SUPER-
ORGANIC
EVOLUTION

LLURIA

SUPER-ORGANIC EVOLUTION

Nature and the Social Problem

BY

DR ENRIQUE LLURIA

WITH A PREFACE BY

DR D. SANTIAGO RAMON Y CAJAL

TRANSLATED BY

RACHEL CHALLICE

AND

D. H. LAMBERT, B.A.(Oxon.)

LONDON

WILLIAMS & NORGATE

14 HENRIETTA STREET, COVENT GARDEN

1910

SUPER-ORGANIC EVOLUTION

Note

Owing to the lamented death of Miss Rachel Challice, the greater part of this work has been translated, and the whole translation revised, by D. H. Lambert, B.A.

Preface

Dr Lluria has been so good as to class me as an expert in matters of sociology, and has invited me to express my opinion on the present work, which treats of the anthropological causes of the so-called social question.

Such a request places me in considerable difficulty, since, not being conversant with the science created by A. Comte, and developed by H. Spencer, I have studied very little, or rather I have not had time to study, the moral and intellectual evolution of man, considered in relation to society and the State. A worker bee of the great human hive, I have confined myself chiefly to gathering honey in the garden of Nature, in order to build my small individual cell, leaving others, with the eagle's vision and powers of concentration, to trace the perspective and found the philosophy of a common labour, marking the future routes of the human swarm.

But, as in the present case my silence might

be interpreted as want of respect, I accept the proffered honour, explaining, without dogmatising or *arrières pensées*, my individual impressions on the doctrine elaborated by Dr Lluria, and the solutions, still very remote, of the terrible social problem.

I am entirely in accord with the critical part of this book. The author has abundance of reasons for declaring that present humanity has contemptuously severed herself from Nature, occasioning this systematic and perpetual violation of the laws of evolution by initiating inequalities and torturing pain and misery.

The social man of to-day, corrupted by his unhealthy worship of capital, represents a strange mixture of civilisation and barbarism. He thinks and feels, apparently, like a Christian, but he acts like a citizen of the aristocracy of the ancient inhuman republics. The sphere of his intelligence has enlarged as much as that of his will has decreased.

More attached every day to a sense of justice, present society presents the sad and paradoxical spectacle of a world upside down; above, sit enthroned and honoured vice and laziness; below, struggling with hunger and pain, the toilers and helpers — the brains, that is, that, as Spencer would say, sharpened by necessity, sovereign

moulder of the mental clay, have best adapted the internal dynamic relations to the external. Hence the inevitable decadence and weariness of the human race; since highly strung organisations, worn out by overwork and misery, lose their power of originating, or leave behind a miserable posterity decimated by disease; whilst, on the other hand, the drones, the unadaptable, the poor in spirit, surfeited with pleasure, produce a robust offspring, thus perpetuating the dead-weight of the social machine.

For civilised man, therefore, the principle of the selection of the fittest does not hold good, nor does the better cast prevail in the struggle for existence; on the contrary, as Dr Lluria shrewdly remarks, adaptation adjusts itself to an artificial extra-organic condition quite unknown to the rest of the animal world, and an inexhaustible cause of weariness, retrogression, and false organisation —for instance, the acquisition and enjoyment of capital with the sole view of guaranteeing the perpetual sloth of the few and the incessant increase of the parasites of labour. So that the human species, eternally oscillating between destitution and superfluity, anæmia and plethora, becomes something strange and incomprehensible; a kind of fool, cursed with the monomania of condemning others to hunger in order to procure for

themselves the overwhelming satisfaction of suicide from satiety.

Equally with the author, I agree that the only legitimate capital, anthropologically considered, is the human organism and the forces of nature, factors of production which cannot harmonise with justice and the law of evolution unless collectively sustained and directed. The earth for all, the natural energies for all, talent for all: this is the fair division of future society. It is, then, according to Dr Lluria, highly important to re-establish man according to the law of evolution; to apply capital, diverted to the enjoyment of a few, to the common store; to continue, in fine, as Cánovas would say, the biological history of the human race, wearied of the selfishness and injustice of three thousand years of civilisation.

But is it possible? If it is more than a sweet, flattering dream, how can it be realised? Will the man in power, duly expropriated for the common good, resign himself to mediocrity? Will not the deeply rooted prejudices of a dethroned aristocracy and the utilitarian instinct of the slave-driver arm his enraged hand? And if these dangerous longings for ill-regulated ease have to be forcibly repressed, will not the society of the future be threatened with new wars of class with class, with the consequent ruinous waste of men and weapons,

and the inevitable overwork of the better sort? And even on the fascinating hypothesis that calm may be re-established and the world converted into a vast workshop controlled by love and moderation, how shall we prevent the sexual instinct, acting without foresight or restraint, from flooding the world with millions of hungry mouths as a terrible charge upon society and a constant danger to the general peace? And if, after all, Malthus's theory prove true? What will our future statesman do with the excess of population when, with America and Africa glutted with European emigrants, there remain no virgin soils to plough, no mines to be exploited?

And turning our attention to the march of civilisation itself, will not the *aurea mediocritas*, to which society aspires, enervate the mental faculties, undermining the energy for scientific investigation? Will not collective capital be timid, and lack the dash, on romantic and supreme occasions, of individual capital? Will glory, the passion of philosophic and scientific genius, prosper in the grey and subdued atmosphere of the commonweal? When injustice is banished, will not the best spring of the mental evolution of humanity perhaps have ceased to act? Pain is itself a great moulder of character, and incites to heroic deeds. When misery and misfortune are reduced to a tolerable

minimum, will not the sublime abnegation of heroes and the mighty genius of the pioneers of science descend to the same level?

All these torturing doubts and questions are answered by Dr Lluria in a system highly sympathetic and inspiriting. This is our interpretation of it:—

Present production, the work of a hungry and uneducated minority, is deficient as regards the necessities of the race. Divorced from the natural laws, our brain evolves but poor and most inadequate results. And, as an inevitable consequence of the poverty of nutriment and the rigorous overworking of the majority, is produced moral and physical suffering, physiological misery, the degeneration of the species, and, in the moral sphere, hatred of class and discontent.

But such a deplorable state of things cannot last for ever. A time will come when science will illumine the conscience and elevate the mind. And then, when, having banished the fetish of capital, man has incorporated himself with the laws of evolution; when, having scrutinised and exploited the forces of Nature, the cosmos labours for ourselves, setting in motion an endless number of machines, and manufacturing articles at ridiculous prices; when, having discovered the secret of chemical synthesis, the engineer of the future

elaborates, without competing with the earth, the seed, gluten, albumen, sugar, and fat, utilising for the purpose the living force of the solar ray or some form of natural energy; when leisure well earned permits the universalisation of science and art, and all can taste the ineffable harmonies and beauties that palpitate in the lap of Nature; when, in fine, redeemed by solidarity and love, we all feel within us the waves of one and the same vital current, sister-cells of the same body, — what meaning will attach to the words "rich and poor," "master and slave," "happy and unfortunate"? What will it matter then that love multiplies the species without end, or that a blazing sky and a barren earth are niggard of their gifts? Full of energy and alertness to take action against all kinds of cosmic accidents, there will be the human brain, exalted by its faithful adaptation to the mechanism of the world, generously offering us new and saving inventions. Ours, too, will be the treasure of the inextinguishable solar ray, which science, emancipated perhaps from our old, worn-out nurse, the earth, will be able to turn and adapt to the production of shining fruits and golden ears. Who fears the exhaustion of the solar force, of the movement of the wind, and of the seas, of the cataracts of the mountain gorges, of the sovereign power of thought?

Proud and encouraging ideal, that may perchance one day be changed into a living, palpitating reality!

Let us believe that its coming is at hand; for in this base world only what is earnestly hoped for and expected is capable of realisation.

Setting aside the doctrine and the luminous horizons that its author reveals to us on evoking with prophetic vision the future society, disdainful of individual capital and addicted to the worship of Nature, there are in this book many suggestive ideas and conceptions which, even separated from the fundamental thesis, have a peculiar value and brilliancy, like jewels set in an artistic crown.

One of them is assimilation of life to a rhythm, to a system of waves comparable in principle to the palpitations of the ether or to the most complete order of relations marked in the tables of Mendeleef and Sir W. Crookes.

At first sight the idea seems obscure and even difficult of conception; but reflecting upon it, one discovers luminous facets and most interesting points of view.

Because, in brief, life represents a complex system of forces, of vibrations in ascending progression. Like an orchestra successively reinforced, organisation begins with the mono-rhythmic

note of the infusorium, and ends with the grand symphony of the mammal, in which millions of cell-voices take part. And when the volume of sound of the organic orchestra reaches its highest note, again rises the enchanting *refrain* of the germ, that is, the simple cadences of the ovule, starting from which the melody develops with a *crescendo*, ever more complicated, until arriving again at the fullness of the modulations and motives of the organisation of the adult.

In no organic apparatus do we find this rhythmic character in greater relief than in the cerebral instrument. Our mind is nourished on waves gathered from all parts of the cosmos, and its principal mission consists in classifying, combining, and reflecting them, with reference to their origin. Perceptions, ideas, the spoken word, even muscular contraction, what are they, in their ultimate analysis, but palpitations of heat, of light, of chemical energy, of electricity, etc., transformed, refined, and converted into other palpitations more subtle and spiritual? Like a lens of singular virtue and power, our nervous system gathers all the noises and minute tremblings in the world, in order to concentrate them, now in the splendid form of an idea, now in the flame of will and of passion.

If viewing the animal series as a chromatic scale, as a symphony executed by natural forces that,

after forming the brain, play upon the nervous fibres like the wind on the harp, is an interesting conception, no less so is the attempt to explain the inheritance of the qualities acquired by the trophic influence of the nervous system.

Certainly the attempt is somewhat premature. We are in want of anatomico-physiological data to prove how an organ made perfect by adaptation to the conditions of its environment can so influence the brain that the latter in its turn modifies the germinal cells. Nor are there wanting savants like Weissman who roundly deny the transmissibility of the acquired characteristics, imputing all to the chance elements of variation and natural selection. But, in fine, if the arduous problem has not at the moment obtained a complete solution, it is something to know that our ideas and feelings exert an influence, by means of the great organ of sympathy, upon the nutrition of the glands and the molecular architecture of the germinal cells. At all events, the aim is a tempting one, and if science ultimately confirms this principle (the action of the nervous system upon the molecular adjustment of the nucleus and the protoplasm), the nerve theory of the inheritance of acquired qualities will replace the arbitrary hypothesis of Darwin, Haeckel, De Vries, and others on such an interesting problem.

Full of enthusiasm, too, is the song that Lluria sings of the indefinite perfectibility of the brain, of this vital organ, eternally young, that we all have within us. The former slave of cosmic forces which sculptured, with painful minuteness, the network of its associated passages, the human brain is destined one day to become the tyrant of that same natural energy to which it owes its appearance. Certain it is that the senses, the too narrow windows of the soul, have broken the continuity of the scale of ethereal vibrations, obliging us to select only the most useful for the increase and prosperity of the species; but equally so is it that, by a wise compensation, our cerebral cortex, exquisitely plastic and creative, has succeeded in filling with ideas and inventions the gaps in the diminishing sensory register. What are the instruments of science, the microscope and the telescope, the galvanometer, and the photographic camera, the screen of the radioscope, and the resources of analytic chemistry, but retinas and complementary apparatus, perceived from afar, in virtue of which human ingenuity, correcting Nature, enters into possession of all the palpitations of cosmic energy?

I have done; for it is not my intention to sully with inapposite commentary the diverse and seductive themes which, with abundance of erudi-

tion and sound criticism, are unrolled by Dr Lluria in his beautiful work, written, I may remark, with clearness, brightness, and suggestion, and with a mastery of thought and calmness of judgment which might be the envy of many well known in the world of philosophy and social science.

S. R. Y CAJAL.

Contents

Super-Organic Evolution

CHAPTER I

INTRODUCTORY

THE ideas set forth in this book are only an experiment, and they are only notes which I hoped to have enough time and peace of mind to extend with necessary amplitude. Time passes: the pressing things of life do not decrease, and I long to give to the world the thoughts which are my most earnest convictions. I have always considered the existence of a humanity eternally unhappy as an incomprehensible thing, and I have rejected this monstrous injustice from childhood.

I am, and I shall always be, an imperturbable optimist, and this has given rise to the trend my spirit has taken for some time past.

In Nature organic life obeys harmonious laws which represent relations constantly realised in definite and exact proportions; humanity forms

part of this organism; therefore, if man is an exception, it is because he has infringed natural laws.

As the error of this course is evident and notorious, it is important to ascertain how the fundamental principles of Nature are infringed.

Full of this idea, I set to work to find the key of the problem, and my imagination soon got on the track. "The inheritance of humanity," I said to myself one day, "is Nature, natural forces. Capital or *money* is but a limited resource, and it does not confer joy on man as a whole." But this statement did not satisfy me without a justification. It was necessary to justify and prove it, and so I went on seeking. My profession as a doctor brought me to the consideration of the relation existing between an organ and its function.

I read what Spencer says on this subject. However, it did not satisfy me; on the contrary, it gave me another idea.

Intelligence is a function of Nature, and the brain its intermediary organ. It was then that I understood that the socialism of the world and its instruments of industry could have a legitimate basis; and what appeared a more or less platonic aspiration could be explained in a positive form, and the inheritance of man could be increased by humanity through the socialism of Nature. My conviction was fortified more and more by seeing

how the newest and most daring aspirations of modern philosophy could be justified.

Darwinism caused a great change in religious and philosophical ideas: polemics became strong and heated. Virchow accused Darwinism of leading directly to socialism. The German Darwinists, including Haeckel, protested vehemently. From the reasoning brought forward by both sides it was clearly evident that, if transformism were given its due weight, the relation it bears to the social science was certainly not taken into account. It is surprising that the great Herbert Spencer did not discover the relation existing between the two, as all his philosophy leads directly to the new and much-wished-for social condition. In his theory of evolution this worthy philosopher arrives at super-organic organisms; but on applying the law of evolution to humanity, an organism of this kind, he does not arrive at fixing the precise conclusion to which his own ideas ought to have taken him.

In the admirable study which he makes of the intelligence, considering it as a natural, logical, and exact consequence of what he calls "the law of correspondence or concordance," it is shown that intelligence is a product of natural laws. This chapter sets forth, in my opinion, the ruin of the present conception of property, and shows what

ought to be the future ideal—*that Nature is the inheritance of humanity.* It is through not having logically evolved this deduction that Herbert Spencer has not solved the great social problem. And the notion of property as it has been in vogue for centuries is so rooted in the brain of men, it has formed so many grades of associations and systems of associations in the cerebral nucleus, that the powerful mind of the great thinker, weary with the superhuman effort of his intellectual life, could not break with the old bonds. This shows the enormous work which is necessary for other minds of minor capacity than that of the great English philosopher to break loose from the routine.

When we think of this complex organism which goes on developing in such a systematic and laborious way to rise from protoplasm to man, when we see the intelligence in this, and Spencer shows us the correspondence which exists between the formation of the human brain and this same evolution, the mystery seems to vanish, and instead of being a blind and capricious force, Nature legitimately acquires its own conscience, and, in a word, intelligence is Nature incarnate in man.

We see that human super-organism has to follow the same laws which presided over the process of all organisation in its perfecting, and

that the same law which made man from a unicellular organism has to be followed by humanity to arrive at unlimited or limitless perfection, which, in the ultimate term, is the production of the greatest concordance of the external with the internal of which Herbert Spencer speaks. Then this era of peace and justice of which all men dream nowadays will be realised.

It is easily understood, and it has been repeated a thousand times, as it is the supreme aspiration of sociology, that a change in the economic basis of life, *property,* would immediately involve a complete transformation of actual society, and all institutions from that of the family to the State would be transformed.

The true basis of the family of the future will be love, which is the natural medium of selection in the human species.

Woman has a great part to play in the perfection of the race. She will work for progress more than man, because she, with the instinct of maternity and the feeling of responsibility, which are keener and deeper than in man, will be the one to found the race of the future.

All societies have liked to enslave woman, ignoring her true significance; and present society, like that of the past, not only persists in its error,

but sacrifices, spoils, or corrupts women. By changing the economic basis of property for the effective intellectual one of love, the transformation will be marvellous.

Nothing will remain of the State ; its institutions, its administration of justice, its armies on sea and land, etc., will all disappear completely, because they are a natural consequence of a state of things which requires the support and equipment of force. The only authority which will remain will be that of the master in the most complete sense of the word, being the one who has the authority of intelligence. "Superior" men will be those who enjoy this privilege, because only the most perfect brains can fulfil the function of being true explorers in the road of truth. They will go forward in the conquest and dominion of Nature to prepare and facilitate the task for others.

Religions will continue for a long time, because they will go on transforming, like the Christian religion in North America.

On the day that religions have no more money as a means for transactions with their gods, morality will improve religions, and by degrees theogonies will go on being integrated with the new morality which will carry with it the society of the future, viz. the cult of truth and beauty.

These ideas will conflict very much with the present prevailing prejudices, and it is natural that they should do so. How can it be admitted that man should obey other motives than that of money? How will it be believed that a morality will exist which will dignify man to the point of being useful to his like solely for the satisfaction of being so?

The suggestive power which a morality, however false it may be, exercises upon a man is proved by the sentiment of honour and love for one's country making nations arm themselves to the teeth for the despoliation of each other, especially the weakest ones.

