the pus of an hepatic abscess, following on "typhus," white and red blood-corpuscles, fat drops, crystals of fatty acids, and bacteria. Besides these there were two kinds of peculiar pale bodies from about 7–12 times the diameter of a red corpuscle, which the author took to be *Amœbæ* and Flagellata. The abscess was probably due to the bacteria, and the presence of the Protozoa only accidental.

Amœbæ in Dysentery.‡—Sig. M. Vivaldi found in the evacuations of twenty cases of dysentery numerous bodies having characteristics ascribed to dysenteric *Amœbæ*. Attempts at cultivation were made in hay decoction, which was slightly alkalinised, filtered, and distributed in Petri's capsules. Having been inoculated with flakes of mucus, the capsules were incubated at 37°. Growth-appearances were observed on the second or third day, and these were found to consist principally of *Amœbæ* in various stages of development. The sizes of the cystic forms varied between 7 and 11 μ, that of the amœboid from 11–25 μ. Cultivations to the third and fourth remove were made in order to obtain material as free from bacteria as possible, for the purpose of experimenting on animals. In rabbits an injection of 10–20 ccm. into the rectum caused only a transient rise of temperature; in cats, diarrhœa, emaciation, redness of anus and discharge of mucus. Some animals died in 10–15 days in a marasmic condition, and on examination there was found diffuse catarrh of the large intestine, but no abscesses. It would appear, therefore, that *Amœbæ* do play some part in dysentery, but not an

* Biol. Centralbl., xv. (1895) pp. 676–86, 700–10.
† Deutsche Zeitschr. f. Chirurgie, xl. Nos. 1 and 2. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 212.
‡ La Riforma Med., 1894, No. 238. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 17.

exclusive one, and that the changes which are found in a dysenteric intestine are, in part at least, to be ascribed to the action of intestinal bacteria. The dysenteric bacillus described by Ogata was never encountered by the author.

Parasites in Sarcoma-Cells.*—Dr. Heinatz found in seven sarcomata intra-nuclear inclusions resembling corpuscles, which were round and having a diameter of from 2–5 μ. They stained deeply with nuclear stains, and contained in their interior one or more granules of a round or crescentiform shape. The author is inclined to regard the corpuscles as parasites.

Parasites of Chronic Malaria.†—Prof. B. Danilewsky describes some appearances he has observed in malarious blood, especially in cases of chronic microbiosis:—(1) Pseudo-cysts in leucocytes. These are about 1/2–1/3 the size of the leucocyte; they contain numerous oscillating granules; their shape is unaltered during the pseudopodal extensions and retractions of the leucocyte. (2) Leucocytozoa. In certain greyish, finely-granular leucocytes two bodies are to be seen—one probably the shrivelled nucleus, the other a circular (or spherical ?) body with well-defined margin and homogeneous structure. (3) Unusually large *Laverania;* these are 20–22 μ, or $2\frac{1}{2}$–3 times longer than a red corpuscle, and 4–6 μ broad. Within these large crescents is a collection of melanin granules. (4) *Laverania*, with secondary or extra corpuscles. These *Laveraniæ* are intra-cellular, 8–10 μ long and 3–4 μ broad, with central irregular collections of melanin granules. They are enclosed in a capsule, the remnant of the red corpuscle, while between the capsule and parasite lies a small dark spherule with sharp, plainly double contour. It appears to be quite free.

* Wratsch, 1894, Nos. 8 and 9. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 18.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 225–8.

BOTANY.

A. GENERAL, including the Anatomy and Physiology of the Phanerogamia.

α. Anatomy.

(1) Cell-structure and Protoplasm.

Structure of Vegetable Protoplasm.* — Prof. C. Mikosch has examined the structure of the protoplasm in the epidermal and parenchymatous cells of *Sedum*, *Sempervivum*, and *Malva*. In the living condition the cytoplasm appears to be homogeneous, without special differentiation. After lying some time in water, an apparently reticulate structure is formed, caused by the action of the water. If sections from the living object are fixed in 1–1·5 per cent. nitric acid, washed, and stained with hæmatoxylin, the cytoplasm is seen to be composed of threads and granules. The threads are either straight or wavy, and their framework may be either homogeneous or granular. Both these elements, as well as the nucleus and leucoplasts, are imbedded in a soft matrix, which does not stain.

Chromatophily of the Nucleus.†—Herr F. Rosen has studied the chromatic behaviour of the cell-nucleus, especially in meristem-cells. In the root of the hyacinth he finds the nuclei to be larger and more numerous in the meristem-cells than in the permanent tissue, and also to be richer in cyanophilous substance. The amount of nuclear substance is, as elsewhere, in inverse proportion to the number of nuclei. In the apex of the root of *Phaseolus*, *Pisum*, and *Zea* the large nucleoles of the meristem-cells are not permanent; their absorption takes place very slowly during karyokinesis, so that they can frequently still be detected while the daughter-nuclei are being formed. But the nucleoles of the daughter-nuclei are undoubtedly new formations, being formed from the substances which pass out of the absorbed nucleoles of the mother-nucleus into the cytoplasm.

Derivatives of Cellulose.‡—According to Messrs. C. J. Cross, C. J. Bevan, and C. Beadle, the formation of wood (in jute) is connected with the production of oxidised derivatives of cellulose. The modified cellulose was separated from the unchanged cellulose, and showed a percentage of 42–43 of C and 6 of H; it is termed by the authors β-cellulose, and differs from α-cellulose in containing methoxyl-groups. This oxycellulose was found to be a constant constituent of jute-fibre, in addition to about 25 per cent. of non-cellulose substances (lignon).

(2) Other Cell-contents (including Secretions).

Vegetable Albuminoids.§—Vitellin occurs abundantly, according to Herr W. Palladin, in the seeds of the yellow lupin; it occupies an

* SB. Vers. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 198.
† JB. Schles. Gesell. Vaterl. Cultur, 1894, 8 pp. See Bot. Centralbl., lx. (1894) p. 115.
‡ Ber. Deutsch. Chem. Gesell., xxvi. pp. 2520–33. See Bot. Centralbl., lxiii. (1895) p. 69.
§ Zeitschr. f. Biologie, 1894, pp. 191–202. See Bot. Centralbl., lxiii. (1895) p. 67.

intermediate position between globulin and albumose. Myosin is simply a calcium-compound of vitellin. New kinds of albuminoids have often been erroneously stated to occur in plants, the reactions being due to a mixture of other substances which appear to alter the general characters of the albuminoids.

Composition of Albuminoids.*—According to M. E. Fleurens, gluten and legumin may be associated together as substances with the general formula $C_nH_{2n}N_2O_5$; while albuminoids belonging to the animal kingdom have the composition $C_nH_{2n}N_2O_4$.

Xanthophyll and Phyllocyanic Acid.†—Prof. A. Tschirch has come to the conclusion that chlorophyll is a compound of phyllocyanic acid. The spectrum of the yellow pigment of plants shows that xanthophyll has three, not two bands. The treatment of Umbelliferæ with chloroform in an alkaline solution produces a very unstable substance with a spectrum resembling that of chlorophyll.

Laccase in Plants.‡—M. G. Bertrand has detected the presence of this substance in a number of plants,—in the root, stem, leaves, and fruit, and especially in the latex. Laccase resembles the diastatic ferments in its properties, except that, instead of hydrolysing, it incites direct oxidation.

Colouring Matter of Cucurbita Pepo.§—Dr. H. Ritter Schrötter v. Kristelli has investigated the nature and the distribution of the colouring matter in the pericarp of highly coloured varieties of the pumpkin, and finds it located to a small extent in the palisade cells, to a much larger extent in the underlying parenchymatous layers, in both a crystalline and non-crystalline form. When separated in a pure state, the chemical reactions show that it is a lipoxanthin, and identical with carotin.

Toxic Principle of Acokanthera.‖—Dr. T. R. Fraser and Dr. J. Tillie have investigated the nature of the poison used for smearing arrows in Somali-land. It is obtained from the wood of *Acokanthera Schimperi* (Apocynaceæ) and probably from other species of the genus. It contains a crystallisable active glucosidal principle, with the formula $C_{30}H_{48}O_{13}$. The action of the poison on the cardiac organs corresponds almost entirely with that of the poison obtained from *Strophanthus.*

Secretion of the Fruit of Peltandra.¶—Miss J. A. Keller finds the leaves of young seedlings of *Peltandra undulata* (Araceæ) to be immersed in a voluminous jelly-like secretion. Examination of the mature plant showed that this secretion was derived from the fruit, where it appears to be formed in glandular trichomes, situated on a basal thickening of the pericarp.

* Comptes Rendus, cxxi. (1895) pp. 216–9. Cf. this Journal, 1894, p. 217.
† SB. Vers. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 201.
‡ Comptes Rendus, cxx. (1895) pp. 266–9; cxxi. (1895) pp. 166–8.
§ Verhandl. K. K. Zool.-Bot. Gesell. Wien, xlv. (1895) pp. 298-302.
‖ Proc. Roy. Soc., lviii. (1895) pp. 70–4.
¶ Proc. Acad. Nat. Sci. Philadelphia, pp. 287–90.

Mineral Food-ingredients of Plants.*—Herr O. Loew discusses several questions in connection with the supply of mineral food-substances to plants. Magnesium salts by themselves are poisonous to the plant, and can contribute to its nutrition only in the presence of calcium salts. Calcium, on the other hand, is essential to all the higher plants (not to Fungi), and exercises no injurious influence; but the presence of magnesium also is essential.

Calcium Oxalate in the Leaves of Conifers.†—Prof. K. Wilhelm finds crystalline calcium oxalate abundantly in the walls of the parenchymatous cells of the leaf in many Abietineæ, but not in *Larix*. The crystals were found also in the cell-cavity. In the cuticle of the upper surface of the leaf of *Pinus montana* he observed peculiar granular doubly refractive bodies, soluble in chloroform, as well as spherites in some of the epidermal cells.

(3) Structure of Tissues.

Assimilating Tissue.‡—In the opinion of Sig. L. Montemartini, the palisade-parenchyme is not the specific assimilating tissue of plants, not being adapted for any great activity in the chloroplasts which it contains. Observations, chiefly on *Opuntia*, lead him to the conclusion that, under similar conditions, the chloroplasts are more active in a spongy than in a palisade parenchyme, the access of carbon dioxide being more difficult in the latter.

Phloem-islands in the Xylem of Strychnos.§—M. L. Sauvan has investigated the origin of these structures in both the stem and root of *Strychnos nux-vomica*, and finds the phenomena to be the same in both cases. As to their mode of origin, he supports the conclusions of Hérail, Scott, and Brebner,‖ rather than those of Perrot.¶ The inclusion of phloem-islands in the xylem is the result of an irregular function on the part of the generating layer, which ceases to produce xylem, and then of the formation of a complementary cambium. This complementary cambium frequently arises in the midst of the phloem-tissue, and produces a layer which gives birth to both phloem and xylem. The continuity of this layer with the normal cambium is only apparent. The medullary rays are continued, not only across the phloem-island, but also across the new cambium zone, and are then lost in the phloem-tissue. The complementary cambium appears to be formed by septation of the cells of the secondary phloem-parenchyme.

Vittæ of the Umbelliferæ.**—M. C. van Wisselingh has studied the nature of the cell-wall, and the mode of formation of the secretion, in the vittæ of a large number of Umbelliferæ, and his conclusions differ

* Bot. Centralbl., lxiii. (1895) pp. 161–70. Cf. this Journal, *ante*, p. 545.

† SB. Vers. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 198.

‡ Atti Ist. Bot. R. Univ. Pavia, iv., 40 pp. and 1 pl. See Bot. Centralbl., lxiii. (1895) p. 74.

§ Journ. de Bot. (Morot), ix. (1895) pp. 266–73 (7 figs.).

‖ Cf. this Journal, 1886, p. 1010; 1890, p. 199.

¶ Cf. this Journal, *ante*, p. 445.

** Arch. Néerl. Sci. Ex. et Nat., xxix. (1895) pp. 199–232 (2 pls.).

in several respects from those of Meyer.* The substance which clothes the cavity of the vittæ is allied to suberin and cutin, but is not identical with either of them, differing in the absence of fusible substances. The phellonic acid which characterises suberous layers is replaced by a different substance, very resistant to potassa. To the substance, or rather the mixture of substances, found in the walls of the vittæ, the author gives the name *vittin*. Vittin may occur either by itself in the cell-wall or mixed with cellulose, but always more or less in association with pectic substances. In the clothing of the cavity and in the septa it is on the outside of the cellulose membrane. The solid substance sometimes found within the vittæ is of the same nature as vittin.

The vittæ of *Astrantia major* diverge from the ordinary type. The clothing is wanting on the transverse walls, and the epithelium does not contain vittin in its cell-walls; it is replaced by a substance of a suberous nature, which is also found in the septated vittæ of *Eryngium pandanifolium*.

Water-stomates.†—Dr. A. Nestler discusses the structure and distribution of those stomates which are especially concerned with the escape of water rather than of air. He finds there is no sharp line of demarcation between these and true aerial stomates, the one passing into the other by insensible gradations. Their mode of formation is also the same, but they always arise earlier than aerial stomates. They may even continue contractile till maturity. The strong curvature of the guard-cells is due to turgidity.

Anatomy of the Bulbs of Crinum.‡—Prof. G. v. Lagerheim records the presence of latex-tubes in the bulb-scales of *Crinum pratense*, a feature not hitherto observed in the Amaryllideæ. They occur in the reserve-store tissue, near the outer side of the scales; the latex is a turbid emulsion, without crystals or starch-grains.

(4) Structure of Organs.

Adaptation of Plants to an Alpine Climate.§—M. G. Bonnier has pursued his experimental researches on the cultivation of the same species of plant at different altitudes. He finds that, as a rule, under Alpine conditions the subterranean parts of the plant are more developed relatively to the aerial stems; the latter are shorter, more procumbent, and more hairy; the leaves are generally smaller, thicker, and more hairy; the flowers are relatively or even actually larger, and are more brightly coloured. The internal structure corresponds to the functional peculiarities of Alpine plants already pointed out, viz. that, on the same leaf-area, chlorophyllous assimilation and transpiration are more intense, the epiderm is not so strongly cuticularised, and the stomates are more numerous.

* Cf. this Journal, 1889, p. 662.

† Nov. Act. K. Leop.-Carol. Deutsch. Akad. Naturf., lxiv. (1895) pp. 139–74 (2 pls.). See Bot. Centralbl., lxiii. (1895) p. 75.

‡ Christiania Vidensk. Skrift., i. (1894) No. 3. See Bot. Centralbl., 1895, Beih., p. 264.

§ Ann. Sci. Nat. (Bot.), xx. (1895) pp. 217–360 (12 pls. and 28 figs.). Cf. this Journal, 1891, p. 71.

Anther of Loranthaceæ.*—M. P. van Tieghem points out that in the Loranthaceæ there is a remarkable want of uniformity in the number of pollen-sacs in the anther. In *Dendrophthora* there is only one, a solitary instance among Angiosperms; in *Phoradendron* and *Arceuthobium* there are two; but much the most common number is four, which occurs in nearly all Loranthoideæ, and in some Viscoideæ. In some cases each pollen-sac is septated by transverse partitions, giving rise to four longitudinal rows of short superposed sacs. In *Notothixos* the anther has an indeterminate number of small sacs; while in *Viscum* the anther has completely disappeared as such, its entire surface being covered by a large number of small sacs. In all cases, whatever the number of the pollen-sacs, each dehisces by a fissure of its own; and, by comparison with the structure in other orders of flowering plants, the author points out that this mode of dehiscence of the pollen-sacs, by separate fissures, is the rule, rather than the exception, among Angiosperms.

Fruit and Leaves of Yucca.†—Mr. H. J. Webber traces a connection between the variation in the structure of the fruit which characterised the subgenera of *Yucca*, and the mode of dissemination of the seeds. Where the seeds are enclosed in a core, this appears to be altogether rejected by birds. Where the seeds are surrounded by a fleshy pulp, they are swallowed by birds, but are speedily voided in a condition fit for germination. The reflexion of the leaves in some species of *Yucca* appears to serve both to throw off the falling fruit or seeds to a distance, and to protect the fruit against the attacks of climbing animals.

Fruit of Aucuba.‡—Sig. L. Pampaloni describes the fruit of *Aucuba japonica*, which differs from that of the true Cornaceæ in being a berry, not a drupe; while the embryo, instead of being as long as the fleshy endosperm, is only one-third its length. On these grounds the author proposes to separate *Aucuba*, as a distinct suborder, from the typical Cornaceæ.

Youngest Stages in the Development of Lateral Organs.§—Prof. S. Schwendener adduces further evidence in favour of his "*Anschluss-Theorie*" of phyllotaxis (replying to the objections of Raciborski ‖ and others), drawn chiefly from the development of the foliar organs in water-plants.

Axillary Shoots of Symphytum.¶—Herr R. Kolkwitz contests the theory of Schumann that the displacement of the lateral shoots in the Borragineæ is merely apparent. In *Symphytum officinale* the primordium of the axillary shoot is unquestionably, from a morphological point of view, a unit. The decurrent wings do not belong to the leaf, but to the stem.

* Bull. Soc. Bot. France, xlii. (1895) pp. 363–8.
† Rep. Missouri Bot. Garden, vi. (1895) pp. 91–112 (3 pls.).
‡ Nuov. Giorn. Bot. Ital., ii. (1895) pp. 257–61.
§ SB. K. Preuss. Akad. Berlin, 1895, pp. 645–63 (1 pl. and 1 fig.). Cf. this Journal, *ante*, p. 69.
‖ Cf. this Journal, *ante*, p. 70.
¶ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 280–5 (1 pl.). Cf. this Journal, 1892, p. 635.

Influence of Running and Dripping Water on the Form of Leaves.*—Herr J. R. Jungner states that the leaves of plants growing within reach of the water or the spray of waterfalls (in Norway) or in eddying currents, exhibit the general character of "rain-leaves," viz. a tendency to an elongation of the apex, a smooth edge, absence of hairs, and the formation of a cushion at the base of the lamina. Other peculiarities, such as the recurving of the margin and the crinkling of the leaf, are due to the low temperature of the water. Similar differences also occur between those leaves on the same individual which are, and those which are not, exposed to the influence of running or dripping water.

Phyllotaxis.†—Prof. F. Delpino enters into detail on various points of this subject, controverting some of the views of de Candolle and others. Coalescence (symphysis) of leaves, he regards as having two distinct origins, either a splitting of the lamina, or the concurrence of two cones of growth from pressure and the want of space for their separate growths.

Parallel Venation of Leaves.‡—Sig. L. Gabelli points out that the term parallel venation is often used loosely and inaccurately in describing leaves. It should be confined to those cases, comparatively rare, in which the vascular bundles enter the leaf independently from the stem, and remain distinct throughout their whole course, whether mathematically parallel or not. This is the case with *Plantago*. But in the greater number of so-called parallel-veined leaves—as, for example, those of grasses—the vascular bundles do not enter the lamina of the leaf independently, but coalesce at its base. This is simply an instance of palmate venation modified by the ribbon-like form of the leaf, and corresponds essentially to the palmate venation of the leaves of many palms, a group of plants to which the Gramineæ are shown, by other morphological characters, to be more nearly allied than they are to the Cyperaceæ.

Form and Function of Stipules.§—Pursuing his researches on this subject, Sir John Lubbock describes the structure of the stipules in a large number of genera belonging to a great variety of natural orders. The most frequent, though not the only, function of stipules is the protection of the young leaves while in course of formation. Where stipules are wanting, there is generally some other arrangement for the protection of the bud.

Underground Shoots.‖—Herr A. Rimbach has made a series of observations to determine the mode in which underground shoots—bulbs, corms, and tubers—gradually sink to a greater depth in the soil. He finds that these underground organs possess the power of forming contractile roots, and that this is especially displayed when they are young; it is the contraction of these roots that drags the organ deeper

* Biblioth. Bot. (Luerssen and Frank), Heft 32, 1895, 40 pp. and 3 pls. Cf. this Journal, *ante*, p. 449.
† Malpighia, ix. (1895) pp. 185–203 (1 fig.). Cf. this Journal, *ante*, p. 448.
‡ Tom. cit., pp. 356–64.
§ Journ. Linn. Soc. (Bot.), xxx. (1895) pp. 463–532 (7 figs.). Cf. this Journal, 1891, p. 622.
‖ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 141–55 (1 pl.).

into the soil. When the organ attains a certain depth, varying with the species, these contractile roots are no longer formed. The observations were made on *Phædranassa chloracea*, *Tigridia* sp., and *Oxalis elegans*.

Tubers of Helianthus tuberosus.*—Herr G. Meyer asserts that the inulin is formed in the older internodes of the aerial stem of the artichoke, and passes from them into the stolons. The thickening of the stolons depends on the activity of the original cambium, on the production of parenchymatous tissue from the interfascicular cambium inwards and outwards, and on the subsequent elongation of old parenchymatous cells.

β. Physiology.

(1) Reproduction and Embryology.

Embryology of the Ranunculaceæ.†—Prof. D. M. Mottier has followed out the development of the embryo-sac and its behaviour previous to fertilisation in American species of Ranunculaceæ belonging to the genera *Delphinium*, *Caltha*, *Aquilegia*, *Ranunculus*, *Anemonella*, *Thalictrum*, and *Hepatica*.

In *Delphinium tricorne* the most remarkable phenomenon observed was the presence of two and sometimes more initial cells, and their development into mature embryo-sacs. The two embryo-sacs were continuous for their whole length, separated only by a very thin and indistinct membrane. In *Caltha palustris* there were a large number of initial cells forming a massive archespore, and as many as five may develope into embryo-sacs. In *Aquilegia canadensis*, where all the cells are very small, the antipodals become enormously enlarged before fertilisation; and this was also the case with the species of *Ranunculus* examined. In *Hepatica acutiloba* the egg-apparatus and antipodal cells, as well as the cavity of the sac itself, become unusually large before fertilisation. At the upper ends of the synergids appear a number of protoplasmic strands converging to a point, and thus forming a star-shaped cap. The cells of the developing embryo and endosperm afford favourable objects for the study of karyokinesis. The centrospheres were distinctly observed.

The most important point in these observations is the frequent presence of several initial cells, and their development into normal embryo-sacs. In *Aquilegia* a small cell is occasionally cut off from the initial cell, and may possibly be regarded as a tapete.

Embryology of the Hazel.‡—According to Herr S. Nawaschin, impregnation takes place in the same way in the hazel as in the birch and alder, viz. by chalazogamy; while in other features *Corylus* presents a greater resemblance to *Casuarina*. The mature ovule contains several embryo-sacs, of which only one becomes impregnated. The embryo-sacs are developed out of the cells of a tissue which may be compared altogether with the "sporogenous tissue" of *Casuarina*. This consists, in the hazel, of a number of elliptical or fusiform cells grouped round the

* Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 184-5.
† Bot. Gazette, xx. (1895) pp. 241-8, 296-304 (4 pls.).
‡ SB. Naturf. Gesell. St. Petersburg, March 22 (April 3), 1895. See Bot. Centralbl., lxiii. (1895) p. 104. Cf. this Journal, *ante*, p. 548.

axis of the nucellus, but not so sharply differentiated from the adjoining tissue as in *Casuarina*. The cells of this tissue divide into daughter-cells, of which some remain sterile and subsequently disappear, while others are the rudiments of embryo-sacs.

The antipodals are to be distinguished at an early period in the embryo-sac of the hazel, clothed with cellulose-membranes, before the appearance of the egg-apparatus. They always contain three nuclei, the free nuclei of the embryo-sac being five in number. At the time of impregnation the antipodals have moved from their original basal position, and occupy a lateral situation much nearer to the micropylar than to the chalazal end of the sac. The sterile embryo-sacs recall the sterile megaspores of *Casuarina*. The apex of the pollen-tube reaches the summit of the embryo-sac at the point of attachment of the egg-apparatus. After impregnation the oosphere coats itself with cellulose; and the formation of the embryo takes place in the ordinary way.

(2) Nutrition and Growth (including Germination, and Movements of Fluids).

Latent Life of Seeds.* — From a series of experiments made on a variety of seeds, M. C. de Candolle comes to the conclusion that in their latent life seeds pass through a period of suspended animation (*vie ralentie*), in which all the functions of the protoplasm are quiescent, but from which they revive when again placed in conditions suitable for germination. This period of suspended animation may extend over an indefinite time, probably through a long series of years, and the seeds may, during this period, be subjected to very low temperatures without losing their vitality. In the case of wheat, oat, and fennel the temperature was reduced as low as – 30° C.—and the experiment was repeated as many as 118 times in succession on the same seeds—without injurious effects; the greater number of the seeds of the sensitive plant, however, succumbed to this temperature, and nearly all those of *Lobelia Erinus*. This immunity appears to depend on the protoplasm of the seed passing into a completely inert state, incapable of either respiring or assimilating, before it is placed in the unfavourable conditions.

Dispersion of Seeds.†—Sig. G. Lo Forte discusses the various contrivances for the dispersion of seeds found in Angiosperms, and lays great stress on the part played by water in effecting the dissemination. These various contrivances are especially conspicuous in cases where there are a large number of species in a genus, or a large number of genera in an order; and those are described in some detail which are found in the orders Cruciferæ, Leguminosæ, Umbelliferæ, Compositæ, and Labiatæ. In the case of indehiscent fruits a very important function is performed by the mucilage which ultimately causes the decay or the rupture of the pericarp.

Germination of Bromeliaceæ.‡—Herr F. Müller describes the structure and mode of germination of the seed of some Bromeliaceæ belonging to the tribe Tillandsieæ. They are in many cases provided with a

* Arch. Sci. Phys. et Nat., xxxiii. (1895) pp. 497–512. Cf. this Journal, *ante*, p. 197.
† Nuov. Giorn. Bot. Ital., ii. (1895) pp. 227–57.
‡ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 175–82 (1 pl.).

parachute-like crest of hairs formed from the cells of the outer layer of the testa of the seed; or there may be two such tufts, one attached to the seed itself, the other to the funicle. In *Catopsis* the appendage consists of a dense tuft of thick club-shaped hairs, and the inner layer of the testa projects above the outer layer.

Propagation of Opuntia.*—According to Mr. J. W. Toumey, several species of *Opuntia* natives of Arizona, belonging to the subgenera Platopuntia and Cylindropuntia, have almost entirely lost their power of sexual reproduction; either they do not produce seeds, or the seeds which they produce do not germinate. These species are propagated almost entirely by the detachment of joints or branches, which, from the large amount of moisture which they contain, retain their vitality, and root in the soil, even after the lapse of a very considerable time. The carriage to a distance is greatly promoted by their abundant spines and bristles.

Parasitism of Cuscuta.†—Prof. A. Silvestri records the remarkable occurrence of an example of *Cuscuta epithymum* parasitic on *Nicotiana tabacum*.

Influence of Lime on Vegetation.‡—An explanation of the fact that alpine species of plants are frequently found on calcareous rocks at a low elevation and in southern latitudes, is proposed by Dr. S. Nicotra in the fact that lime is a bad conductor of heat.

Influence of Phosphates on the Growth of Plants.§—According to experiments carried on by Herr F. Noll, phosphorus is not indispensable to the growth of plants in their earliest stages; but there comes a time when growth entirely ceases if the quantity of this substance which has been consumed is not replaced by a fresh supply. The activity of the protoplasm in the meristematic cells of the growing point is dependent on the presence of phosphorus. But the presence of too large an amount of phosphorus may be injurious to the plant.

Torsion of Pine-trees.‖—As the result of a number of observations Prof. R. Hartig states that all pine-trees (*Pinus excelsa*) turn to the left during the first years of their growth. At a later period (varying from the 20th to the 100th annual ring) either the growth becomes straight, or a torsion to the right takes the place of the left-handed torsion. This twisting is in each case dependent on the oblique direction of the cells in the initial cambium layer. No connection can, however, be established between this torsion and the length of the cells of the wood-fibres; this latter is regulated by the nutrition of the tree.