It is of no import that the Christian religion says in one of its finest precepts: "Love your neighbour as yourself," because society is organised in such an absurd way that men have to deaden their consciences, and so it is not a rare thing to see ministers of a religion of peace implore the support of a God who is all love for the more effective destruction of the neighbour for whom pardon is asked every day.

All this could not be more absurd and ridiculous, and yet it is seen as a common fact. The power of the suggestion of morality is so forcible in man that not only does it impel him to irrational things, but it leads him to be in a constant state of apostasy in

one of the precepts of the same religion, and this without any rebellion of his conscience.

And in fact this could not be otherwise, as it is a logical consequence of a monstrous social organisation. It requires such a strong lesson to show that, if man is capable of sacrificing his life and his conscience to contradictory or immoral principles, what would not the conduct of the same man be were he educated in a morality of pure reason and positive science ?

Routine is to the intelligence what inertia is to the brute body. The victims of this human calamity are countless, and the more so as the majority of noble men whose ideas illuminated the path of truth have been rewarded with martyrdom.

However, from the time of Copernicus, who combated the geocentric theory (showing that the earth is not the centre of the universe), until Darwin overthrew the anthropocentric theory, routine lost much of its resistance. Copernicus had to wait patiently till the Church let him publish his work, and under the form of a philosophical inquiry. What a humiliation ! At last, after thirty years, Copernicus saw his work printed, but it was on his deathbed. However, he had the good fortune to escape the pious theologians of his day.

What that great man must have suffered in

having to conceal his ideas and not being able to fight for them must have been horrible. A man who discovered the marvellous movement of the stars, and had to hide his emotion at the final salvation of his work!

The ideas of Copernicus impelled Galileo to the sacrifice of abjuration, and helped Bruno to the honour of dying for them.

Darwin, whose work raised a storm of protests and keen polemics, had the immense satisfaction of having his triumph during his lifetime. Pasteur had a sharp and hot struggle, but his victory was as rapid as it was complete. The struggle against routine is terrible, because it has an organic origin which is difficult to destroy; and for the better understanding of the mode of annihilating it the following words of the eminent Ramon y Cajal on this subject should be read:—

"If the suggestions of teachers and parents are dictated by prejudices and false ideas about science, religion, conduct, etc., they establish exclusive and abnormal connections between certain groups of cells, cerebrales, in the brain of the child, and the psychological result will probably be a routine of thought, a contempt of science, excessive credulity, a longing for the marvellous, and other vices of thought as grave as they are difficult to uproot.

"An education based on positive ideas, whole-

some and generous feelings, an impartial conception of science will lead men to the perfection of physiological associations of the cerebral neuronas, and the result, when arriving at the adult age, will be a man of wholesome judgment, free from prejudices, and especially prone to the study of arts and sciences.

"Given the defects of our education, there are few brains whose cellular architecture has not been somewhat deformed, or whose natural associations have not manifested signs of mental aberration. Even in superior minds the spirit of sect, the absence of impartiality, and an excessive appreciation of their own merits are very common. But the consequences of a defective and exclusive education are most apparent in political, religious, and literary sects. Every political, philosophical, and artistic school produces in its adepts a style of association of ideas, judgments, and reasonings so exclusive and limited that it is impossible not to attribute it to the special and systematic connection between various groups of nervous corpuscles.

"These modes of intercortical association repeatedly adopt contrary forms which determine manifestations as opposed to each other, as materialism and spiritualism, realism and romanticism, socialism and individualism, etc. When such associations, systematised and formed during youth,

arrive at the robust stage expressed in political, religious, and philosophical convictions, be they true or false, they cause a real cerebral state, and to attempt to change them is like trying to alter the anatomy of the encephalus or to change a personality. It is certain that the brain of a positivist does not function like the brain of a spiritualist, and the physiological differences which distinguish the two forcibly imply structural difference, which could only be overcome at the cost of much time and hard contra-suggestive labour. For the protoplasmic and nervous expansions are as slow in forming and establishing new associations as they are reluctant to withdraw or change them."

This fine paragraph seems to exhaust all that can be said on *routine.*

I am impelled to the publication of these remarks by the constant spectacle of human pain and sadness; the perennial tragedy of life, the dramas of misery whose cries of woe echo through the press of all nations; the chronic and dreadful but implacable misery to which millions of victims succumb in silent neglect; the infinity of children who die for the want of every kind of care, and who, having come into the world, have to submit to the pauperism which prematurely cuts short their lives; and the

penury of poor old people exposed to the greatest of all misfortunes, that of being unable to gain their living.

The war between Russia and Japan, in which thousands of men were killed, made me sad at heart, for penalties and sacrifices were imposed on an infinity of families, and innocent beings were orphaned, and all without anything definite coming of it.

Hunger and misery, more terrible than wars, continue their devastating course. All these pictures of life are not only painful but barbarous, albeit they take place in countries which consider themselves civilised. Hence my surprise at seeing how the just aspirations of socialists and anarchists, who wished their arguments to figure in an assembly united under the auspices of science, were received at the Congress of Freethought at Rome.

Why these protests? I do not understand; I cannot conceive that among modern scientific men there can be one capable of considering the great social problem as foreign to Nature. Neither can we believe that men convoked in the name of positive science and who have studied the heavens can refuse to recognise the legitimate right of sociology to redeem man.

Just as terrestrial magnetism attracts the compass from north to south, so the human conscience also has its magnetism which attracts it to happiness.

At present the legitimate desire of man for happiness has reached the stage of indifference, when it must be cultured and directed in order to facilitate the evolution of that force which is as irresistible as the force of magnetism itself.

The danger of the situation consists in the problem not having been stated; and yet the desire to improve things is so intense, misery has so stimulated the will of some men, that the paroxysm of their anxiety gives rise to social phenomena of terror and violence. Responsibilities! It is still very early to speak of them, but the responsibility falls particularly on many men of science who have not understood the theory of evolution, giving it, for example, such a false and iniquitous interpretation as *the struggle for existence*—a dreadful distortion of the natural course of ideas. The false interpretation of this law is the more to be lamented, as it seems to justify and support all those abuses with the prestige of a scientific argument, whilst the right interpretation of this same law would dissipate the shadows which envelop the social problem. This meanness of spirit is inexcusable

in those who dedicate themselves to the investigation of truth.

I am also impelled to hasten this publication by the desire of presenting the vision of this ideal world to the minds of those whose exaltation leads them to extremes.

I prosecute this attempt, to show that this world, hitherto sunk in sleep, can be stirred by other shocks than those of violence. I want to call the attention of the investigators of the solution of the knotty social problem, that they may note how Nature herself offers a sure and expeditious road by which the highest ideals have ready access, are legitimatised and developed.

The social question has one solution. Who can doubt it? I know that this will seem utopian to most people, but I turn to men devoid of prejudice, who are concerned for human misery and the fate of those who hunger and thirst for justice, I address those who wish to bring consolation and hope to the pariahs of life, and I tell them that, if not they, their children, will dwell in this anxiously looked for land of promise. To those who are seriously occupied with this question I may be allowed to say that *the solution of the social problem is contained in the law of evolution.*

I also hasten to publish these notes because in

the struggle between capital and labour the triumph of the former will accomplish no satisfactory result.

The responsibility is not that of capital or capitalists; the evil lies in the social organisation. Society lives in profound error as to property. It has chosen the paltry medium of money instead of the grand inheritance of Nature, which belongs to it by right, confirmed by the theory of evolution.

The reasons before set forth will excuse the abruptness of these simple remarks, as I have not the necessary time to arrange a methodical book, rich in doctrine and facts. Being doubtful of finding another occasion, I resign myself to publishing them. One thing, however, consoles me, and that is, that, if I am not mistaken, the law of correspondence which rules the intelligence will lead thousands of brains to see the same connection which I have noted between the theory of evolution and sociology, and this series of correlations would be my final and strongest confirmation.

These notes are a programme of the association of my ideas on sociology as derived from the theory of evolution, and I hope to prove :—

That humanity should follow the same law of evolution as that which is seen to extend from the

sidereal world to man. The theory of Kant and Laplace gives an idea of a cosmogony starting from a primitive nebula. Lyell justified the doctrine of the periodic evolution of the world, thus destroying the theory of the cataclysms of Cuvier; Lamarck and Darwin proved the evolution of the vegetable and animal world; and Herbert Spencer, by a summary of all these evolutions, founded the great system of positive philosophy, only that on arriving at social evolution, instead of applying the same principles, he turned aside from the evolutive system, and did not see an aberration of evolution in humanity due to capitalism.

I will divide this programme into two parts. In the first I propose to show how the social organism is in complete disaccord with the theory of evolution. In the second I will prove how it is possible that a society organised according to the laws of the said theory becomes susceptible of a rapid and indefinite development.

Humanity will be able to advance its most natural and noble aspiration, which ought not to be relegated to one of many insoluble problems like the squaring of a circle, albeit the immense majority of men think differently. Ossip Lourie says: "To live is to aspire to happiness. The desire of happiness exists in man like the principle of life."

Sociology requires the law of evolution in order that it may take its place in the great monist philosophy, being hitherto a dislocated member for want of legitimate solutions. The day when sociology arrives at perfection, in realising its aspirations in the domain of positive science, will complete the synthesis to which the human understanding aspires, and the great monist conception will have realised its unity.

The masters to whom I am most indebted are the great English philosopher Herbert Spencer, and the illustrious Spanish neurologist Don Santiago Ramon y Cajal.

CHAPTER II

GENERAL ADAPTATION

When monistic philosophy studies separately astronomical, geological, biological, and sociological evolution, it is done to facilitate the work, and not because the evolutions are in any way different from each other. All these divisions are integrated in the main evolution of the cosmos—there is only one evolution, as there is only one energy.

The blood which circulates through our veins, and the energy which thought represents, form one unity with the cosmic forces.

Crude matter, as well as live matter, are both the product and adaptation to the medium. There is no solution of continuity between the phenomena of organic and inorganic substance—all is one. That which changes is the form; but the virtue, the essence, of the thing is the same; they are distinct phenomena of a single energy.

The same unity which exists between force and

matter also exists between organ and function. The priority of the former or the latter is often discussed, but when the question is propounded in that form it is not satisfactorily answered; the confusion arises through only defining its mental representations, instead of defining the thing itself.

Organ and function are two entities which exist separately as mere abstractions of the intelligence, but in Nature they are one. We say this to enable our readers more fully to realise the extent of the theory of adaptation. Instead of organ and function we ought to speak of organisation, and then the two concepts are represented as a unity, for it is much easier to follow their modifications when they are considered as one thing, obedient to one and the same impulse, than as a duality which does not really exist, and only complicates the interpretation. Let us lay aside all these arbitrary divisions, which were established when the solidarity of phenomena was not known, and the classifications could not be other than purely abstract. Thus the terms force and matter are still used, even by those who, like Louis Büchner, proclaim the unity of these two terms; and people also speak of physics and chemistry, and biology and sociology; and all these divisions increase the confusion and retard the spread of the monistic theory.

All this is due to the old form of metaphysic, which accepted as real phenomena what are only mental representations. In these cases, says Bosnier, physiology and psychology do not keep step, and the result is that philosophy falsifies itself. Giving due weight to all that is real and positive in Nature, we see that from the inorganic to the most transcendental there is only a change in the rhythm of the science of energy; that one form of energy always transforms itself into another form of energy; that the organisation with its forms and structures is a unity rooted in the bowels of the universe, and ending, as we now know, in the intelligence of man. Light, colours, sounds are distinct modes of vibration, parts of this rhythm, this universal harmony which rises from the inorganic world to a state of consciousness in our brains. The energy which regulates adaptation in live beings, like all the factors of evolution, does not originate in the same organic substance, for this energy is derived from the great principles of general mechanics. The initial impulse which obliges biological evolution to transform itself into beings which progress from the simple to the complex, from the homogeneous to the heterogeneous, is not an essential force peculiar to organic substance, for this force would not exist if the earth did not form an integral part of the cosmos.

If it were possible to isolate the earth from the rest of the universe, life would be immediately extinguished on our planet, just as an electric light goes out with an interruption of the current, and the earth, having lost its equilibrium and declined from its orbit, would disappear in space. It is not possible to conceive of a change of energy without a concomitant change of matter. The organisation goes on because it is an essential condition of the force—the continuity and the persistence of the rhythm to which it is subject. When the sun and the other planets were in a state of primitive nebula no organisation was possible, by reason of the great diffusion of matter.

The transformation of a part of the nebulæ into sun argues a great integration of matter and a great *concentration* of energy. In the same way, when the substance which has to form the brain is floating in space it has the minimum of strength; but from the moment that this substance integrates and organises itself—to form the brain of an Aristotle, for example—it acquires an extraordinary energy. The virtue of the force is in proportion to the quantity, quality, and structure of the integrated matter.

Organic Adaptation

The initial movement of the organic adaptation has its origin in the same cosmic energy; it is a chapter of the total evolution of the universe. The correspondence with the external medium, or the adaptation of organised beings, is the most constant phenomenon of life. When plants and animals change their climate they change their adaptation. If the adaptation takes place, the animal or the plant goes on living; if not, it dies. The entity that is not capable of adapting itself, the organisation which is not mobile enough for this constant work of adjustment, disappears. Animals and plants that live on land or water represent a perfect correspondence with the medium in which they have been evolved. The lungs and the heart of man are adapted to atmospherical pressure, and there are persons who are much upset by a slight change in this same pressure; the ascent of high mountains is not supportable by everybody, and going up in a balloon any considerable height may not only produce vertigo but hæmorrhage, for want of equilibrium between the internal and the external pressure, which causes an accidental failure of adaptation.

Eyes are an adaptation to light; animals which

live in darkness have no sight; and those which have it may lose it, as happens with a certain class of crawfish, whose organ of vision gets atrophied to the point of losing it through living outside the influence of light.

The sense of sight is extremely curious and instructive with regard to adaptation, and it is very important for our object, if one bears in mind that it is the sense with the most dynamic force, and therefore it plays a great part in the cerebral structure and the intelligence.

With regard to the genesis of this sense, Ramon y Cajal well observes that he is not satisfied with Herbert Spencer's explanation of the formation of the eye and its nerves by adaptation and selection alone. And, in fact, as the first of these authors says, how is the point of departure of this evolution to be explained?

Thus, for example, we do not understand why the coloured spots or rudimentary eyes of worms (*Turbellaria*, *Trematodes*, etc.) are round, in couples, and are exactly on that part of the skin which covers the supra-œsophagic ganglia, and not upon other corresponding nerve-centres; or why, in the course of time, there appeared in front of the coloured spot and the underlying nerve nothing less than an epidermic lenticular thickening, whose radius, index of refraction, etc., seem calculated to

project a distinct image in the expansion of the optic nerve.[1]

The necessity of an explanation emboldens me to state something which seems to throw light on this interesting problem. I believe that the situation of the supra-œsophagic ganglion and its proximity to the coloured spots have the same origin, and that they respectively owe their situation to a phenomenon of phototaxia. The animal adapts itself according to the light, and the point by which it most adapts itself is that which acquires the most activity, the more so when the luminous phenomena are always accompanied by chemical caloric action, etc. Thus, the coloured spots and the aforesaid ganglia retain a relation with each other, because both are the product of the great dynamic force in the point where adaptation has commenced. We have still to explain why the spots are regular and in couples, but this question is one with the symmetry of bodies, and probably the explanation of the one thing will come with that of the other.

With regard to the lenticular epidermic thickening, which is the point of departure of the evolution of the crystal, Cajal implicitly replies by saying that this lenticular thickening has a radius and an

[1] Ramon y Cajal, *The Texture of Man's Nervous System and the Vertebrates*, p. 8.

index of refraction which seem calculated to project a distinct image on the expansion of the optic nerve.

Light, and light alone, is capable of doing this. It is that which not only causes the coloured spots, the first sign of the organ of vision, but, as adaptation, it causes the image to be clearer each time, and it is this which makes the expansion of the optic nerve and the coloured spots act simultaneously in the completion of the work of adjustment or correspondence. As these spots go on increasing through the action of the light, so their thickness is increased ; and having then to withdraw from the optic expansion, the light, to continue its relation with it, has to refract in passing through the lenticular thickness. This refraction has to be according to the laws of optics, and therefore the lenticular thickness possesses a radius and an index of refraction which is that of the lens, and it always corresponds with the optic nerve, without which requisite, vision would be impossible.

The organ of sight, like every organisation, obeys the general laws of mechanics. Attention must be drawn to the fact that in this sense its architecture is ruled by the laws of optics, and it is not that the crystal *accommodates itself to these mechanical conditions of light*, but, on the contrary, these mechanical conditions mould the organic substance,

the crystal whose differentiation *makes it sensible to light.* As the mechanical conditions of Nature are invariable, the great unity represented by all comparative anatomy and embryology follows; therefore, ontogeny reproduces phylogeny, and all this organic unity which constitutes the organisation is the echo, the reflection, the material reproduction of the great rhythms of natural forces. Without this invariable unity which is Nature, there would be no explanation of the phenomenon of evolution, there would be no possibility of tracing the sense of sight from that of the most inferior animals up to that of man. And the human brain would have no explanation either, if there did not exist the same elaboration, affiliation, and evolution of the nervous system of all animals, and if the psychical neurona or thinking apparatus of man had not its first representation in the mio-epithelial nervous system of the lower animals.

Nobody would now venture to deny (because it is a common conception in positive philosophy) that all the senses are specific numerical registers of movements which constitute the sensations, and that the development of these senses, the accumulation of all these sensations, is that which gives rise to the development of the brain in such a way that one feels that without the senses there would be no brain. Then, if the senses obey the laws of Nature

in their architecture and functions, the brain and its function reflect the same Nature, and an intelligent man is one whose brain reproduces with the greatest accuracy the series of external phenomena. Intelligence is the sublimation of natural laws. Thus we say that Nature is the inheritance of humanity, and therefore miseries and egoisms are absurd, through an error in the social organisation when it severs itself from natural laws.

Frogs and tadpoles are a surprising case of the rapidity of adaptation. These animals, when they are young, live in the water and breathe through their gills; then, as adults, they live on *terra firma*—their gills get atrophied and they acquire pulmonary respiration. The metamorphosis of the frog, by the disappearance of its tail and the evolution of legs, is very curious and instructive, as this species of embryology, which takes place under the eyes of the observer, shows also its phylogeny; for its primitive form of a fish, as well as its respiration by the gills, are proofs of the transition of fishes into batrachi. It is a phenomenon in which man sees evolution in the very act, when the aquatic vertebrata are changed into terrestrial vertebrata.

Some years ago the axolotl of Mexico (*Siredon pisciformis*), very like the triton, excited great

curiosity among naturalists. This animal had been known for some time, and in late years they were produced in the Jardin des Plantes of Paris. Like the triton, this animal has also external gills, but it retains them during its life like other gill-breathers. The axolotl generally lives and propagates in the water, but suddenly a hundred of these animals in the Jardin des Plantes came forth from the water and lost their gills, so that they were indistinguishable from the tadpole without gills of North America (*Amblyostoma*), and thenceforward they breathed by their lungs. In such interesting cases one can see the sudden transformation made by an animal of aquatic respiration on its conversion into an animal of aerial respiration. This rapid transition is also seen in the larvæ of frogs and salamanders; they pass from the condition of an animal with gill respiration to that of an amphibious creature with pulmonary respiration. In the same way, the group of frogs and salamanders is seen to be akin to the *Siredon* in its origin as an animal of gill respiration. Up till now they have remained in this low stage of development. One sees how ontogeny can explain phylogeny, and how the history of individual evolution explains that of the whole group.[1]

While treating of the correlative adaptations, that is to say, the adaptation of an organ necessarily

[1] E. Haeckel, *Histoire de la Création naturelle*, p. 214.

connected with adaptations of other organs and the whole individual, it will be interesting to read what Virchow says, in a pamphlet entitled *The Cell and Woman*, which I find quoted by Haeckel :—[1]

"Woman is only woman through her glands of generation. All the characteristics of her body, her soul, her life of nutrition, her nervous activity, her delicacy, the roundness of her form, the narrowness of her pelvis, the development of her thorax cavity accompanied by a paralysis in the development of the organ of the voice, her luxuriant hair, contrasting with the finest down which covers the rest of her body, and finally the intensity of her feelings, her rapid and accurate perception, her sweetness, abnegation, and fidelity, and all the essentially feminine characteristics which we admire and venerate in woman, all depend on the ovary. Do away with the ovary, and the virago will appear in all her horrible imperfection."

This same correlation between the functions of nutrition and generation is seen in plants. When a certain quantity of leaves or branches are taken from them the flowers are more plentiful; or, on the contrary, when branches meant to flower are cut, the green organs of the plant are more developed.

This is a sort of preparation for the better under-

[1] *Histoire de la Création naturelle*, p. 217.

standing of the chapter on psychical adaptation, and it must be borne in mind that, though separate chapters are adopted for clearness, the matters are not in reality so. It is the same with organ and function, which are so closely connected that they cannot be conceived of separately, and they are united from being identical, even as force is considered as a function of matter.

CHAPTER III

GENESIS OF THE NERVOUS SYSTEM

TYNDALL says: "I have here a bell-formed glass bowl placed mouth upwards and supported on its base. I pass a violin bow across the edge, and I hear a sound. If I pour sand into the bowl, it takes the form of a regular figure; and if I fill the bowl with water, its surface is ruffled by beautiful undulations. These waves show that the bowl, on emitting a sound, divides into four vibrating portions, separated from one another by non-vibrating lines." It is well known by analysis that the different colours which appear in white light are due to differences in the number of vibrations; that is to say, the colours are distinguished from each other for the same reason as one sound is distinguished from another in an instrument of music.

It is now known that sound, heat, light, electricity, and radio-activity are different from each other because they are diverse modes of vibrations or movements.

A change of colour in the light suffices for the modification of all under its influence according to its genus of movement; red and blue have entirely different caloric or chemical effects. The experiments of putting plants during their development under the influence of different colours are well known, the same species showing completely different results under the different conditions.

Matter obeys force everywhere; every form obeys some special mode of movement or systems of movement—so much so that one can say: "The *form* is the result of a system of forces."

The cell, the biological unity which can be considered as the point of departure of the organic world, is subject to the infinite variety of the rhythmic movements, for which it has a marvellous affinity, and these rhythms of an infinite potentiality go on permeating the organic substance and evolving harmonies more and more complex, until it arrives at the representation of man in the actual moment of evolution.

Man is a product of natural forces, and so much does he depend on them that life without them would be impossible.

Man is the result of the woof formed by the different rhythms of Nature, as the figures in a tapestry are the outcome of the blending of threads

of different colours. Thus, as the figure of a tapestry depends on each and all of the threads which form it, so man in Nature depends on each and all of the natural rhythms. If we drew the threads out of the picture, the man would disappear, just as in Nature, if the rhythms which compose man were stopped, the human personality would dissolve.

When all the rhythms which give life to a man are used up in energy, death comes, just as the figure disappears from the tapestry if we draw out all the threads from the woof.

Between Nature and man there is a relation of cause and effect; it is a system of progressions, as in music between the initial sound and the melody; systems of force in which neither the man nor the melody has arrived at the limit of progress, they each having an endless time for their future.

In the bosom of a mother-solution crystals of typical forms have birth. Every solution has its appropriate forms, because its chemical composition always represents the same system of forces. If an angle or corner is broken off a crystal, the broken crystal will reform itself identically if it be placed in the mother-solution.

If we add this fact, like a thousand others which can be quoted, to the regular figures which the sand forms in the crystal bowl on its vibration with a violin bow, the relation to forces is readily understood. If the forces were not rhythmical and constant the figures would not be regular, nor would they have the consistency of form. From the lowest organic bodies to man himself, everything evolves and lives in the bosom of Nature, like crystals in the bosom of a mother-solution.

Comparative anatomy, comparative physiology, and embryology, with their phylogenic and ontogenic branches, would be incomprehensible without this harmony and constancy of rhythms.

In a word, the theory of evolution would not exist, whereas, thanks to these harmonies, all beings are reproduced with typical forms.

Man and societies can degenerate by falsifying their natural conditions, but, like broken crystals, they also reconstruct themselves in virtue of the constancy and persistency of these harmonic rhythms in the bosom of Nature.

The cell, the primordial organism, has its form adjusted to a rhythm, and every rhythm has its peculiar form, just as every mother-solution has its crystal form. The cell is in the organic world what the crystal is in the inorganic, and the phenomena

of karyokinesis in the cells are similar to the phenomena of crystallisation in the mineral world. The mechanical phenomena of karyokinesis remind one of the polarisation which light suffers in crystals of double refraction, and the curious molecular dispositions of the included crystals or microliths.[1]

In the same way as the cellular organism is evolved by successive unfoldings, the morula, blastoid, gastrula, and all the animal world up to man takes form, and I need not treat of them here, as they are facts studied and known, and, albeit not complete, their common descent is indisputable. Neither is it for this book to show how the skin, senses, and the whole cerebro-spinal axis are formed from the ectoderm.

We will, however, treat briefly of the neurona, which is a newer fact and less known, and above all because it aids directly in the comprehension of these points.

We can easily understand that if the forms of bodies obey the mechanism of natural forces, the neurona, like all cells and bodies, obeys in its form the same mechanics; and thus, as every vibration and every colour has on its substantia-

[1] See *Light*, by Tyndall, p. 89; and *Cours de Minéralogie*, Lapparent, p. 333.

tion a distinct form, the neurona, which is a distinct cell, will obey a distinct rhythm, and as rhythms in the course of time and space go on developing and combining and becoming more complex, it is natural, also, to think that the nervous cell, which in its chronological order is later in appearance, is also the most complex, as is testified by its composition and import. It can be affirmed that the neuronas are the result of the most complex rhythms which give life to the animal world, but, like everything else, they are in harmony with the universal mechanics.

The cellular organism, on becoming polycellular and multiplying its elements, allows a better relation or concordance with the external. Hence a better adaptation to the rhythms and the differentiation follows in increasing progression. When the polycellular organism becomes gastrula a marked differentiation is seen between the external covering or ectoderm, and the internal or entoderm; the first, in intimate relation with the external, receives more varied rhythms than the internal part — hence follow completely different functions.

In the external covering the life of relation takes place, and there is the germ which becomes the skin, senses, nerves, and intelligence of man.

The life of nutrition germinates from the interior covering, and this in man becomes lungs, digestive apparatus, nerves, intelligence, etc.

The epithelial cells which constitute the external

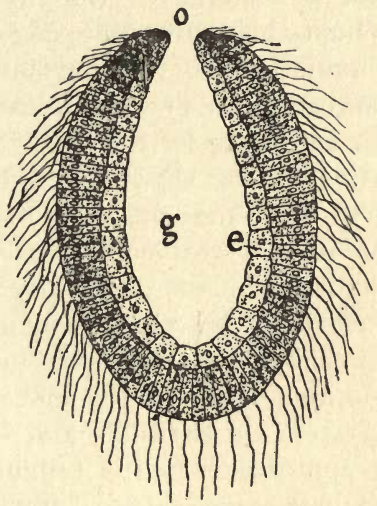


FIG. 1.

Ciliated gastrula of Olynthus (chalk-sponge). *o*, round aperture; *g*, digestive cavity lined by the entoderm (*e*).

covering of the gastrula are the registers of all the rhythms, and in the bosom of the infinity of energy the epithelial cells are a docile instrument which inscribes in the easy and simple pentagram of its organisations the primary harmonies of organic evolution.

In the gastrula the cells store these vibrations, whose weak potentiality is diffused through the whole animal and is fortified by the radiation and the contiguity of some cells with others. The constancy and persistency of the rhythm lead to their narrow limits being overstepped; the currents forming the radiations of the movement which is necessarily spread from every cell cause these to lengthen their substance for the better transmission and distribution of the rhythm or incitation to a distance, and thus the nervous filaments (the prolongations of the real cellular substance) are formed by rhythmic impulses of energy. Thus we see that the origin of the nerve-filament is due to the constancy and persistence of the inciting cause. The form adapting itself to the movement is the result of a system of rhythms, and the neurona, by its tardy appearance in the organic evolution, obeys, as we have seen, more complex rhythms. Its form obeys the resultant of certain determinate movements, and thus, as we saw how sand in a glass bowl forms regular figures through the rhythm of the vibration communicated to the crystal, so the neurona also owes its form to the result of the rhythms which it alone can perceive and interpret.

Nobody can doubt that the lowest animals, like sponges, polypi, etc., are an effect of the natural

mechanics. Therefore E. Haeckel's theory of the gastrula, confirmed by comparative embryology, phylogeny, and ontogeny, shows that the gastrula stage exists in all animals in the embryonic period, even if it be momentary; and thus the animal descent from the sponge to man is demonstrated by the great biogenetic law of Haeckel. Thus it can be deduced that if man has an ancestral claim to such primary metazoa as sponges, both they and man are the outcome of the universal mechanics. Thus, just as in the first period of animal life in the world the gastrula represented the future of man, so in the epithelial cell of the ectoderm of the said gastrula there was represented in germ that which in time to come was to be the human intelligence.

But man has a still more elementary origin: the gastrula is a double line of cells; it is an enormous advance if we compare it with the morula, which is a conglomeration of cells arranged in a spherical shape; here one finds no difference between the internal and the external covering.

The morula is an anterior stage to the blastula, as it has a more backward place in the cell. This primitive form is still preserved by the human species, for the human being rises from the union of the zoosperm and the ovule. Thus man meets his ancestors on the very borderland of the in-

organic world, that is to say, in the kingdom of the protists.

These facts give man a right to be the usufructuary of Nature, as man is one of its functions, and he alone can continue his evolution under the same natural laws which lead to happiness.

CHAPTER IV

PHYLOGENY AND ONTOGENY OF THE NEURONA

THE embryonic history of the neurona, from the time it appears in inferior animals until it is seen in man, is what constitutes its phylogeny. In approaching such a subject in a book of this kind it is enough to present it in outline, to give a sufficient idea of how the intricate human brain proceeds by successive complexities from a simple element, that is to say, how the concordance of the external with the internal is verified throughout the animal kingdom.

On this point Herbert Spencer says: "Physical or psychical life is a combination of movements, which correspond to another series of movements or external facts. By the law of succession they necessarily coexist internally, they are in indispensable correspondence." In other words, the human brain is a progressive complex association, a plastic reproduction of the movements of universal mechanics.

To understand the genesis of the neuronas, one must go back to inferior animals like the gastrula (*vide* fig. 1). The cells which constitute its external covering, called ectoderm, are the first organs of the nervous system. From its direct

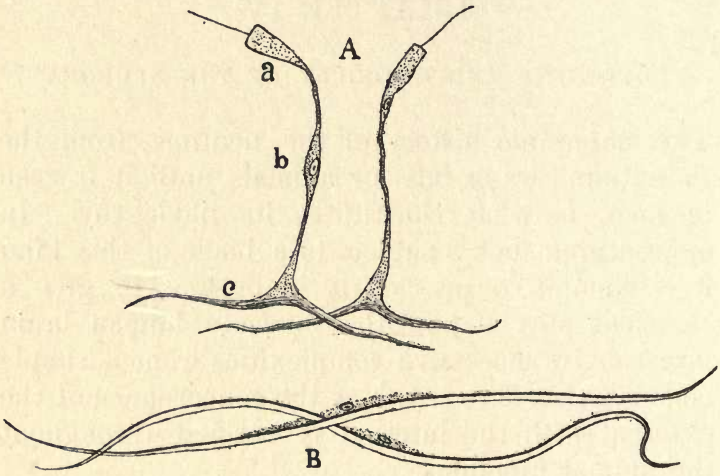


FIG. 2.

A, mio-epithelial cells of the actiniaries (cœlenterade) ; *a*, peripheric end with a cilium ; *b*, middle part, which contains the nucleus ; *c*, the deep part of the cell differentiated by a contractible fibre. B, muscular ectodermic fibres. (*According to O. and R. Hertwig.*)

relation with the exterior they are the first registers of these special rhythms, which are those which give to the nervous element its significance. In virtue of these affinities with the external agents cells are created, like the red corpuscule of the

blood for its affinity with oxygen, and nerve-cells, like the acoustic and optic, which have specific affinities with sound and light. The epithelial cells which we have seen forming the external covering of the gastrula are more differentiated in the actiniaries (fig. 2). The incitations, or rhythms, of which we have spoken, and which were received and stored in the external cells of the gastrula, are those which give rise to the cells called mio-epithelial, because, as they register sensations through their external extremity, they are the origin of sensation, and oblige the opposite extremity of the cell to transform this sensation into action, making it contractible. Therefore sensibility and mobility seem united in one and the same element, and hence the name of mio-epithelial cell.

Referring to the ectoderm of the gastrula in fig. 3, A represents a portion of the epithelium of an actinia, where one sees how one of the ectodermic cells (*n*) is differentiated from its fellows, and the nerve-branches which start from the body of the cell are also seen (*n*).

The other cells, less prone to register the specific incitations of the external agents, retain their epithelial form and serve as a support and protection. This cell is called neuro-epithelial.

Fig. 3B represents one of these cells, which have advanced to a higher grade of differentiation.

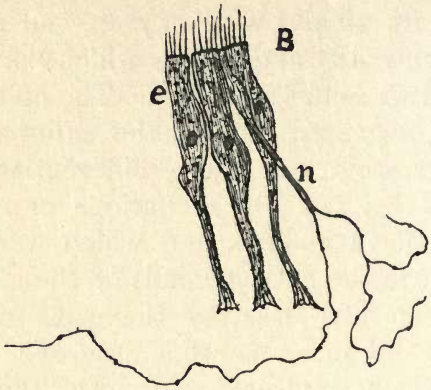


FIG. 3A.

B, trunk of the epithelium of the actinia; *n*, the neuro-epithelial cell somewhat separated from its natural position; *e*, cells of support with vibratory cilia.

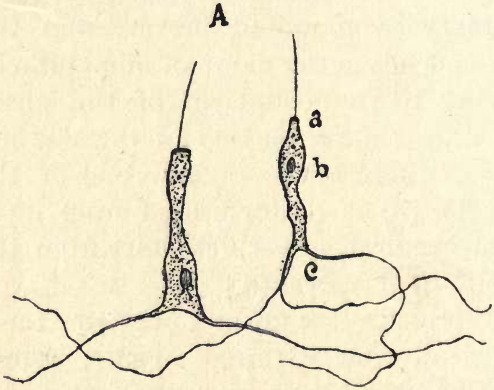


FIG. 3B.

The isolated neuro-epithelial cells of an actinia (cœlenterade). *a*, peripheric end of the cell with its non-vibrative cilium; *b*, thick part of the cellular body which contains the nucleus; *c*, base of the cell with its slender prolongations, which serve to open up communication with nervous subsidiary cells.

To understand the differentiation and nervous progress one must bear in mind how the nerves go on detaching themselves from the surface of the animal body. The superficial situation which they had in the gastrula goes on deepening according as they advance in the animal kingdom. Nevertheless, the nerve retains the same relation with the exterior, because the body of the nerve, as it withdraws, leaves behind it a peripheral prolongation which forms future sensitive nerves, whose office is to carry to the nervous centres the impressions received externally.