Assimilation of Nitrogen by the Papilionaceæ.¶—From the results of a series of experiments on *Vicia*, *Pisum*, and *Lupinus*, and of control-experiments on *Polygonum Fagopyrum*, Herr J. Billwiller supports Frank's conclusions as to the power of certain Papilionaceæ to assimi-

* Bot. Gazette, xx. (1895) pp. 356-61.
† Atti Accad. Pontif. Nuovi Lincei, xlviii. (1895) pp. 37-9.
‡ Malpighia, ix. (1895) pp. 220-35.
§ 'Der Einfluss d. Phosphaternährung auf d. Wachsthum u. d. Organbildung d. Pflanzen,' Bonn, 1895. See Bot. Centralbl., lxiii. (1895) p. 184.
‖ SB. K. Bayer. Akad. Wiss. München, 1895, pp. 199-217 (2 figs.).
¶ 'Ueb. Stickstoff-assimilation einiger Papilionaceen,' Bern, 1895, 50 pp. See Bot. Centralbl., lxiii. (1895) p. 152. Cf. this Journal, *ante*, p. 198.

late the free nitrogen of the atmosphere through the agency of tubercle-microbes; but the extent to which this faculty exists varies in different plants belonging to the order.

Action of the Water of the Soil on Vegetation.* — Pursuing his investigations on this subject, M. E. Gain states that the growth of the root is especially influenced by the quantity of moisture contained in the soil. When once the seed has begun to swell, the amount of water required for germination is very small. The flowering of a plant is retarded by a dry soil or by a moist air, while it is hastened by a dry air or by a moist soil. For the production of ripe fruit a certain desiccation is necessary.

(3) Irritability.

Sleep of Plants.†—Prof. E. Stahl discusses Darwin's interpretation of the nyctitropic position of the leaves of plants, viz. that its purpose is to protect the leaf from nocturnal radiation. He considers, on the contrary, that its main object is to promote transpiration in the night and early morning. It is especially marked in those plants (Leguminosæ, Oxalideæ) in which the position of the leaves is unfavourable to transpiration during the day.

(4) Chemical Changes (including Respiration and Fermentation).

Albuminoids as Products of Assimilation.‡—As the result of a series of experiments, made chiefly on *Vitis vinifera* and *V. labrusca*, Herr W. Sapoznikow claims to have demonstrated that the albuminoids are a direct result of assimilation, being formed, along with the carbohydrates, within the chlorophyll-bodies. For the formation of the former, the presence of nitrates is indispensable; and, by increasing the amount of these salts and decreasing the intensity of the illumination, the formation of carbohydrates can be diminished or even entirely suppressed. The author suggests the idea that the albuminoids are the first product of assimilation, the carbohydrates resulting from their decomposition.

Action of Alkaloids on Plants in the Dark and in the Light.§—As the result of a series of experiments on the action of alkaloids on the growth of *Lemna minor* and *Elodea canadensis*, Sig. A. Marcacci says that the action of different alkaloids is not uniform. While quinine arrests the transformation of starch into saccharose and of dextrose into levulose without the action of light, strychnine produces the same effect only with the assistance of light, and morphine does not completely arrest it even in the presence of light. From these facts the author draws the conclusion that the hydrating processes are not simple chemical processes, but are dependent on other forces as yet insufficiently recognised.

Migration of Phosphate of Lime in Plants.‖ — M. L. Vaudin believes that he has determined in what condition phosphate of lime

* Ann. Sci. Nat. (Bot.), xx. (1895) pp. 63–215 (4 pls. and 19 figs.). Cf. this Journal, *ante*, p. 452. † Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 182–3.

‡ 'Eiweissstoffe u. Kohlenhydrate d. grünen Blätter als Assimilationsproducte,' Tomsk, 1894, 61 pp. and 1 pl. (Russian). See Bot. Centralbl., lxiii. (1895) p. 246. Cf. this Journal, 1892, p. 235. § Nuov. Giorn. Bot. Ital., ii. (1895) pp. 222–7.

‖ Ann. Inst. Pasteur, ix. (1895) pp. 636–42; Comptes Rendus, cxxi. (1895) pp. 362–4.

(and with it the phosphates of iron and magnesia) are transported in wheat, both from the grain to the young shoot and from the different parts of the plant to the ear; the agents of this migration are the sugars with the alkaline malates. Similar phenomena occur in all plants the seeds of which contain starch; the sugars, and the salts of fixed organic acids, malates, citrates, &c., which aid in this transportation, may vary; but the fact remains the same, and seems to have a general character in vegetable physiology.

Influence of Oxygen on Alcoholic Fermentation.* — Herr N. v. Chudiakow draws an important distinction between the influence of oxygen on fermentation and on the multiplication of yeast-cells, and confirms Iwanowsky's statement that it has no effect on the energy of the former process. Fermentation in pure dilute solution of sugar in the presence of air is not lasting. Oxygen in fact makes the process impossible. The better the nutritive solution the less is the unfavourable effect of the oxygen. For the multiplication of yeast-cells oxygen is necessary when the nutritive solution is pure, but is almost unnecessary when sugar-peptone solution and worts are employed. Apparent intramolecular respiration occurs only when yeast contains bacteria, or when the yeast-cells still contain sugar. There is no intramolecular respiration in pure yeast, which in this respect resembles moulds.

γ. General.

Tropical Epiphytes.†—Herr G. Karsten describes the various adaptations of epiphytes growing in the Moluccas, due in the first place to excessive moisture, and in the second place to drought.

In the former category a new liverwort is described, *Dendroceros inflatus* sp. n., belonging to the Anthoceroteæ, with a porous spongy thallus consisting of a single layer of cells, derived by segmentation from the apical cell. In *Trichomanes peltatum* and *T. motleyi* the vascular system is greatly reduced; in the latter species it survives simply as hypodermal cover-cells which protect the leaf from the attacks of snails. The structure of these Hymenophyllaceæ indicates a degraded rather than a rudimentary origin. *Teratophyllum aculeatum* var. *inerme* (Filices) has dimorphic leaves, the erect ones serving the purpose of assimilation, while those which are adpressed to the substratum are water-receptacles.

To the second class belongs *Conchophyllum maximum* sp. n. (Asclepiadeæ), which has peltate leaves adhering closely to the substratum, and but very few stomates. The partially or entirely hollow stem of *Polypodium imbricatum* and *P. sinuosum*, densely covered with a coating of scales, fulfils the same purpose of preventing excessive transpiration. The author suggests that the wall of the cavities in the stems of *Myrmecodium* and *Hydnophytum* affords a surface for the absorption of water in which is contained the soluble constituents of the excrements of the ants which inhabit the hollow stems.

* Bied. Centralbl., xxiv. (1895) pp. 122-8. See Journ. Chem. Soc., 1895, Abstr. p. 282. Cf. this Journal, 1894, p. 594.

† Ann. Jard. Bot. Buitenzorg, xii. (1895) pp. 117-95 (7 pls.).

"Heterotopic" Plants.*—By this term Dr. F. X. Gillot designates those plants which are occasionally found on soils apparently very different from those on which they normally occur. This apparent indifference frequently arises from the observer having taken into account only the geological, and not also the chemical nature of the soil. It is especially common to find colonies of calciphilous plants on a siliceous soil; and this arises frem the silica being accompanied by calcium silicates and phosphates.

B. CRYPTOGAMIA.

Cryptogamia Vascularia.

Leaves of Ferns.†—From a comparison of fossil with recent forms, Herr H. Potonié draws the conclusion that the truly pinnate structure of the frond of ferns has been derived phylogenetically from an archaic dichotomous form. Transitions from one to the other are to be observed in fossil forms, while the great majority of the oldest (Palæopterideæ) exhibit a dichotomous venation with but a small development of the central vein.

Mucilage-Canals of the Marattiaceæ.‡—Mr. G. Brebner, who has studied the mode of formation of the mucilage-canals in the Marattiaceæ (*Angiopteris evecta*, *Marattia cicutæfolia*, *M. alata*), finds it to be, with but little exception, typically schizogenous, differing in no important respect from that of resin-canals; they are not produced by the mucilaginous degradation and death of cells. In the roots of *A. evecta* no mucilage-canals were found, but in their place rows of tannin-sacs. The roots of *Marattia attenuata* possess true mucilage-canals. In the aerial roots of some varieties of *A. evecta* there is in the cortex a ring of peculiar mucilage-cavities, which have no secretory epithele, and appear to have a schizo-lysigenous origin.

Development of the Sheath of Equisetum.§—Herr H. C. Schellenberg contests C. Müller's theory ‖ that the lines on the leaf-sheaths of *Equisetum* are the result of traction. From observations made on *E. limosum* and *hyemale*, he states that they are formed by the unequal growth of the commissure and median plane of the tooth at the base of the sheath. The lines are at first narrow, but become subsequently broader from the opening of the teeth.

Sphenophyllaceæ.¶—Prof. G. Arcangeli discusses the systematic position of this family, which he regards as having no near affinity with any other group of plants, either fossil or recent. The structure of the stem recalls that of the Calamarieæ, while the mode of formation of the spores presents a greater resemblance to that of the Lycopodineæ.

* Bull. Soc. Bot. France, xli. (1895) Sess. Extraord., pp. xvi.–xxxv.
† Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 244–57 (3 figs.).
‡ Journ. Linn. Soc. (Bot.), xxx. (1895) pp. 444–51 (1 pl.).
§ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 165–74 (1 pl.).
‖ Cf. this Journal, 1889, p. 256.
¶ Nuov. Giorn. Bot. Ital., ii. (1895) pp. 261–72. Cf. this Journal, 1894, pp. 374, 595.

Lyginodendron and Heterangium.*—The late Prof. W. C. Williamson and Dr. D. H. Scott discuss the structure and relationship of these fossil forms from the Coal-measures, which they regard as forming an intermediate link between the Vascular Cryptogams and the Cycadeæ. In *Heterangium* the primary structure of the stem is much like that of a monostelic fern such as *Gleichenia*, while the leaf-trace bundles closely resemble the foliar bundles of a Cycad. In *Lyginodendron* the whole structure of the stem suggests a Cycad, but with the remarkable peculiarity that the bundles have the structure which in Cycadeæ is usually limited to those of the leaf. Both genera have, in various respects, points in common with Gleicheniaceæ, Osmundaceæ, Marattiaceæ, Ophioglossaceæ, and Cycadeæ.

Muscineæ.

Dissemination of the Spores of Mosses.†—Prof. K. Goebel has studied the part taken by the peristome and by the columel in the dissemination of the spores in the various families of Musci. The peristome may serve only for the hygroscopic closure of the capsule, or may also aid, with or without the assistance of the capsule, in securing the gradual escape of the spores. This may be effected, when the peristome is simple, either by its consisting of long teeth which remain curved over the opening when dry, or by the teeth remaining united at their tips; when the peristome is double, either by the opening being partially closed by the inner peristome, or by the presence of elaters.

The development of the peristome appears to have proceeded on different lines in the different families of mosses; and to have undergone retrogression in some. This has taken place either when the number of spores in a capsule is very small, or when other contrivances are provided for the dissemination of the spores, such as its violent bursting in *Sphagnum;* its splitting in *Andreæa;* the narrowing of the mouth in *Physcomitrium;* or the formation of a basal opening in *Phascum.* The columel assists in the dissemination of the spores in *Tetraphis*, where it takes part in the formation of the peristome-teeth; in the Splachnaceæ, where it reduces the opening of the capsule; and in the Polytrichaceæ, where it forms the epiphragm.

The author regards the sporogone of *Nanomitrium* as probably an archaic form. The capillary peristome of *Dawsonia* consists of rows of cells which have the same origin as the peristome-teeth of the Polytrichaceæ.

Algæ.

Murray's Introduction to the Study of Seaweeds.‡—After an Introduction, treating of the distribution of seaweeds and the best mode of collecting and preserving them, Mr. G. Murray classifies the existing forms into five sub-classes, viz. the Phæophyceæ, Chlorophyceæ, Diatomaceæ, Rhodophyceæ, and Cyanophyceæ. The Fucaceæ are made a family of the Phæophyceæ. Under the Chlorophyceæ are included the Peridinieæ, Coccospheres, and Rhabdospheres. The Rhodophyceæ are

* Proc. Roy. Soc., lviii. (1895) pp. 195–204; Ann. Bot., ix. (1895) pp. 525–35.
† Flora, lxxx. (1895) pp. 459–86 (1 pl. and 13 figs.).
‡ London, 8vo, 1895, xvi. and 271 pp., 8 pls. and 88 figs.

divided into five families,—the Nemalionaceæ, Gigartinaceæ, Rhodymeniaceæ, Cryptonemiaceæ, and Bangiaceæ; and these again into numerous orders. The marine Cyanophyceæ are comprised in two families, the Nostocaceæ and Chroococcaceæ. Under each family the general characters and mode of reproduction are explained in detail; and leading types in each family are specially described.

Gloiothamnion, a new Genus of Algæ.*—Under the name *Gloiothamnion Schmitzianum*, Herr T. Reinbold describes the type of a new genus of Ceramiaceæ from Japan, with the following diagnosis:—Frons filiformis, teretiuscula, axi monosiphonio articulato, continue corticato constituta; cortice cellulis conformibus constante; favellæ intra periderma hyalinum gemmidia foventes plurima [*sic*] ad ramos superiores sessiles, ramellis conformibus paucis (uno majore) involucratæ; sphærosporæ in ramulis stichidiosis immersæ, sphæricæ, triangule (?) divisæ, verticillatim dispositæ; antheridia in pulvinulis superficialibus apices ramulorum amplectentibus evoluta.

Filamentous Thallus of Dumontia.†—Mr. G. Brebner has found the discs of *Dumontia filiformis* forming an incrustation on *Fucus serratus*. The perennial creeping basal thallus is attached to the host on which it is epiphytic by plugs of tissue which cause disintegration of the cells of the host. This may be brought about by the action of an enzyme secreted by the epiphyte. The ordinary filiform thallus owes its origin to the intercalary transverse septation of the articulations of certain branches of the creeping thallus. The group of active filaments may be endogenous or exogenous. These filaments emerge from the creeping thallus, remaining attached to it by their basal portion, and, by their subsequent growth and division, give rise to the erect annual thallus.

Phyllophora.‡—From an examination of the species of *Phyllophora* belonging to the German Baltic, Herr O. V. Darbishire states that the erect thallus is in every respect an outgrowth from the basal disc; it serves both for assimilation and for propagation. The midrib of *P. rubens* is a layer of secondary thickening, corresponding to the thickening-layers in the erect cylindrical stem of *P. Brodiæi* and *P. membranifolia*. The nemathece of *P. Brodiæi* is the only propagating organ which produces tetraspores. After the impregnation of the carpogone by a pollinode—which, however, has not been actually observed—the fertilising action is transmitted to the nutrient cells by hyphal cells, which are at first in connection with the basal cell of the carpogonial branch, from cell to cell, after the formation of fresh filaments. From these nutrient cells the clusters of spores are then formed by budding. The relationship of the various species to one another is dealt with, including a new species, *P. parvula*.

Acetabularieæ.§—Prof. Graf zu Solms-Laubach publishes a monograph of this family of Algæ, consisting of the genera *Acetabularia*, *Halicoryne*, *Acicularia*, and *Chalmasia* g. n. *Acetabularia* comprises 14 species, arranged in two sections—Acetabulum, including *A. mediter-*

* Hedwigia, xxxiv. (1895) pp. 205–9 (1 pl.).
† Journ. Linn. Soc. (Bot.), xxx. (1895) pp. 436–43 (2 pls.).
‡ 'Die Phyllophora-Arten d. Westl. Ostsee Deutschen Antheils,' Kiel, 1895, 38 pp. and 48 figs.
§ Trans. Linn. Soc. Lond., v. (1895) pp. 1–39 (4 pls.).

ranea only, and Acetabuloides, made up of the remaining 13 species, five of them new. *Halicoryne* comprises two species. The new genus *Chalmasia* is thus defined:—Fertile cap terminal, composed of free wedge-shaped rays, united only by the calcification; corona inferior wanting; segments of the corona superior not touching each other laterally, knob-shaped, and not sharply delimited towards the base; spores free, with thick much calcified membrane, and coarse cuticularised outer layer. It includes only one species, from the West Indies. In *Acicularia* are comprised one recent and three fossil species.

The author suggests that the cap of *Acetabularia* corresponds to a true zoosporange, the zoospores of which no longer develope cilia and do not escape, but rather surround themselves with a membrane at the place of origin, and enter at once into a resting stage. After a lengthened rest these spores then give rise to the sexual generation of gametes. In the development of the cap, the whole margin first makes its appearance in the form of a continuous cushion below the arched apex of the shoot. The spores of *Chalmasia* are characterised by a remarkably thick membrane, which is beautifully stratified and surrounded by a definite coarse cuticular layer. As in the other genera the spores possess a removable lid.

Structure of Volvox.*—Prof. A. Meyer calls attention to a distinction between the structure of the globes of *Volvox globator* and those of *V. aureus*. The membrane of the comparatively large globe of *V. globator* consists of only a single thin layer, the outer strata of which are gelatinous, the central stratum alone relatively solid. In *V. aureus* the membrane is comparatively thick and the cavity comparatively small. The membrane is here homogeneous, and is perforated only by the openings through which the cilia project. In both species the globe is divided into two hemispheres, one of which is trophic, and consists of cells united to one another only by simple protoplasmic threads, which do not become either sexual cells or parthenospores; the other is the generative hemisphere, in which lie the reproductive cells, united to one another by numerous protoplasmic threads. In both species, when in motion, the trophic hemisphere is in front, a position favourable for the nutrition of the organism.

Fungi.

Influence of Cold on Spore-Germination.†—Prof. J. Erikson has made some laboratory experiments with spores of fungi, to see if the action of cold had an accelerating influence on germination. From the table given it would appear that cold of itself does not appear to possess the power of quickening the spores; indeed, germination seems occasionally to be quite unaffected by low temperatures. It would, however, appear that germination may be promoted, at any rate under natural conditions, when spores are exposed to a period of moisture followed by a spell of cold.

Value of Mineral Salts for Fungi.‡—Herr C. Wehmer deprecates the attempts of other observers to draw too general conclusions on this

* Bot. Centralbl., lxiii. (1895) pp. 225-33 (4 figs.). Cf. this Journal, 1891, p. 226.
† Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 557-65 (1 fig.).
‡ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 257-65. Cf. this Journal, *ante*, p. 545.

subject from experiments. Each species has its own optimum of conditions with respect to the composition of its substratum, and we are not at present in a position to lay down laws which hold good for all fungi. Calcium salts are certainly not essential as a general rule.

Spore-Formation of Thamnidium.*—From experiments made by Herr J. Bachmann, it is stated that *Thamnidium elegans* is the only fungus at present known which can be made, by alteration of the external conditions, to form different kinds of sporange, or to suppress their formation altogether. The different forms are classed under six types, viz.:—(1) Terminal sporanges, sporangioles with few spores; (2) terminal sporanges, sporangioles with numerous spores and often with a columel; (3) terminal sporanges only; (4) sporangioles only; (5) mycele with thick ends and gemmæ, or with thin ends and no gemmæ; (6) zygospores. These forms occur according to the chemical constitution of the nutritive substance, its concentration, its fluidity, the degree of moisture, or the temperature; and the various conditions are given in detail. *Thamnidium* exhibits less heliotropism than *Mucor*.

Exoascaceæ.—From a further examination of the parasitic fungus which causes deformation of the carpels of the aspen, Herr R. Sadebeck † concludes that it belongs to the genus *Exoascus* and not to *Taphrina*, and he proposes to call it *E. Johansonii*. This establishes on firm ground the distinction between the genera *Exoascus* and *Taphrina*. He now enumerates 30 species of *Exoascus*, 13 of *Taphrina*, and 6 of *Magnusiella*.

Prof. G. F. Atkinson ‡ describes thirteen species of *Exoascus* parasitic on different species of *Prunus* in the United States, and causing curl or plum-pocket. The following are new:—*E. confusus*, on fruits and flowers of *P. virginiana*; *E. longipes*, on fruits of *P. americana*; *E. mirabilis*, on buds, shoots and fruits of several species; *E. rhizipes*, on buds and fruits of *P. triflora*; *E. decipiens*, on leaves, shoots, and fruits of *P. americana*; *E. varius*, on leaves and shoots of *P. serotina*; *E. cecidomophilus*, on *Cecidomya*-galls on fruit of *P. virginiana*.

Yeast- and Mould-Fungi on Grapes.§—From observations made during fermentation experiments, Dr. H. Eckenroth and Herr R. Heimann have come to the conclusion that mould-fungi undergo a peculiar metamorphosis on grapes. The grapes came from various parts of the Palatinate, almost all being covered with mould, and more or less sprinkled with *Oidium Tuckeri*. Microscopical examination showed that these grapes were coated with yeast-like cells. Cultivations were made from these cells on moist gelatin plates, and pale rose-coloured colonies, consisting of torula-like cells, grew up. These cells were in their turn cultivated in sterilised must in Freudenreich's flasks, and developed a mycele consisting of a branched dematium-like vegetation. This increased considerably on continued cultivation, and sprouting cells and large swellings on the mycele appeared, while the terminal branches,

* Bot. Ztg., liii. (1895) 1te Abt., pp. 106–30 (1 pl.).

† Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 265–80 (1 pl.). Cf. this Journal, 1894, p. 487.

‡ Cornell Univ. Agr. Exp. Stat., 1894, pp. 319–55 (20 pls.). See Bot. Centralbl., 1895, Beih., p. 360.

§ Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 529–36 (6 figs.).

when in contact with air, began to bifurcate and to form sterigmata from which conids were developed. Cultivations were made from the stage when yeast-like cells were separated off, in must, raisin decoction, and beer wort. In the last only yeast-like cells and a few torula cells developed. Plate-cultivations were made from these cells, and two kinds of colonies, red and white, came up. The white were spherical (6–7 μ), and always possessed fermenting properties. The red cells were ellipsoid (4–5 μ), and many contained one or two oil droplets. These had no fermentation properties. The complete development of the fungus on the grape itself has yet to be made out, but it seems possible that the metamorphosis may be dependent on much moisture.

Fungi participating in Sake-making.*—MM. J. Kosai and K. Yabe found that two quite different organisms share in the production of sake. If a plate-cultivation be made of koji two different kinds of colonies arise—one an *Aspergillus*, the other a yeast. If Pasteur's medium be infected with the *Aspergillus* colony, only mycele and spores grow up. If, on the other hand, a saccharated or non-saccharated medium or boiled rice or potato be inoculated from the yeast colony, not a trace of mycele appears. When inoculated on rice, or, after an interval of several days, on moist gypsum, this yeast forms 1–3 ascospores; in koji many of these spores, mixed with *Aspergillus* spores, are found under the Microscope on careful examination. This sake yeast most resembles *Saccharomyces cerevisiæ*.

Morphology of the Lichen-Thallus.†—After some further arguments in favour of his views respecting the systematic position of Lichens, Prof. J. Reinke describes in great detail the structures of the thallus in the families Caliciaceæ, Lecideaceæ, and Graphideæ.

From the true Caliciaceæ the author separates a number of genera as PROTOCALICIACEÆ; these are true fungi, their mycele being destitute of alga-gonids, and appear to form an archaic branch of the Discomycetes. On this ground the author separates from *Calicium* those species which have no true lichen-thallus, placing them under *Mycocalicium*. The Lecideaceæ have clearly descended from the Ascomycetes, and are Patellariaceæ with a lichen-thallus. They are arranged under two families, the Lecideæ and the Bæomyceæ, of which the latter is far the most differentiated. Here again we have corresponding genera, of which one is a Fungus, the other a true Lichen, e. g. *Biatorella* and *Biatoridium*. The Graphideæ constitute, like the Lecideaceæ, a polyphyletic tribe, the genera of which have descended from various Discomycetes. The gonids belong, for the most part, to the genus *Chroolepus*, while others are formed from *Palmella*, *Protococcus*, or *Phyllactidium*. The fungus element is frequently descended from the Patellariaceæ; hence the close relationship with the Lecideaceæ; *Lecidea* may be traced back to *Patinella*.

Relationship of Lichens to Fungi.‡—Herr G. Lindau criticises adversely Reinke's view that Lichens should be maintained as a distinct

* Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 619–20.

† Jahrb. f. wiss. Bot. (Pfeffer u. Strasburger), xxviii. (1895) pp. 39–150 (75 figs.). Cf. this Journal, *ante*, p. 83.

‡ Hedwigia, xxxiv. (1895) pp. 195–204. Cf. this Journal, *ante*, p. 82.

section of Cryptogams. He maintains that the relationship of the fungus to the alga is one of true parasitism rather than of symbiosis. Though the alga is not killed, it is undoubtedly injured by the parasitic fungus. The soredes are not found in all lichens, and may be compared to gemmæ (*Brutzellen*). It is probable that representatives of various families of Fungi have acquired the habit of carrying on a parasitic life on Algæ.

Pigments of Lichens.—Prof. W. Zopf * has extracted the following crystallisable substances from various Lichens :— Pinastrinic acid from species of *Cetraria;* solorinic acid $C_{15}H_{14}O_5$ from *Solorina crocea;* rhizocarpic acid from *Rhizocarpon geographicum;* pleopsidic acid from *Pleopsidium chlorophanum;* vulpinic acid from *Calycinum chlorinum;* æthyl-pulvinic acid from *Physcia medians* and *P. Callopisma;* calycin from various lichens; psoromic acid, &c. from *Rhizocarpon geographicum;* zeorin from *Physcia cæsia* and *P. endococcina.*

Herr O. Hesse † finds in *Usnea barbata* α usninic acid $C_{18}H_{16}O$, and barbatin $C_9H_{14}O$; also, in various varieties, carbonusninic acid $C_{19}H_{16}O_8$. *Parmelia perlata* yields small quantities of vulpinic acid; from *Cladonia coccifera* cocellic acid $C_{20}H_{22}O_7$ was obtained; from *Cetraria juniperina* var. *Pinastri*, a substance identical with pinastrinic acid; from *Parmelia parietina*, a substance previously named physciacic acid and chrysophyscin, which the author now determines to be a chinon with the composition $C_{15}H_9O_4(OCH_3)$, and names physcion.

Minks's Microgonids.‡—Herr O. V. Darbishire enters into a detailed criticism of Minks's claim to have discovered organs in Lichens to which he gives the name microgonids. These observations rest, according to the author, on erroneous interpretations, largely due to the fact that Minks made his observations not on Lichens in the living state, but on preparations which had been subjected to the action of various reagents. From observations made chiefly on *Leptogium saturninum* in the living condition, Darbishire comes to the conclusion that the so-called microgonids observed within the gonids are probably identical with the small granules detected by Bornet and Flahault in the cells of the heterocystous Nostocaceæ.

Uredineæ with Repeated Formation of Æcidia.§—According to Dr. P. Dietel, those Uredineæ which produce æcidia and teleutospores, but no uredospores, can form æcidia directly from the germination of æcidiospores without the intervention of an alternate generation. This was proved experimentally with *Puccinia Senecionis*, *Uromyces Behenis*, *U. Ervi*, and *U. Scrophulariæ.* These species either produce no spermogones, or the formation of spermogones precedes the first æcidial generation, and is suppressed in the following ones.

Entomogenous Fungi.‖—Mr. R. H. Pettit gives the results of a series of experiments on inoculating noxious insects with entomogenous

* Ann. d. Chemie, cclxxxiv. pp. 107–32. See Bot. Centralbl., lxiii. (1895) p. 174. Cf. this Journal, 1893, p. 496.
† Tom. cit., pp. 157–91. See Bot. Centralbl., lxiii. (1895) p. 177.
‡ Hedwigia, xxxiv. (1895) pp. 181–90. Cf. this Journal, 1879, p. 311.
§ SB. Vers. Deutsch. Naturf. u. Aerzte, 1894. See Bot. Centralbl., lx. (1894) p. 161.
‖ Cornell Univ. Agric. Exp. Stat., Bull. No. 97, 1895, 39 pp. and 11 pls.

fungi belonging to the genera *Cordyceps*, *Isaria*, and *Sporotrichum*. A copious bibliography is appended.

Parasitic Fungi.—Herr P. Hennings * describes a very large number of new species of parasitic and saprophytic fungi from Goyaz, in Brazil, belonging to the genera *Ustilago*, *Uromyces*, *Puccinia*, *Cronartium*, *Ravenelia*, *Uredo*, *Æcidium*, *Asterina*, *Asterula*, *Asteronia*, *Dimerosporium*, *Parodiella*, *Meliola*, *Hypocrella*, *Ophioceras*, *Trabutia*, *Xylaria*, *Phyllachora*, *Dothidella*, and *Tryblidium*.

MM. E. Prillieux and G. Delacroix † find that a prevalent disease of the sugar-cane in Mauritius is due to the attacks of *Coniothyrium melasporum*.