If we study fig. 4, taken from Ramon y Cajal, and start always from the ectodermic cell of the gastrula, we shall understand the evolution of that same cell, seeing that it is deeper according as it belongs to a lumbar, a mollusc, or a vertebrate.

Recollecting what was said about the genesis of the eye, it will be seen how the optic neurona goes on separating itself from the coloured spots, so that on crossing the light the focus of the epidermic discs may correspond with the place of the optic neurona.

From this rudimentary state of the eye in worms to the sense of sight in man, the optic neurona has gone on retiring step by step, but leaving new optic neuronas in every one of these stages, and

these increase their force according as they establish fresh connections.

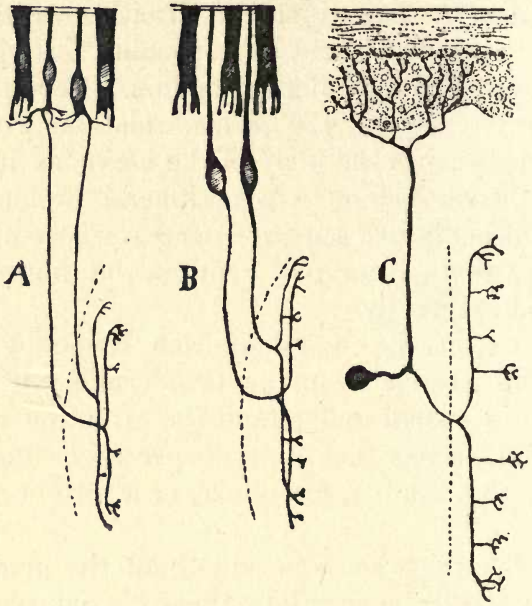


FIG. 4.

Progressive concentration of the sensitive cells in the animal series. A, sensitive nerves of the lumbar; B, sensitive cells of a mollusc; C, sensitive cells of a vertebrate.

In fig. 5, taken from Ramon y Cajal,[1] the neuronas have risen to a more elevated grade of organisation, and we can easily understand the successive com-

[1] *Texture of the Nervous System of Man and of the Vertebrates.*

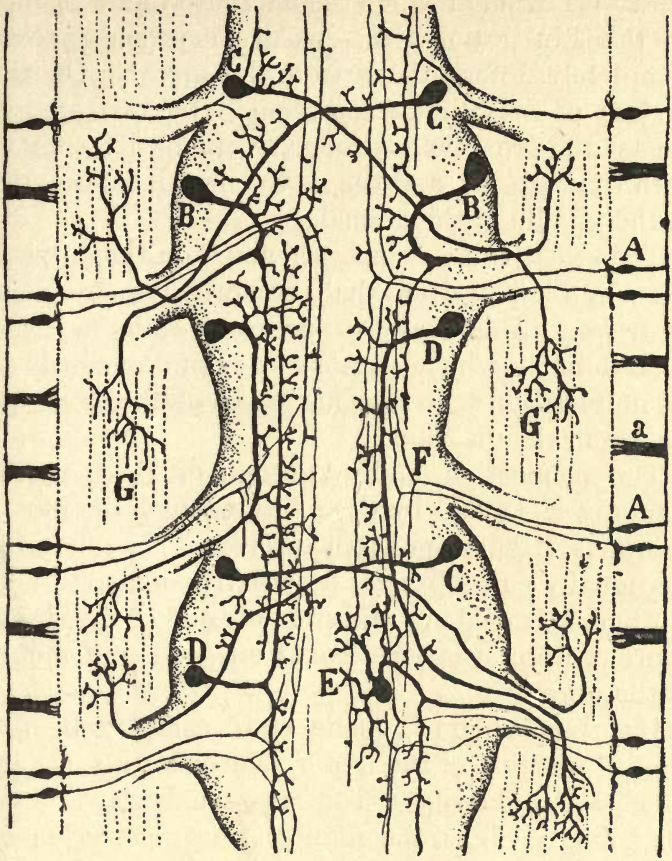


FIG. 5.

Sketch of the sensitive nervous system and motor of a worm. A, sensitive cells of the skin; B, direct motor cells; C, crossed motor cells; D, cells of interganglionic association; E, multipolar motor cells; G, ramifications terminating in muscles of the motor neuronas.

plications through which the nervous system passes. In this illustration the sensitive neurona appears completely differentiated from the motor. On the surface of the animal represented by this picture we see the sensitive neuronas, A, in direct contact with the exterior, and the motor neuronas situated in the middle of the animal.

The sensitive neuronas, which are on the surface, show by their position that they originate from the gastrula. The sensitive neurona emits a little nerve-branch which establishes simultaneously a communication with various parts of the body, as we see in the diagram.

The connection and extension of these movements is also aided by the relation which the motor neuronas, B, have among themselves. The solidarity continually established between sensation and movement is evident, and reminds one of the single neurona when it is sensitive at one end and motor at the other.

But the problem is made more complex by the crossed position of the motor neuronas (fig. 5), by which the solidarity exists between both sides of the animal. Thus, the number and connection of the neuronas increase in parallel form with the size and organisation of the animal. The moment comes when the continuous emigration of the neuronas, first the motor ones and then the sensitive,

ends by their uniting themselves in the centre of the animal, which is what Herbert Spencer calls *transversal integration.* Hence the cerebro-spinal system originates here, and arrives in man at the importance it now holds.

The mechanical or functional unity is not lost, in spite of the progressive division and differentiation of the form; and this, as we have seen, is the result of universal mechanics, and in this case the structure, like the sand in Tyndall's experiment, keeps its regular forms by reason of the rhythms which made the crystal bowl vibrate.

Therefore we say that there is no disputing the priority of the organ over the function, nor the former over the latter; the one being a static manifestation, the other dynamic, of the same cause, viz. universal mechanics.

The form of bodies is the resultant of natural rhythms. The organ is the point of support which Nature takes to give expression to its rhythms.

When the heart quickens its beat at some emotion it moves the circulatory springs to quicken the circulation of the blood and increase the activity of the cerebral neuronas in which the emotion or enthusiasm has rise. The rhythms of natural forces go on generating the harmonies of intelligence in

the cerebral instrument, in the same way as an artist draws from his instrument the notes of the melodious creation of his genius. Nature and the artist make the marvellous rhythms of the universal harmony vibrate in the brain or the instrument.

The relation of the intelligence with Nature is so intimate and close that we say that the one is the property of the other, seeing that the intelligence is a function of Nature, and there exists the same unity between them as between organ and function. Strictly speaking, property does not exist, given that man and Nature are the same thing. Now that science has shown the perfect harmony and dependence of all forces, man, the result of those same energies, cannot live outside the natural laws as he does in the actual social organisation, but he has to follow the function of Nature within evolution, and he thus follows the development to which it points.

Let us stop a moment here to recapitulate and deduce, from all that has been said and set forth in the study of the illustrations, what is the mechanism by means of which the configuration of the neurona develops itself and facilitates its evolution up to the human brain itself.

As we gather from the monistic theory, embry-

ology, comparative anatomy, and comparative physiology, and particularly from the works of Santiago Ramon y Cajal, Kölliker, Van Geuchten, etc., the nervous tissue of the neurona always proceeds from an ectodermic cell.

Let us start from the ectodermic cell of the gastrula. We have seen this cell, being in contact with the exterior, prolong its substance by forming a little nerve-branch with the object of connecting the interior of the animal with the exterior. We will call this the central prolongation. We have seen that, according as the animal organisation advances, the ectodermic cell withdraws from the surface, leaving a nerve-filament behind it, which maintains its contact with the exterior. This we will call the peripheric prolongation.

This state of development of the cell constitutes a typical form called the bipolar. All the nervous progress from this form up to the psychic neurona of man is formed from derivations from it. The elements which have appeared in different epochs of evolution present themselves in a chronological order, which is the same in its phylogeny and ontogeny, and they are known as: (1) form, *somma*; (2) central prolongation, *cylindric axis*; (3) peripheric prolongation or protoplasmic sprout.

As our object is to make known these fundamental facts in the simplest form, we try to simplify the ideas and denominations, with the idea of everyone seeing their supreme importance without their signification being lost. The bipolar form is

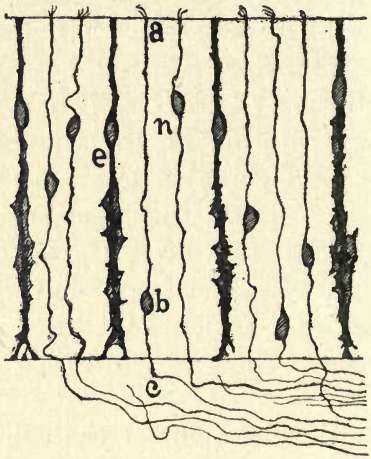


FIG. 6.

Cells of the olfactory mucous membrane of a rat eight days old. *e*, epithelial cell or support; *n*, bipolar cell (neuro-epithelial) with a superficial end provided with several free appendices, fine and non-vibrative, a little body, oblong or fusiform, where a nucleus is lodged; and, *b*, a deep expansion which is continued by a fibre of the olfactory nerve. (*According to S. R. y Cajal.*)

not exclusive to the lower animals, as it is found in the mammiferæ and also in man.

The illustration fig. 6 represents the type of bipolar neurona, and it has an important signification, as it shows that the simplicity of form in the neuronas

is independent of the complexity of the animal. In the olfactory sense of man these neuronas have the same form.

We must keep this bipolar form well before us, because, as from the ectodermic cell one arrives easily at the bipolar neurona, by fixing the attention well on this form it is easy to understand the changes which it goes through until we arrive at the neuronas in the brain of man.

Cerebral Cortex of the Batrachi.—These animals are the first in which the cerebral cortex appears differentiated, which is the point to be dwelt upon, so that the evolution of these centres should be understood.

In spite of the jump we have taken in organisation, it is easy to recognise at first sight the same bipolar nerves of which we have spoken as a typical form. The body remains equal (*p*); its central prolongation is the same. The peripheric prolongation, however, appears complicated with a series of thorns throughout its branches. They have somewhat the appearance of seaweed; this disposition of the cerebral cells is retained by the peripheric branch till it reaches the neurona of man.

In the same diagram is a cell of the same epithelial origin as the neurona, and its object

seems to be to serve as a support and to insulate some nerves from others, to conserve the integrity of the nervous current; it is a neuroglic cell.

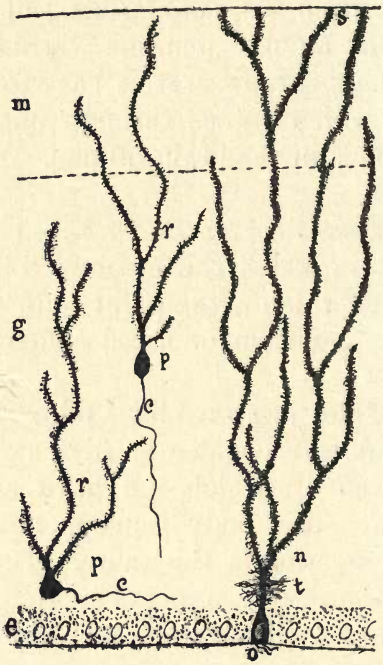


FIG. 7.

Cerebral cortex of the batrachi. *e*, epithelial zone; *g*, cellular zone or zone of the pyramids; *m*, molecular zone; *p*, pyramidal cells with their protoplasmic branches and their cylindric centre; *c*, *n*, epithelial cell (neuroglic) with two cilial expansions at its shoot; *o*, a large sprout; *t*, branched and directed to the periphery where the top little rough varicose branches terminate in a conical dilatation (*s*). (*According to Ramon and S. R. y Cajal.*)

We see how, in the batrachi, the ramifications of the peripheric prolongation begin to take form in the body of the neurona (*p*) (fig. 7), and how these ramifications are well defined towards the cerebral surface, and also how the central prolongation turns to the internal sheath of the brain.

The cerebral neurona of the batrachi is derived from a more simple form, which is the bipolar.

The Cerebral Cortex of Reptiles.—Here the body of the neuronas already begins to undergo modification. The superior cerebral physiology of these animals, compared with the anterior group, is seen in the protoplasm increasing, and that in the form most calculated to multiply its contacts, ramifying as we see in fig. 8, *d*.

This multiplication of the protoplasm constitutes a most important differentiation, and its significance will be better understood when we arrive at the study of the neurona in man.

The central prolongation also presents by its ramifications a modification parallel to the body and of equal significance, viz. the necessity of multiplying the contacts so as to establish fresh functional complexities.

In the central prolongation, C (fig. 8), the first ramifications appear. The peripheric prolongation

also presents a novelty in the fact that, instead of the ramifications taking form at the root of the

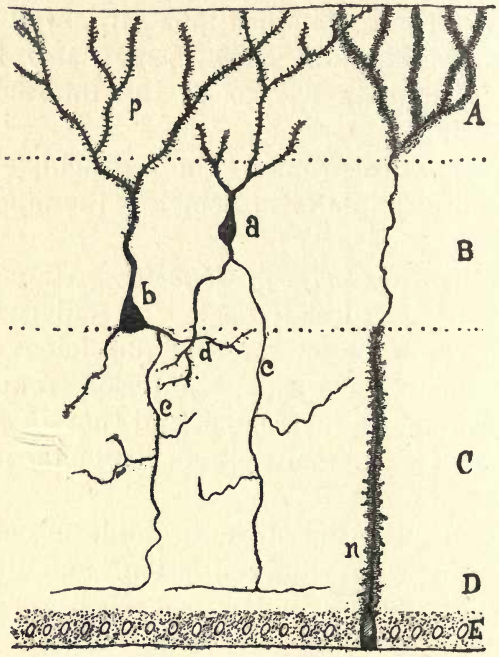


FIG. 8.

Cerebral cortex of reptiles. A, molecular superficial sheath ; B, sheath of the fibres or pyramids ; C, deep sheath molecules or polymorphous corpuscles ; D, sheath of the white substance ; E, epithelial sheath ; *a*, *b*, pyramidal cells with their protoplasmic branches (*p*, *d*), and the cylindric centre ; *e*, *m*, epithelial neuroglic cell. (*According to Ramon and S. R. y Cajal.*)

trunk, they now take rise in a shoot, as we can see in the neurona in the same fig. 8.

Cerebral Cortex of Birds.—The body of the neurona here makes a marked advance in its

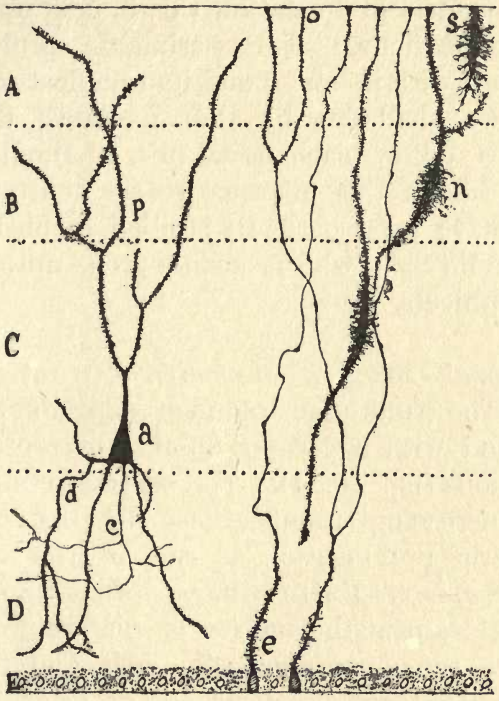


FIG. 9.

Cerebral cortex of birds. A, molecular sheath; B, sheath of little starred cells; C, sheath of large starred cells; D, sheath of deep starred cells; E, epithelium; *a*, pyramidal cell with its peripheric (*p*) and basal (*d*) protoplasmic expansions; the cylindric axis; *c*, *e*, neuroglic epithelial cells; *n*, *s*, neuroglic cells of the neuroglic epithelia. (*According to Sala.*)

differentiation (*vide* fig. 9, *p*); the protoplasmic prolongations have considerably increased through their higher grade of evolution.

The central prolongation (fig. 9, *c*) appears with its ramifications. The peripheric prolongation continues with its shoot and its ramifications.

As we shall see by the diagrams, the complexities follow each other in a methodical way. By the side of this neurona we see neuroglic cells, which have been perfectly studied in birds by Dr D. Claudio Sala, who is such a great authority on these subjects.

Cerebral Cortex of Mammiferæ (a rat a month old).—The trunk appears much more differentiated here, and with a greater number of protoplasmic expansions (fig. 10, *d*). The central prolongation, with increasing ramifications (fig. 10, *c*). The peripheric prolongation in one of the neuronas (fig. 10, *e*) is seen with a large sprout whose small tuft divides near the surface of the brain. By the side we see some neuroglic cells and the edge of a small artery.