Herr F. Schwarz ‡ describes the extensive injuries caused in fir plantations by the attacks of *Cenangium Abietis*. It produces two kinds of pycnid, one with unicellular, the other with pluricellular conids.

Herr B. Frank § describes the injuries inflicted on the cultivated beet by the attacks of *Phoma Betæ*. The fungus is both parasitic and saprophytic, but dryness is indispensable to its development; in fresh green leaves and stems it can only penetrate injured spots. The spores germinate in the soil; as many as 160,000 may be contained in a single pycnid.

Herr F. Krüger ‖ gives details of the mode in which the parasitic fungus *Septoria graminum* attacks and destroys wheat-crops.

Prof. G. F. Atkinson ¶ gives the life-history of those fungi which are the most active in producing the phenomena of damping off, viz. *Artotrogus debaryanus* on seedlings; *A. intermedius* and *Completoria complens* on fern-prothallia; *Volutella leucotricha* sp. n. on cuttings; together with some sterile and undetermined forms.

Prof. R. Hartig ** describes a disease which is very destructive to the leaves of the larch, caused by a hitherto undescribed parasitic fungus, *Sphærella laricina* sp. n.

From an examination of the uredospores of *Uredo Aspidiotus* Peck parasitic on *Phegopteris Dryopteris*, Herr P. Magnus †† now concludes that it must be removed from this genus and placed under *Melampsorella*.

Fungus-diseases of Cultivated Crops.‡‡—The most recently published parts, completing the first volume of this beautifully illustrated work by Dr. P. Voglino, contain descriptions of the structure and life-history, and instructions as to the best mode of combating the attacks of the following parasitic fungi; each part having a coloured plate:—

* Hedwigia, xxxiv. (1895) pp. 88–112.

† Bull. Soc. Mycol. France, 1895, p. 75 (1 pl.). See Hedwigia, xxxiv. (1895) Rep., p. 94.

‡ 'Die Erkrankung d. Kiefern durch *Cenangium Abietis*,' Jena, 1895, 126 pp. and 2 pls. See Hedwigia, xxxiv. (1895) Rep., p. 116.

§ Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 192–9.

‖ Tom. cit., pp. 137–41 (1 pl.).

¶ Cornell Univ. Agric. Exp. Stat. Bull. No. 94, 1895, 40 pp., 6 pls. and 4 figs.

** SB. K. Bayer. Akad. Wiss. München, 1895, pp. 279–93 (7 figs.).

†† Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 285–8.

‡‡ 'I Funghi più dannosi alle piante coltivate,' pts. 10–12, Casale, 1895, 45 pp. and 3 pls. Cf. this Journal, 1893, p. 223.

Exoascus Pruni on species of *Prunus* and *Cerasus*; *Ascochyta Pisi* on *Pisum sativum*, *Phaseolus vulgaris*, and *Cicer arietinum*; *Puccinia coronata* and *P. rubigo-vera* on various grasses; *Fusicladium dendriticum* on the apple and pear; *Sphærella Fragariæ* on the strawberry. In the same publication the action is described of *Bacillus Oleæ* in producing cortical tubercles on the olive.

Formation of a Thallus from Pycnogonids.*—In various species of Lecideaceæ, especially in *Catillaria denigrata* and *C. prasina*, Herr Hedlund finds, among the pycnogonids which have been expelled from the pycnids, some which were germinating, and producing young myceles. A mature thallus of *C. denigrata* consists of a number of more or less connected warts, each of which is composed of a mass of densely interwoven hyphæ and a large number of gonids, which multiply by division. The hyphæ are attached to the gonids by means of haustoria. Towards the surface of the lighter-coloured warts the weft of hyphæ passes insensibly into young myceles which have sprung from germinating pycnogonids.

Development of Colletotrichum.†—Prof. G. F. Atkinson has succeeded in obtaining a number of pure cultures of *Colletotrichum Lindemuthianum*, the parasitic fungus which produces anthracnose in the bean. The spores failed to germinate in water and in ordinary agar-agar-peptone broth, but succeeded well when transplanted from moist chambers into vetch or bean-stems.

New Genera of Fungi.—Under the name *Mylittopsis*, M. N. Patouillard ‡ describes a new genus of Auriculariaceæ, allied to *Mylitta*, from forests in Louisiana, with the following diagnosis:—Receptaculum tuberculiforme, indurato-gelatinosum, e fibris radiantibus omnino compositum, hymenio amphigeno; basidiis rectis, transverse septatis, cum paraphysibus immixtis.

In a collection from Brazil, Herr P. Hennings § finds a fungus which he makes the type of a new genus of Hypocreaceæ, allied to *Bivonella*. The diagnosis is as follows:—Stromata parasitica, subcrustacea, subnectriacea; asci octospori, aparaphysati; sporidia oblongo-ovoidea v. subclavata, multiseptato-muriformia, brunnea. It is named *Uleomyces*.

Development of Tricholoma.‖—Sig. P. Voglino has followed out the life-history of *Tricholoma terreum*, belonging to the Agaricineæ. The ellipsoidal or subglobular spores give rise to a germinating tube which branches in various ways, and produces narrowly ellipsoidal conids, and from these is developed the mycele. The mycelial branches produce, at the end of summer, the receptacles as well as sclerotes; the latter remain dormant through the winter, and develope, in the next year, into new myceles and organs of fructification or receptacles.

* Bot. Sekt. Naturv. Studentsällsk. Upsala, April 9, 1891. See Bot. Centralbl., lxiii. (1895) p. 9.
† Bot. Gazette, xx. (1895) pp. 305–11 (1 pl.).
‡ Journ. de Bot. (Morot), ix. (1895) pp. 245–7.
§ Hedwigia, xxxiv. (1895) p. 107.
‖ Nuov. Giorn. Bot. Ital., ii. (1895) pp. 272–87 (2 pls.)

Receptacle of Mutinus.*—Herr E. Fischer describes the development of the receptacle of *Mutinus caninus*, and contrasts it with that of *Ithyphallus impudicus*, the two presenting important differences from their earliest stages, in the form of that portion of the tissue which is enclosed by the jelly of the volva, and in the first origin of the glebe. *I. tenuis* presents in these points an intermediate condition. Fischer's observations still further widen the gap which separates the Clathreæ from the Phalleæ.

Histology of Pholiota.†—Herr B. Isatschenko states that a process of indirect nuclear division takes place in the cells of the pileus and stipe of *Pholiota aurea*. The chromatin substance collects in the equator of the nucleus and divides into two nearly equal portions, in which a few chromosomes can be detected united into threads by achromatin substance. These threads gradually approach the poles of the nucleus. The nucleus meanwhile becomes constricted in the middle. In the newly formed daughter-nuclei the chromatin substance is first deposited in the periphery, becoming subsequently more or less uniformly distributed in the centre of the nucleus. About the same time a central chromatin granule makes its appearance, but no true nucleole. The microsomes which abound in all the cells of the receptacle consist partly of oil, partly of albuminoids, partly of bodies resembling chromatin granules; the albuminoid microsomes of a crystalline character are especially noteworthy. The surface of the pileus is covered with protruding cells which contain resin, and are in direct connection with the resin-passages of the receptacle.

Maturation of Soft Cheese.‡—M. E. Marchal has studied the microbiology of the maturation of soft cheese. Two cheeses much made in Belgium, the "Limburger" and the "Cassette" or strong cheese, were selected for examination. In the latter *Oospora lactis* was chiefly found, though there were besides, especially on the surface, *Oospora crustacea* and another chocolate-coloured species of *Oospora*. *Oospora lactis* appears to play an important part in the ripening of soft cheese, and the way the cheese is made favours the growth of the *Oidium* fungus, and at the same time is unfavourable to the development of bacteria.

In the Limburger cheese a copious bacterial flora was encountered and four species are specially noted:—(1) a liquefying bacillus (*Bac.* α); (2) a non-liquefying bacillus (*Bac.* β); (3) a yeast; (4) *Oospora lactis*.

Bac. β is a lactic acid ferment. The yeast exercises a feeble action on the milk. *Bac.* α vigorously attacks casein, converting almost all the insoluble casein into the soluble form with the formation of ammonia and fatty acids, and it must therefore be regarded as one of the chief factors in the ripening of the cheese. *Bac.* α, which is probably a species of *Tyrothrix* Duclaux, appears to be peculiar to this kind of cheese, for it is rarely met with in hard cheese or in other kinds of soft cheese.

* Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 128–37 (1 pl.).
† SB. Naturf. Gesell. St. Petersburg, Feb. 15 (27), 1895. See Bot. Centralbl., lxiii. (1895) p. 103.
‡ Ann. Soc. Belge de Microscopie, xix. (1895). See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 506–7. Cf. this Journal, *ante*, pp. 468, 569.

Protophyta.

a. Schizophyceæ.

Development of Eremosphæra.*—Prof. R. Chodat has followed out the life-history of *Eremosphæra viridis*, which has no relationship to the zygospores of desmids. In its mature condition the cell divides in the ordinary manner of the Protococcoideæ; and it may then pass into a *Palmella* or *Glœocystis* state by swelling of the membrane; or the two cells may again divide into four, the cell becoming thus a sporange. The zoospores are produced from the *Palmella*-form, and resemble those of *Chlamydomonas*. *Eremosphæra* must be placed provisionally among the Protococcaceæ, but shows a distinct affinity to the Volvocineæ.

Terminology of Diatoms.†—Dr. O. Müller proposes a new terminology for diatoms, founded, in its main points, on the scheme of Schulze ‡ for animals.

The overlapping half-cell is the *epitheca*, the underlapping half-cell the *hypotheca*; the shells are valves, and for the girdle-bands he proposes the term *pleuræ*; the epitheca is composed of the *epivalve* or larger shell and the *epipleura*, the hypotheca of the *hypovalve* or smaller shell and the *hypopleura*; between the shells and the girdle-bands are often other pieces of cell-wall, the intermediate bands or *copulæ*. Although the epitheca and hypotheca are unequal, they are yet similar; to this resemblance the term *consimilitude* is applied. Diatoms are either "syngrammæ" with linear, or "sympedæ" with superficial symmetry. The main axis is always "heteropolar," with two or more "isopolar" transverse axes, vertical to the main axis. If the transverse axes are equal the cell is *monaxon*; if unlike, it is *heteraxon*. The main longitudinal axis of the diatom is the *pervalvar axis*, viz. the line which, from the centre of the dividing plane, penetrates the cell-cavity in the epitheeal and hypothecal directions, at equal distances from homologous points of the enclosing walls, and unites the centres of the two valves. In all diatoms this axis is heteropolar; in the syngrammal forms it is also the line to which all parts of the cell lie symmetrically; its middle point is the "centre." In the monaxon syngrammæ the plane which contains the pervalvar axis is the "meridian"; the planes parallel to it are "parameridian." The plane which passes through the centre vertically to the pervalvar axis is the "transversan" plane; those parallel to it are "paratransversan." The axis which lies in the transversan plane, cutting the pervalvar axis, is the "transversal" axis. The *apical axis* is the line which passes through the centre of the pervalvar axis in the direction of the raphe, at equal distances from homologous points of the girdle-band surfaces, and through the apices. The second transversal axis at right angles to the apical one, and passing through the centre of the pervalvar axis, is the *transapical axis*. The plane which passes through the apical and the transapical axes is the *valvar plane*; the plane at right-angles to this one passing through the pervalvar and the apical axes is the *apical plane*; the one at right-angles to both

* Bot. Ztg., liii. (1895) 1te Abt., pp. 137–42 (1 pl.).
† Ber. Deutsch. Bot. Gesell., xiii. (1895) pp. 222–34 (1 pl.).
‡ Cf. this Journal, 1893, pp. 159, 815, 816.

these, passing through the pervalvar and the transapical axes, is the *transapical plane*.

The author proceeds to define the different kinds of symmetry which may occur in the diatom-frustule, and gives a number of examples of the use of the terms which he proposes.

Sporulation of Diatoms.*—L'Abbé Count F. Castracane records an example of the formation of spores within the frustule of *Fragilaria crotonensis*. The spores were very small, but showed a distinct nucleole. The number in each frustule was in most cases only two, though in some instances there were four, evidently resulting from the division of the two primary ones.

Fossil Diatoms from the Quirinal.†—Dr. M. Lanzi gives a list of about 70 fossil diatoms from the Quirinal. Their nature suggests that the deposit was in fresh or at most slightly salt water.

Phycocyan.‡—Herr H. Molisch has succeeded in separating phycocyan from an *Oscillatoria*, probably *O. leptotricha*, in the form of beautiful indigo-blue crystals, the chemical and physical reactions of which are given in detail. These show it to be of the nature of an albuminoid.

β. Schizomycetes.

Assimilation of Free Atmospheric Nitrogen by Microbes.§—According to M. S. Winogradsky, the power of fixing atmospheric nitrogen is not the property of all microbes, but belongs to one form only, which he names *Clostridium Pasteurianum*, nearly allied to *C. butyricum*, and which he was able to isolate from other organisms of the soil. The nitrogen which is fixed is mainly in an insoluble organic form. Of 15 other soil-microbes on which experiments were made, none was found capable of assimilating nitrogen; nor were they able to utilise carbohydrates in the absence of combined nitrogen.

Bacteriology of Water.‖—The fourth report of the Royal Society's water research committee is occupied by an essay on the biology of *Bacillus ramosus* by Prof. H. Marshall Ward. This Schizomycete occurs at all seasons more or less, and forms on isolation plates white colonies which rapidly develop into large membranous growths. It seems to be commoner in the river water in autumn and winter than in spring or summer. Prof. Ward has succeeded in following out the life-history of this species in a singularly complete manner; and as he finds the organism to be a remarkably typical and instructive one, he has thought it worth while to give in detail all the facts which have come under his observation, and especially to call attention to the fact that this species runs through its entire life-history from spore to spore-formation in from thirty to sixty hours at ordinary temperature. The author has, moreover, been enabled to follow the course of this life-history by continuous observation under powers (1/12 and 1/20 oil-immersions)

* Atti Accad. Pontif. Nuovi Lincei, xlviii. (1895) pp. 87–8. Cf. this Journal, *ante*, p. 562.
† Op. cit., xlvii. (1894) pp. 156–60.
‡ Bot. Ztg., liii. (1895) 1te Abt., pp. 131–5 (2 figs.).
§ Arch. Sci. Biol., iii. (1895) pp. 297–352. See Journ. Chem. Soc., 1895, Abstr., p. 283.
‖ Proc. Roy. Soc., lviii. (1895) pp. 265–468.

much higher than have commonly been employed successfully for such observations. Prof. Ward begins with an account of his bacteriological cultures, and gives in tabular form the characters of the species. He next discusses its classification, and remarks that many bacteriologists are not always sufficiently careful to look up the synonyms of the forms they describe, though this precaution is really more necessary in the deplorable state of their literature than probably in any other department of biology. The germination of spores is next considered, and the formation of stresses is described. The development of the spores is fully discussed, and is followed by measurements of the growth of the rods and filaments. Growth and cell-division come next under discussion. After some comparative measurements, the results of germination and growth behind glass screens are described. It is clear that growth occurs with increasing rapidity in suitable food-materials and under suitable conditions. The rate of growth may vary according to the action of certain factors partly external and partly internal, and this variation may be local in a filament, or general. Prof. Ward's experiments show that the growth is slower on exposure to sunlight passing through certain screens, whereas it is not retarded perceptibly in light through other screens. It is possible that actively growing filaments may have some power of overcoming the detrimental action of rays which seriously injure or even kill the spores in a state of rest. There can be no question that exposure to direct sunlight kills both spores and filaments. Prof. Ward has made a series of very important experiments on temperatures, as he was by no means satisfied with some of the results that he obtained. So far as the spores exposed in the ripe resting condition are concerned, it may be regarded as proved that the blue-violet rays can retard or kill them apart from any temperature effect. Actively growing bacilli are affected by the light action which retards their growth and even eventually kills them.

In attempting to trace the effects of light, it is so difficult to keep two growing filaments exactly at the same temperature under different conditions of illumination, that the quantitative results cannot be insisted on too much in detail, for there is always the suspicion that even a difference of less than one degree of temperature may affect the rate of growth. Some results suggest the possibility that the organism may even make use of rays at the red end of the spectrum in combating any effect of those at the blue end. Experiments made without the use of glass show distinctly that the spores are retarded or killed by five or six hours' exposure to daylight even of low intensity; and apart from temperature the growing filaments are often not measurably retarded within the period observed, but the evidence goes to show that the light slowly retards the growth. Whatever the light action consists in, it is evidently exerted by the more refrangible rays, and is the more pronounced, the more intense the light. It would appear that there are three points to be considered as regards the growth and behaviour of the organism:—(1) The rate of germination; (2) the rapidity of post-germinal growth; and (3) the time occupied in completing the life-cycle from spore to spore. It is impossible for us, with our space, to give a full account of the enormous amount of work which Prof. Ward has done on this bacterium. He is led by his studies to suggest that it might be worth investigating how far some heliotropic effects and retardations of growth in higher plants, and the retarding action of light on growth generally, are due to destructive oxidations in the cell-sap of highly combustible food-materials, at or just prior to the moment they are ready to be assimilated into the living substance of the protoplasm.

Thermophilous Bacteria.*—Mdlle. Lydia Rabinowitsch has verified and extended the observations of Globig, who found that certain bacteria have an optimum temperature of from 50°–70°. The behaviour of these bacteria on different media and at different temperatures was tested, and an attempt made to ascertain under what meteorological conditions they would grow. The cultivation and isolation of bacteria on agar is not easy, on account of the great amount of condensation water and of the rapid drying. These difficulties were, however, skilfully obviated. Four species were isolated from earth, and these were afterwards demonstrated in fresh snow. Spree water contained 7000–8000 thermophilous bacteria in 1 ccm. They were found in cow and horse dung, and in the intestinal tract of the horse, cow, goat, guinea-pig, rabbit, dog, mouse, pigeon, duck, parrot, man, frog, *Varanus pythau*. From the rabbit, cow, and mouse, three species were isolated. As these bacteria were infrequent in the stomach, frequent in the small intestine, and most numerous in the large intestine, the author came to the conclusion that they increased in the body. At higher temperatures they grew anaerobically, but more slowly as aerobes at lower ones; though, conversely, simultaneously made cultures always developed more quickly aerobically at higher, than anaerobically at lower temperatures. Thermophilous bacteria are found on wheat, oats, and barley. In barley they are most numerous during the middle stage of germination. The author considers it not improbable that thermophilous bacteria have some share in the spontaneous heating of malt, manure, wool, hay, and tobacco.

Fluorescing Bacteria.†—Herr K. Thumm has made experiments with *Bacillus fluorescens tenuis*, *Bac. fl. putidus*, *Bac. fl. albus*, *Bac. erythrosporus*, *Bac. viridans*, *Bac. pyocyaneus*, *Bac. syncyaneum*, for the purpose of ascertaining whether the pigment produced was alike in all cases, whether the production is dependent on the development of the organism, or whether it is influenced by the nutritive medium. The experiments were numerous, and only some of the more important results can be referred to. All fluorescing bacteria, when cultivated in alkaline media, produced first a blue fluorescence, which afterwards becomes of a green hue, while the substratum assumes a yellow colour. All the species form alkali and the *same* pigment. If acid-forming bacteria also be present in a culture, they prevent the fluorescence. All oxidise grape sugar to acid, which is neutralised by the ammonia afterwards formed. The formation of pigment and ammonia takes place only in the presence of oxygen.

Fluorescing Function of Microbes.‡—According to M. C. Lepierre, fluorescence is due to an extremely complex function, and up to a certain

* Zeitschr. f. Hygiene u. Infekt., xx. No. 1, p. 154. See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 585–6. Cf. this Journal, *ante*, p. 346.

† Arb. a. d. Bakter. Inst. d. Techn. Hochschule zu Karlsruhe, i. (1895) p. 291. See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 586–8.

‡ Ann. Inst. Pasteur, ix. (1895) pp. 643–63.

point is independent of the development of the species. It is only manifested when the general conditions of the nutritive medium (temperature, amount of carbon, nitrogen, &c.) are favourable. Fluorescence does not appear to be the exclusive appanage of one function or of one chemical element; very different molecular groupings enjoy the power of manifesting it. This function is independent of the existence and of the relative quantity of phosphates, though a certain quantity is necessary for the life of the species. The author lays special stress on the fact that the addition of these salts does not of itself bring about the development of fluorescence in a medium which previously did not produce it.

Association of Aerobic and Anaerobic Microbes.* — M. Monod describes a case of puerperal fever in which part of the liver was found to be gangrenous. Three species of bacteria were isolated therefrom, a *Streptococcus*, *Bacterium coli commune*, and *Vibrio septicus*. The author favours the view that *V. septicus* must have come from the intestine, and considers it not improbable that *B. coli* had the same origin. With regard to *Str. puerperalis* he leaves it open whether the anaerobe found its way through the fallopian tubes or from without. Hence there appears a great probability that this was a case of auto-infection from the intestinal canal rather than of traumatic infection.

Air of Schoolrooms.†—Herren Ruete and Enoch have made quantitative examinations of schoolroom air for the purpose of ascertaining the average number of germs, and whether any of these be pathogenic. A modification of Hueppe's method was adopted; measured quantities of air were passed through gelatin; the windows were closed an hour before the examination began. The maximum number of germs amounted to over 3,000,000 per cbm., the minimum to 1500 per cbm., the average being about 268,000 per cbm. of air. The examinations were made from September to March, and the individual results were extremely variable. Eighteen different species of bacteria are described, but only one of these was found to be pathogenic to mice, rabbits, and guinea-pigs, and the post-mortem inspection was negative.

Asteriform Intestinal Microbe.‡—Dr. C. de Klecki has isolated from the small intestine of the guinea-pig a species of bacterium, the colonies of which present on gelatin plates an unusual shape. It is a saprophytic bacillus with rounded ends. In young cultures it is 2 μ long and 0·75 μ broad, but longer in older ones. It is mobile, forms little heaps, rarely short chains, does not liquefy gelatin, and is stainable by Gram's method. Stroke cultures on gelose at 33° are of a yellowish-grey colour in 24 hours. From each side of the track extend fine branching prolongations, thus giving the colonies an asteriform appearance, somewhat like starfishes.

Biology and Morphology of the Tubercle Bacillus.§—Herr W. Lubinski has obtained some interesting results from cultivating the

* La Semaine Méd., 1895, p. 224. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 207–8.

† Münch. Med. Wochenschr., 1895, Nos. 21 and 22. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 128.

‡ Ann. Inst. Pasteur, ix. (1895) pp. 735–6 (6 figs.).

§ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 125–8.

tubercle bacilli in media containing vegetable, viz.:—(1) 4 per cent. glycerinised potato-broth; (2) 4 per cent. glycerinised potato-agar; (3) 4 per cent. glycerinised potato-meat-pepton-bouillon; (4) 4 per cent. glycerinised potato-meat-pepton-agar. On the first two the tubercle bacillus was found to thrive just as well as on the ordinary glycerin-meat-pepton-bouillon, while on the last two the energy of growth was almost twice as great. Cultivations of the tubercle bacillus were also made on media of similar composition but with acid reaction. Of these the agar cultures showed a brownish-yellow pigmentation; the virulence was only half as great as that of ordinary cultures; microscopical examination showed that the cultures consisted of long filaments (in the bouillon cultures they were especially long). No lateral branching was noticed. By transferring these cultures to alkaline media the ordinary bacillar form reappeared. The author regards the filaments as heteromorphic forms of the tubercle bacillus produced by growth on acid media.

Morphology of Tubercle and Glanders Bacilli.*—Herr Semmer found in old tubercle cultivations on potato which had been grown in a thermostat at temperatures varying from 25°–35°, dichotomously branched, long, matted filaments, the thickness of which was much greater than that of ordinary tubercle bacilli, being about the same as that of anthrax in the blood. In the filaments were bodies, in part staining darker, in part remaining unstained. The author considers the filament form as the perfectly developed stage of the tubercle bacillus, which grows as a saprophyte at low temperatures, while in the human and animal body the short small bacilli are an intermediate stage adapted to altered conditions. The glanders bacillus is also pleomorphic and variable; for under certain circumstances it grows into long filaments with vesicular and club-shaped expansions, and also with unstained refracting vacuole-like corpuscles. These corpuscles apparently consist of mucoid or colloid substance, and have some connection with the formation of resting-forms. If animals be inoculated with cultures consisting of the long filaments, they die of glanders, and only the ordinary bacillus of glanders is found in their organs. The author is of opinion that all pathogenic micro-organisms are originally saprophytes, and only appear in the human and animal organisms in intermediate and transition stages. Hence they must all be potential and not essential parasites.

Serum Therapeutics of the Plague.†—MM. Yersin, Calmette, and Borrell have made experiments for the purpose of demonstrating the possibility of immunising animals against the plague, and of curing those already attacked by the disease. Cultures on gelose heated to 58° for an hour were injected into the veins, the peritoneal sac, and beneath the skin of rabbits. The animals were found to have become immune to inoculations of the living virulent microbe, provided that they had quite recovered from their previous illness. Positive results were obtained from the serum of the immunised animals, three cubic centimetres of serum being sufficient to protect a fresh rabbit from virulent

* Zeitschr. f. Tiermed. u. Vergleich. Pathol., xxi. pp. 212–6. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 68–9.
† Ann. Inst. Pasteur, ix. (1895) pp. 589–92.

plague injected subcutaneously, and the same quantity injected twelve hours after inoculation cured the animal. The authors then proceeded to immunise a horse, using for the purpose cultures of the plague which killed mice in two days. The result of the first injection (intravenous) was a prolonged and severe reaction. The reactions of subsequent injections became less and less severe. After six weeks, serum was obtained, which showed that it was able to protect guinea-pigs and mice.

Antistreptococcus Serum.—Dr. A. Marmorek,* after discussing the various appearances presented by streptococci, the differences in their virulence, and the pathological phenomena caused by them, narrates his attempts to obtain a preventive and curative serum from vaccinated animals. After failing to obtain a successful serum from rabbits, sheep, asses and horses were tried. From these last a serum giving very satisfactory results was obtained, though its power was not so great as was desired. The serum was not only preventive and therapeutic, but also to some degree antitoxic. 411 cases of streptococcous disease were treated with the serum, the deaths numbering 14—a mortality of 3·4 per cent.

Dr. D. Gromakowsky † obtained an immunising serum from rabbits which had received intraperitoneal injections of a virus attenuated by heat. The streptococcus used was derived from a case of erysipelas, and cultivated in bouillon. The serum was mixed with an equal volume of 2 per cent. boracic acid, and, when injected into persons (2) suffering from erysipelas, seemed to exert a very favourable action.

Micro-organisms of Scarlet Fever Blood.‡—Dr. J. Crajkowski has found a diplococcus in the blood of scarlet fever patients. It was always in the plasma, and never in the corpuscles; sometimes short chains consisting of oval cocci were observed. The organism did not possess a strong affinity for stains, and was easily decolorised. No capsule was observed. Blood was taken with the usual precautions from the ear, and cultivations made on glycerin-agar, agar with hæmoglobin, blood-serum and gelatin, pepton-bouillon, dropsical serum, and hydrocele fluid. On the solid media, except gelatin, colonies 1/3–1/2 mm. in diameter, resembling dewdrops, developed, but the liquid media were more favourable to the growth. Mice reacted energetically to injections of pure cultures, death ensuing in 3–4 days. The same diplococcus was found in the blood of the mice after death.

Ætiology of Acute Articular Rheumatism. — Dr. Singer § has examined the urine in seventeen cases of acute articular rheumatism. Each case was repeatedly tested. In ten cases *Staphylococcus pyogenes albus* (and in two of them in the blood) was found. Once *Staphylococcus pyogenes aureus*, thrice *Streptococcus pyogenes*, and twice *Staphylococcus albus* and *Streptococcus* were found together. In one case, complicated by cystitis, numerous colonies of *Bacillus coli commune* developed. Owing to the quantity and the constancy of the excretion of these

* Ann. Inst. Pasteur, ix. (1895) pp. 593–620. † Tom. cit., pp. 621–4.
‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 116–9 (3 figs.).
§ Wiener Klin. Wochenschr., 1895, p. 449. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 130.

germs, as shown by the plate cultivations, the notion occurred to the author that there might be an ætiological connection between them and the disease; and this view became all the more plausible, as with defervescence and convalescence the number of colonies first diminished, and then disappeared. There is no indication of whether the urine was passed or drawn off.

Dr. F. Chvostek * made repeated examinations of the urine of twelve cases of articular rheumatism. In nine cases the results were quite negative; while from the urine of three, micro-organisms were isolated. One of these was *Diplococcus ureæ*, one was *Staphylococcus albus*, and the third was a large coccus, probably from the urethra. In these examinations the urine was withdrawn by means of a sterilised catheter.

The author has also examined the contents of joints of numerous cases of acute and chronic articular rheumatism, and the effusions into joints arising in the course of acute infectious diseases, but the results were invariably negative. It is however stated that positive results have been obtained in some cases of blood-poisoning and gonorrhœa.

Present Position of the Cholera Question.†—Sig. G. Galeotti has collected together the results of 109 monographs of cholera literature, which deal with the present position of the question of immunity from, and the bacterio-therapeutics of Asiatic cholera. For those acquainted with the subject the compendium contains nothing actually new, and for those who are unacquainted therewith, it is too little critical to serve as a useful guide.

Illuminating Cholera Cultures.‡—Of the three illuminating colonies which were used by Herr F. Weleminsky, two were from true cases of Asiatic cholera, one of them being fatal. The phosphorescence was first exhibited after passage through pigeon's blood. The third case came from the Hamburg epidemic of 1893, and had phosphoresced from the start. Light only appeared where there was access of air. But if reducing bodies (e.g. grape-sugar) were present in the medium, no light ever appeared, nor did it in an atmosphere of hydrogen, but it returned with the access of oxygen. The absorption of oxygen seems to be favoured by the lively movements of the vibrios, and the movements in their turn to be favoured by the presence of oxygen. According to the author, illumination or non-illumination is not to be considered as an actual and specific distinction; illumination is to be regarded as the expression of the function of absorbing and incorporating the oxygen of the air carried to a very high degree.

Dissemination of Anthrax by Coleoptera.§—M. F. Heim received from Luxembourg some insects found on dried sheepskins. An examination was desired, as some of the workmen had been attacked by

* Tom. cit., No. 26. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 231–2.

† Centralbl. f. Allgem. Path. u. Pathol. Anat., vi. (1895) pp. 472–503. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 220.

‡ Prager Med. Wochenschr., 1895, No. 25. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 285.

§ Compt. Rend. Soc. Biol., 1894, No. 3. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 179.

malignant pustule. The skins were covered with a powdery mass which was recognised as excrement, and the insects were found to be *Attagenus pellio*, *Anthrenus museorum*, and a species of *Ptinus*. All these insects, together with their larvæ, were rubbed up with sterilised water, and guinea-pigs subcutaneously injected with the fluid. In 48–53 hours the animals were sick with anthrax. From the investigation it was determined that anthrax spores could pass through the alimentary canal of insects without losing their virulence. The disease therefore could be spread by insects; for the dry powdery excrement is disseminated by the wind, and the anthrax spores thus scattered about. Moreover there is some probability that the spores may develope into bacilli within the digestive tract of the insects.

Effect of Electrolysis on Diphtheria Cultures.*—Herr Krüger finds that by passing an electric current through a bouillon culture of virulent diphtheria, the bacilli are killed and their toxins neutralised, while an immunising substance remains. The fluid is colourless, quite clear, and faintly alkaline. It contains only slight traces of albumen, and is easily evaporated in a vacuum to 1/5 of its volume.

Cultivating Streptococci on Acid Media.†—Dr. R. Turró has shown that streptococci are cultivable on nutrient media with an acid reaction, the acidity being either imparted by the addition of some acid, such as tartaric, or even hydrochloric, or the result of the previous cultivation of another micro-organism such as cholera or anthrax. One advantage of the acid reaction would appear to be that streptococci in almost pure cultivation can be isolated in 24 hours from a crowd of organisms which may be present in the material examined. Another advantage is that the vitality and virulence of the cultivations are maintained for a longer period than when the reaction is neutral or alkaline. The virulence is, however, not increased. Just as on alkaline or neutral media, the vitality of streptococci is diminished or extinguished by cultivating at high temperatures. The initial vitality of streptococci is very variable; thus in nine cases out of fifteen of streptococci isolated from tuberculous sputum, the vitality was lost in the first generation; in suppuration of the urinary tract or vagina streptococci possess extraordinary vitality; sometimes it takes 2 ccm. of culture to set up erysipelas, at others the merest scratch suffices.

Etiology of Small-pox.‡—Mr. J. Christian Bay states that he has discovered the microbe of small-pox. It belongs to Kern's genus *Dispora*, and is called *D. variolæ*. The bacillus has, to a great extent, the same appearance as those found by Plant and Zimmermann. In sheep-pox the bacilli measure 0·6 to 1·0 μ by 0·2 to 0·3 μ. There are two spores in each cell, one at each end. Mr. Bay thinks that the diagnostic value of his discovery is yet uncertain, but hopes to be able to report further progress when the work in hand has reached completion.

Red Water Disease in Cattle.§—Mr. C. J. Pound has made an official report on the red water disease which has occasioned so much

* Deutsch. Med. Wochenschr., 1895, No. 21. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 151–2.
† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xvii. (1895) pp. 865–74.
‡ Amer. Natural., xxix. (1895) pp. 699–709 (1 pl.).
§ 'Red Water Disease in Cattle,' Brisbane, 1895, 8vo, 20 pp.

uneasiness in the minds of cattle-owners in Queensland. He finds that the disease is due to a microbe which passes a large part of its life in the body of the cattle-tick. The results of the invasion of this parasite are perhaps most strikingly seen in the blood, which becomes very thin and watery, owing principally to the disintegration of the red blood-corpuscles, and their rapid absorption by the spleen, which is seen to be enormously enlarged in cattle that have died of the disease. The microbes vary in form in different blood-cells. They primarily appear as minute oval-shaped bodies, usually in pairs, though sometimes singly. The smallest of them scarcely exceed $0 \cdot 5\ \mu$ in length, while the largest are about $2 \cdot 5\ \mu$. Mr. Pound's cultivation experiments have not as yet been successful.

Bacteria in Caterpillars.*—Herr K. Eckstein has made experiments to ascertain the effect of infecting healthy caterpillars. The infection materials were eighteen species of bacteria, two of which were cocci. The author found that *Bacillus B.* Hofm. and *Bacterium monachæ* v. Tub. are identical, and that this species is pathogenic to most caterpillars which can be infected by inoculation or by feeding. *B. lineatus* and *aureus* also showed themselves to be pathogenic under certain conditions. *B. flavus* and *M. vulgaris* were harmless parasites. The different species of caterpillars were found to be unequally sensitive to bacteria, e. g. *Porthesia auriflua* appeared to be immune to *B. monachæ* and *B. aureus*. Though the experiments were made towards the close of the Nun-disease, the results obtained lead to the conclusion that *B. monachæ* v. Tub. may, under conditions not perfectly determined, set up the *Schlaffsucht* in the caterpillars of the Nun.

Bacillus Mori.†—Under this name Dr. P. Voglino describes a new micro-organism which causes black spots on both sides of the leaf of the mulberry. The microbe has a pathogenic effect on the silkworm, producing flaccidity in the larva. The following is the diagnosis of *Bacillus Mori* sp. n.: — Baculis cylindraceis, apicibus rotundatis $0 \cdot 9–1 \cdot 5\ \mu$ longis, $0 \cdot 2–0 \cdot 6\ \mu$ latis, lente mobilibus, nunquam in filamenta connexis, numerosissime consociatis.

Suppurative Pleomorphic Microbe.‡—Dr. Garten records an instance of chronic suppuration, having the clinical aspect of actinomycosis, from which, on bacteriological examination, a pleomorphic organism was isolated. The author calls it *Cladothrix liquefaciens* 2. It is an aerobe, easily cultivated in the usual media, and inoculations on rabbits and guinea-pigs gave positive though only slightly virulent results.

Tubercle Bacillus in the Fœtal Umbilical Vein.§—MM. Bar and Rénon injected blood coming from the placental portion of the umbilical vein of five children, the mothers of whom were tuberculous, into the

* Zeitschr. f. Forst. u. Jagdw., xxvi. (1894) pp. 3, 228, 285, and 413. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 292–3.

† 'Ricerche int. alle macchie nere d. foglie del gelso,' Casale, 1894, 13 pp. and 5 figs.

‡ Deutsche Zeitschr. f. Chirurgie, xli. Nos. 4 and 5. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 287–8.

§ Semaine Méd., 1895, No. 34. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 286.

abdomen of guinea-pigs. Two cases gave a positive result. In one case the mother was suffering from tuberculous pulmonary phthisis, with bacilli in the sputum. The child died the day before birth. The guinea-pig died of tuberculosis two months after it had been injected with blood from the umbilical vein. Three other guinea-pigs injected with an emulsion of the spleen from this child died of tuberculosis. In the other case the mother had extensive excavation of the lungs. The child died forty days after birth of broncho-pneumonia. At the birth two guinea-pigs were injected with blood from the umbilical vein; one of these died from extensive visceral tuberculosis. Both mothers died soon after parturition.

Bacteriology and Small-Bores.*—Dr. J. Karlinski has made some interesting experiments with rifles of different patterns, to determine to what extent the wound made by the bullet can be contaminated by foreign particles dragged in by the projectile. Rifles of six different patterns were fired at varying distances at boxes filled with sterilised gelatin and covered with cloth impregnated with different organisms or sterile Shots were also fired at animals and at dead meat. It was found that foreign particles, such as fibres of cloth, hair, &c., were not only carried in but actually forced to no little distance (3 cm.) from the track. Hence, if a soldier's clothing be contaminated with pathogenic organisms, the passage of a small-bore bullet might carry in along with it the germs of blood-poisoning, and so distribute them as to render antiseptic treatment of the bullet-track itself useless.

Differential Diagnosis between the Microbes of Swine Fever and Fowl Enteritis.†—The bacillus of swine fever may be distinguished, says Dr. E. Klein, from the microbe of fowl enteritis by being shorter and thinner. The colonies in gelatin at 20° are smaller, grow less quickly, and are greyer and smoother. In gelatin puncture cultivations it forms a narrow grey transparent band with slightly crenated edges, while the bacillus of fowl enteritis grows rapidly along the cultivation-track, forming in 2–3 days a broad white band with irregular rather thin edges. On agar neither organism presents anything specially characteristic. On potato at 37° fowl enteritis forms in a few days a brownish slightly elevated moist platelet. The swine fever bacillus forms a colourless thin transparent membrane. The bacillus of swine-fever is pathogenic to pigeons, rabbits, guinea-pigs, and mice, but not to fowls. The bacillus of fowl enteritis is not pathogenic to pigeons; to rabbits only in a restricted degree; it is pathogenic to guinea-pigs and mice.

Margarin Bacteria.‡—Herren Jolles and Winkler have examined margarin and its products bacteriologically for the chief purpose of contrasting the number and kind of germs with those found in butter. The more important results of their investigation were that the number of bacteria in margarin and its products is quite small as compared with the number found in butter (10–20 millions in 1 grm.) The number of germs varies with the kind or variety of margarin and its derivatives; thus, in crude margarin it is higher than in oleomargarin; less in mar-

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 97–102.
† Tom. cit., pp. 105–7.
‡ Zeitschr. f. Hygiene, xx. pp. 60–108. See Centralbl. f. Bakteriol. u. Parasitenk., te Abt., i. (1895) pp. 644–5.

garin lard than in margarin butter. Pathogenic bacteria were not discovered in margarin or its products, and all the bacteria found were saprophytes. From margarin two bacilli were isolated—*Margarin-bacillus* α and β. From margarin butter four hitherto undescribed microbes were obtained—*Diplococcus capsulatus margarineus*, *Bacillus viscosus margarineus*, *B. rhizopodicus margarineus*, and *B. rosaceus margarineus*.

Vibrios and Spirilla of Liquid Manure.*—Herr Kutscher succeeded in isolating from liquid manure eight different species of curved bacteria. They were cultivated in the following way: With each 80 ccm. of the manure placed in Erlenmeyer's flasks were mixed 8 ccm. of a 10 per cent. pepton-salt solution, and then the flasks incubated for 24 hours at 28°. The flasks were then examined to see if any species of vibrio had increased. If this were the case several loopfuls were removed, and agar-plates inoculated with dilutions thereof. If no vibrios were found, the flasks were returned to the incubator until vibrios were discovered, though occasionally they were not. The different species were then isolated on agar-plates. Among these were four slightly bent species called vibrios, among them being one with all the characters of *Spirillum serpens*, and four strongly curved species called spirilla. Of the latter, No. 1 is a slender spirillum, which was isolated by the author also from swine's excrement, and is identical with the delicate spirillum observed by Smith in pigs' dung. No. 2 corresponds morphologically to *Spirillum tenue*, No. 3 to *S. undula*, and No. 4 to *S. volutans*.

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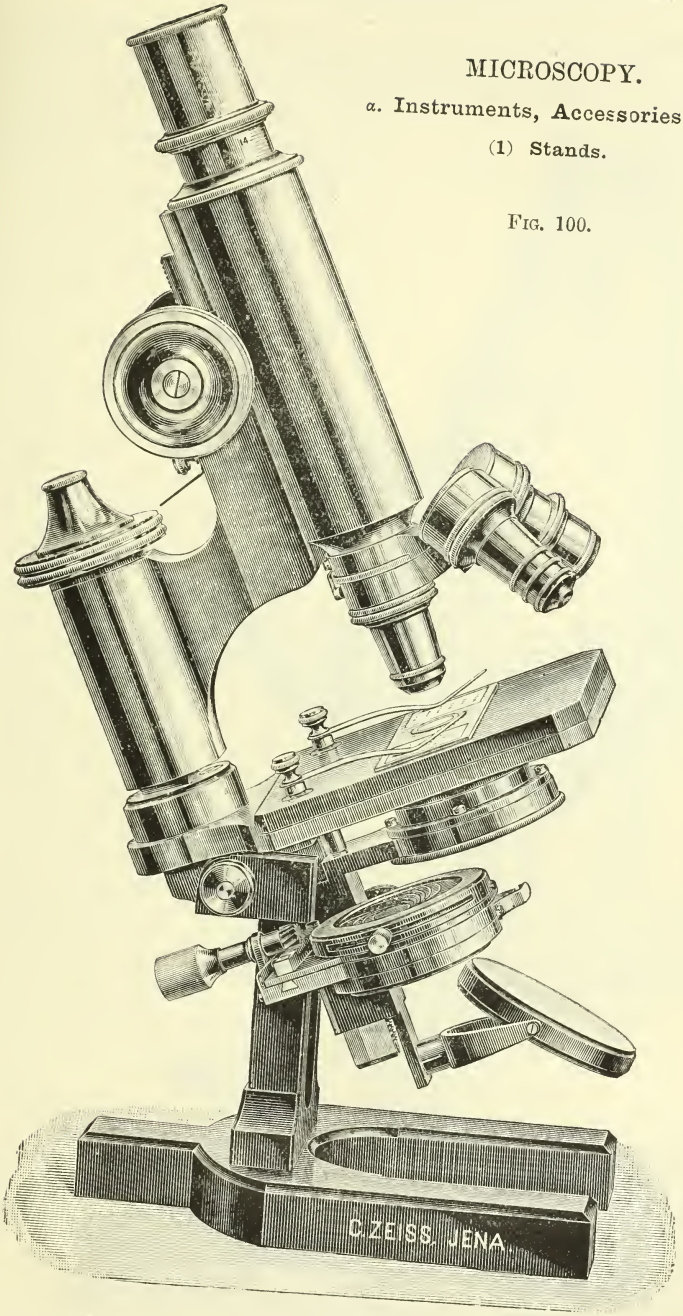
* Zeitschr. f. Hygiene, xx. pp. 46–59. See Centralbl. f. Bacteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 645–6.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

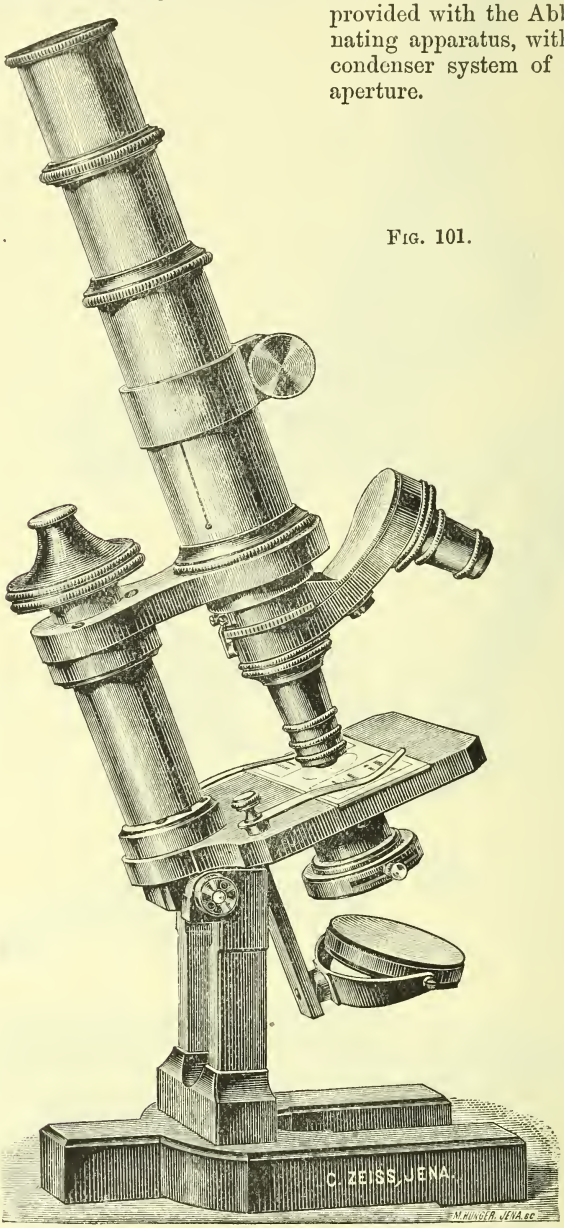
Fig. 100.



* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

Zeiss' Stand IVa.*—This stand is shown in fig. 100 in half full-size. It is inclinable without clamping lever. The vulcanite stage is fixed. The coarse- and fine-adjustment are as in other Zeiss stands. It is provided with the Abbe illuminating apparatus, with iris and condenser system of 1·20 mm. aperture.

Fig. 101.



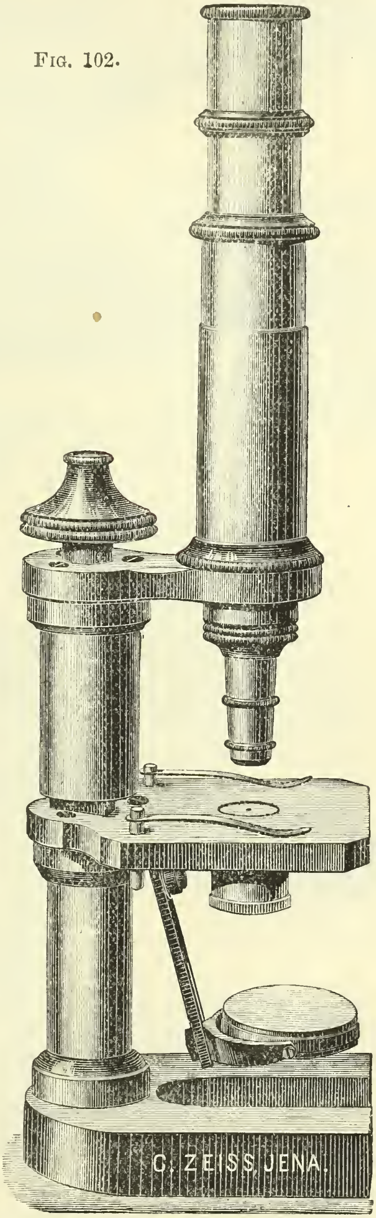
* Zeiss' Catalogue, No. 30, 1895, pp. 46–7.

Zeiss' Stands VI. and VII.*—Stand VI. (fig. 101) is inclinable and has a fixed stage (63 × 70 mm.). The coarse-adjustment is by sliding tube, the fine by micrometer-screw.

Stand VII. (fig. 102) is in all respects similar to Stand VI., except that it is not inclinable. It is substantially built for laboratory use.

Great care has been taken in the construction of the fine-adjustment of both these stands, so that they can be used with the highest dry powers, and even with immersion systems if particular care be taken.

Fig. 102.



Zeiss' Dissecting Stands.†—The Paul Mayer's Dissecting Stand I., shown in fig. 103, has a heavy horse-shoe foot, and a stage consisting of a large metal frame (10 × 10 cm.), to which are attached wooden folding hand-rests. The adjustment is by rack and pinion. The dissecting system may be fixed in the ordinary lens-holder *p*, or in a suitable ring R on the movable arm L R, which is inserted into the ordinary lens-support at L. By this latter arrangement the whole of the stage can be scanned.

Dissecting Stand III. (fig. 104) has a heavy square metal base, and large stage (75 × 60 mm.) with leather-covered hand-rests B. It is provided with different lens-holders, according to the lenses to be used.

Dissecting Stand IV. (fig. 105) is constructed after the well-known former model of Zeiss. The coarse-adjustment is by sliding lens-holder, the fine-adjustment by micrometer-screw.

Polarisation Microscope for the Examination of Butter.‡—Sig. C. Besana describes a new method of examining the purity of butter, which consists in smearing the butter on a selenite plate so orientated on the Microscope-stage between crossed nicols as to give a reddish-violet field. Pure butter

* Zeiss' Catalogue, No. 30, 1895, pp. 54–5. † Tom. cit., pp. 96–9.
‡ Zeitschr. f. Angewandte Mikroskopie, i. (1895) p. 53.

Fig. 103.

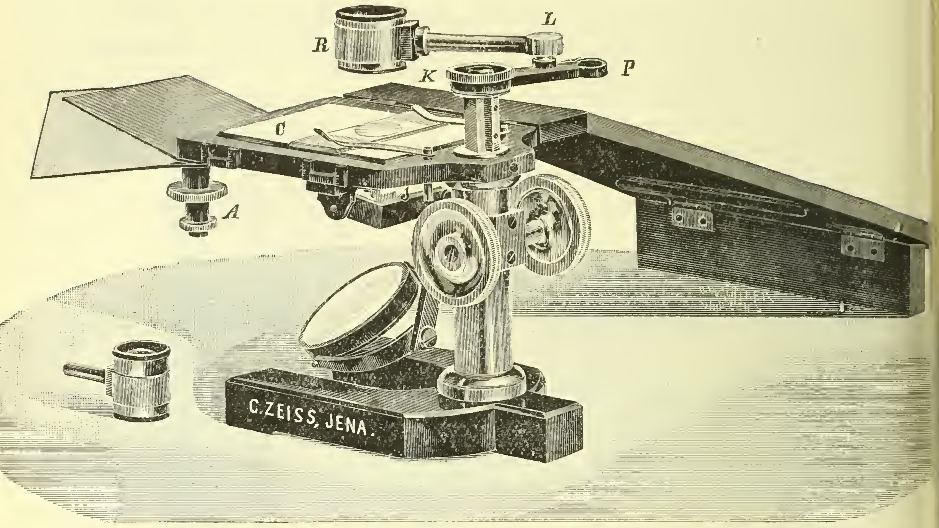
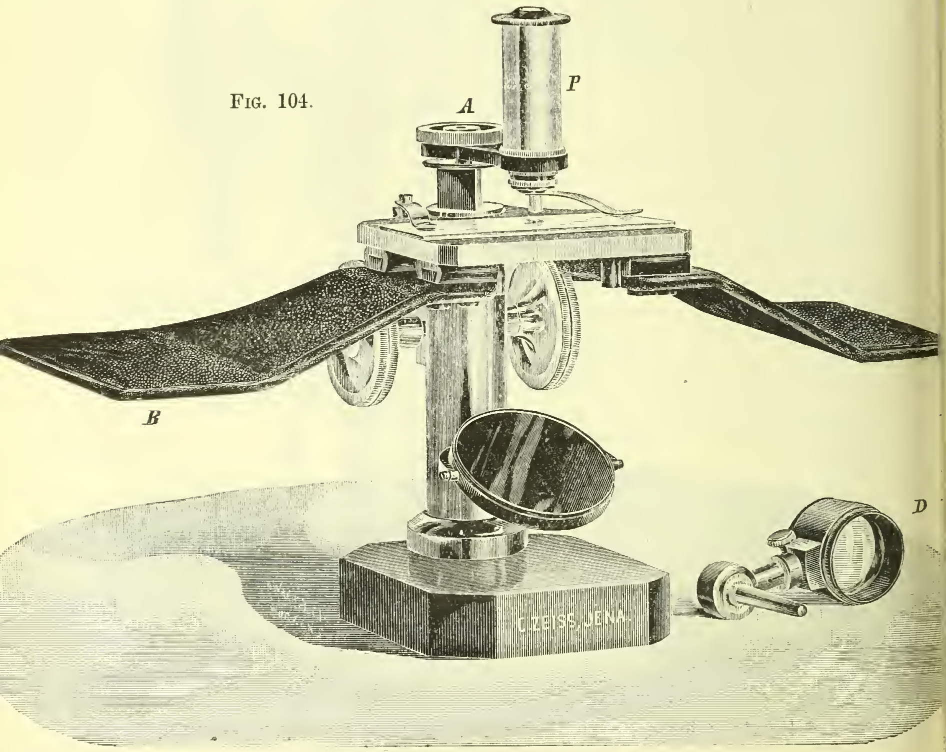
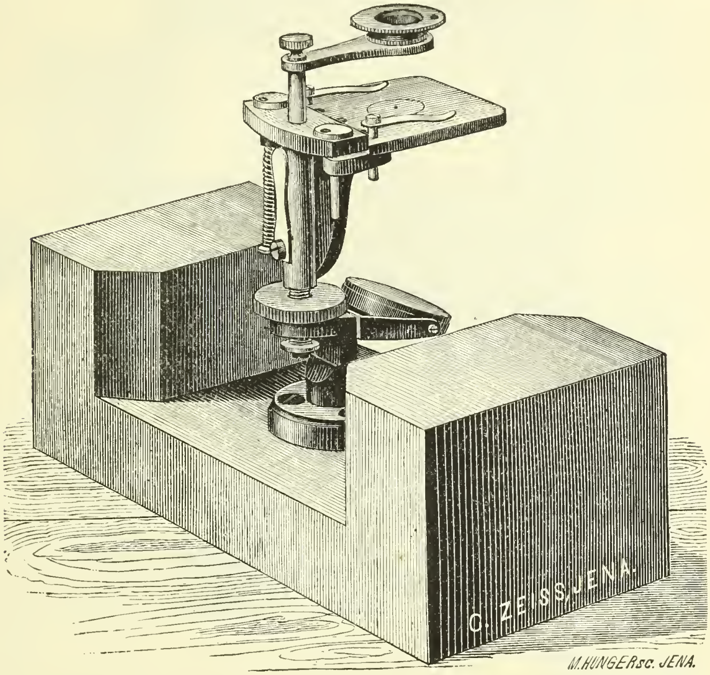


Fig. 104.



under these conditions shows, according to the author, small grains and globules of fat, all giving the same colour as the field. Margarine, on the other hand, shows on the reddish-violet field grains of a yellow to greenish-blue colour. These colours also occur if the butter is old and rancid or contains boric acid, milk-sugar, or salicylic acid.

FIG. 105.



Zeiss' Attachable Mechanical Stage.*—This stage (fig. 106) is in principle similar to those designed by Mayall and later on by Reichert. Two sliding pieces are moved in two rectangular directions by the milled heads S, T, and their position is recorded on millimetre scales. The extent of the rack-and-pinion movement is 30 mm., that of the lateral movement 50 mm.

(2) Eye-pieces and Objectives.

Zeiss' Achromatic Objectives.†—With the aid of the extended list of materials produced by the Jena Glassworks, many of the older types of achromatic lenses have been reconstructed so as to more completely eliminate the spherical and chromatic aberration than was formerly possible.

In fig. 107 the objectives a_1, a_2, a_3, are seen attached to the tube and focused with respect to the plane of the object *o o*. They are so mounted

* Zeiss' Catalogue, No. 30, 1895, p. 95. † Tom. cit., pp. 22-4.

Fig. 106.