Human Cerebral Cortex (a child thirty days old). —Fig. 11 shows us at once the enormous change this neurona has attained in man. The illustrious Spanish neurologist Ramon y Cajal calls it the

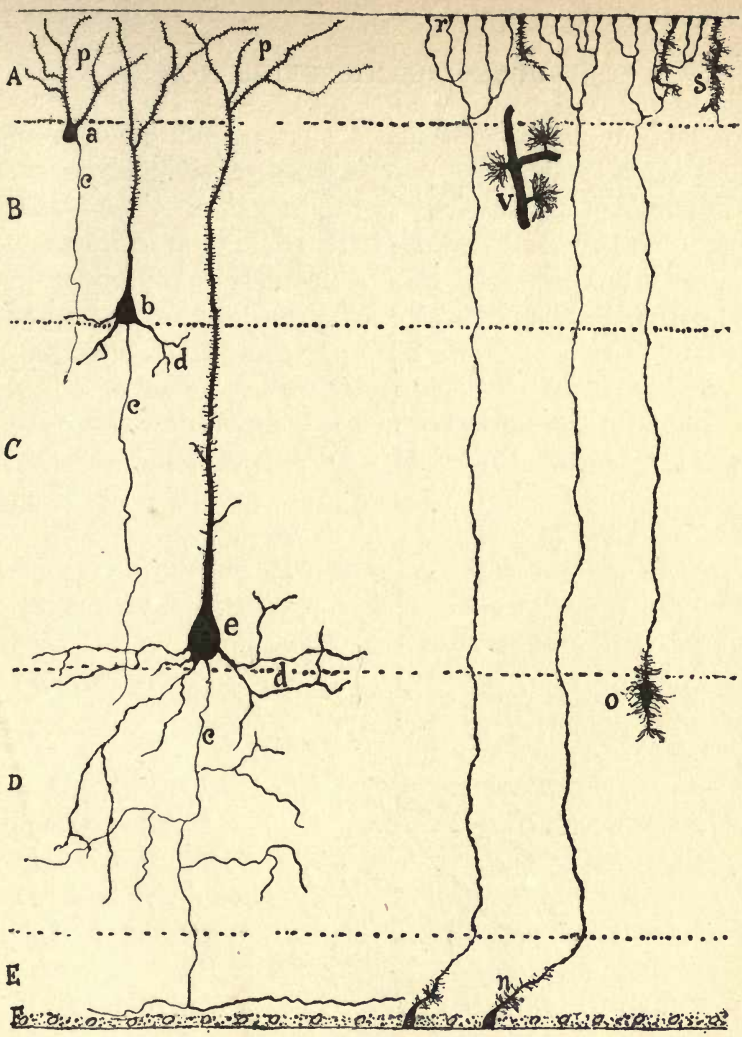


FIG. 10.

Cerebral cortex of mammiferæ (a rat a month old). A, molecular sheath ; B, sheath of little pyramids ; C, sheath of the great pyramids ; D, sheath of polymorphic corpuscles ; E, sheath of white substance ; F, extract of the neuroglic epithelial cells ; *a*, *b*, little pyramids ; *e*, a large pyramid with protoplasmic expansions ; *d*, the cylindric axis ; *e*, *n*, neuroglic epithelial cells ; *s*, neuroglic cell ; *v*, vaso with three neuroglic cells. (*After S. R. y Cajal.*)

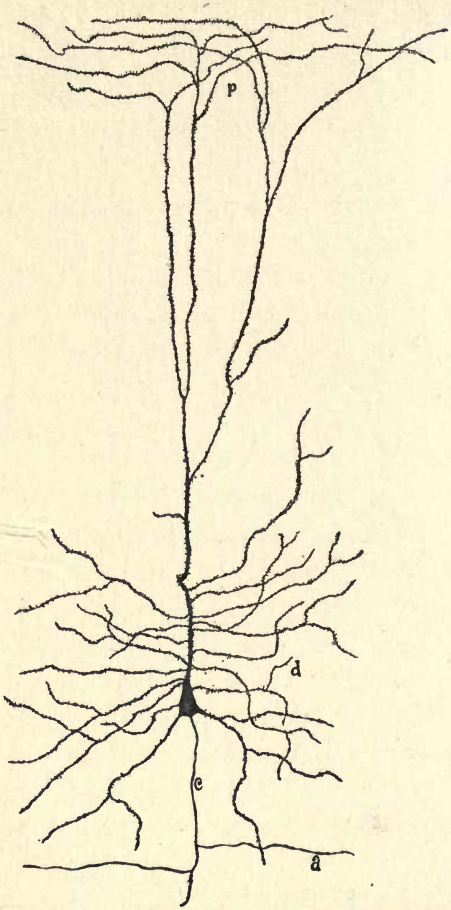


FIG. 11.

Gigantic deep pyramidal cell of the parietal circumvolution of a child thirty days old. *c*, cylindric axis with its collaterals; *a*, *d*, dentrited basals; *p*, terminal tuft. (*After S. R. y Cajal.*)

psychic denomination. The body of the cell shows the necessity of extending and multiplying its surface. Its wealth in prolongations from the trunk is extraordinary; and if we remember that we are considering the brain of a child a few days old, one can imagine how important is the increase of prolongations in an adult.

The central prolongation is little seen in this diagram, but it goes on multiplying its ramifications in consonance with that of the trunk of the neurona.

The peripheric prolongation appears splendidly here; the shoot is very large, and terminates in the cerebral surface, spreading out into a magnificent tuft. The diagram explains more than any description.

Ontogeny

The history of the embryonic evolution of the neurona in the same individual, the various and successive phases by which it arrives at a definite state, is what we call the ontogeny of the neurona.

The study of ontogeny is transcendental, because the evolution pursued by the human neurona during the nine months of gestation corresponds to the phylogenic evolution by which the neurona passes from the gastrula through the whole animal kingdom up to man. That is to say, that, as

Haeckel says, "ontogeny amounts to an abbreviation of phylogeny." The thousands of years which

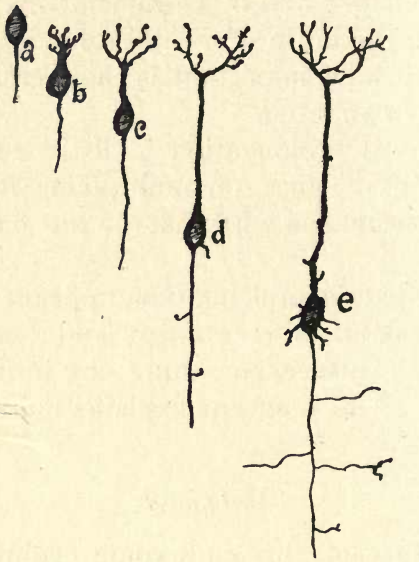


FIG. 12.

Cellular series to show the evolutive phases through which the pyramidal cell of the brain passes. *a*, neuroblastoderm, in which there is a sketch of the cylindric axis, but without any protoplasmic shoot; *b*, commencement of the protoplasmic shoot and of the ramifications which will form the terminal tuft; *c*, the protoplasmic shoot and the ramifications advance to a certain development; *d*, appearance of the collaterals of the cylindric axis; *e*, formation of the protoplasmic expansions in the trunk and in the shoot. (*After S. R. y Cajal.*)

the animal organisation has required to rise up to man are fulfilled by man in the short space of nine months.

Resuming the study of phylogeny in the animal world, it originates in a cellular organism which terminates in man; and the ontogenic evolution of the same man takes its origin from a cellular organism like the ovule, so as to terminate its evolution at the nine months in the child. The difference between phylogeny and ontogeny lies in the time in which they take place.

In fig. 12, which represents the embryonic period in a vertebrate, the elements of the neuronas are found to appear in the same chronological order in which they showed themselves in the animal or phylogenic series. In *a*, we see a periform cell and an undivided prolongation: this phase is called the neuroblastoderm of His. In *b*, we see the peripheric prolongation; in *c*, the peripheric prolongation extends to the form of a shoot. In *d*, its trunk appears with a protoplasmic expansion, the central prolongation begins to branch out, and the peripheric prolongation prolongs its shoot still more. In *e*, the same features appear much more pronounced.

Fig. 13 represents the ontogenic series after Kölliker, studied in a human embryo, and one sees that the progression and differentiation are the same.

In this sketch (fig. 13) we see three young cells of a human embryo about 23 centimetres long.

The corpuscule marked by the letter *a* shows a

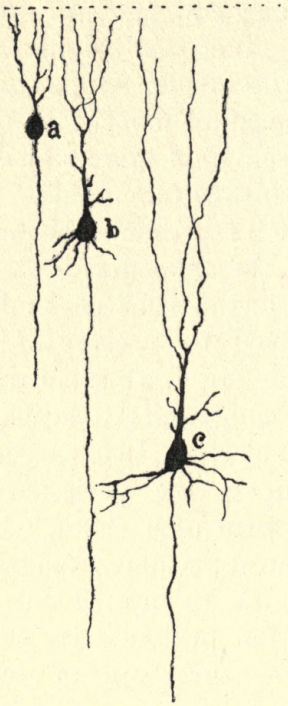


FIG. 13.

Young pyramidal cells of the cerebral cortex of a human embryo 23 centimetres long. *a*, cells without basilar edges; *b*, cell in which these little teeth begin to evolve; *c*, cell in which these basilar edges are fairly developed. (*After A. Kölliker.*)

shoot and protoplasmic peripheric ramifications slightly developed, but without collateral little teeth

or basiliary in the cylindric axis. The corpuscule *b* shows some protoplasmic expansions at its base. All the structural elements go on complicating together with the evolution of the psychic cell, as we see in corpuscule *c*.

And for the comprehension of the great psychic unity in the whole organisation figs. 14 and 15 give a sketch of the olfactory and visual senses of man.

In these diagrams we see represented all the types of neuronas which we have seen in the phylogenic and ontogenic series, starting from the bipolar type. The structure of these senses consists principally in the immense multiplication of the neuronas; the variation in the form is of minor importance.

From this structure of the senses in man we clearly see how they have been formed by the successive integration and multiplications of the neurona—as, for example, to start with the eye, the coloured spots in the worm have become the perfectly formed optic organ of the human being. The same causes, light and the external world, which elaborated the former, are those which gave rise to the structure of the cerebral centres of smell and sight, etc., in the human brain, and hence all cerebral is a reflection of mechanical structure.

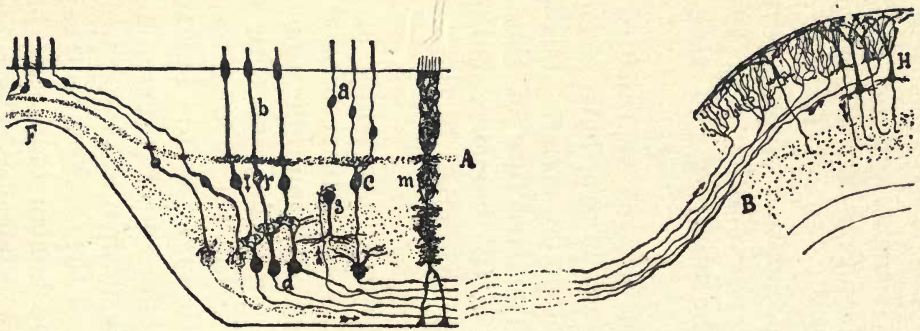


FIG. 14.

Sketch of the course which the nervous currents probably take in the retina and optic centres. A, section of the retina; B, anterior quadrigeminal tubercle; F, little depression; *a*, rods; *b*, cones of the retina; *c*, bipolar for rods; *r*, bipolar for the cone; *d*, ganglionic cells; *m*, epithelial cell or Müller's fibre; *s*, spongy blastoderm on which the ramification of fibres from the optic centres rest; *h*, nerve-cells of the anterior quadrigeminal tubercle.

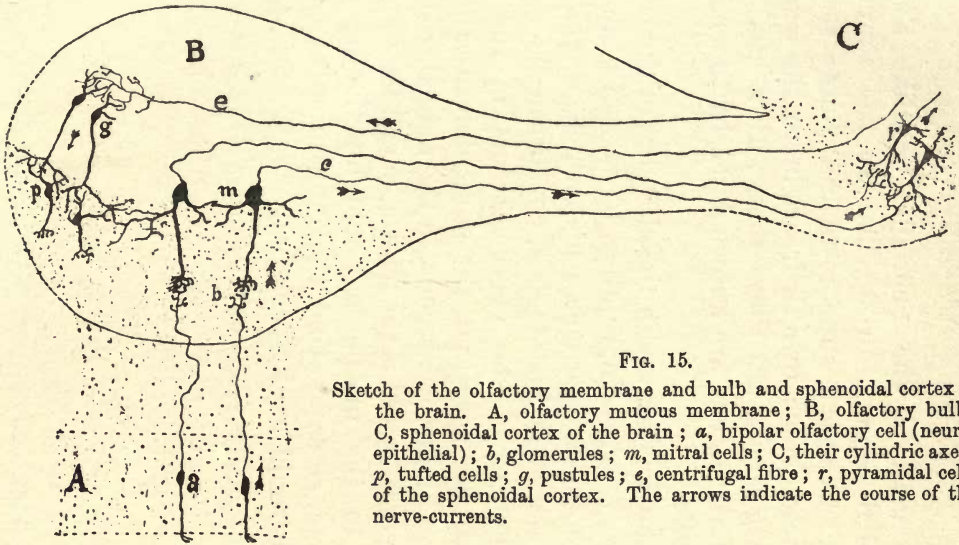


FIG. 15.

Sketch of the olfactory membrane and bulb and sphenoidal cortex of the brain. A, olfactory mucous membrane; B, olfactory bulb; C, sphenoidal cortex of the brain; *a*, bipolar olfactory cell (neuro-epithelial); *b*, glomerules; *m*, mitral cells; C, their cylindric axes; *p*, tufted cells; *g*, pustules; *e*, centrifugal fibre; *r*, pyramidal cells of the sphenoidal cortex. The arrows indicate the course of the nerve-currents.

Neuroglia

The cells of the neuroglia are like those of epithelial origin. In fig. 3A we see some cells which serve as a support to the young neurona, and these, which owe their origin to the ectoderm of the gastrula, are those that, with a less degree of differentiation, are known later by the name of *neuroglia.*[1]

In the diagrams with the sketches of the cerebral cortices of batrachi, reptiles, birds, and mammiferæ we see these neuroglia cells, which, according to the majority of histologists, constitute the separating element of the nerve-currents in the brain. One can conceive that, the more delicate the brain and the higher it ascends in the animal series, the more complicated is the neuroglia cell for its adjustment to the morphology and functioning of the neurona, so as to avoid the infiltration of currents which would weaken cerebral action.

[1] A cell that serves at once to sustain and isolate the neurona.

CHAPTER V

OTHER RHYTHMS OF THE ORGANISATION

HERE I propose to show, and these points prove, that *man is a product of universal mechanics*, that the regularity existent in crystals in form and structure exists in a still greater degree in all animals; that all organisations from crystals to man would be inexplicable if there did not exist mathematically precise universal rhythms which prevail from the sidereal world to the mechanical cell of organisms as complicated as that of man. In one word, all that pertains to the animal world, in the form of comparative anatomy, phylogeny, and ontogeny, could not exist without the rhythms of energy, whilst a few details suffice for the comprehension of the exactitude and persistence of this mechanical law.

In the cellular division and multiplication we find a proof of the organic mechanics which, from my point of view, is much more interesting than that of crystallisation.

The most curious phenomena of cellular division, called mitosis by Flemning, and karyokinesis by Schlezcher, are, to sum them up, the following :—

Every cell is composed of protoplasm nucleus

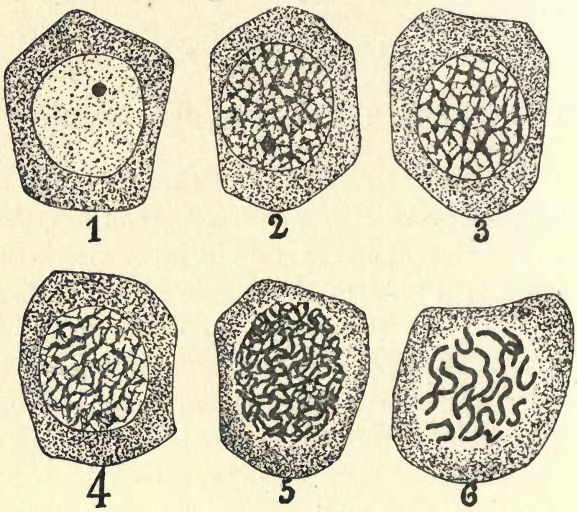


FIG. 16.

Epithelial cells in course of karyokinetic division of the skin of the larvæ of the Pleuro of the Walti. 1, rest; 2, reticulation; 3, coarse reticulation; 4, reabsorption of the nucleolus and glomerule phase; 5, ovary ligaments; 6, pins.

and nucleolus. The nucleolus is the little black spot which we see in fig. 16 (1), at nearly the centre of the nucleus; thus, as the girdle surrounding this is the protoplasm, that and the nucleus give rise to phenomena more easy to observe in the cellular

division, which, as we shall see, is a most delicate proof of organic mechanics.

With fig. 16 we can follow the different

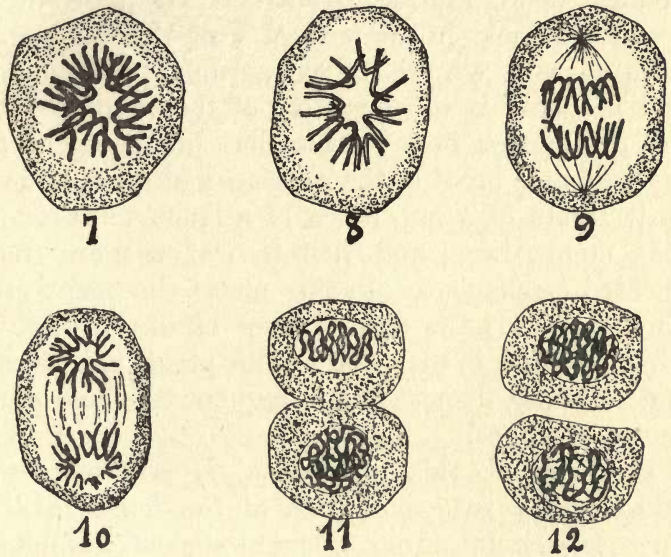


FIG. 16.