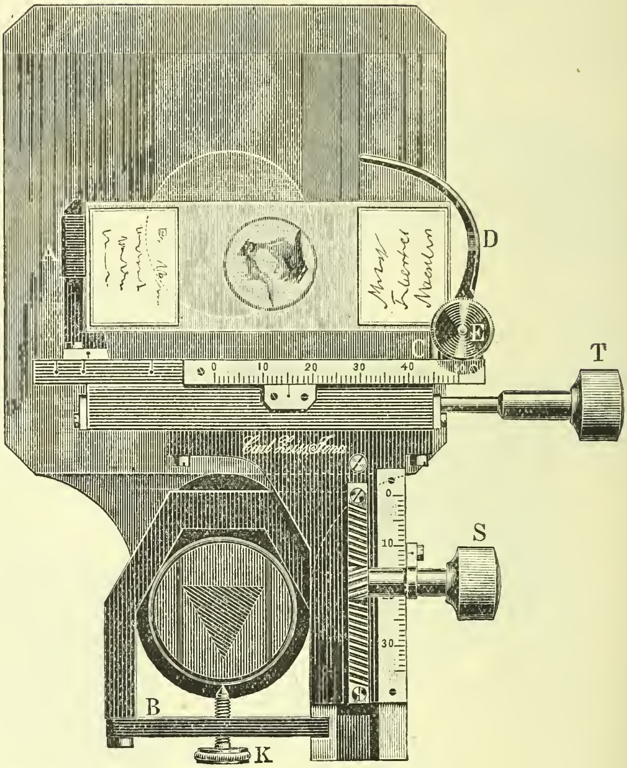
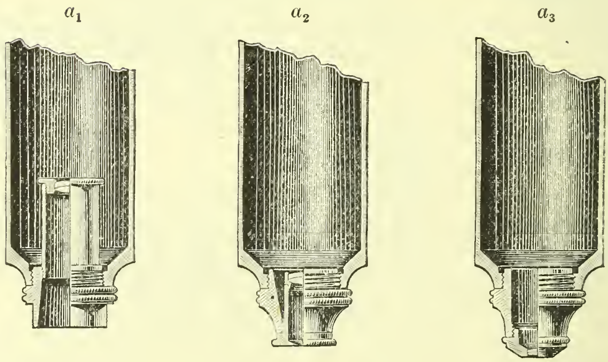


Fig. 107.



that, notwithstanding their great focal length, the body of the Microscope remains at its ordinary elevation.

The objective a* (fig. 108) consists of two achromatic lenses combined after a special formula. The distance between the lenses can be

Fig. 108.

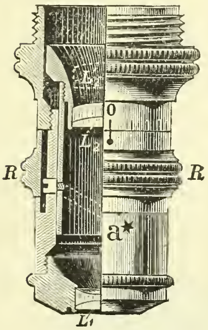
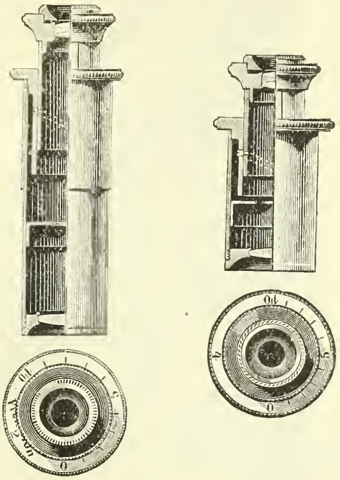


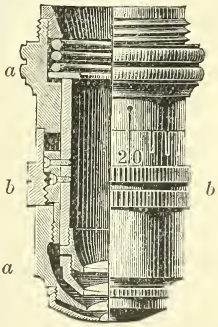
Fig. 109.



varied by the ring R R, like a correction-collar, so that when one of the lower eye-pieces is used the magnification can be varied in the proportion from about 1 to 2.

The new objective D* is a water-immersion lens of great focal length, but with a relatively small aperture. It is intended for the examination of living zoophytes and plants floating in water-troughs.

Fig. 110.



Zeiss' Projection Eye-pieces.*—These eye-pieces (see fig. 109) consist of a collective lens and a compound system which is corrected spherically and chromatically after the principle of apochromatic lenses. A diaphragm is placed between the lenses, and the compound lens can be made to approach it or recede from it.

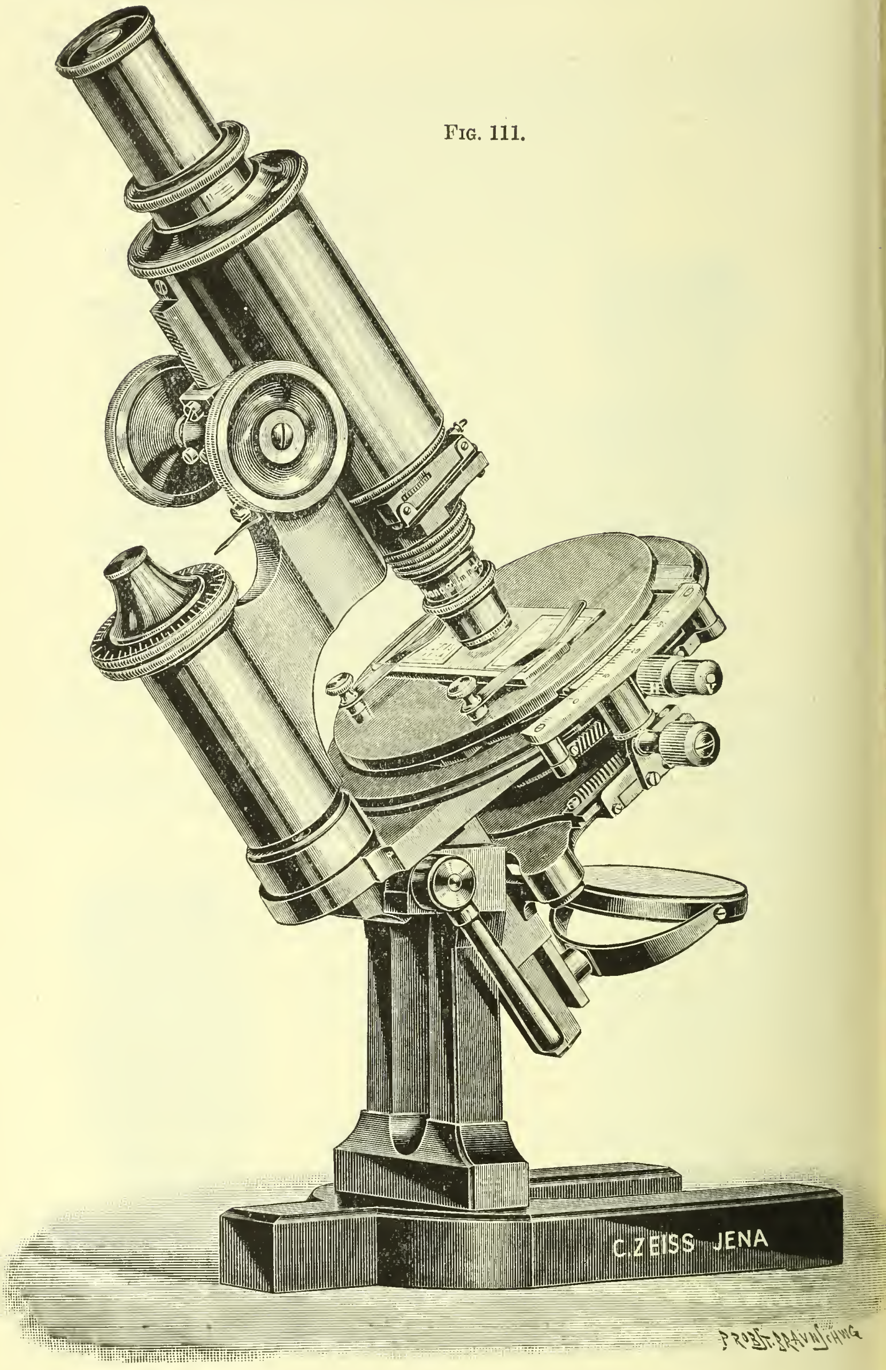
(3) Illuminating and other Apparatus.

Correction Adjustment.†—In fig. 110 is seen the construction of the Zeiss correction arrangement. The ring *b b* serves to adjust the distance between the two upper double lenses and the two lower lenses attached to the mounting *a a*. The divisions on the collar *b b* indicate for each position of the collar that thickness of cover-glass which gives the best correction for that position. The

* Zeiss' Catalogue, No. 30, 1895, pp. 20–1.

† Tom. cit., p. 5.

Fig. 111.



correction for cover-glass thickness is particularly necessary in the case of the apochromatics 4·0 and 3·0 mm. (dry) and 2·5 mm. (water-immersion).

(4) Photomicrography.

Zeiss' Photomicrographic Stand.*—The stand shown in fig. 111 is in size and general arrangement similar to the Zeiss stand I*a*. The round rotating stage is of brass, and has a diameter of 100 mm. By means of the co-axial milled heads H and V, it can be moved in two rectangular directions and its position can be read off on the verniers. The body-tube is very short and unusually wide, so as to provide for the use of long focus lenses.

(5) Microscopical Optics and Manipulation.

Diffraction Theory.†—Herr K. Strahl remarks that the knowledge of the diffraction theory is daily becoming more important for the practical optician. It becomes more than ever necessary therefore to understand what is meant by diffraction-theory. According to the author there are two diffraction theories which are constantly being confounded. One diffraction theory relates to the modification which light suffers in passing across sharp edges or between narrow slits.

The diffraction, however, which is of such importance for the telescope, for observation and measurement, is something quite different from this. Here the edges and diaphragms act not as edges consisting of brass or steel, but as geometrical boundaries which prevent the incident light-wave being effective in its whole extent. The greater the effective part, the smaller is the effect of the diffraction.

Compensation of Errors of Objectives.‡—Herr K. Strahl gives some of the results which follow from the calculations of the most important errors of objectives which he has made.

According to geometrical optics, it is easy to conceive the possibility of correcting the positive spherical aberration of an objective by the negative equally great one of an eye-piece.

According to geometrical optics, it is, however, impossible to correct the positive error of an objective by an equally great positive error of the eye-piece.

And yet this is, according to the diffraction theory, perfectly possible.

The author, by a closer investigation, finds that the light-distribution in the region of the focus of an objective of which the spherical aberration A is < 1 (for yellow rays this is the case with all newer objectives) is so similar to that of an aplanatic objective, that the difference amounts to scarcely more than one-hundredth of the complete light-intensity. A compensation of such errors is therefore unnecessary.

The author accordingly concludes that the influence of the spherical aberration has been up till now considerably overrated by the theorists.

Indication of Magnification in Micrographic Drawings.§—M. H. Bolsius, referring to Dr. Carazzi's note on this subject,‖ states that he considers that the method advocated in that note should be combined

* Zeiss' Catalogue, No. 30, 1895, pp. 40–1.
† Central-Ztg. f. Optik u. Mechanik, xvi. (1895) p. 213.
‡ Tom. cit., pp. 183 and 194.
§ Zool. Anzeig., xviii. (1895) pp. 386–8.
‖ See *ante*, p. 368.

with the old method which consisted in giving the numbers of the eye-piece and objective. In order to judge of the value of a drawing, the indication of the magnification in diameters is not sufficient, at least in the case of high magnifications: in these cases the particular eye-piece and objective used should also be given. In illustration of his contention the author gives two examples in which magnifications of 250 and 370 times can be obtained by four different combinations, in each case, of objectives and eye-pieces of Zeiss.

Theory and Technique of the Microscope.* — This contribution from the literary remains of Dr. Th. Marsson consists of notes on the theory and technique of the Microscope, arranged under the following headings:—General optical principles; Dioptrics; Lenses; Objective systems; Focal length; Angle of aperture of the system; Eye-piece; Magnification; Field of view; Aberration.

The information conveyed is for the most part such as is given in more extended form in the ordinary text-books, but may be found useful as a review of the more important facts to be remembered in Microscopical work. A few points may be noticed. Under the heading of Objective-systems the influence of the cover-glass is discussed. Divergent rays from the object passing through the cover-glass produce a series of images one above the other, the effect of which is similar to that of spherical aberration. With weak objectives the effect is negligible, but increases with the strength of the objective and with the thickness of the cover-glass. The thickness of the cover-glass also stands in a certain relation to the length of the body-tube: the more the tube is shortened, the thicker must be the cover-glass.

The effect of immersion systems is to give correction of aberration, increase of magnification and of angular aperture, increase of the distance between objective and object, and admissibility of thicker cover-glasses. In the use of the correction arrangement, the Microscope is adjusted on the dark edge of an object, and the lenses are brought nearer together or farther apart, until an equally strong broadening of the edge results, whether the object be brought within or beyond the principal focus.

The objective system should be somewhat over-corrected, the eye-piece a little under-corrected.

The methods of Gray and of Govi for determining the angular aperture are described. In the Govi method the Microscope is in the ordinary vertical position on a dark table. A lens of from 2 to 3 cm. focal length is brought above the eye-piece, and two strips of white paper are placed on the table near the Microscope. These are separated from each other until their images just come on the opposite edges of the field of view. If the distance between the two strips of paper $= d$, the distance of the objective from the table $= a$, the tangent of the half angular aperture is

$$T = \frac{d}{2a}.$$

For testing spherical aberration, a mercury thread in a capillary tube is recommended for weaker objectives, and fine scratches on silvered glass for stronger objectives.

* Zeitschr. f. Angewandte Mikroskopie, i. (1895) pp. 33–7 and 65–9.

As regards the chromatic aberration, when the distance between objective and object is within the normal focal length, with an over-corrected system the image is surrounded by a violet border, passing into blue; while if the objective is beyond the normal focal distance from the object, the image appears surrounded by a red border, passing into yellowish-red. With an under-corrected system exactly the reverse colour-effects are seen. Still more sensitive are bright lines on a dark ground with oblique illumination. A line at right angles to the light falling obliquely from the right, shows with an over-corrected system the left edge violet or blue, the right red or yellowish-red. With an under-corrected system the appearance is just the opposite.

Introduction to Microscopy.*—This is an excellent book. The optical part is most clearly written, the whole of the chief problems being worked out by examples and diagrams, without a number of formulæ, but yet scientifically. The chapter on the polariscope—not, as a rule, a strong point in the ordinary text-book—while to some extent perhaps recalling Nägeli and Schwendener, is particularly good. The individual apparatus described is, naturally, entirely German, and therefore the weakest part is that devoted to the substage condenser, Abbe's chromatic being the only form dealt with. The practical sections appear equally satisfactory, and altogether it is one of the best works on general microscopy we have met with for some time.

(6) Miscellaneous.

Determination of the System of Microscopic Crystals.†—Dr. J. L. C. Schroeder van der Kolk describes the method he employs for determining the system of small crystals under the Microscope. The greatest difficulty is experienced in the case of minute needles with straight extinction. For such cases the author makes use of a glass hemisphere which rests with its convex surface in the opening of the Microscope-stage, while the flat surface serves as stage for the object. The radius of the opening in the Microscope-stage amounts to about 9 mm., that of the hemisphere to about 15 mm. The hemisphere can now be turned in any way required, while the middle point remains stationary.

The solution to be examined is allowed to crystallise on a thin cover-glass which is attached to the glass stage with some oil or Canada balsam. The needle to be examined is now centered and brought into coincidence with one of the cross wires, when it can be turned

(1) about its own axis;
(2) about the horizontal normal to its own axis;
(3) about both axes successively;
(4) about the vertical.

The author then gives some practical examples of the uses of the hemisphere in distinguishing between isotropic and uniaxial pinakoidal plates, optically uniaxial and biaxial needles, rhombic and monoclinic pyroxenes, and in determining the oblique extinctions of the plagioclases.

* Dr. A. Zimmermann, 'Das Mikroskop. Ein Leitfaden d. wissenschaftlichen Mikroskopie,' Leipzig and London, 1895, 8vo, 334 pp., 231 figs.
† Zeitschr. f. wiss. Mikr., xii. (1895) pp. 188-92.

β. Technique.*

Notes on Experimental Technique.† — Dr. E. Centanni uses an apparatus for injecting animals (fig. 112), which consists of an ordinary rubber bulb A. Into the opening is fitted a metal tube B, having a diameter of about 1 cm. It projects about 2 cm., and its end is cut off obliquely. From the side of the tube, just where it leaves the bulb, another metal tube C comes off at right angles. Its diameter is rather less than the former's, and it is connected with a rubber tube about 50 cm. long. D is a hook to attach the apparatus to the operator's coat. When a squirting action is required the opening B is first closed with the thumb and then the rubber ball squeezed. If aspiration be needed the procedure is reversed. If it be necessary to keep up a permanent pressure or aspiration a Mohr's pinchcock is placed on the rubber tube and only opened when the bulb is working. The diameter of the bulb may be

Fig. 112.

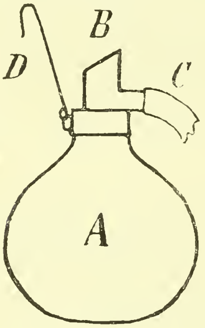
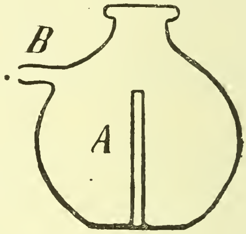


Fig. 113.



from 3–6 cm., and if thick fluids are being worked with, e. g. glycerin extracts, or emulsions of tissues, the wall of the bulb must be very thick.

For collecting serum the author uses an almost spherical bottle (fig. 113) with short neck and flat bottom. From the side, at about 2/3 of the height of the bottle, comes off a short tube B. From the middle of the bottom rises up the glass rod A to 2/3 of the height of the bottle. After the apparatus has been sterilised, the free end of the tube in the jugular vein of an animal is passed through the neck of the bottle and blood allowed to flow in until it reaches the level of the side tube B. When the serum has properly separated it is removed through the side tube, the central glass rod preventing the clot from becoming detached.

For obtaining thin emulsions or for separating the solid and liquid portions of emulsions, the author has devised two instruments which filter by aspiration and can be worked with a metal net and with filter

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. f. Bakteriol. u. Parasitenk., 1[te] Abt., xviii. (1895) pp. 276–82 (6 figs.).

paper. The funnel-filter (fig. 114) is an ordinary copper funnel along the edge of which a flat ring of tinned iron A is fastened. This is in two parts, the outer being fixed, while the inner one is movable and serves for the support of a circular metal net D, which closes the opening of the funnel. Upon this lies another flat ring B, and the two are fastened

FIG. 114.

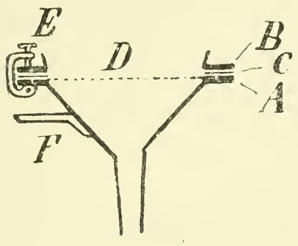
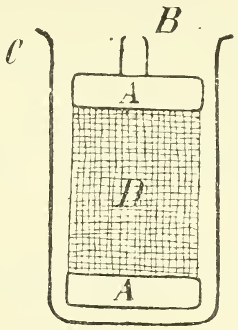


FIG. 115.



together by four clamps E, and in order to hermetically close the space a rubber band C is interposed. F is a projection or handle for fastening the apparatus to a support.

The bougie-filter (fig. 115) is somewhat like the porcelain bougie-filter in appearance, though shorter and wider. It is made of metal net-

FIG. 116.

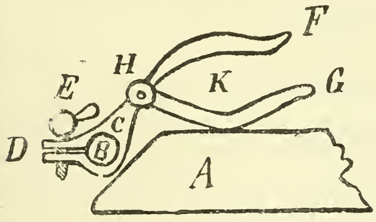
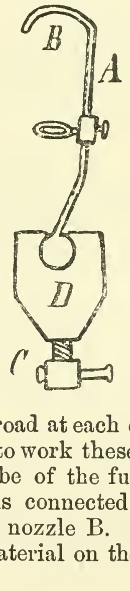


FIG. 117.



work. The top and bottom as well as a strip 2 cm. broad at each end are made of metal plate and are exactly alike. In order to work these filters the ordinary aspiration apparatus is used. The tube of the funnel is placed in a Kitasato's bottle, and the bougie-filter is connected with a similar receiver by a rubber tube fastened on the nozzle B. A thin emulsion is obtained by placing the pounded up material on the metal net D (fig. 114), constantly stirring during aspiration, or by placing it in a beaker C (fig. 115) with the bougie-filter inside.

For securing the legs of rabbits the author substitutes for the ordinary fastening a more secure contrivance (fig. 116). To the obliquely-cut side of the board A is fixed an iron rod B, on which runs the fixation clamp. This consists of the piece D C F which is split on the rod B—D and fixed by the clamp E. At H is a joint on which moves the piece G, the lower fang of the forceps. As G on its anterior half is split in two, the space K can be reduced to nothing, as the two prongs of G allow F to pass between them. There are four of these grips, one for each extremity, and all are covered with rubber. The limb is fastened after it has been passed through K by pressing F down and then screwing up E. For fastening the head the author uses a modification of Tatin's apparatus, which prevents operations on the brain and sometimes on the face, while the apparatus shown in fig. 117 allows of both.

Suggestions on Bacteriological Technique.*—Dr. A. P. Ohlmacher uses commercial benzene in the technique of bacteriological autopsies on small animals. The benzene is employed as a bath for the instruments and also to disinfect the surface of the animal's body before the final incision. After the skin has been removed the benzene is applied to the surface and then ignited. When the instruments are required they are removed from the dish, the benzene is lighted and allowed to burn off. The instruments should be redipped and ignited as each particular organ is dealt with. This procedure, if properly carried out, satisfies all the requirements of antisepsis.

By far the best methylen-blue is that proposed by Ehrlich for blood-work, especially for staining *intra vitam* ("methylen-blau nach Ehrlich"). This dye gives much better and more effective results than the pigment ordinarily used.

For staining the diphtheria bacillus methyl-violet 5 B (Grübler) is highly recommended. To a saturated alcoholic solution of the dye, water in the proportion of 10 to 1 is added.

(1) Collecting Objects, including Culture Processes.

Use of the Microscope in Fermentation Industries, with an Introduction to Study and Cultivation of Yeasts.†—The work of Herr P. Lindner is intended for persons engaged in brewing and other fermentation industries and appears to be admirably adapted for their requirements. In it are described the Microscope and its manipulation, the fittings and apparatus requisite for a fermentation-laboratory, their application, the appearances of the different yeasts under cultivation, the method of isolating particular organisms, the sources of contamination and the effects of deleterious organisms, the determination of the number of organisms present in wort, beer, water, &c., and in fact, every branch of the subject that is likely to interest the student of fermentation and the practical brewer.

* New York Med. Journ., lxi. (1895) pp. 268-9.

† Berlin, 1895, 4 photographic plates and 105 illustrations. See Bot. Centralbl., 1895, Beih., p. 300.

Obtaining Germ-free Water with Calcium Chloride.* — Germ-free water, says Herr Bassenge, can be obtained in less than 15 minutes by chemical means. In order to render water which is most impure from the presence of pathogenic bacteria perfectly germ-free, it is sufficient to add 0·0978 grm. of pure calcium chloride (equivalent to about 0·15 grm. of commercial chloride) to the litre, and allow it to act for 10 minutes. The quantity of chloride may be decreased if its action be prolonged, e. g. two hours requires only 0·0108 grm. The chloride not used in the disinfection or in the form of hypochlorous acid is reduced by the addition of bisulphite of calcium, a precipitate of sulphate of lime being deposited. Water thus treated is harmless, has no ill flavour, and is of increased hardness. It can be used for a long time without any influence on the organism (the author has tested it on himself), for the chemical treatment has only imparted to it constituents present in natural drinking waters. No chemical test is required to find out whether all excess of chloride has been reduced; it is quite sufficient to trust to taste and smell.

Air and Germ-tight Cap for Bacteriological Work.† — Herr R. Burri describes an air- and bacterium-tight cap which is adapted for closing test-tubes or other similar vessels used in bacteriology. One of its chief merits is that it quite prevents diminution in bulk of the medium from evaporation. Fig. 118 shows the shape and position of the rubber cap when placed on the neck of a test-tube or bottle before it is sterilised. At *e* is a narrow slit which leads to the under part of *a*. This slit, which can act like a Bunsen valve, is not visible externally, for its edges are firmly approximated. When, however, the contents of the vessel are heated and the air therein expands, the valve opens and allows the gases to escape. When the pressure inside is equal to that outside the valve closes itself, and as the contents of the vessel cool down the upper part of the cap is sucked in and assumes the shape shown in fig. 119. In this way the vessel becomes hermetically sealed.

Fig. 118.

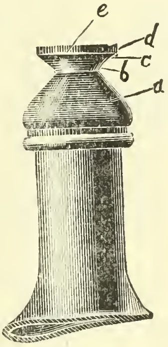
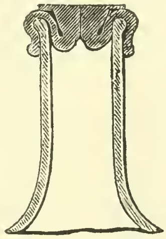


Fig. 119.



Syringe for Bacteriological Purposes.‡ — Herr K. Ilkewitsch uses a syringe for bacteriological purposes, which consists of a graduated glass pipette *a* holding 1–5 and 10 ccm. At *b* is seen the needle fitting into the neck *c*. To the other end is joined the caoutchouc tube *d*, 10 cm. long, which runs into the rubber ball *e* with a diameter of about 5 cm. From the side of the ball projects a short tube made of hard rubber and containing a valve so arranged that it is closed when the ball is pressed

* Zeitschr. f. Hygiene u. Infektionskrank., xx. p. 227. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 239–40.

† Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 627–9 (2 figs.).

‡ Op. cit., 1te Abt., xviii. (1895) pp. 55–9 (3 figs.).

together, and open when the ball is free. The illustration shows that the ball *e* lies between the metal cups *g g*, from which proceed two

Fig. 120.

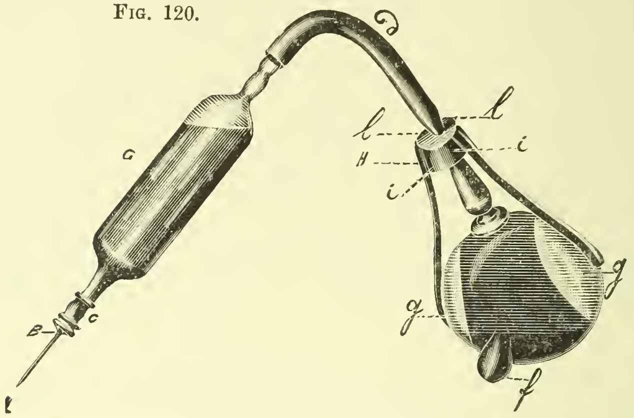
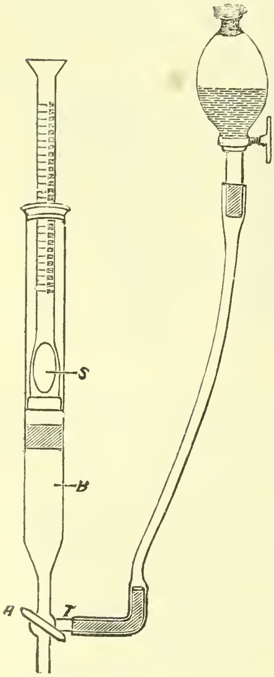


Fig. 121.



handles *i i*. The latter are joined together by a band *k* running round the rubber tube and playing the part of a hinge. The ends *l l* of the holders *i i* are flattened, bent at a right angle and embrace the tube *d*, which is quite closed by their joint action and the elasticity of the ball. Hence by pressing on the cups the tube *d* is opened and air from the ball passes through the tube. To get the inoculation fluid into the pipette the ball is held in the right hand, the thumb and forefinger nipping the upper end of the pipette or the adjacent part of the rubber tube. By pressing with the other three fingers on the cups air is expelled from the ball. The end of the pipette or the needle is then immersed in the fluid, the thumb of the left hand closing the aperture at *f*. The pressure is then removed gradually, and the inoculation fluid finds its way into the pipette, and when a sufficient quantity has collected therein the thumb is removed from *f*. The procedure for injecting an animal is too simple to require description.