Epithelial cells in course of karyokinetic division of the skin of the larvæ of the Pleuro of the Walti. 7, the mother star; 8, the longitudinal division (polar view); 9, metakinesis; 10, fixed star; 11, young ovary; 12, segmentation of the protoplasm.

phases. In 1, it is the period of rest; in the following 2, 3, 4, we notice that a kind of network appears in the nucleus, and its meshes increase in size, albeit in irregular form. In phase 5, the meshes have assumed a uniform shape and calibre,

and begin to have a much more regular arrangement. In 6, the filament, which appeared united in the preceding phase, increases in calibre and divides itself into apparently equal parts in a species of hooks in the form of V or U.

In phase 7, we see an extraordinary movement, and not only is it suggestive of the regularity in the phenomena of crystallisation, but it seems to me a greater proof of the regularity of the rhythms, as it treats of a substance of a much more complex composition, and therefore of a more complicated mechanism. In this phase the surprising phenomenon is the arrangement of all the meshes which seemed in disorder in the preceding phase, and now are disposed in a regular fashion round centre of the cell.

In phase 8, this mechanism is still more interesting, by reason of each of the hooks called *chromosomes* initiating a simultaneous unfolding from which results a double number of hooks or hemichromosomes.

In phase 9, the single central arrangement is followed by a double polar movement in which the protoplasm enters into play in a radiating form round each of the poles of the cell.

In phase 10, the hemichromosomes appear grouped round each pole, and as every fork is duplicated we find that each pole has the same number of forks

as the primitive cell had, the cell strictly reconstituting itself.

In phase 11, the forks have become united by their extreme points, and thus form one single filament, and with this reconstitution of the nucleal filament the division of the protoplasm is initiated by the circle of the cell.

In phase 12, the filament goes on reproducing itself in inverse order—5, 4, 3, 2, and 1, which is that of repose before recommencing the same phases of mitosis or karyokinesis. This mode of division is most general in plants and animals.

When we see that these mitotic phenomena succeed each other incessantly in the whole animal and vegetable kingdom, and that this mechanism constitutes a rhythm which repeats itself from the time the first vegetables appear in the world, we can understand that in the organic world, which is infinitely more complex, there exists the same exactitude as in the inorganic world in the curious phenomena of crystallisation. As to precision, one can but wonder at the mitotic phenomena which succeed each other in the organic world, from the infinitely small to the precision of the angles and cubes of the best crystals.

The cells on dividing do not diminish in volume, but they become equal in size with the substance that comes to their nutrition, like the phenomena

of crystallisation in which the crystals take form, increase, and reconstitute themselves in the mother-solution; and the cells, equally, in the medium in which they take form in Nature, and by virtue of the rhythms they engender, reproduce the same form and size in their obedience, like the crystals, to an unalterable mechanism. And we can repeat what we said before, that the form is the resultant of a system of rhythms.

All these phases of cellular division we should admire if the phenomena of conjugation did not exist—that is to say, the union of the male and female cells, which gives great importance and signification to the phenomena of karyokinesis, and hence to the universal mechanics. The fecundation in virtue of which the ovum cell joins with the spermatic cell is a fact which increases the interest of karyokinesis. The cellular division generally takes place as explained, but when it is a question of formation of a new being, the progenitor elements present phenomena of an extraordinary importance, which prove that Nature in the smallest point ensures the most rigorous numerical exactitude.

The zoospore, like the ovum, represents an equilibrium of forces, and for the establishment of the affinity and attraction which leads to union there succeeds what is called the reduction of

maturation. Every animal species has in its cells an equal number of chromosomes, and the male and female element an equal number of these same elements.

The most curious thing in these phenomena of reduction or ripening is that, as in the current cellular division, the half of the chromosomes resulting from the unfolding unite within the same cell in one of the poles ; in the phenomena of reduction, on the other hand, as its name indicates, half of the chromosomes do not unite in the poles, but are expelled from the cell. The first expulsion is followed by a second, so that if there are eight chromosomes they are reduced to two, which is when the cell is incomplete. This want of equilibrium is most important, because it is the same as the male and female elements undergo; the spermatic cell and the ovule cell suffer a similar loss of equilibrium after their reduction.

Reduction in the Ovum (*Ascaris megalocephala*).— In this explanation and the plan accompanying it we see the double division suffered by the ovum in being fertilised, a division always parallel to that suffered by the zoospore of the same species. The parallelism is the more exact, inasmuch as both eliminate the same number of chromosomes.

The phase 1 of fig. 17 represents the moment in

which the nucleus has divided its chromosomes into two equal parts. In this case there are four for each half. In the karyokinesis which does not precede the maturation, each of the chromosomes

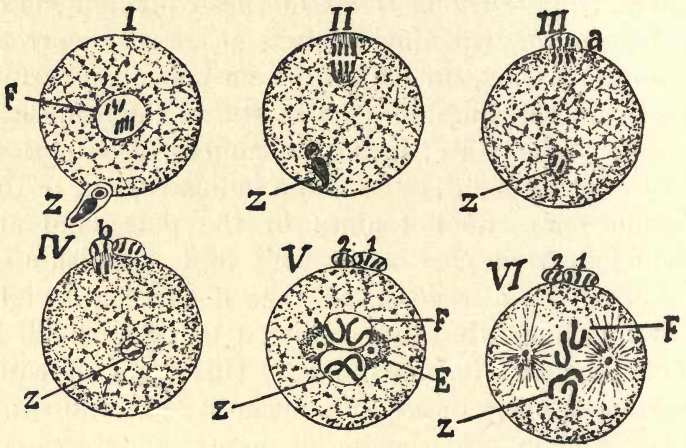


FIG. 17.

Phases of the process of conjugation and the elimination of the polar corpuscules in the ovule of the *Ascaris megalocephala*, according to O. Hertwig. F, feminine nucleus; Z, zoospore, or the nucleus derived from the zoospore; E, sphere of attraction, a formation of the first polar corpuscule. *Phase* 1, the zoospore Z penetrates the ovum; *Phase* 2, the nucleus of the ovule prepares to eliminate the primary polar corpuscule; *Phase* 3, elimination of the first polar corpuscule and transformation of the zoospore into a nucleus; *Phase* 4, elimination of the second polar corpuscule and transformation of the masculine nucleus into a nucleus in repose; *Phase* 5, approximation of the masculine and feminine nuclei, each possessing two chromatic meshes; *Phase* 6, formation of a mother-star of the four chromatic meshes, two masculine and two feminine.

would unfold itself to reconstitute the typical cell of the species of its chromosomes. But the maturation expels these four before the unfolding, as we

see in phases 2 and 3; of these four remaining chromosomes, two are expelled as we see in phase 4, and it is at the moment when the half of a cell acquires affinity for the spermatic cell that its state of maturation is constituted.

The male element, when it goes in search of a ripe ovum or one commencing to ripen, obeys the same affinity, or attraction, which must have according rhythms, because harmony results from their union.

In phase 1 of fig. 17, we see in Z the male element at the moment of contact with the female element. In phases 2, 3, and 4, we can follow as far as the centre of the ovule, and there, counting on an equal number of chromosomes to those that remain in the ovule after its reduction, they wait for the union with the female filaments, as we see in phase 5.

Phase 6 represents the moment in which the two chromosomes, male and female, constitute one cell, and where the four chromosomes unfold themselves to the formation of eight nucleal elements, which is the number of the filaments corresponding to this complete cell; so that, in virtue of equitable division, the new cell will have four male chromosomes and four female chromosomes, and the hooks of both sexes unite themselves faithfully at both ends.

From this moment the same mitotic phases which we saw succeed each other in fig. 16 are those

which give rise to the evolution of the new being. The attraction of one sex for another, love, the sentiment which the human race has idealised, is a case of the universal harmony.

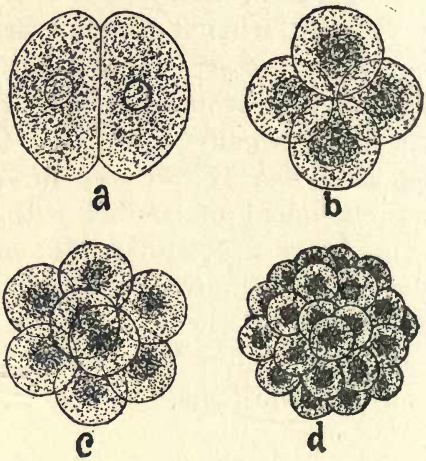


FIG. 18.
Progression of the segmentation cell *a* up to the morula condition, *d*.

Morula. — When once the male and female elements are united, the cell resulting from this union goes on multiplying itself by karyokinesis, so that one cell produces two, and then four, eight, sixteen, etc.; and when there are sufficient to form a conglomeration, which is like the fruit of the mulberry tree, this cellular conglomeration is called morula (fig. 18, *d*).

In examining the diagram we easily see that from the second to the third segmentation, *a*, *b*, *c*, there exists a fixed law for the arrangement of the planes of segmentation (O. Hertwig). The planes of segmentation always cut one another at right angles, so that they may be of equal size.

As we see, the organic architecture is subject to exact principles which are understood better every day, as the intelligence is imbued with the knowledge of Nature. When they seem not to be regular, it is because they are not known, as man has not been able to penetrate the mechanism which underlies them.

Blastula (fig. 19).—The pluricellular germ called morula arrives at the moment when a cavity, called a cavity of segmentation, begins to form in its centre. In this cavity appears a liquid which, as it increases, permeates the cells to the periphery, until the pressure puts them in a lineal pattern in the form of a circle. This form is known under the name of blastula. A number of inferior animals exist in this arrangement. This vesicle sometimes presents vibrative cilia which cause a rotary movement in the animal, and is called blastospheric.

Gastrula.—There comes a time when that portion of the blastula marked with the letters *cv* bends

inwardly until it penetrates the blastula's cavity of segmentation, and puts itself in contact with the other portion that remains fixed, so that instead of one cellular stratum there are two. When both portions are in contact, the embryonic animal form resulting from it is called gastrula (see fig. 1).

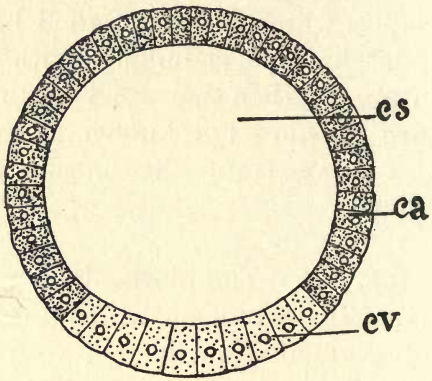


FIG. 19.

ca, animal cell ; *cv*, vegetable cell ; *cs*, cavity of segmentation.

"This form has a great importance in embryonic history, as Haeckel has shown in his celebrated theory of the gastrula. One finds it, in fact, in all the great ramifications of the animal kingdom. So it constitutes a period common to all animals. It is from this form that the divergence of all the animal kingdom commences" (O. Hertwig).

Many inferior animals exist in the form of

gastrula in their adult condition, and it is in embryonic form in all superior animals, showing the unique affiliation of all these beings.

Nature has a unity of plan so admirable and so faithful that the cellular condition of the morula, blastula, and gastrula, which is found in all beings, causes the superior animals, mammiferæ, and even man to reproduce them in their embryonic period. Thus every plant or animal starts from a cell, and man in the actual moment of evolution passes through in his period of gestation (nine months) the same phases, starting from the cell, as the whole animal kingdom has passed through in periods of time which imagination and knowledge cannot fix, but which can be counted by thousands and thousands of years.

That man of every epoch should believe himself the end and object of something is easily understood, as much through the limitation of his perceptions as through a defect of education, because the education of humanity has consisted until now in exploring the past; so we always have before our eyes a panorama which unfolds itself in a retrospective state. The great law of evolution is necessary for man to understand that his actual form is a moment in evolution, and to call attention to the future which stretches out as far as the past.

And one should ask: "What perfections does

evolution reserve to the man of the future?" This is of great importance, because the longer man delays penetrating and perfecting himself through the great teaching which is given by the theory of evolution, the longer will his pain and miseries endure.

Nothing is further from my mind than the animal organisation step by step; suffice it to observe that the same regularity which we have noticed up to now in form and number, is to be discovered histologically in the body of every animal and man in every tissue, and in every one of the elements of these tissues, and in the most varied cells of man. In every one of them, from the noble psychic cell to the conjunctive, we can find the affiliation or series of affiliations which lead us, as in mathematics, to find its genesis in a single point of departure—the cell.

All this that has been set forth, from the genesis of the nervous system up to this point, has no other object than to establish the bases on which to rest one of the piers of the bridge by which we contend we can pass from the universal energy to the super-organic evolution.

The object before us is to prove that the plan of unity and mechanism on which Nature proceeds, whilst legitimatising the law of evolution, making

a man out of protoplasm, is the only road and the only mode of getting out of the present absurd social condition. And, moreover, we want to show that, as man is a result of universal mechanics, the intelligence, the function of an organ whose genesis can be followed from the lowest animals—intelligence, we say, is a function of Nature.

We have said elsewhere that it is impossible to establish a priority between organ and function, that they are terms that have become separated mentally; but in Nature the unity and coexistence of both terms are absolute, so that it can be deduced and enforced that Nature is the patrimony of humanity, as air is of the lungs.

Man must be freed from these hard and fast meshes which cripple society too much for the brain to find its natural expansion in the midst of the infinity of Nature. The fact of society being exposed to want of money, which is scarce, so as to enhance its value, is like an alarm of fire being given in a theatre full of people, where the insufficiency of exits inevitably causes a large number of victims.

CHAPTER VI

PSYCHIC ADAPTATION

MEDIUM, adaptation, selection, and heredity are the chief factors of this great movement which passes from the homogeneous to the heterogeneous, from the simple to the complex, by virtue of phenomena which repeat themselves serially, and the advancement of which consists in the aggregation of other series to these simple series for the formation of a combined series still more complex. This mechanism of phenomena arranged in an ever-increasing progression is called the theory of evolution.

In proceeding to expound psychic evolution I come to an extremely important point—indeed, the crux of the question. When once this is understood, the application of the theory of evolution to sociology appears more clear and complete, as it removes the antagonism that has been declared to exist between socialism and positive science, owing to the neglect of even

Herbert Spencer to take account of it. Social science, the principal aim of which is the happiness of mankind, is the end of the law of evolution, both of which find their confirmation and completion free from contradiction or extenuating circumstances.

Psychic life starts with the lowest in the animal scale, and continues to develop until it forms the intelligence of the human being, contemporaneous with whose appearance on the earth for a life mutually interdependent arises the first germ of the new super-organism—human society.

Psychic and physical life are widely differentiated in man ; the one has almost completed its evolution, whilst the other, the life of the intellect, still continues, and is destined to a wonderful development.

The law of evolution, applied to the psychic life, will serve to demonstrate, first, how man, through having severed himself from natural laws, lives in an absurd state of civilisation ; secondly, that this very law, when properly applied to society, is the one that must conduce to man's being perfected indefinitely.

For this study we must follow Herbert Spencer, who has probed this delicate subject with the intuition peculiar to genius :—

" It has been shown that, starting from the lower

life of plants and rudimentary animals, the progress of life in the upper species consists essentially in a continual adaptation between the organic processes and those which enclose the organism. We have seen that with complexity of their organisation there is also an increase in the number, the extension, the specialisation, and the complexity of the adjustment of the internal to the external relations. And, following this increase, we have passed by gradual transition from the phenomena of corporal to those of intellectual life." [1]

With regard to this differentiation between physical and psychic life, we particularly call the reader's attention in order to facilitate his interpretation of the law of evolution in its relation to sociology; since, although the *spirit* which underlies that law is the same in both cases, not so is the *letter*, which is liable to cause confusion.

"With the lower animals, each part of the organism, if produced by and for itself, as well as all the vital functions, respond in and by such parts to *external* stimulus; the psychic changes are almost to the same extent as the physical both simultaneous and successive. As the nervous system appears, these psychic changes are visibly co-ordinated, and a connection between their several most perfect series is established. And in accord-

[1] H. Spencer, *Principes de Psychologie*, p. 298.

ance with the gradual completion and perfecting of these connections, the nervous system forms correlatively, by fresh interlacings, a single woof of greater completeness and perfection." [1]

One now sees how the most rudimentary psychic life is an adaptation to the external medium, and how Nature possesses herself of this first trace of intelligence to mould it to her image, and, increasing in series ever more distinct and complex, she rules paramount in human intelligence.

I will continue to quote Herbert Spencer, to show the notable fact that this great thinker has not solved the problem, when his whole theory of the association of ideas should have led him naturally to such a conclusion. Never has human brain discovered so close a correspondence with Nature as is presented by the philosophy of Herbert Spencer, whose ideas seem to vibrate in harmony with all the succeeding and simultaneous series of natural phenomena. Thus his work is the first of its kind, and the most complete that any age has produced.

Referring to the differentiation itself, Herbert Spencer states :—" But this progress is not merely a progress in the physiological branch of the matter, but also a progress towards the separation between physical and psychic action, the

[1] H. Spencer, *Principes de Psychologie*, p. 420.

first advance of psychic action towards another series. . . .

"The skin, being the part that is more immediately sensible to different kinds of external stimulus, necessarily undergoes a change where the psychic variations take their origin. This mutual connection between the internal and external relations, which constitute intelligence in all its forms, must take its rise in every case from the internal action of things upon the organism."

For a positivist these ideas imply an acquaintance with phylogeny, ontogeny, embryology, and comparative anatomy, which the illustrious philosopher had so fully at his command.

Apropos of this, let us see what E. Haeckel states :—"Comparing the embryogenic evolution of the various sense-organs, it is clear that, at the moment of their appearance, they assume the simplest form imaginable ; and only by degrees do they attain their admirable state of perfection, whereby the sense-organs finally acquire the very curious and complicated structure of the organism."[1]

The same author adds :—"It is easy to understand the extraordinary impression these facts impose upon anyone who wishes to form a just idea of intellectual life. *All science will undergo a*

[1] E. Haeckel, *Anthropogénie, ou évolution humaine*, p. 470.

transformation when psychology, familiar with these genealogical facts, adopts them as the basis of its studies."

In dealing with the law of intelligence, Spencer states :—" A correspondence between the internal and external order implies that the relation between two states of consciousness answers to the same relation as exists between the two external phenomena that have originated it. How is this correspondence produced? The two states of consciousness are produced in succession, and all the successions are similar, considered as such. In what, then, will the correspondence consist? It consists in this : that the persistence of connection between the two states of consciousness is in proportion to the persistence of the connection between the two external phenomena to which they correspond. The relations between the external phenomena undergo all gradations from the absolutely necessary to the merely accidental. The relations between the corresponding states of consciousness must consequently undergo the same gradations in all respects. When the correspondence is complete, that is, when it has reached its greatest perfection, the various gradations of the one must each time more closely approximate the various gradations of the other."

The inference is that the intelligence is a repro-

duction of natural laws, to which it adjusts itself, its susceptibility of improvement being intimately in accordance with this relation. Hence the conclusion that Nature is the inheritance of mankind; that man, bound to Nature by indissoluble ties, is completely within her power; that humanity as a super-organic organism has but one road to follow—the law of evolution, a road hitherto neglected. The progress of humanity is due to their greater adaptation to the *external*, and is in exact ratio to the number and quality of the brains apt for this work; one may form an idea of the degree of psychic adaptation still to be acquired by humanity by considering the very small proportion of men engaged in this work of *correspondence*.

The relation between two states of consciousness corresponds to the same relation as exists in the two external phenomena that have originated it. Thus one understands that, as soon as man applied himself to the observation of the facts of Nature, the progress of so-called positive science really began. To observe a fact and its relation towards another fact; to investigate this relation with the same persistence with which this connection is carried out; to see the whole scale of relations of external phenomena, from the absolutely necessary to the merely accidental, in order to assign it its

due proportion in consciousness,—such is the unceasing work being carried on by psychic evolution.

The cerebral structure is a true product of this relation. The nerves acquire their protoplasmic elongations precisely because, in order to continue this progression of relations, they must keep increasing their collateral elongations and adjusting themselves to external parallelism.

The form of the neurona is a mechanical consequence, in order to produce this parallelism on which the intelligence depends; the brain is an organ of association, provided it be healthy, so that the series of external phenomena may be repeated in the brain, just as they are in Nature. The power of induction and deduction by which the human intelligence is distinguished resides entirely in the brain, in which the series of internal relations is interwoven and virtually formed, and sometimes one single fact is sufficient to set in motion the whole series of relations to which the fact corresponds.

All science is a continual demonstration of such correspondence. Copernicus, Galileo, Kepler, were brains which perceived by a direct observation of Nature the series of phenomena by which the movements of the stars are governed, their order of succession, and the persistence of these same

relations, and thus they were able to found a new cosmogony.

Newton succeeded in fixing the relation of quantity through which the persistence of these phenomena exists, and in formulating the law of gravitation, by which the precise terms of these relations are established.

Lavoisier, by his celebrated experiment, demonstrated the indestructibility of atoms, which, on uniting to form composite bodies, preserve their individuality, mass, and weight, resulting in a combination equal to the sum of the weights of the component parts. From one single apparently insignificant fact the genius of that illustrious man contributed to strengthen the parallelism between the external and internal series.

The simultaneous demonstration achieved by Mayer and Joule of the mechanical equivalent of heat served to establish the great principle of the equilibrium of forces.

The ability to measure the velocity of light and electricity has served to demonstrate the analogy between them. Spectral analysis proves to us the solidarity of the universe and discloses its very elements.

Lamarck and Darwin showed the inconsistency of the idea of species, and established the theory that all animals may have descended from one

stock. All these data of modern science are combined by H. Spencer, forming a systematic whole which concentrates up to the present the greater parallelism between Nature and human intelligence.

A casual fact led to the discovery of the Röntgen rays, followed by that of the radio-activity of matter, a fact that for the moment has upset all surmises, but which, when duly interpreted, that is, when its real significance has been appreciated, will mean a further step in advance, namely, the correspondence between internal and external order, and will thus forward human progress.

The sum of knowledge embraced by positive science is still very slender, for very slender also are the brains whose state of culture allows of the discovery of these parallel series. In view of the great disproportion that still exists among human beings between active and passive brains, one can understand the state of barbarism in which one lives, and the great task which is still left for man to realise, whose need for learning will never be exhausted.

If the intelligence of a few individuals, whose life is so small compared with time and space, has, within the short period during which we have existed, been able to conceive such great ideas as those which form science, what will humanity not accomplish if it devotes its intelligence to the

investigation of the infinite series of phenomena and relations which its brain will demand through time and space? Whither will the parallelism of these series conduct it? What limits will there be to progress?

Although Nature is made up of one indefinite series of phenomena and human intelligence, an adaptation of successive integrations starting from the lowest grade, the progress of humanity is indefinite. Accepting the theory of evolution, the perfecting of human intelligence knows no limits; this parallelism, in which the one is a reflex of the other, must be prolonged indefinitely as time goes on.

Of Nature we know nothing, or hardly anything; to claim to read the future, to fix limits to human affairs, without even knowing the conditions of the problem, seems to me as great an absurdity as if I expected my son, just beginning to read, to explain to me the works of Spencer. All religions and philosophies have the same original fault of wishing to solve problems without the necessary data. In his total ignorance, man fancied he knew what he was, whence he came, and whither he was going. These are questions for future man, but in a future still very distant; then perhaps these questions may be answered; at present we must learn, to enable the men of the future to answer them.

That intelligence is an adaptation of natural laws is a fact admitted but little known. Such importance has the descent of intelligence as a result of psychic evolution, that Haeckel even noticed that the application of this knowledge to psychology would result in the transformation of modern science.

In order to thoroughly understand H. Spencer's inductions on this head, we must study the actual facts, which such an authority on the subject as the illustrious neurologist Ramon y Cajal made known to the International Medical Congress in Rome :—

"In the animal kingdom, the nerve-cell represents a series of evolutive terms corresponding to the phases which the neuroblastoderm of His passes through in the ontology of the mammiferæ. . . . Here, as in other organic textures, ontogeny is a *résumé*, with slight variations, of phylogeny.

"The following are the evolutive ontogenic phases, with the phylogenic gradation to which they correspond (see fig. 12) :—

"*First Phase : Neuroblastoderm of His.*—Is a pear-shaped cell, of smooth surface, provided with a single expansion, the cylindric axis, which terminates within or without the nerve-centres, due to a free ramification more or less extensive. This primordial form is represented, as is proved by the

investigations of Retzius and Lenhossek, in the ganglion of the invertebrates.

"*Second Phase.*—The neuroblastoderm undergoes modification, showing two kinds of expansions, the cylindric axis and some protoplasmic appendices, generally sprung from the initial portion of the latter. This phase, somewhat modified, constitutes the permanent morphology of many medullary and brain corpuscules of fishes and batrachi; it is characterised, above all, by the absence of basal and lateral protoplasmic expansions of the cellular body. The functional elongation narrows, springing generally from the protoplasmic shoot, and resembling a protoplasmic stem differentiated.

"*Third Phase.*—From the inside of the neuroblastoderm, as well as on its sides, spring new protoplasmic expansions, which ramify repeatedly. The nervous cell acquires consequently a starred or pyramidal form. The majority of the nervous elements of the encephalus and medulla of birds and mammiferæ correspond to this morphological type, which represents the last ontogenic stage of the neuroblastoderm.

"From this explanation one sees that during the ontogenic development appear forthwith the chief or direct passages (cylindric axes and their free ramification), and later the collateral or indirect passages. In the differentiation of the phylogenic

species of neurona arises an order probably parallel to that which phylogenic evolution shows us: at first the motor and sensitive apparatus (cells of the early asta and bipolar spinal cells with their direct passages); later is differentiated the apparatus of association (elements of the cords or funicular cells of the medulla and brain); and of all systems of association, the cerebral, which is the most modern phylogenically considered, is also the last to appear. Such must have been also the order of function of the central nerve-apparatus in the phylogenic series; the first invertebrates endowed with a distinct nervous system only had to possess sensitive and motor passages connected with one another by direct cylindric axes; further, the collateral expansions would shoot out, and the associating passages would be opened (similar funicular cells of the medulla by which a single sensitive impression could excite the co-ordinated actions of the motor nerve-corpuscules)."

From these comparative studies Cajal draws the following most important conclusion:—

"There exists, then, one nervous system, the sensory and sensitive (peripheric ganglia), which has terminated its development by differentiation, increasing only by extension; and another nervous system, the cerebral, which continues its progress in the animal series, as well by extension or

multiplication of its cells as by their morphological differentiation."

From all these questions, as interesting as they are instructive, and without which sociology would have no possible *raison d'être*, one draws a conclusion of paramount value: *The brain of man still continues its psychic evolution.* The mere enunciation of this suffices for it to appear as a revelation rich in its consequences; the brain of man is still in full course of evolution; the neuronas and their cerebral cortex are not only increasing in number and extent, but are also becoming perfect by differentiation. This fact, deduced from embryology and comparative anatomy, from phylogeny and ontogeny, awakens a new world of ideas.

All the fancies of religions, philosophies, and even poets with regard to the intelligence are a mere bagatelle; the future of man has a limitless horizon. Nature abandons not her work, nor has she exhausted all her resources. In the need to adapt the internal to the external, she follows a consistent and tenacious elaboration, and in this extraordinary progress she will not only augment the number of elements, but will improve their form; the number of collaterals will grow, and with these the number and extension of the associations, allowing always a greater complexity,

in order to follow the parallelism with the external series.

But this is not all; there remains still the improvement of the substance of the histo-chemical composition, not only of the nervous cells, but of all the elements that contribute to good cerebral architecture; healthy, sound histo-chemical composition augments the precision and virtue of the cerebral energies. And such a constant perfectibility gives an idea of a future that appears like a dream, since man will attain in science, in art, and all applied studies a prodigious progress compared with the social state of the present time.

When the facts relating to the descent of the nervous system are known, it is useless to discuss this or that mode of demonstration: there is but one, that which secures the greatest adaptation of the intelligence to natural phenomena; this method being founded on observation and experiment. There can be no other; firstly, because this is obtained from a knowledge of psychic evolution, from the first animal to man; secondly, because it aims at the adaptation of the intelligence to Nature. It is the only means of progress, the only road that leads to the truth.

Furthermore, in order to appreciate the great light that is shed from a knowledge of the structure of the human brain, and to interpret history posi-

tively, Cajal thus sums up the conditions which chiefly, or more or less exclusively, influence mental phenomena :—

"Firstly, the number of nerve-cells of the cortex.

"Secondly, the variable development of the collateral and terminable protoplasmic expansions of the cylindric axes.

"Thirdly, the correlative proportions of the corpuscules of association in front of the sensitive, sensory, central, and psychomotor ones.

"Fourthly, the way in which the medullisation of the nervous fibres is shared, since, the greater the covering of the mielina, the better the isolation of the currents.

"Fifthly, the relative abundance of interstitial cement, which probably is intended to impede the diffusion of the nerve-movement.

"Sixthly, the variable number of neuroglic cells, whose office appears to be to separate the nerve-fibres, to avoid contact and filtration of currents.

"Seventhly, the state of the reticulum or intercellular woof (still very little known).

"Eighthly, the existence of perturbations or modifications more or less lasting in the chemical combination of the cells and interstitial cement.

"By this we mean only the anatomical conditions of the grey substance; but it is clear that they may also influence the absolute or relative

vascularity of the encephalus, the quality of the nutritive plasma, the amplitude of the peri-vascular lymphatic sheaths of the grey substance, and even the state of the vasomotor innervation, by means of which is regulated the quantity of blood that penetrates into each encephalic region through the solicitation of the will and the influx of the attention."

The attentive study of these grand conclusions illuminates the history of humanity and explains the alternations of civilisation and decadence. Such contrasts, which may be explained as a natural and necessary consequence of progress, as a species of cyclic movement, obey other laws, and the explanation of yesterday, and even of to-day, is completely gratuitous. This flux and reflux in civilisation are inadmissible as an essential condition in it; that would be tantamount to ignoring or denying the spirit of the law of evolution. From the first protist to man, evolution has always followed an ascending course, all the more rapid, the greater the differentiation in the organisms. Why should humanity have these oscillations?

Organisation in this case follows rather a uniformly accelerated movement, as it starts from the law of *consistency of form*, with regard to simplicity of structure; whilst, the higher the organisation, the more rapid the adaptation. Therefore, in

society, super-organic organism, the rapidity of change will be greater than in any other. So that the progress of humanity, when once it has found the true path, will not only be free from alternations, but proceed with greater speed. The decadence of humanity as an organism cannot be admitted until our planet begins to decline in its evolution, and until then we need not think about this reflux, which would be unique and definite.

When Ramon y Cajal made known the conclusions quoted in the last paragraph, the seventh, of supreme importance, excited the widest interest, as it deals with the reticulum or cellular woof, which was then little understood, although the clever neurologist was tracing by experiment and observation the modifications which the body of the neurona has necessarily to undergo, according as it is in a state of activity or repose.

The philosophic spirit of Ramon y Cajal succeeded in discovering the collateral terminations of the cylindric axis, looking for them, not, as Golgi, in man, but, knowing well the law of evolution, in the lower mammiferæ in embryology and ontogeny; for in animals of small size it was easy to discover at the edges the terminations of the collaterals, or rather to come upon their development in the embryonary period, and thus show the very important datum of the independence of the neurona.

Returning to our subject, we were saying that to the philosophic mind of Ramon y Cajal is due the recent discovery or interpretation of the reticulum of the neurona. This reticulum is formed of small neurofibriles. Let us see what account Dr Azoulay gives of this discovery and the interpretation :—

"The authors who, until now, have dealt with the small neurofibriles, have always thought that their reticulum was immobile, that it was a question of a fixed apparatus incapable of transformation.

"This view is untenable; the neurofibrile reticulum cannot be more variable, whether in its normal or pathological state. Facts demonstrate this better than any preconceived idea."

Variations during the Normal State.—Let us first consider the observation of Señor Cajal and his assistant Tello during the normal state :—

"Being anxious to ascertain the aspect of the neurofibrile reticulum in lizards, Señor Tello destroyed a few of these little animals during last *winter*, with the view of studying their nervous system by Cajal's method.

"Great was his surprise when, contrary to all his anticipations, he found in the cells only a very small number of neurofibriles, so compact that, with a slightly more powerful microscope, he could easily distinguish them. These neurofibriles, separ-

ated from one another by very clear spaces, presented, moreover, in some places a slight increase in bulk. Señor Tello discovered, then, a fresh appearance of neurofibriles in the vertebrates, and this appearance differs considerably from that till now observed in the mammiferæ.

"Some time after, always in *winter*, it occurred to Señor Tello to find out what influence might be caused to the nerve-fibres of the lizard on cutting its tail. After the operation the animal, which was then hibernating, awoke suddenly and manifested the greatest excitement. He killed it in this condition, and its marrow was examined, always by the Cajal method. This time the result was still more extraordinary—the neurofibriles were numerous and extremely delicate. There was no increase in their volume, and the separating spaces had in great measure disappeared. The appearance offered was almost identical with that of the neurofibriles of a rabbit or some other mammifera (fig. 20).

"This naturally arrested the attention of Cajal, under whose direction these experiments were being conducted. 'Whence comes this change?' it was asked. 'Why are the neurofibriles of the lizard, when intact, so few and so compact? Why, when the lizard is mutilated and excited, are they, on the contrary, so numerous and delicate?'

"Ramon y Cajal resolves these complicated questions. He recalls that the lizard is a *hibernating* animal, and this reminder makes the matter clear to him.

"The thick, rarefied neurofibriles which Señor Tello discovered, and which he thinks are characteristic of the lizard, are not so, from this point of view. They characterise only his *winter* state; things correspond to the state of somnolence, inertia, sleep, and reflect the state which the lizard assumes during the cold of winter. But no sooner does spring come, together with the heat and excitement that it produces, than these thick and scanty neurofibriles disappear, to make room for others finer and more numerous.