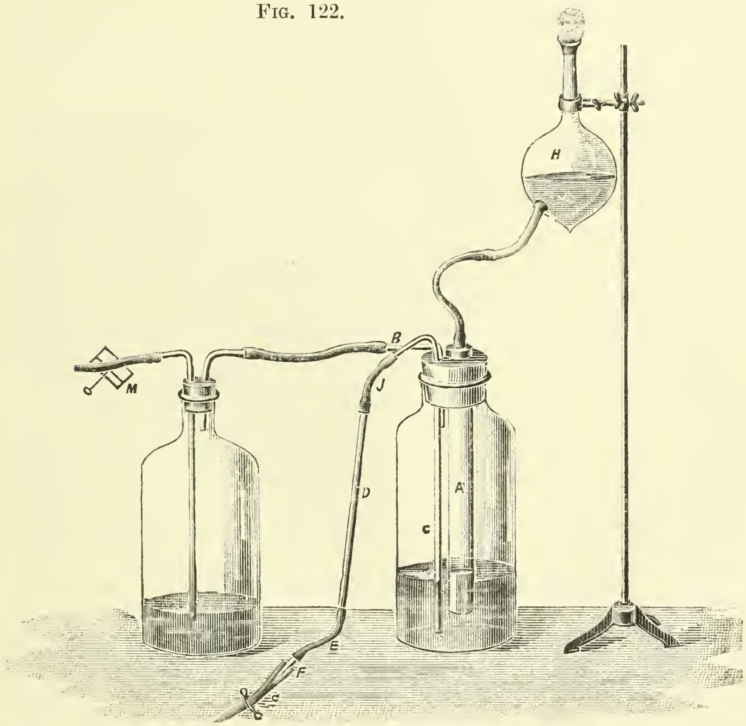
Automatic Burette for Emptying off Sterilised Fluids.*—Dr. A. Lode describes an apparatus for emptying out definite quantities of fluids such as nutrient media and preventive serum. The special

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 53–5 (3 figs.).

point of the apparatus is that it works automatically. It consists of a burette (see fig. 121), at the bottom of which is a three-way tap, which connects with the burette, the reservoir, and the outflow tube. Inside the burette is a sort of glass piston-rod, the lower end of which is expanded into a chamber containing a float. The chamber is in communication with the lower part of the burette by a small aperture, so that when the fluid is allowed to flow in from the reservoir the float is pushed up and the further ingress of fluid stayed. By giving another turn to the tap the fluid runs out at the bottom into the vessel placed there to receive it. In this way definite quantities of a nutrient fluid can be safely removed.

Filtering Apparatus for Fluids containing Bacteria and for Preventive Serum.*—Prof. A. Pawlowsky and Dr. G. Gladin have devised an apparatus for filtering fluids, especially anti-diphtheritic serum, which permits any quantity of the filtrate to be drawn off without risk

Fig. 122.



of contamination. The apparatus consists of a glass vessel closed by a caoutchouc plug with three openings. In one is a Pasteur's bougie A; in another is a short bent tube B, and in the third the glass tube C, the end of which reaches nearly to the bottom of the vessel, while the other

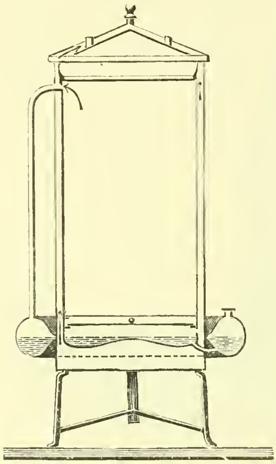
* Centralbl. f. Bakteriol. u. Parasitenk., 1[te] Abt, xviii. (1895) pp. 170–2 (1 fig.).

is joined to the glass tube D by a rubber tube J. D is connected with a pointed glass tube F, also by a rubber tube E, and the pointed end is inserted into a clamped tube G. The end of the tube B is somewhat constricted and plugged with cotton-wool; this tube is connected by means of a Wolff's bottle with an aspirator. A rubber tube joins the bougie to the flask H, the lower half of which is somewhat funnel-shaped. The neck of the flask is plugged with cotton-wool, and the vessel itself fixed to a stand. The whole apparatus is sterilised in an autoclave, or in a steamer. The autoclave not unfrequently cracks the glass vessels.

During filtration the air is removed from the apparatus, in consequence of which the tubes G, E, J become flat, showing that the apparatus is working properly and that it is air-tight. After the filtration is finished, the aspirator is closed and the receiver disconnected from the Wolff's vessel. The clamp is removed from G to E, and the tube G having been removed, the filtrate can be drawn off. The object of the clamp M is to render aspiration with a closed aspirator possible, for if kept open too long damage may ensue to the apparatus; so that after the air has become sufficiently rarefied the clamp M is fixed on. If the Wolff's bottle be large (3 litres), the apparatus will work with the aspirator shut off for 12–20 hours.

Sterilisation of Water by Ozone.*—Dr. E. van Ermengem describes the system adopted at Oudshoorn for sterilising the water of the Old Rhine. The results appear to be very satisfactory, for not only are all chemical and bacterial impurities removed, but the physical characters are greatly improved. The system consists in passing powerful electric currents of high tension through dry filtered air. The ozonised air is then forced or aspirated through vessels containing the water to be sterilised. The source of electricity is a Brush machine with alternating currents, and is driven by a small dynamo. The currents pass to two transformers, where they are converted into high-tension currents. The positive electrodes are made of thin copper or platinum plates, placed parallel to one another, and the current reaches these electrodes after passing through resistance-tubes 0·6 inch high, filled with glycerin. The negative pole is connected with the earth.

Fig. 123.



Müller-Unkel Steam Steriliser.†—The chief merit of this apparatus, according to Dr. R. Blasius, is that it gets into effective working condition in about ten minutes. The accompanying illustration (fig. 123) shows the simplicity of its construction. It consists of two metal cylinders, the inner one being made of copper with a vaulted bottom. The water reservoir is circular and communicates with the inner cylinder

* Ann. Inst. Pasteur, ix. (1895) pp. 673–709 (4 figs.).
† Zeitschr. f. Angewandte Mikroskopie, i. (1895) pp. 171–3 (1 fig.).

by means of a narrow pipe. The level of the water above the highest part of the vaulted bottom is never more than 1 cm., and it is owing to this that steam is rapidly and copiously developed. Through the space between the two cylinders circulates hot air, which, if desired, can be let out through an aperture in the lid. The excess of steam passes out through a pipe in the side and condenses in the receiver.

Potato Media for Cultivating the Tubercle Bacillus.*—Herr Ws. Lubinski prepares nutrient media containing potato for cultivating the tubercle bacillus in the following way. Four varieties were used:—(1) 4 per cent. glycerinised potato-broth; (2) 4 per cent. glycerinised potato-agar; (3) 4 per cent. glycerinised potato-meat-pepton-bouillon; (4) 4 per cent. glycerinised potato-meat-pepton-agar. 1 kg. of clean, finely-chopped potato is boiled in 1500 ccm. of water for 3–4 hours on the open fire or in a steamer, and then the acid decoction filtered off. The filtrate, mixed with 4 per cent. glycerin and neutralised, is medium No. 1. By the addition of 1–1·5 per cent. agar to the latter, boiling and filtering, medium No. 2 is obtained. Media Nos. 3 and 4 are made like the ordinary meat-pepton media, except that instead of water the potato decoction is used, that is to say, 500 grm. of finely chopped up meat and 1000 ccm. of the potato-broth are, after standing for 24 hours, filtered and mixed with 1 per cent. pepton and $\frac{1}{2}$ per cent. NaCl; after boiling and so on, 4 per cent. glycerin is added.

These media are also used with an acid reaction by merely omitting the neutralising alkali.

Diphtheria Antitoxin as Culture Medium for the Diphtheria Bacillus.†—Profs. A. E. Wright and D. Semple point out the difficulty which the ordinary practitioner has in making a bacteriological diagnosis of diphtheria. This is due to the fact that blood serum, which constitutes by far the best culture medium for the diphtheria bacillus, is not readily obtained. This difficulty can be easily overcome by the use of the antitoxic serum, which is as good a culture medium for diphtheria as the serum which is derived from a non-immunised animal. A small quantityof the antitoxin should be poured into any clean, small wide-mouthed bottle. This bottle should be brought into the horizontal position, and the albuminous substances of the serum so coagulated as to adhere to the sides of the bottle. This may be conveniently done by laying the bottle sideways over the mouth of a steaming kettle. Any water of condensation having been poured off, the culture medium is to be allowed to cool down. It is then to be inoculated by passing a stout wire or glass rod, which has been brought in contact with the diphtheritic throat, lightly over its surface. The bottle is to be kept as nearly as possible at a blood temperature, and the microscopical examination may be undertaken after 24 hours. The material for examination may be obtained by lightly scraping the surface of the culture medium with a platinum needle.

Diphtheria Antitoxic Plasma.‡—Prof. A. E. Wright and Surgeon-major D. Semple state that the plasma instead of the serum of immunised

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 126.
† Brit. Med. Journ., 1895, No. 1815, p. 907. ‡ Tom. cit., p. 997.

animals may be used as an injection material. Besides being equally effective there is a much larger yield of the fluid, often over 65 per cent. of the blood volume. Antitoxin plasma can always be obtained perfectly free from red corpuscles. It is readily prepared by leading off the blood from the horse's vein into a little citrate of soda dissolved in normal salt solution. An addition of 5 grm. of citrate of soda for every 1000 ccm. of blood is all that is required, provided that the tube through which the blood is led into the receiving vessel reaches quite down to the bottom of that vessel, so as to ensure a complete mixture. The easiest method of siphoning off the antitoxic plasma is to use a glass tube bent into a U-shape in such a manner as to leave one limb considerably longer than the other. Near the extremity of the longer limb another glass tube is to be fused on at an acute angle. To this side tube a piece of rubber tubing is to be attached. The other end of the rubber tube is fitted with a mouth-piece plugged with cotton-wool. A siphon is thus formed which can be started by exhausting the air in the side tube. A tap or a piece of rubber tube fitted with a pinchcock is fixed at the end of the long limb of the siphon.

Importance of Sugar in Cultivating Media.*—Dr. Th. Smith, after pointing out that the presence of sugar in cultivation media is often of great importance, inasmuch as a differential diagnosis between two or more species may not be possible if sugar be absent, discusses the relations between sugar, acid-formation, gas-formation, and anaerobiosis. In these connections the most important particulars are that with ordinary meat-broth, the formation of acid and gas are only noticed when sugar is present. The formation of acid keeps pace with the splitting up of the sugar and is common to all anaerobes (potential and essential). The formation of alkali requires the presence of oxygen. Hence both in aerobiosis and in anaerobiosis the one process may mask the other. All gas-forming species produce an explosive gas as well as CO_2. If at least three kinds of sugar (including muscle sugar) be used, the formation of acid and gas are valuable diagnostic criteria. The division into acid and alkali formers must be given up.

Preparing Clear Agar.†—Herr L. Żupnik recommends the following modification of Fraenkel's sedimentation method for obtaining clear agar. Fluid agar is poured into a tall glass vessel placed in a steamer on a water-bath. The fire is gradually let out, and the whole apparatus left till the morning. Next day the solid mass of agar is easily removed, and the turbid portion cut away with a knife.

Another procedure worth mentioning on account of its facility and simplicity consists in adding the requisite quantity of agar powder to perfectly clear meat-bouillon. The liquid is next steamed for an hour, and then filtered in a hot-water funnel through a thin layer of hydrophilous cotton-wool. The cotton-wool is adapted to the shape of the funnel, and then moistened with hot distilled water, any excess of water being pressed out with the finger. The hot agar is at once poured in, and it runs out in a full stream perfectly clear.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 1–9.
† Tom. cit., p. 202.

(2) Preparing Objects.

Development of Limax.*—Mr. C. A. Kofoid, in his study of the development of *Limax*, found the following the most successful method for keeping the animals in captivity. A tin box with proper ventilation is filled to the depth of one inch with clean sand, which forms a suitable substratum for the retention of moisture. On this is laid a sheet of moss, to whose under surface the earth still adheres. The leaves of the common plantain furnish acceptable food, and when this is no longer available, fresh cabbage leaves and apple parings can be used. During the first week of captivity, the slugs furnish eggs in great abundance, but after that time the number diminishes and the quality deteriorates so rapidly that it is imperative that a new colony be secured. Abnormalities in the living egg show themselves in the early stages by a loose assemblage of the cells, and the increasing opacity of the embryo. Before hardening the embryo, it is necessary to free it from the envelopes and albumen which surround it. By inserting two fine cambric needles in one holder, so that the distance between the points is less than the diameter of the unshelled egg, it is possible to hold the egg between these two needles and pierce it by a third. A quick shear-like cut with the third needle against one of the other two tears open one side of the egg, and allows the albumen and the ovum to escape from the envelopes. As the albumen interferes with section-cutting, and obscures whole preparations, it must be removed entirely. This for a long time presented a most serious obstacle to the author's work. Washing off the albumen with water is a very slow and tedious process, and not always successful. Hypochlorite of soda may indeed be used, but the difficulty of using this lies in the necessity of stopping the action of the hypochlorite before it attacks the ovum. It does indeed free the eggs from the albumen, and does not interfere with staining, but the proportion of eggs destroyed in the process is very great. The method which gave the best results was the following. The living eggs are placed in normal salt solution (0·75 per cent.), in which they are at once shelled. They are then freed from the albumen by washing them in the salt solution, which is dropped upon them from a pipette. The operation is carried on in large glass dishes resembling watch-glasses, but provided with flat polished bottoms, which are placed upon a black tile; this renders the eggs visible to the naked eye. The salt solution dissolves away the albumen, leaving the egg entirely free. It can then be transferred to any desired killing reagent by the use of a capillary glass tube. It is well to shorten the exposure in the salt solution as much as possible, for nuclear conditions are somewhat altered by its action. Eggs which are laid in it for ten minutes have their nuclear membranes much distended, and the chromatin gathered into a homogeneous mass in the centre of the nucleus, surrounded by a clear region of nuclear sap. Excellent results were obtained by subjecting the eggs to the action of Fol's modification of Flemming's mixture for one minute, and then transferring them at once to Orth's picro-carminate of lithium. Rapid decolorisation with 90 per cent. alcohol plus 5 per cent. hydrochloric acid gave very good results. The eggs were studied in the clearing

* Bull. Mus. Comp. Zool., xxvii. (1895) pp. 37–40.

agent under a cover-glass placed on glass rollers made of bits of capillary tubing. This allows the use of high-power objectives, and the orientation of the embryo in any desired position for a camera drawing.

Methods of Investigating Sponges.*—Mr. G. Bidder's experiments on the alteration of cells during preservation for histological purposes showed him that the dangers of the imbedding process are modified by very gradual dialysis from alcohol into benzole, and largely guarded against by super-hardening in 1 per cent. osmic acid, and in absolute alcohol. For osmic acid even sponge tissue requires to be cut into the smallest practicable pieces, and repeatedly shaken, or the inner chambers will not be thoroughly hardened. Dialysis from water into absolute alcohol, or from alcohol into benzole, each took from 6 to 12 hours. Mr. Bidder's best preparation was stained in bulk with equal parts of Grenacher's hæmatoxylin and 70 per cent. alcohol, being brought into this solution from 40 per cent. alcohol by four equal changes of strength. No acid was used, and the result was a very valuable over-staining of the collars and iris membranes. It will be found convenient to have in a pipette a thin solution of balsam in chloroform, so that it can be squirted instantly on the sections after removal from the chloroform, to prevent drying before the thicker balsam has time to spread.

Study of Paramæcium.†—Mr. Ryder found that osmic acid and corrosive sublimate gave good results in killing and fixing his material, as both reagents act with such rapidity as to exclude in a large measure the production of artifacts. Staining was done on the slide with hæmatoxylin and Biondi's (= Heidenhain's) mixture. Very good results were also to be got by staining objects *in toto*.

(3) Cutting, including Imbedding and Microtomes.

Strasser's Ribbon Microtome.‡—Prof. H. Strasser gives detailed instructions for mounting and preserving the serial sections prepared by his so-called "Schnitt-Aufklebe" Microtome.§ For sticking the sections on the paper band the author uses the following mixture:—Gum arabic 80 to 100; water 100; glycerin 10; with the addition of a little carbolic acid. The paraffin sections gummed on the paper with the solution can be numbered and kept for months and years unchanged, until opportunities for their further treatment, colouring, &c., may arise.

The staining of the serial sections involves the following operations:—

A. Transformation of the paraffin section into a celloidin section. (1) Xylol bath, 1 hour. (2) Bath of 95 per cent. alcohol, $\frac{1}{2}$ to 1 hour. (3) Collodionising.

B. Staining. (4) Colouring solution (hæmatoxylin acidified with acetic acid). (5) Bath of Müller's liquid, 5 to 10 minutes, wash in water. (6) Bath of permanganate of potash (1 in 600 water), 5 minutes, wash in water. (7) Bath of differentiating liquid (potassium sulphide

* Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 38 and 9.
† Proc. Acad. Nat. Sci. Philad., 1895, p. 170.
‡ Zeitschr. f. wiss. Mikr., xii. (1895) pp. 154–68.
§ See this Journal, 1891, p. 281; 1892, p. 703.

and oxalic acid), 5 minutes, wash in water. (8) Second staining (e.g. in very dilute neutral carmine, 24 hours), rinse, dry.

C. Freeing from water and preserving. (9) 70 per cent. alcohol with a trace of picric acid, 1 hour. (10) 95 per cent. alcohol, ½ hour, dry. (11) Plates on the sides of the section covered with filter paper moistened with carbol-xylol.

Then follows a layer of canvas, then the second plate paper, and so on. Finally the plates are placed in (12) thin resin solution, then in (13) thick resin solution. (14) Transfer of the sections to glass slide. (15) Mounting.

For the paraffin imbedding of large objects (brains) the author uses the following processes:—Immersion in 95 per cent. alcohol, then in carbol-xylol from 18 to 22 days, allow to evaporate, place in yellow vaselin, first on and then in the oven at 40° C., up to 8 days, until every trace of xylol has been removed; place in a mixture of paraffin, which melts at 42°, and yellow vaselin (the proportions are 4 : 1, or 3 or 2 : 1 according to the size of the plates), in oven at 40°, one to several days.

The author has introduced modifications in his microtome, so as to make it suitable for celloidin objects. In the large model with double slide-way, the old knife-slide is replaced by a new one, in which the knife, by means of a special holder, can be displaced to right or left in a cross slide-way.

(4) Staining and Injecting.

Formalin as a Mordant.*—Dr. A. P. Ohlmacher finds that formalin acts as a powerful mordant with anilin dyes. It may be used in 2–4 per cent. aqueous solution as a preliminary treatment before staining. The cover-glass film is treated for one minute with the solution, washed in water, and then stained in the cold. Or it may be used as a base in the same way as anilin, carbolic acid, &c., are; e.g. formalin-fuchsin may be made by adding 1 grm. of fuchsin dissolved in 10 ccm. of absolute alcohol to 100 ccm. of a 4 per cent. aqueous solution of formalin.

Formalin methylen-blue, which affords a very effective stain, is made by dissolving 1 grm. of methylen-blue (methylen-blue Ehrlich) in 100 ccm. of 4 per cent. formalin.

A curious effect is obtained when safranin (O water-soluble, Grübler) is dissolved to saturation in 4 per cent. formalin. This results in a plasma stain, and when sections are previously coloured with the formalin methylen-blue solution a beautiful double stain results, the blue stain being nuclear.

Staining Yolk-Nucleus of Lumbricus.†—Mr. G. N. Calkins arrived at his conclusions concerning the nature of the yolk-nucleus chiefly by micro-chemical reactions with differential staining. The combination stain of Heidenhain's hæmatoxylin and orange makes the chromatin and the yolk-nucleus a blue-black, while the nucleus of the germinal vesicle and the cytoplasm are orange. The Biondi-Ehrlich mixture stains the young yolk-nucleus a bright green, while in the older eggs the disintegrated yolk-nucleus is stained a bright red. As the principal constituents of this mixture are methyl-green and acid fuchsin all doubt

* Med. News, lxvi. (1895) pp. 184–5.
† Trans. New York Acad. Sci., 1895, pp. 227 and 8.

in regard to the chemical action of these colours was removed by a solution containing basic fuchsin and acid green. The result was a reversal of the colours; the chromatin and the yolk-nucleus were stained red, and the cytoplasm green. Other differential stains were used, and all gave similar results.

Teichmann's Cold Injection.*—Prof. J. Kollmann explains the excellencies of this method. The red injecting mass consists of powdered chalk 500 grm., red lead 100 grm., thick linseed oil 80–90 ccm., to which carbon disulphide is added in proportions varying with the calibre of the vessels to be injected. The blue mass consists of zinc white 450 grm., ultramarine 25–30 grm., and boiled linseed oil 60–75 ccm., dissolved in carbon disulphide or sulphuric ether. For injecting the lymph-vessels in white, the mixture is zinc white, thickened linseed oil, and sulphuric ether. The advantages over wax injection are great.

(5) Mounting, including Slides, Preservative Fluids, &c.

Distortion of Sponge-cells in Preservation.†—Mr. G. Bidder gives the results of a few measurements on sponge-cells which may be of interest to those who study histology on preserved materials of other groups as well as of sponges. All the sponges were preserved in osmic acid for one hour; followed by alcohol, benzol, and paraffin, and measurements were made of the collar-cells in six series of sections which may be labelled A to F. In C, D, and F, the change from water into absolute alcohol was effected by dialysis. In all but B, the change from absolute alcohol into benzol was made in the same way. A was the only sponge preserved in ·5 per cent. instead of 1 per cent. osmic acid. It alone was decalcified, it alone was stained in bulk with borax-carmine, and it alone was cut by the ribbon method. The distal expansion and fusion of the collars known as "Sollas's membrane" appeared plentifully in the paraffin sections A, B, C, and F; scarcely at all in D and E, but it was not present in the living sections examined from any of the sponges. It was found that the average cubical contraction of the cells is about one-half of their living dimensions. The best series of sections D and the worst A show respectively the following ratios in their dimensions to those of life.

	In Series D.	In Series A.
Collar width	·83	·5
Basal width	·88	·7
Height	·8	·5
Height of collar	1·0	1·0
Deduced ratio of volume of cell to that in life	·55	·2
Deduced mean linear contraction ratio	·82	·6

The difference of the best two series of sections from all the others lies in the uniformity of their contractions.

We find, then, two principal phenomena due to the transference of cells through osmic acid, alcohol, and benzole, into paraffin, and finally Canada balsam. (1) There is a reduction in the total volume of the cell, which apparently cannot be avoided, corresponding to a mean linear contraction of about 5 to 4 in the best preparations, and 5 to 3 in the

* Verh. Anat. Ges., ix. pp. 77–88.
† Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 33–8.

worst. Secondly, independently of the extent to which this takes place there is generally a change of form. It appears impossible almost entirely to avoid this, but by most methods the rectilinear and angular outlines of life are replaced by pyriform, ovoid, spherical, or even oblate contours in the permanent preparations. It was experimentally shown that the extreme changes of cell form were not produced in alcohol, and further that in some sections of the best series stained on the slide in the ordinary way the cells suffered considerable distortion. The chief engine in distortion appears to be the passage from alcohol into benzole, chloroform, or turpentine, and *vice versâ*. It may be noted that the tendency of all the cells to assume a drop-like form proves that the force which effects their distortion is surface-tension. It does not seem unlikely that the reduction in volume is due to the abstraction of water and soluble matters by alcohol.

Preservation of Mammalian Brains by Formol and Alcohol.*—Messrs. G. H. Parker and R. Floyd think that the advantages of the employment of formol in hardening the organs of the central nervous system over other reagents employed for similar purposes must be obvious to any one that has used it. A sheep's brain, when placed in a 2 per cent. solution of formol, attains in the course of a week or ten days a remarkable degree of firmness and elasticity, while it preserves in great part its original form and colour. The only important defect is a marked increase in volume. With the object of correcting this defect the authors were led to experiment with other hardening fluids. Alcohol and formol appear to do well, and the following combination was found to meet requirements :—Alcohol 95 per cent., 6 volumes, formol 2 per cent., 4 volumes. The formol employed was that sold by Merck of Darmstadt as formaldehyde 40 per cent. Owing to the rapidity with which this mixture penetrates tissues, the hardening of large, freshly prepared brains necessitates little more than simple immersion. Sheeps' brains prepared in this way retain their original colour and form, and show almost no change in volume.

Disinfectant Action of Formalin.†—The experiments made by Dr. G. Burckhard as to the disinfecting action of formalin showed that this fluid has strongly antibacterial properties, though the results did not come up to the expectations formed of it. The animals used were mice, pigeons, and rabbits, and the infecting microbes, anthrax and the bacillus of fowl-cholera. The dead animals were placed on wadding soaked with formalin and covered with a bell-jar. This procedure was found to prevent or considerably retard decomposition. Experiments were also made as to the influence of formalin on the metabolic products of bacteria. For this purpose the bacillus of tetanus was employed. The products of a 10 days' old bouillon culture were passed through a Reichel's filter and injected subcutaneously into mice. It was found that while formalin possesses the power of rendering innocuous the products of *Bacillus tetani*, the quantity required for neutralising the toxin is considerably greater than that used for destroying the toxin of diphtheria.

* Anat. Anzeig., xi. (1895) pp. 156–8.
† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 257–64.

Formol or Formaldehyde.*—Mr. A. B. Lee points out that the already extensive literature which treats of the uses of formaldehyde is much confused by the inaccurate use of the terms formol, formalin, and formaldehyde. The last is the chemical name of the compound HCOH. Formol is the commercial name given by Schering & Co. to a 40 per cent. solution of this substance in water. Formalin is the commercial name given to the same solution by Meister, Lucius and Brüning. The proper way of stating the strength of solutions is to say formol or formalin diluted with so many volumes of water.

Preservation of Cladocera.†—Herr T. Stingelin, after trying various methods for preserving Cladocera, found that it was best to content himself with the exclusive use of a 4 per cent. watery solution of corrosive sublimate. Specimens were at once washed in 65 per cent. alcohol, stained in alum-alcohol for at most three minutes, placed in a 12 per cent. solution of alum, and then washed in water. Hardening was effected in the ordinary ascending grades of concentration of alcohol. The author is well satisfied with the preparations which he got.

Catching and Preserving Medusæ.‡—Mr. E. T. Browne states that his latest method for catching Medusæ is to use a long tow-net made of bolting silk with a mesh not exceeding ·05 mm. At the end of the net is fastened a zinc can, instead of the usual glass bottle which generally breaks when the contents are specially wanted. The author prefers to use a small rowing-boat and work very gently against the tide, with just a slight pull on the net. If the Medusæ are not visible at the surface, the net should be sunk about two fathoms, and, if not successful, it should be tried near the bottom. It is well to remember that Medusæ are very delicate, and quickly die if they are crowded together in a small bottle. The following is given as one of the best methods for killing and preserving small specimens. Place the Medusa in a large watch-glass with sufficient water to float in. Add with a pipette about 5 drops of a 2 per cent. solution of cocain, and about 10 minutes later add another 5 to 10 drops. When the Medusa has become motionless and the tentacles expanded, add suddenly a saturated solution of picric acid. It is best to reduce with a pipette the quantity of water in the watch-glass just before adding the picric acid, and to use plenty of the latter. Often when the picric acid is added a precipitate of cocain is thrown down, which must be removed at once by a pipette, and fresh picric acid added. After being in the acid about half an hour specimens should be gradually transferred to 80 per cent. alcohol. The author strongly recommends the use of the best glass-stoppered bottles and perfectly pure spirit for storing specimens in.

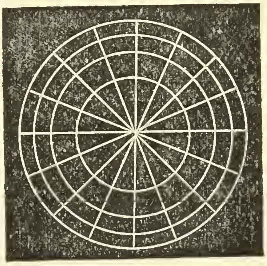
(6) Miscellaneous.

Method for Counting Blood-corpuscles.§—Herr P. Domény suggests the following method for counting blood-corpuscles or other bodies suspended in a fluid, such as bacteria, algæ, infusoria, &c. A slight

* Anat. Anzeig., xi. (1895) pp. 255 and 6.
† Rev. Suisse Zool., iii. (1895) p. 165.
‡ Proc. and Trans. Liverpool Biol. Soc., ix. (1895) pp. 245 and 6.
§ Zeitschr. f. Angewandte Mikroskopie, i. (1895) pp. 168–71.

scratch is made on the under surface of a cover-glass and on the upper surface of a slide. The fluid to be examined having been placed between the two glasses the scratches are brought the one over the other. The cubical contents of the fluid cylinder are then calculated by first ascertaining the diameter of the field with the system in use. This is done by drawing the apparent size of the field at the stage level, and then measuring it with (say) a pair of compasses. This diameter, divided by the magnification, gives the real size. Then the square of the real diameter multiplied by ·7854 gives the area (m) required. The distance (h) between the two glasses or the height of the cylinder is then ascertained by careful and repeated focusing. Then $m\,h$ is the solidity of the cylinder. The number of the corpuscles or bodies in the field are then carefully and repeatedly counted and an average struck (p). With these data the number of corpuscles in a cubic centimetre is easily calculated. An ocular micrometer divided into squares facilitates the counting. In examining blood this fluid should be mixed with an equal bulk of 0·75 per cent. salt solution; if this procedure be adopted it will be necessary to multiply p by 2.

Fig. 124.



Counting-Plate for Petri's Capsules.*—Herr Müller-Unkel has produced a counting-plate of black highly polished glass on which are marked four concentric circles and sixteen radii. This form is more convenient than the older apparatus used for counting.

Writing on Metal and Glass.†—Herr E. Schöbel recommends the following inks for marking slides, bottles, vessels, &c.:—Silicate of soda 1–2 parts, fluid Chinese ink 1 part, is suitable for slides; while for metal vessels he prefers silicate of soda, Chinese white, 3–4 parts of each, sulphate of baryta 1 part. The mixtures should be kept well corked and shaken before being used.

Demonstrating Bacillus coli communis in Water.‡—The question whether water which contains *Bacillus coli communis* is fit for drinking, is, says Dr. Ed. von Freudenreich, an important one. Recent investigations have shown that the microbe occurs in almost every kind of drinking-water, and the demonstration of its presence largely depends on the volume of water used in the test.

Thus, by Vincent's method, wherein about 100 ccm. are used (water 90 ccm., 20 per cent. pepton solution 10 ccm., 7 per cent. carbolic acid 1 ccm., and incubation at 42°) the presence of *B. coli* can almost always be demonstrated, though if 1 ccm. only be used it may not be detected. Attention is called to the facts that—(1) In chemically bad water (i. e. water containing too much organic matter) wherein bacteria are numerous, *Bacillus coli communis* is present in abundance. (2) In water containing few bacteria and chemically good, *B. coli* is present in small numbers only. (3) Very often this organism is absent altogether in water which

* Zeitschr. f. Angewandte Mikroskopie, i. (1895) p. 173 (1 fig.).
† Tom. cit., p. 183.
‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 102-5.

is accepted as good. The inferences from the first and last of these three degrees are obvious, while the interest of the second lies in ascertaining whether and to what degree a water is rendered impure by *B. coli.* Mention has already been made of the satisfactory results to be obtained by Vincent's method, but the object is more quickly attained by using bouillon with 5 per cent. milk-sugar.

A number of flasks containing this medium are inoculated with variable quantities of the water to be examined, e. g. with 1, 10, 20 drops, and incubated at 35°. If coli bacteria be present, in 12–24 hours there will be strong fermentation, and this can be rendered more noticeable by shaking the flasks a little. Often water and putrefactive bacteria do not excite fermentation in milk-sugar. When gas is formed the presence of coli bacteria may be safely reckoned on.

PROCEEDINGS OF THE SOCIETY.

Meeting of 16th October, 1895, at 20 Hanover Square, W.
E. M. Nelson, Esq., Vice-President, in the Chair.

The Minutes of the Meeting of 19th June last were read and confirmed, and were signed by the Chairman.

The List of Donations to the Library since the last meeting (exclusive of exchanges and reprints) was read, and the thanks of the Society were voted to the donors.

	From
Phycological Memoirs. Pts. 1–3. (4to, London, 1892–5) ..	*Mr. Frank Crisp.*
L. Wright, A Popular Handbook to the Microscope. (8vo, London, 1895)	*The Publishers.*
Ten Slides for mounting Foraminifera..	*Mr. D. Bryce Scott.*

Mr. A. W. Bennett—with reference to vol. i. of 'Phycological Memoirs,' presented by Mr. Frank Crisp—said that this would prove a very valuable addition to the Library of the Society. On the Continent and in America every University town was in the habit of publishing some scientific work associated with its name, but in this country there was nothing of this kind undertaken by the great institutions of learning. This work of Mr. George Murray perhaps more nearly represented what was done by the foreign Universities than anything we had here, giving an account of the work which was being done at the British Museum, more particularly in relation to the lower forms of vegetable life. Mr. Murray, who had lately succeeded Mr. Carruthers as head of the Botanical Department at the British Museum, had given great attention to this branch, and was in this way giving the result of his researches.

Dr. W. H. Dallinger thought that the little work by Mr. Lewis Wright—'A Popular Handbook to the Microscope'—was decidedly one of those which would be of great use to the amateur and to the beginner in microscopical work. There was always room for a new work of this kind, because methods were always improving, and Mr. Wright seemed to have brought his description of these quite up to date for the benefit of those for whom his book was specially written.

Prof. Jeffrey Bell said they had received the following letter from Mr. D. B. Scott, describing a method of mounting Foraminifera, and this was accompanied by a number of specimens, which were handed round for the inspection of the Fellows :—

"Dear Sir,—Your kind favour of September 19th, 1895, received. I am sending by parcel post to-day three of the built-up cells for mounting 300 opaque Foraminifera ; also two built-up cells for mounting sixty opaque Foraminifera, one square and the other circular. I have also sent you two built-up cells, one square and the other circular, each containing sixty mounted Foraminifera. This will show you better how the cell looks when finished. I have also enclosed you some of the photographed bottoms. I cannot name the Foraminifera for you, as yet I have only two works on Foraminifera. The two mounted slides you can keep for your own cabinet, if they are of sufficient interest to you. If they do not interest you, give them to some of your friends who would care to have them. The wooden cells are turned off on a small turn-table, to which I have attached a small ·75° motor, requiring 4 volts and 2 amperes, and with a sharp knife turn out the cell."

The Chairman thought these would be found worth looking at, as the mounting was most ingeniously done, and was likely to be very useful to those who were working on the subject.

Prof. Bell thought that in these days of advertising, one of the best donations might be a good advertisement, and as such, perhaps, he might call attention to a paragraph appearing in the *Echo* of the 11th inst. with reference to the Society, the correctness of which would no doubt be appreciated. It read as follows:—"On Wednesday next the annual meeting of the Royal Microscopical Society will be held at the Society's office in Burlington Street. The most interesting feature of this meeting will be papers 'On the Latest Discoveries in Science with the Aid of the Microscope,' by Professors Farmer, Massee, and Reid"!

Prof. Bell said that since their last meeting the Society had the great misfortune to lose by death five of their Honorary Fellows, four of whom he knew personally; the fifth, Mr. Kitton, he did not remember to have met:—Prof. W. C. Williamson would long be remembered in connection with his valuable works on fossil plants; the Rt. Hon. Thomas Henry Huxley, the first man of science to be admitted into the Privy Council, whose work needed no comment from him; his old friend and frequent correspondent, Prof. Sven Lovèn, of Stockholm, who might worthily be put with such men as Van Beneden, Siebold, Owen, and the elder Milne-Edwards, who had done so much to bring modern zoology to its present point; and Prof. Louis Pasteur, whose services to his country, to mankind at large, and to animals were of so remarkable a kind that it had been well said that he had added more to the wealth of France than any financier which that country had ever produced. These vacancies in their list of Honorary Fellows the Council proposed to fill up—at least, so far as four of them were concerned—by nominating the following:—Herrman Graf zu Solms-Laubach, Dr. Anton Dohrn, Prof. Gustav Retzius, and Prof. Camillo Golgi. The vacancy caused by the death of Pasteur they proposed to leave unfilled for the present; the other names would be suspended in the usual way, and would be balloted for at their next meeting.

By request of the Council, he had sent a letter of condolence to Mrs. Huxley, which she had acknowledged.

Dr. Dallinger said that the late Mr. Frederick Kitton had long been a Fellow of the Society, and was elected an Honorary Fellow in 1876. His chief study was that of the Diatomaceæ, his interest in which was not of the dilettante kind. He was a very earnest worker in this branch of microscopy, and had done much towards the philosophical disposition of these organisms, and had contributed many papers upon the classification of the group, as well as descriptions of new genera and species, to this and other Societies. A list of his contributions to the Transactions of the Royal Microscopical Society appeared in the current number of the Journal. His death occurred on July 22nd.

Prof. Bell said it was not often they had to record the deaths of so many of their Honorary Fellows, and still less often that he was able to announce that the work of the Society had been so considerately appreciated as appeared by a letter received from the brother of the late Mr. John Wright, of Worthing, conveying, not only the intimation of his brother's decease, but also that he had made a bequest to the Society of the sum of 250*l*., less duty.

Prof. Bell said that he had received a letter from Mr. Aldous, of Tufnell Park, saying that he would be pleased to forward to any Fellow of the Society a copy of an excellent likeness of the late Prof. John Quekett in his possession, on receipt of request.

Mr. J. M. Swift exhibited a folding portable Microscope, made to the order of Dr. Keightley, entirely of aluminium, with the exception of the mechanical fittings, which were of steel. It was provided with a removable mechanical stage, and the fine-adjustment was on the differential screw principle, rather finer than 1/200 in., and divided in French measurement. The legs were of solid drawn aluminium, and although very light, the instrument was remarkably steady.

Dr. Dallinger said he had felt and expressed the opinion a long time ago that the use of aluminium for a travelling Microscope would be of great advantage. This one was beautifully made, and was extremely light and firm. With slight modification it would form an extremely useful portable instrument.

The Chairman said he had been afforded the opportunity of seeing this Microscope and of comparing it with a brass one of the same size and pattern, but he could scarcely add to what Dr. Dallinger had said about it. It was rather a large instrument to come under the title of a "portable" Microscope, though, of course, all depended upon how much portability was wanted. This certainly seemed to be thoroughly steady and not easily turned over, although he was quite surprised at its lightness as compared with brass, the difference being 2 lbs. $5\frac{1}{4}$ oz. as against 6 lbs.

Mr. Richard Smith also exhibited a Microscope of similar pattern to that shown by Mr. Swift, but in it the tubes were made of aluminium and the stand of brass, which seemed to afford still greater solidity and steadiness with a considerable reduction in weight, as compared with the all brass instrument.

Mr. T. Charters White thought this was a very pretty Microscope, and it looked very nice at present, but should like to ask if it would be possible to work with it without injury to the metal when using acid or alkaline reagents. He believed aluminium was very easily acted upon by acids.

Mr. E. J. Millard believed that the combination known as aluminium bronze was free from this objection; it was light and strong, and would resist ordinary acids, such as acetic acid.

Mr. Swift thought it would be an objection to aluminium bronze that it had so much the appearance of gun-metal. He could not say anything as to whether the aluminium would be damaged in the way suggested by Mr. White, as he had not subjected it to tests of that kind.

The thanks of the Society were given to Mr. Swift and Mr. Smith for their exhibits.

Prof. J. B. Farmer gave an interesting *résumé* of his paper "On the Division of the Chromosomes in the First Mitosis in the Pollen-Mother-Cell of Lilium" (see *ante*, pp. 501–4). The subject was illustrated by drawings on the blackboard and by several large diagrammatic models, to which frequent reference was made.

The Chairman was sure the Fellows of the Society would agree in thanking Prof. Farmer, to whom they were greatly obliged for the beautiful exhibition he had given them of the models upon the table. He scarcely pretended to know much on a subject of this kind, but it happened that he had seen a very great deal of the sort of thing which had been described, and he had any number of slides from a friend who had "gone wrong" in it, but he certainly never had so clear an idea of the matter as he had obtained from seeing these models. Of all methods of illustration there was nothing to compare with a model for making it clear to those who were not otherwise cognisant of a subject.

Prof. Bell said he should like to re-echo the remarks of their Chairman as to their indebtedness to Prof. Farmer on that occasion. As editor of the Journal, he had found it necessary to read very closely the proofs of Miss Sargant's paper, and he found it equally necessary to read closely the proofs of Prof. Farmer's paper; but he felt, notwithstanding the attention which he had given to them, that he was greatly indebted to Prof. Farmer for bringing down these models and explaining the process by their means in the way he had done. He congratulated Prof. Farmer upon the ingenious and successful manner in which these models had been constructed, and ventured to express a hope that some day he would make some more, and that when he did so he would bring them down to the Society.

The contents of Mr. F. J. Reid's paper, "On a Fluorescent Bacillus" were communicated to the Society by Dr. R. G. Hebb, who said that he regarded it as a valuable contribution to the subject.

The thanks of the Society were given to the author of the paper, and to Dr. Hebb for reading it.

Prof. Bell said they had an intimation of a paper for the next meeting entitled, "Numerical Aperture Reconsidered." This subject had already led to some very long and sometimes acrimonious discussions, and though he hoped it would not be discussed acrimoniously on the coming occasion, he felt sure there were many who felt sufficiently interested in it to join in its discussion; those who intended to do so could be supplied with copies of the proofs of the paper on application to the Assistant-Secretary.

The following Instruments, Objects, &c., were exhibited:—

The Society:—Mr. D. Bryce Scott's slides for mounting Foraminifera.

Mr. T. D. Ersser:—*Pleurosigma angulatum*—binocular, Zeiss dry 1/14 inch ob.

Prof. J. B. Farmer:—Models illustrating his paper.

Mr. C. F. Rousselet:—Mounted Rotifers (the male of *Pedalion mirum*).

Mr. R. Smith:—A portable Microscope.

Mr. J. M. Swift:—A portable Microscope.

Meeting of 20th November, 1895, at 20 Hanover Square, W. The President (A. D. Michael, Esq., F.L.S), in the Chair.

The Minutes of the Meeting of October 16th, 1895, were read and confirmed, and were signed by the President.

The List of Donations (exclusive of exchanges and reprints) received since the last meeting was submitted, and the thanks of the Society were given to the donor.

	From
W. Griffiths, The Principal Starches used as Food. (8vo, Cirencester, 1895)	*The Author.*

Prof. F. J. Bell said that their only donation that evening was a copy of a little work entitled 'On the Principal Starches used as Food,' which would be additionally valuable to the Society as having been dedicated by the author to their Treasurer, Mr. W. T. Suffolk.

The President said he was sorry to have to tell the Fellows present that owing to unforeseen difficulties which had occurred at the last moment at the meeting of the Council that evening, the paper which stood first upon the Agenda could not be read. He would therefore call upon Mr. Chapman to favour them with his paper in continuation of the series 'On the Foraminifera of the Gault of Folkestone.'

Mr. F. Chapman said that the paper itself was of too technical and descriptive a character to be of much interest apart from the illustrations with which it would be accompanied when in print; he therefore would merely give them an outline of the contents, indicating the genera which were more particularly treated in this addition to his series of papers upon the subject.

The President was sure that all would agree in passing a hearty vote of thanks to Mr. Chapman for his paper which, when they got it printed in the Journal, they would no doubt find was a valuable one.

The thanks of the Society were unanimously voted to Mr. Chapman for his paper.

Mr. Conrad Beck exhibited a dissecting Microscope made for Prof. Hickson, the wood frame of which was made sufficiently large to afford a sloping support to the whole of the worker's forearm. It was fitted for use with a Steinheil lens, and also with a small compound Microscope as might be required. A series of Stenheil lenses was also being made for use with this Microscope, but there was nothing about these which particularly called for attention, except that they would be inexpensive.

The President expressed the thanks of the Society to Mr. Beck for his exhibit, the form of which was manifestly a very convenient one, although there might perhaps be, as Mr. Beck had suggested—nothing special about it.

Mr. E. M. Nelson said with regard to the photograph of a coloured design, which had been placed on the table, he thought those of a similar subject taken by their member, Mr. J. W. Gifford, were better.

This type of photograph did not have much bearing on photomicrography, because it was taken by reflected light, whereas the bulk of photomicrographs were taken by transmitted light, and the treatment in either case differed somewhat. For instance, it was found that when white light fell upon a pigment, such as red, if the reflected ray were examined by a spectroscope, all the rays of the visual spectrum would be observed; which shows that in this case of reflected light the photographic plate has other rays than red ones to deal with. With transmitted light, however, one usually meets with a band of greater or lesser breadth where the light has practically been absorbed. A stained section obviously falls under this category.

The President said the plate which Mr. Nelson had brought was certainly a fair effort of photography to give the value of colours, and it must be admitted that the isochromatic plates enabled them to go far in that direction. At the same time, to get colours shown in black and white was never satisfactory; they were so often of such a nearly equal value that it was scarcely possible to express them in that way. The difficulty of doing this was also further complicated by the fact that there was hardly one eye out of one hundred which could be called precisely normal, nearly every one being to some extent colour-blind in respect of some of the nicer distinctions between shades of colour, the consequence being that to one man these gradations of black and white might represent colour, whilst to another they did not. It seemed scarcely possible to overcome the difficulty of being able to represent not only what photography could do, but also what the eye was capable of seeing. The example before them did not enable him personally to form a correct idea of the effect of the yellows shown on the coloured plate; the colours themselves might be of equal value, but in any case the idiosyncrasy of the individual eye must always affect the result.

Mr. J. E. Ingpen referred to the colour-sensations produced in the reproduction in black and white of objects of varied light-power. In some of the fine engravings of Turner's pictures—such as that of "The Fighting Temeraire," any one who had seen the picture could mentally reproduce the colour-effect when looking at the print. A flesh tint was also sometimes seen as different from other parts of the subject. Some years ago there was a popular process of colouring photographs called "Crystoleum," by which good colour effects were sometimes produced, which he thought depended upon the colour used being the same as that of the object photographed—e. g. the photograph of a red object not looking well if coloured blue. He could not offer any explanation of this effect.

Mr. E. M. Nelson thought Mr. Ingpen's observation might be to some extent explained by the "key" in which the photograph was pitched. In other words, in what order of luminosity did the colours come? Was yellow or green the brighter colour? Different individuals would probably answer this question differently, because all had not the same visual "gamut," and therefore any given photograph of this coloured design might not be equally pleasing to all.

Mr. Ingpen thought that "yellow cornea" was one of the physical causes affecting the appreciation of colour. He had noticed this when suffering from approaching blindness, due to cataract. After a successful removal of the orange-coloured crystalline lens, he had for some months an abnormal appreciation of colour at the blue end of the spectrum, which gradually subsided into what he believed to be probably a fairly normal colour-vision.*

Mr. Beck said that an interesting experiment on colour vision, whereby a uniform tint was produced by the combination of varying amounts of two different colours on a spinning top—showed that even in normal eyes scarcely two people agreed in requiring the same relative amounts of the two compound colours to obtain the same resultant tint, showing that the relative brilliancy of colours varied largely in even normal eyes.

Mr. G. C. Karop said it seemed to be taken for granted that all men, not known to be colour-blind, were endowed with a perfect chromatic perception, and while all the other senses required to be educated, the eye did not need training, in this direction at least, which of course was quite a mistake. No untrained person would presume to analyse musical tones, but nearly every one thought himself qualified to decide as to shades and tints. So far as he was aware, there was no systematic education in colour, which was possibly due to there being no universally accepted scale or standard.

The President said there was a class of men who were supposed to have a special training in appreciating colours, these were the artists; but he ventured to say, that, though in the case of a broad strong colour they might not differ, yet when it came to a delicate tint, such as the shade upon a tree trunk, it would be found that scarcely two of them would agree. This would not be merely a question of name, because they would mix different colours to match the tint required; and so it would be also found amongst people generally, that where strong colours were concerned there would be a pretty general agreement, but when it came to a discrimination between delicate shades, they would find there was a very wide amount of divergence.

* Professor Liebreich, in a magazine article on 'Turner and Mulready,' published many years ago, attributed certain peculiarities in the paintings of the former artist to astigmatism, and in those of the latter to yellow cornea.

The following Instruments, Objects, &c., were exhibited:—

Mr. C. Beck:—Dissecting Microscope.
Mr. F. Chapman:—Foraminifera illustrating his paper.
Mr. E. M. Nelson:—Plates illustrating Colour Photography.

New Fellows.—The following were elected:—*Honorary* Fellows:—Dr. Anton Dohrn, Prof. Camillo Golgi, Prof. Gustav Retzius, and Herrmann, Graf zu Solms-Laubach.

Ordinary Fellows:—Dr. William Cline Borden, Prof. William Keith Brooks, Mr. Thomas Bruce Dilks, Prof. Joseph Edward Morrison, Dr. Daniel Romaine Van Riper.

INDEX OF NEW BIOLOGICAL TERMS, OR OLD TERMS WITH NEW MEANINGS, RECORDED IN THIS VOLUME.

α. ZOOLOGY.

β. BOTANY.

INDEX.

D.

E.

G.

H.

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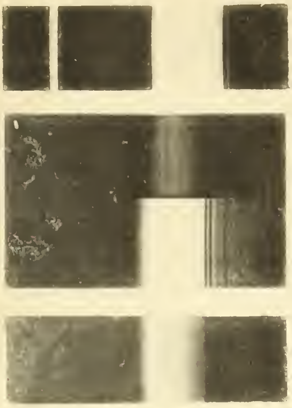

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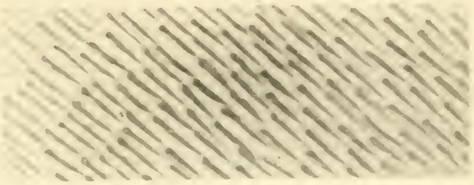

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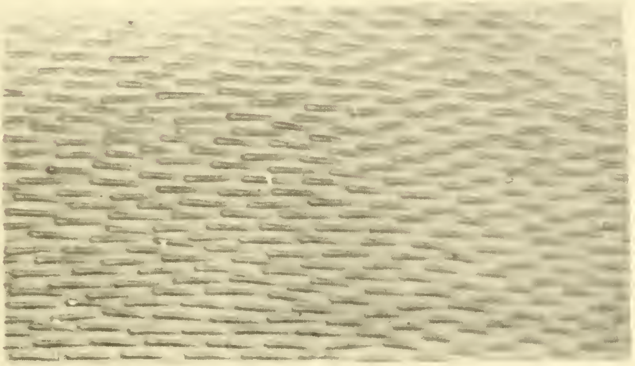

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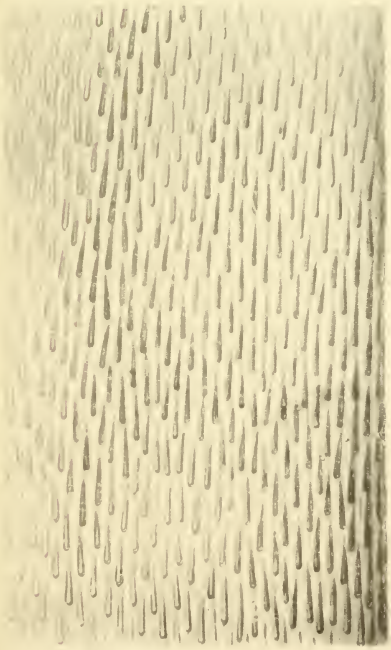

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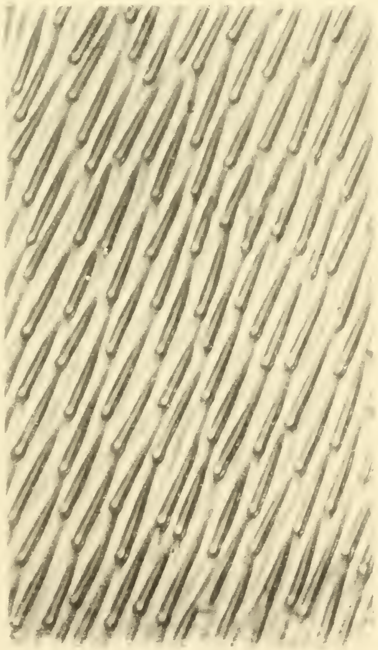
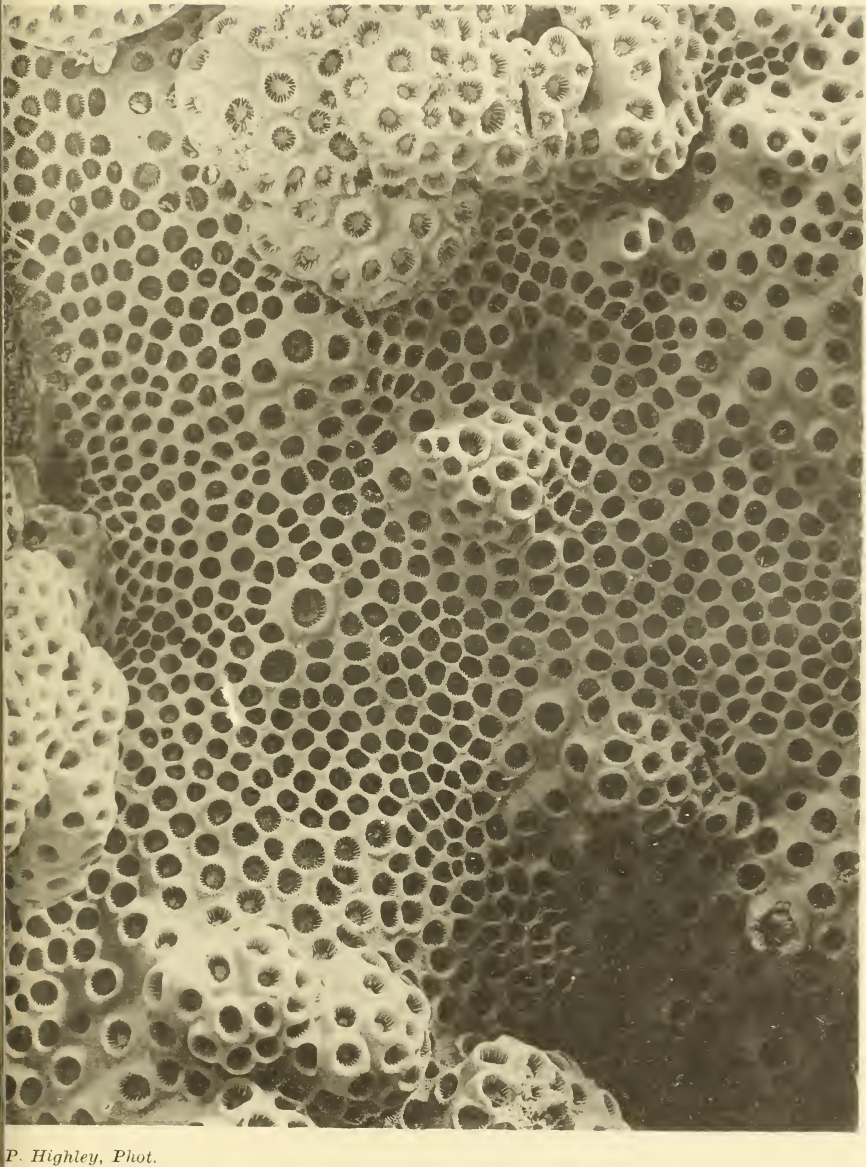


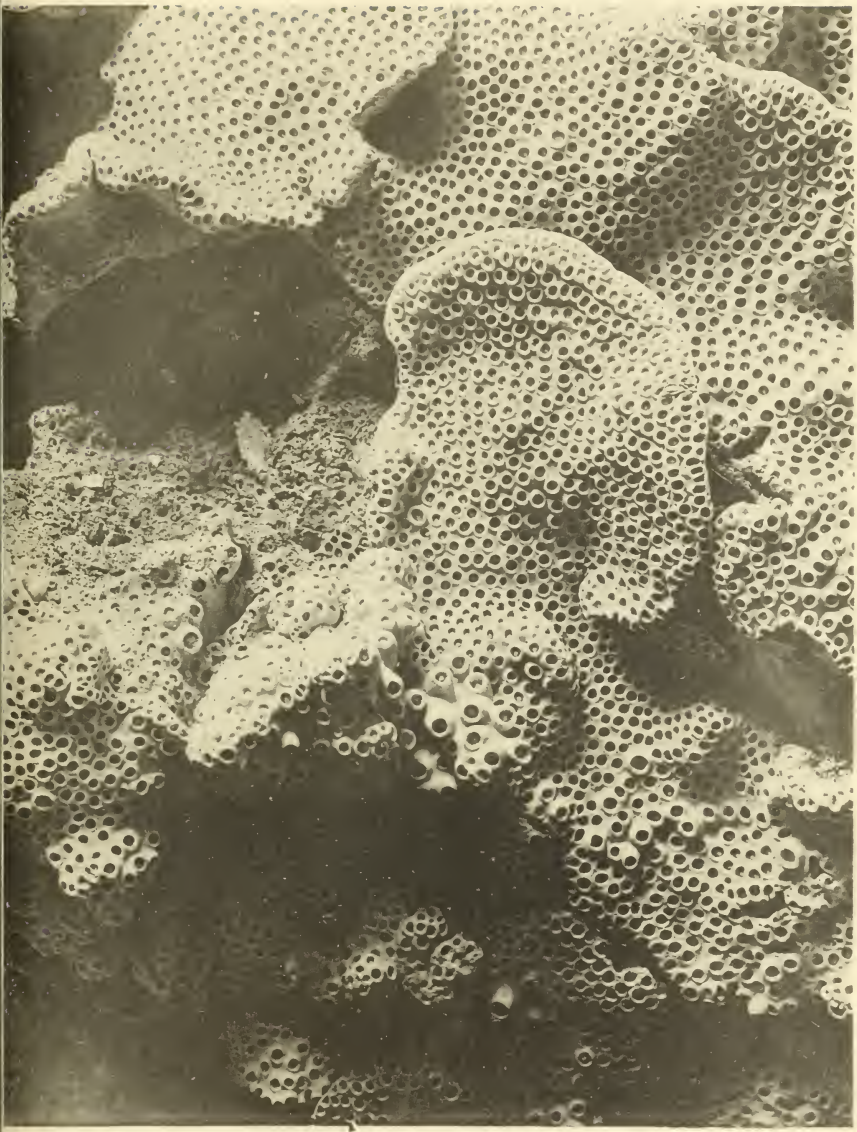
J. W. Gifford, Phot.

MONOCHROMATIC VIOLET.



P. Highley, Phot.

VARIABILITY OF TURBINARIA.



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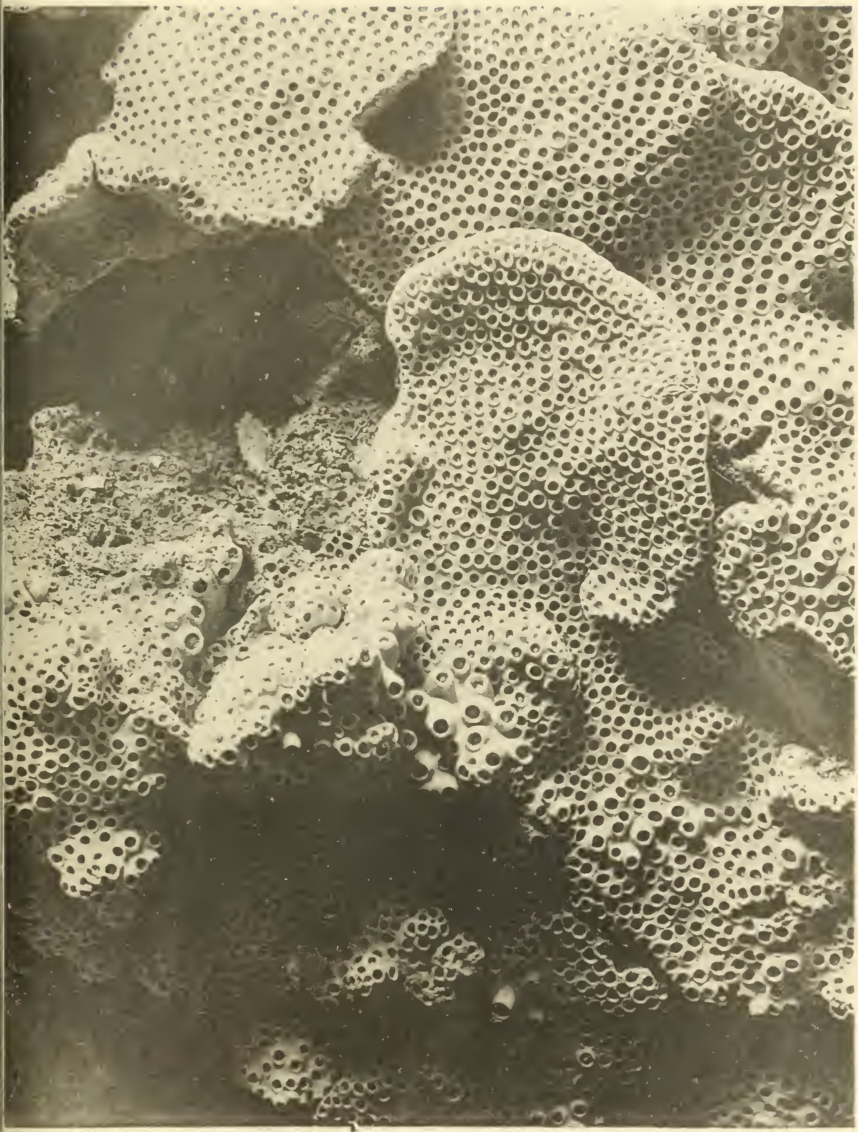

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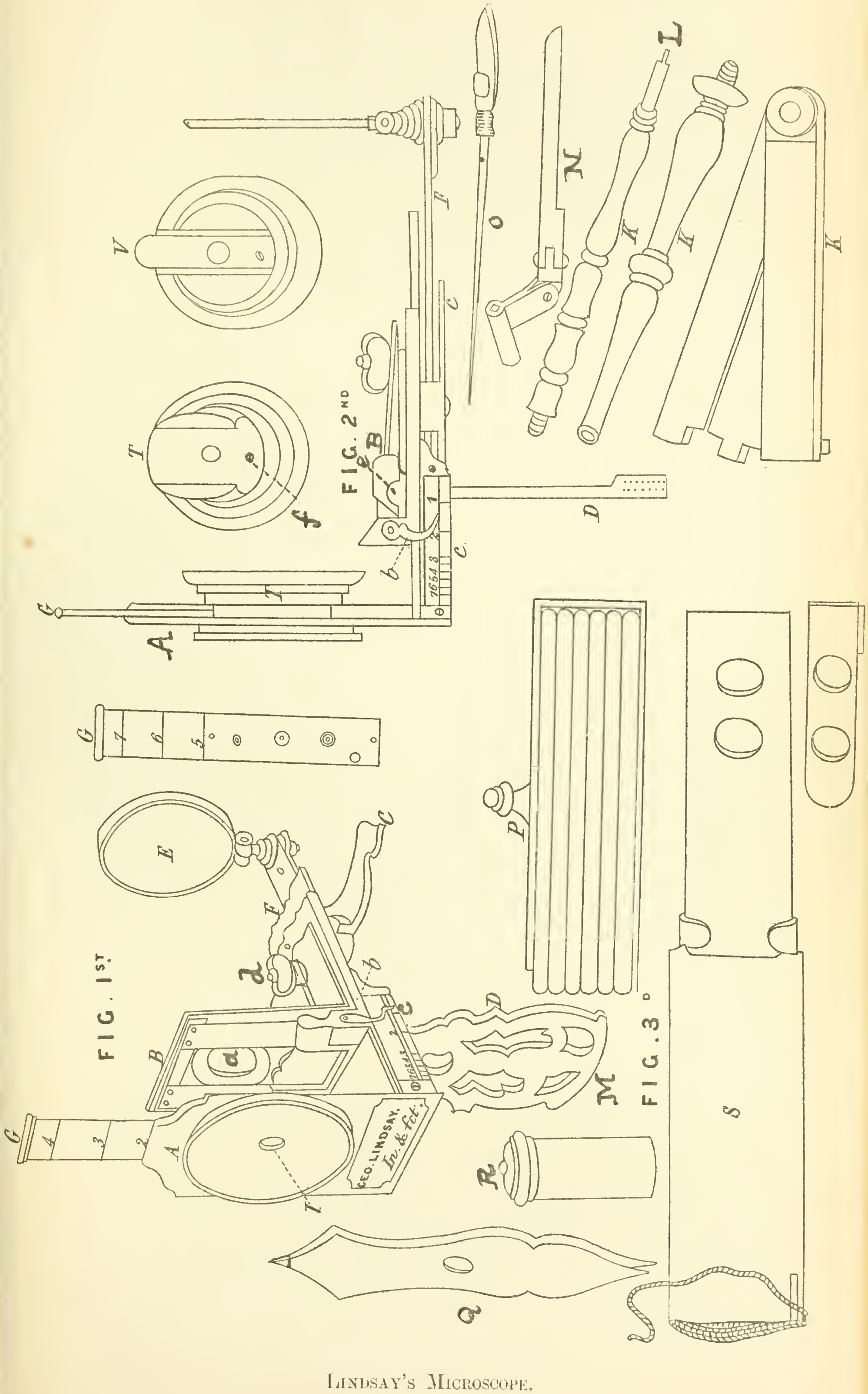
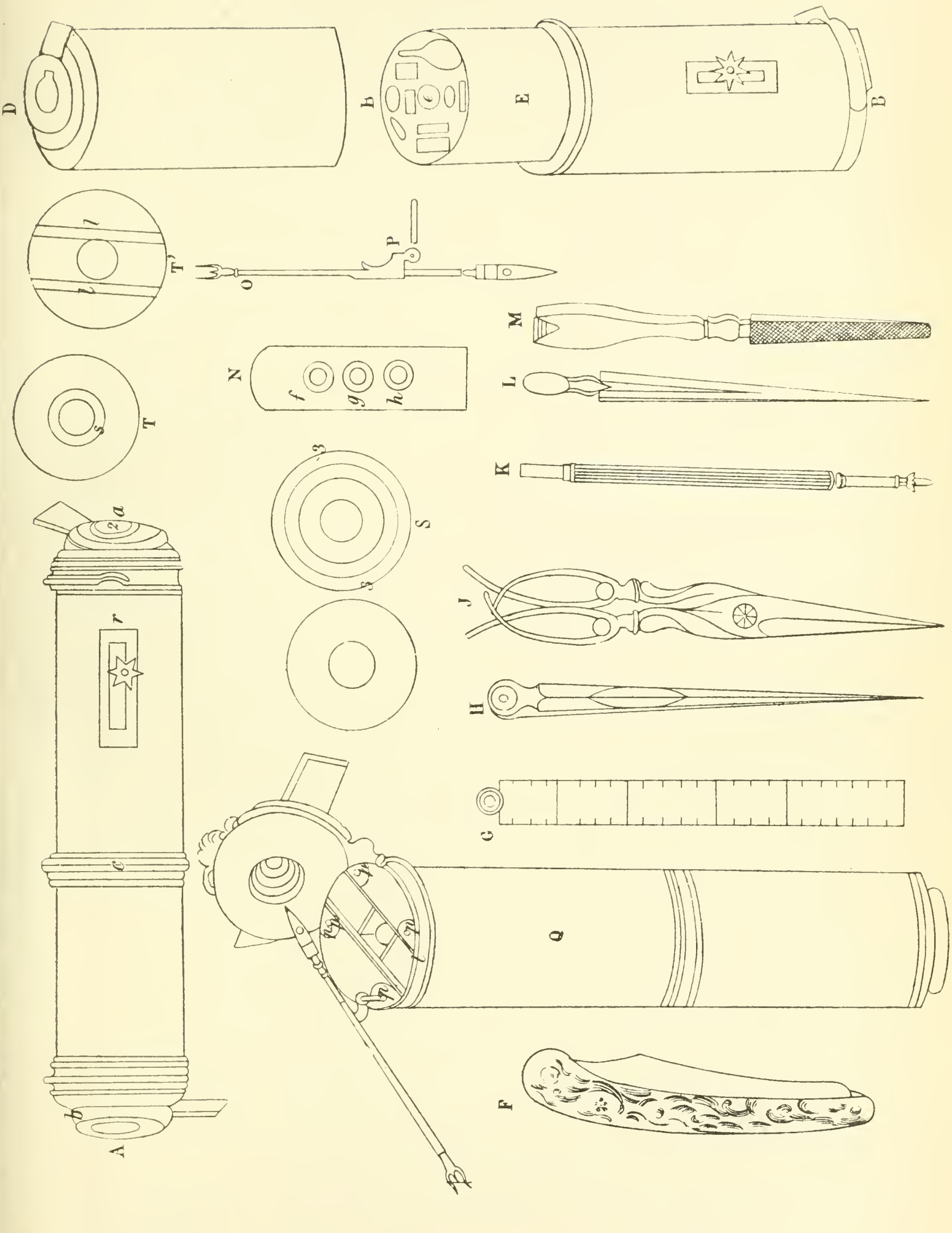
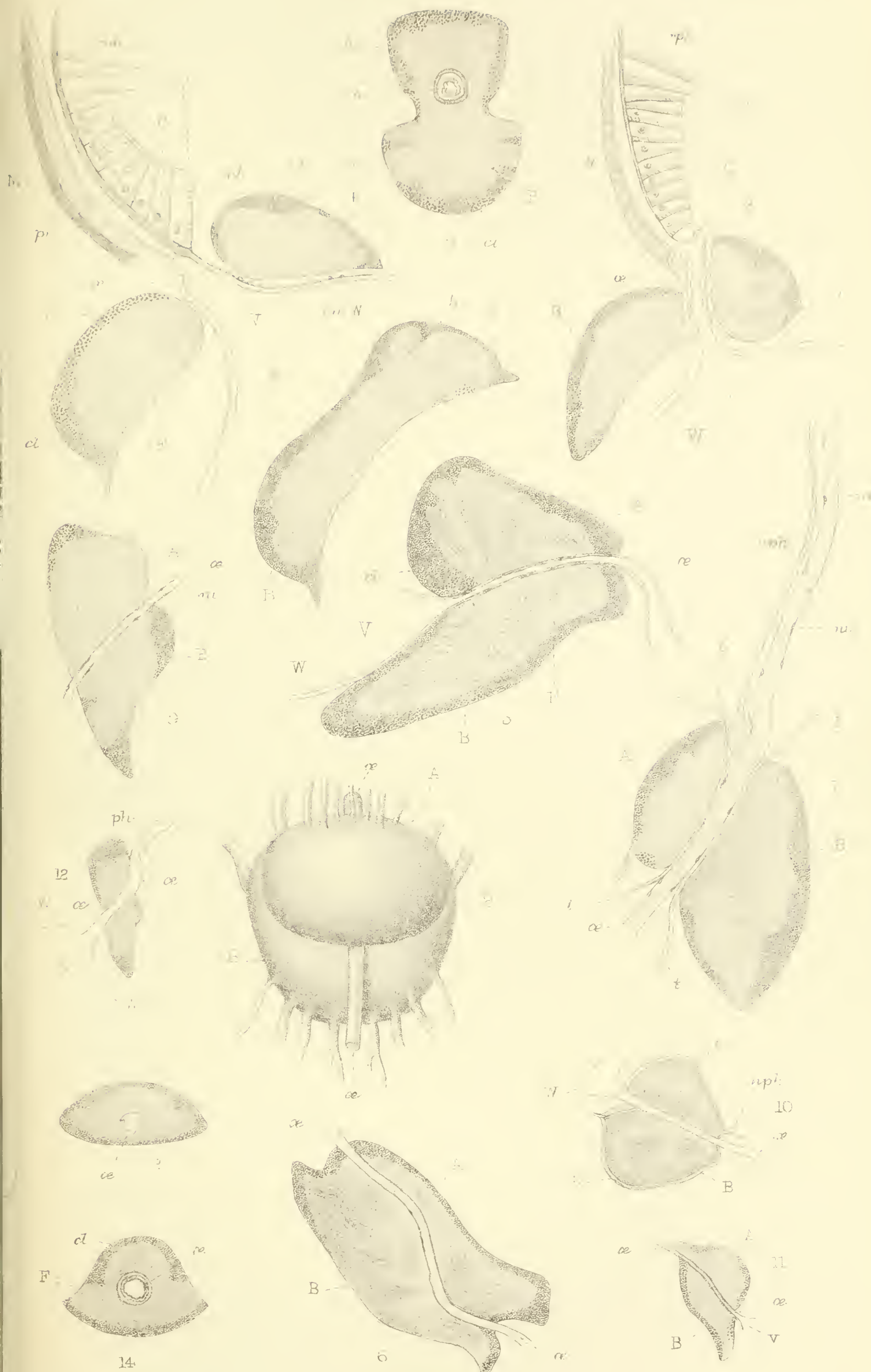


Lindsay's Microscope.



Ribright's Microscope.



A. D. Michael ad nat. del.

West, Newman lith.

The Brain in the Acarina

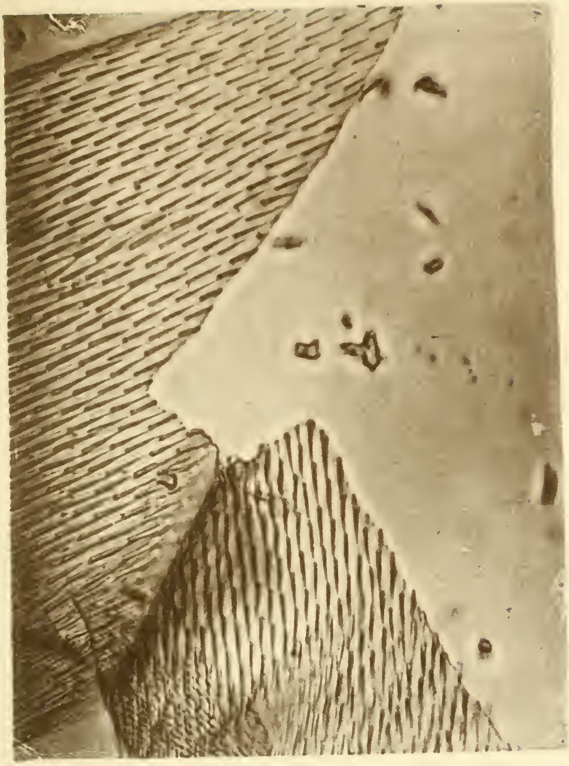


Fig. 7.

Fig. 6.

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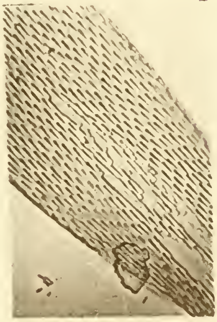


Fig. 1.

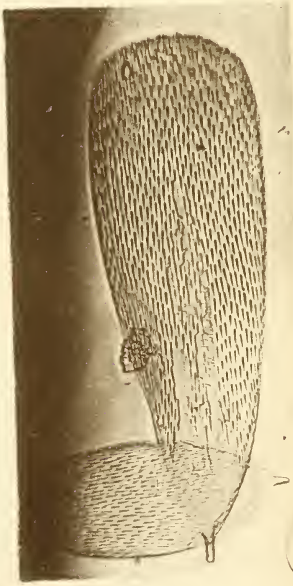


Fig. 4.

Fig. 2.

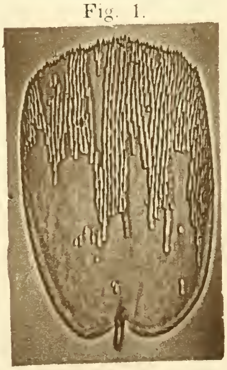
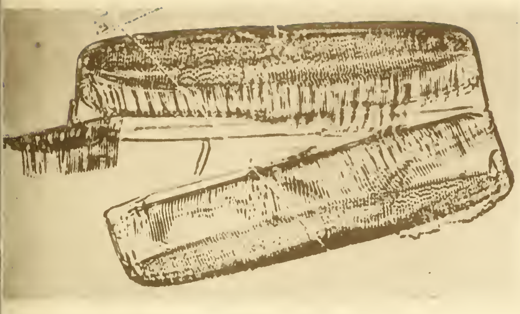


Fig. 3.

A. Letherby, Phot.

PODURA SCALES.



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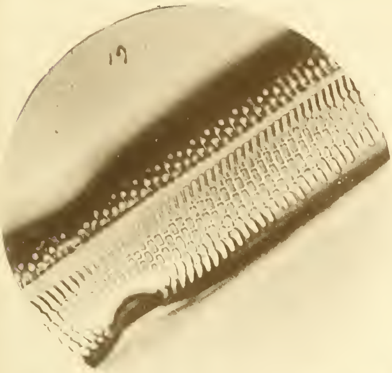

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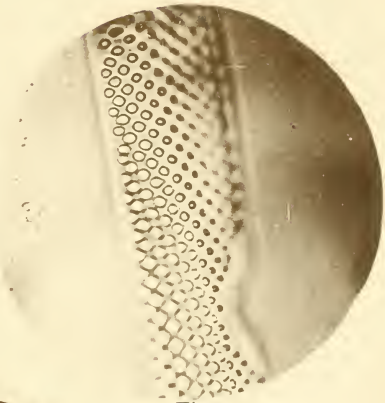

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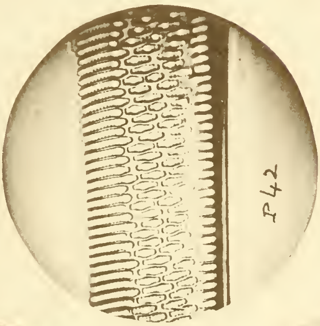

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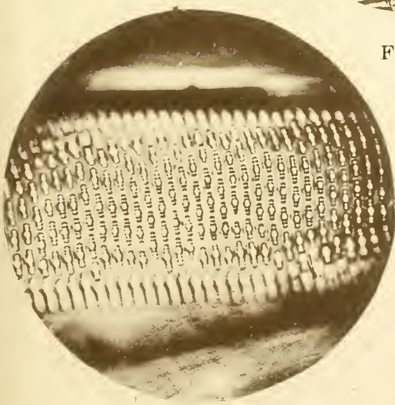

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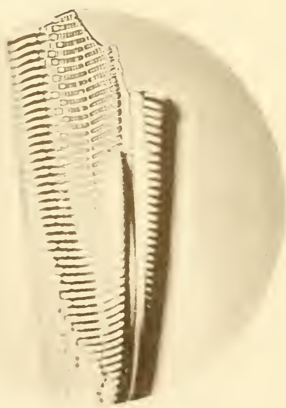
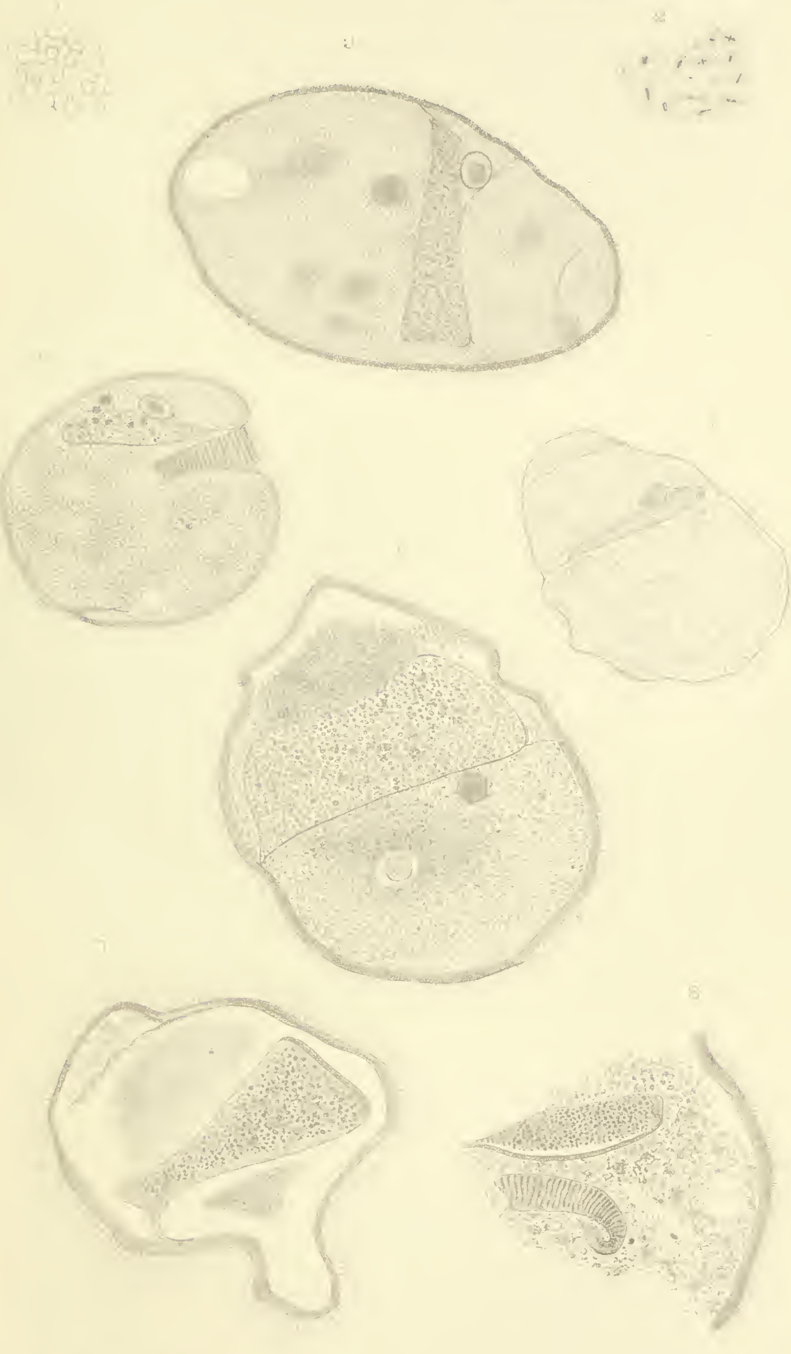


Fig. 7.

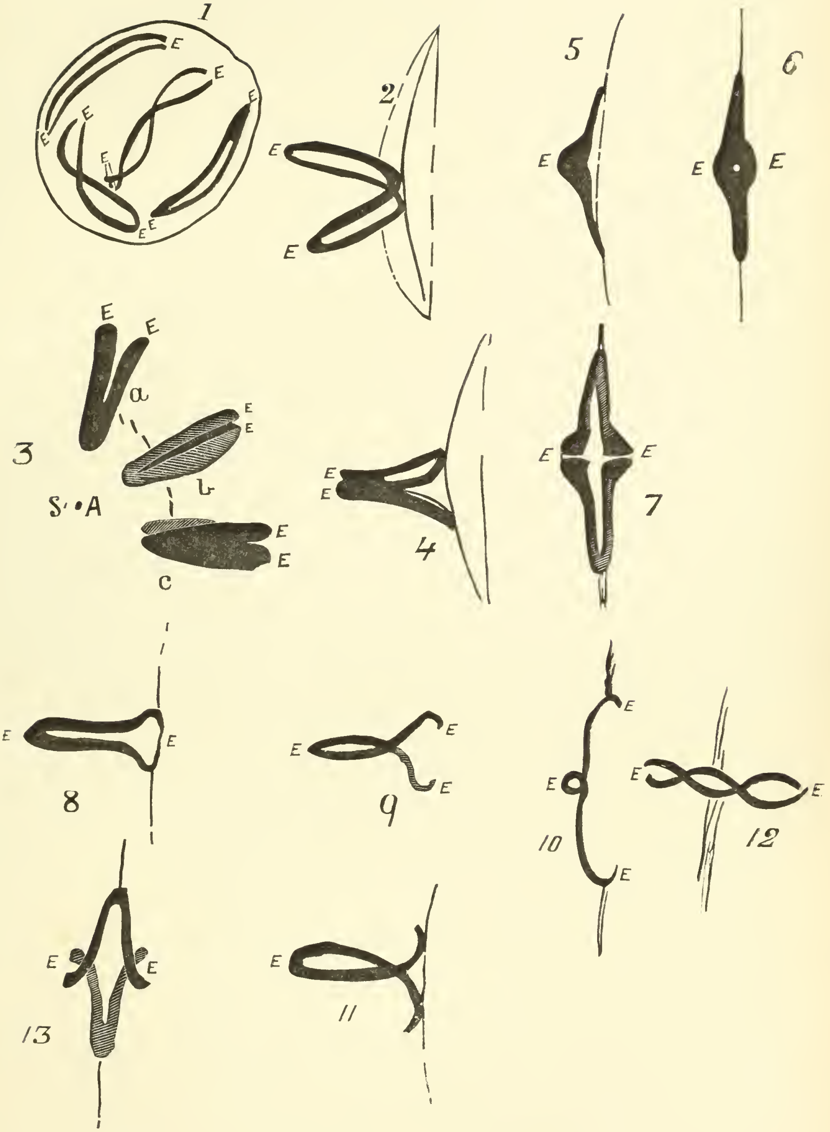
T. Comber, Phot.

TRACHYNEIS ASPERA.



West, Newman lith.

Nyctotherus Ovalis



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DIVISION OF CHROMOSOMES.

The Journal is issued on the third Wednesday in
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JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY;

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS,

AND A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY
(principally Invertebrata and Cryptogamia),
MICROSCOPY, &c.

Edited by

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One of the Secretaries of the Society
and Professor of Comparative Anatomy and Zoology in King's College;

WITH THE ASSISTANCE OF THE PUBLICATION COMMITTEE AND

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