"One could not wait for spring, which was still far off, to know whether the facts would justify the hypothesis. An artificial spring, therefore, was arranged; the lizards were placed in a stove of 37° Cent., and left for a few days. This sufficed to reanimate and excite them. They were killed, and their marrow examined by Cajal's method and system. The hypothesis was immediately verified; in fact, everywhere the neurofibriles, endlessly interlaced, were very delicate and somewhat granular; innumerable secondary filaments in uniting them crossed the vast desert spaces during the winter state. Besides, the cells them-

selves seemed to have increased their volume, as if their activity had attracted towards them a greater amount of nutritive juices. There was, however, no sensible change in the relative position of the terminal masses of the pericellular nests, as, during

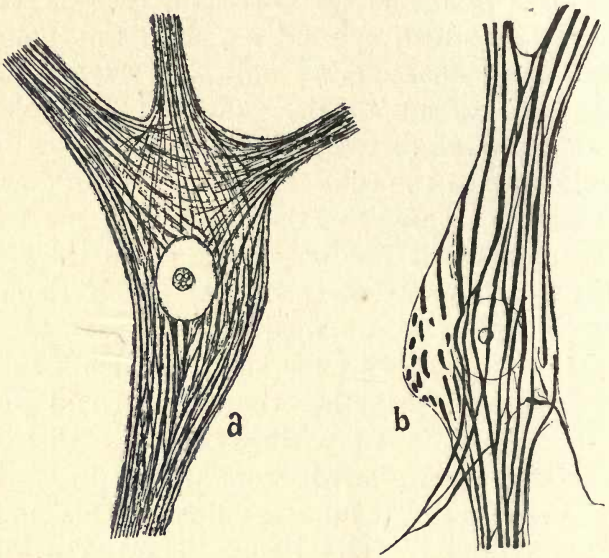


FIG. 20.
a, nerve in activity ; *b*, nerve in repose.

the state of *hibernation*, they are in contact with the membrane, always ready, so to speak, to transmit to the cell the impressions received.

"Fig. 20 gives an idea of these surprising changes. The motor cell *b* is in the winter state

of repose; on the right the cell similar *a* is, on the contrary, in an artificial state of activity.

"A single experiment may very well be deemed insufficient. It was therefore repeated by again placing the lizards in the stove for from one to three days, but this time at 25° Cent. The result was the same.

"Being now certain of the phenomenon, inquiry was made as to the least duration of time in the stove necessary for the winter neurofibriles to transform themselves into active filaments. This duration was found to be an hour at most.

"Other hibernating animals, *e.g.* snakes, were subjected to the same experiments, and the neurofibrile frame of their cells underwent similar transformation.

"When the spring at length arrived, the lizards revived spontaneously and were killed. There was only in the cells of their marrow the tangled reticulum of innumerable fibre filaments.

"The demonstration was therefore complete."

When one sees clearly how a brain—that is, the substance whose active power depends solely and exclusively on the whole psychic activity—can be changed in the quantity and quality of its delicate elements, and that its state of integrity depends in the last resort on a phenomenon of nutrition, there is no further need to explain these changes

of civilisation, nor the other much more delicate history called by Taine "the philosophy of art."

Nothing more explicit could be desired.

A change of pressure or composition in the blood is all that is needed, a modification in the amount of heat, or in the amplitude of lymphatic sheaths which cover the grey substance, for a brain to lose its integrity, and thereby the virtue of which it is capable. It is enough that the mielina or that the interstitial cement should modify the histo-chemical conditions, or be badly distributed, for the nerve-currents to cease to be fully transmitted and diffused throughout the brain, ideas thus losing their precision, their energy; Nature no longer having therefore a faithful substance to register her phenomena in the same series and tonality in which they are produced, the parallelism, the concordance cease, and, as the human intelligence has lost contact with its true guide and motor, society degenerates.

The *mens sana in corpore sano* of the Romans meant nothing else than this. People in perfect health practised every virtue; arts, industries, and science flourished, because the *mens sana* enjoyed its fullest completeness, as it preserved its integrity and its relation to the external medium, the propelling energies of which were registered clearly and precisely in the brain. When mankind, on

the other hand, ceased to be healthy, from want of nourishment or some irregularity shown by a loss of strength, a want of balance, degeneration made its appearance, and with it all human miseries; the brain lost its completeness, and, unable duly to repair its strength, ceased to be susceptible to the external stimulus, separating itself from the real and leading to the era of visionaries, as happened during the long dark period of the Middle Ages.

"The work of human intelligence," says Taine, "like the work of Nature, is only to be explained through the medium."

And in fact, when the medium improves, men become more healthy, the conditions necessary for cerebral activity are realised, a better contact is established between Nature and the brain, and a phenomenon such as electrical induction takes place, and hence the astounding impulse manifested by nations under these conditions. The human brain when sound has forces still more wonderful than the lately discovered power of radio-activity; the intelligence must possess some of these wonderful properties by which phenomena are registered in a series uniform with that of the natural laws, and by means of which, when the substance on which the intelligence is based is kept in a healthy state, the forces of universal mechanics are diffused throughout the human brain, in order to impart to

it its energies. And if the structure and material of the brain change their composition, whether through less pressure in the circulation or loss of purity in the blood, or that, owing to this change in the plasma of the blood, some of these cerebral elements, such as the neuroglia, the mielina, or the intercellular cement, are altered, these properties will disappear, and the intelligence no longer realises the phenomenon of induction or radiation, losing its equilibrium and its size. The *mens sana in corpore sano* will not exist, and the period of decadence will arrive, with all its physical and moral miseries.

The history of humanity proves how much time has been wasted through want of a careful system.

In the civilisation of the extreme East, the Chinese were writing their annals forty centuries ago, and 2200 years before Christ the emperor Yu had obtained a knowledge of the writing of his nine Chinese provinces, while the peoples of India have left striking proofs of civilisation in their philosophy and religion.

The civilisations of the Mediterranean peoples are even finer examples, as being better known, for proving the flux and reflux of a civilisation which has aimed at a foundation based on natural law. If Egypt, Chaldea, Phœnicia, Greece, and Rome have decayed in their civilisation, it was

because they first deteriorated in their cerebral organisation, through adopting conditions contrary to a good and normal civilisation, not through being a consequence of this.

Civilisations decay owing to the changes that the brain undergoes, because men violate the normal conditions of life.

Renan, speaking of the invasion of the Roman Empire by the barbarians, says :—

"I believe that if the Empire had had in the fifth century the great men of the second century, and, above all, that if Christianity had been more centralised in Rome, as it became in the centuries that followed, it would have been possible to convert the barbarians to Roman civilisation before or at the time of the invasion, and thus the continuity of civilisation would have been preserved. It was quite within the bounds of possibility for the Middle Ages never to have existed, and the civilisation of Rome to have continued uninterrupted. If the Gallo-Roman schools had been sufficient in one century to educate the Franks, humanity would have saved ten centuries."[1]

The continual wars, the licence of Roman manners, were changing and debilitating the citizens; their brains were becoming disorganised, and on the arrival of the barbarians it was not

[1] Renan, *Avenir de la Science*, p. 391.

possible to assimilate a civilisation that had no cohesion or controlling force, since, except in name, it no longer existed.

We find equally convincing and even more delicate the deductions drawn from the study of the philosophy of art, and we may refer on this point to Taine's remarks on the development of painting in the Low Countries:—

"Here, as everywhere, art interprets life; the talent and taste of the painter change at the same time and in the same sense as public manners and sentiments. Just as every geologic revolution has its fauna and flora, so each transformation of society has its ideals. . . .

"The fourteenth century is the heroic and tragic period of Flanders; at that time there lived artisans like Artevelt, who were at once tribunes, dictators, captains, who met their death on the battle-field or by assassination; civil and foreign war succeeded one another; city fought with city, state with state, man with man; there were in Ghent 1400 murders in one year; energy was so keen that it survived all ills, and supplied the needs of all forces. . . .

"In this human effervescence the richness and abundance of provisions and the habit of individual action excited courage, unrest, audacity, insolence, and all the excesses of overwhelming brute force;

among these weavers existed great men, and where men exist the arts are not slow to appear.

"Then, as in Florence, about the year 1400, power was welcomed, and society became organised. Here, as in Italy, about 1400, man abandoned the ascetic habit to take an interest in Nature, and to enjoy life; he began to taste the joys of strength, health, beauty, and joy. Everywhere the spirit of the Middle Ages began to change and disappear."

Let us dwell upon Taine's words: *Art interprets life.* Here art means psychic life; and life, physical life, the animal existence. The parallelism is evident, and includes a fact which, for the education of humanity, must not for a moment be lost sight of. When nations reach one of these periods of physical and psychic prosperity, it is because they have an abundant nutriment, which renders possible a more healthy, regular, and intense existence; that is to say, when the medium supplies man with abundant or sufficient substance to repair his losses by good nourishment, man can steadily develop the virtues of which he is capable.

The blood needs all the aliment necessary to recuperate man with all his energies, and when this is the case, appears the *mens sana in corpore sano*, and so the brain, receiving a rich recuperative plasm, preserves the integrity of all its nervous elements, and thus at last the adaptation of the

external to the internal is rendered possible; since man, then receiving inspiration from Nature, conceives great systems of philosophy, or realises great works of art.

But again Taine writes: "The talent and taste of the painter change at the same time and in the same sense as public manners and sentiments."

And in proportion as the nations enjoy this state of material prosperity, all their members will enjoy also the mental balance which constitutes the psychic medium in all that relates to art. In the physical there is also an intimate relation between the external and internal, all the more important that without this completeness in the physical the other completeness in the psychic is impossible.

In speaking of the causes that tend to the development and explanation of a work of art, Taine cites the medium that surrounds the artist or the group of artists of the age: "This family of artists is understood in a wider connection than the world that surrounds it, and whose taste is in accordance with its own. The habits and condition of the spirit of the age are the same in the public as in artists; there are no isolated individuals. It is their voice that we hear now across the distant ages; but amidst their voices that surprise and come vibrating towards us, we recognise as a murmur and a sweet whisper the infinite and mani-

fold voice of the people that was singing in unison with them. It is this harmony that has made them great. Thus it had to be; Phidias, Ictinus, the men who reared the Parthenon and Olympian Zeus, were, like the other Athenians, poor citizens and villagers educated in the palæstra, wrestling and exercising themselves as gymnasts, accustomed to deliberate and vote in the public assembly, with the same habits, the same interests, the same ideas, the same beliefs; men of kindred race, education, and language; so that in all the important circumstances of life they were similar to those who watched them."[1]

I might continue to cite paragraphs and texts in which the evidence proves how the human intelligence is an adaptation to Nature; I might appeal to the psychology of Spencer, which could not be more explicit on this point. But it would be tiresome, and lengthen greatly this work, to undertake to prove that which in science is an accepted fact. Starting from this certain positive basis, what I wish to call your attention to is the application which is logically deduced from it, namely, that Nature is the inheritance, the property, the riches, and the happiness of mankind; that present ownership, which the philosophy of right cannot explain or authorise satisfactorily, is incompatible

[1] H. Taine, *Philosophie de l'Art*, p. 5.

with happiness. It is on this new conception of property that one bases the argument and solution of the great social problem. Property thus understood will be the keystone of the new social edifice.

Now I know that I shall be told that this is not new, that the abolition of capital has long been proposed. My proposal merely tries to legitimatise this aspiration, in availing myself of the law of evolution, giving it greater value by endeavouring to show that it is a logical consequence, and the only one to which modern science leads.

When once this conception of property is admitted, my task will be very simple; and, in applying and interpreting the law of evolution according to its spirit rather than its letter, I shall aim at presenting to society a state of indefinite perfectibility, in which man will be able to satisfy his noblest and highest aspirations. It will enable me at the same time to prove that war between capital and labour is utterly futile; that, in the antagonism between them, labour will end by destroying capital, after a long sanguinary struggle, and will in the result fail to attain the coveted ideal, since the contest is initiated on a wrong basis. The road to be followed is the broad path indicated in positive science by the law of evolution, since the organisation that has made man out of a protist is the only one capable of rescuing present

society from the chaos in which it lives, and leading it to the desired land of promise.

It is plain that, by following the dictates of Nature, the threatening and difficult conflict that is presented to us would end peaceably so soon as men were convinced that they are disputing for possession of a remedy that is no cure; that the other road is easy, expeditious, and more suited to, and worthier of, mankind; that in pursuing this road all the artificialities that now compose the life of the State will, by degrees, be submerged, without noise, without shock, and amidst the most profound indifference. Man will separate, calm and content, from the present state of things, on abandoning a social condition absurd and miserable. I am all the more certain that the solution of the conflict will be peaceful, in that I affirm that some of those who to-day are owners of vast wealth will help so far as in them lies, when convinced that there can be another social organisation better than the present: philanthropists have always been a power in a world. Men have been divided into classes, not because some are good and others bad, but because present organisation inevitably leads to that position, and produces all the lamentable injustices for which it is alone responsible. The antagonism of class is not essential to man, though it is essential to his archaic civilisation.

From what I have said on adaptation, I think I have sufficiently proved that the future of humanity is not subject to the caprice of anyone, but that there exists an irrefragable law which has made man out of a conglomeration of matter, and this same law, sooner or later, will have to be followed, in order that man himself may attain the state of happiness that is his legitimate aspiration. Psychic adaptation would be the best possible correspondence between Nature and intelligence. This adaptation would again place man in the right path for the accomplishment of the law of evolution.

Having explained what has preceded, I can now sum up the facts of psychic life as follows:—

In the lowest beings already appear physical and psychic life, although very slightly differentiated; but both become capable of differentiation as we ascend the animal scale, until attaining their highest degree of differentiation in man. On his appearance upon the earth, the intelligence, the result of successive psychic adaptations, continues to create fresh series, to amplify those existing, and to associate some with others, in order to give rise to more complex and distinct intellectual complications. The brain has progressed, increasing the number of its neuronas, and, just as the neuronas become distinguished by new powers of perfecting themselves which complete a new progress,

individuals, by ever-increasing differentiations, help to integrate a super-organic society more perfect every day. So that we can establish the following analogy :—The neurona is to the individual psychic evolution what man is to the super-organic social evolution. The great evolutionary law attains to the social organism by the same road and by the same processes of adaptation common to all beings. The more numerous the psychic element—in this case *men*—the more exact, the more complex, the more distinct, and the more differentiated and co-ordinated the *human intelligence.*

This prodigous evolution has no limits, no more than has Nature herself. It cannot be stated to what point of progress the super-organic organism will attain in a state of growth ever continuous and every moment more extended. By the law of correspondence, the organic substance, by virtue of its admirable plasticity, registers all these perfections, and by its adaptation and differentiation the organic substance continues to integrate all the external in human consciousness.

CHAPTER VII

HEALTH AND THE GENERAL LAWS OF MECHANICS

HEALTH, that is, individual soundness, presupposes organic and psychic adaptation—the *mens sana in corpore sano.*

The perfect correspondence of mechanical, chemical, and biological laws with the natural laws, is what makes man healthy.

When humanity lives in a normal medium, the adaptation of its chemical and biological organisation must be more stable than in any other, whether crystal, plant, or animal, from the means upon which man relies in order to effect this correspondence.

Health must be man's normal condition; if not, he is not living in a normal medium, but in one in which the order and precision of natural law have been changed. An egg, in order to develop the germ it contains, requires not merely a particular number of days but a suitable temperature, without which its development is not possible. Human

health also requires favourable conditions in the medium. Nature does not alter her laws, which are immutable, and health, which is a consequence of them, must also be unchangeable; therefore, if Nature has fixed principles, man alone is responsible for his own ills. Health has so great an importance in the evolution of humanity, that without it there can be no regular progress; every being that changes its normal state through having lost its adaptation to natural laws is degenerate, and, therefore, selection and heredity cannot take place, and so the process of evolution in man is retarded. A sick humanity is a drag upon progress, if not a cause of regression. A civilisation like the present, which so changes natural laws as to make man an exception, is an absurdity.

Nature has made man healthy; society so undermines his constitution that it ruins his health.

Every organisation is due to definite combinations, and this fact is easily proved in the case of crystals, for example, the symmetry of form being a consequence of exactness in the chemical combination. In plants and animals there exists the same fixity of chemical combination and form: see the elements of which flowers are composed, how they have the same number of sepals and petals, or rather of stamens and pistils; how the leaves are arranged in each species in a peculiar way. In

animals, count the number of vertebræ or of ribs, or the number of bones in the interior of the ear, in the hand or the foot. Note, too, the breeds that preserve *purity of blood*, what a strong resemblance separate specimens have in the spots on the skin, or in the designs on the feathers, in the conformation of the body, in the whole and in detail, and even in characteristic traits.

In man, in whom health would be the normal chemical state, and in whom these conditions should be observed with greater precision, the contrary is the case; on which account, as we said above, society ill-treats human organisation to the point of denaturalising his biological conditions.

If we pass beyond the frontiers of organisation, scrutinising beyond, where matter, combining in definite and concrete proportions and forms, produces crystals, plants, animals; beyond all this concrete world of settled forms we find the same definite laws or rhythms of force, some of which man has been able to discover, and will go on discovering daily, in virtue of the relation that exists between Nature and intelligence.

The Pythagorean forecast, in which number ruled the universe, evolved the theory of the unity of physical forces, to be to-day converted into the current application of universal mechanics to all orders of life.

All forces are correlative harmonic rhythmic vibrations, which are mutually transformed into simple relations in the numeric series expressive of universal harmony.

Sound, light, heat, electricity, mechanical work, chemical affinity, constitute forms of universal energy equivalent to one another, and can, in the majority of cases, be weighed and measured.

We can study in special treatises the mechanical equivalents of heat, of work, of chemical reaction; and though the series is not complete, ever extending with new discoveries, it is none the less certain that man has been enabled to fix the definite proportions of the majority of these rhythms.

The law of gravity continually attracts matter *in direct ratio to its mass, and inversely as the square of the distance.*

For the so-called chemical forces, Lavoisier discovered the simple numeric relation formulated in his law: *The weight of any combined bodies is equal to the sum of the weights of their components.*

No less simple is Dalton's law of multiple proportions: *Whenever two elements are combined in variable ponderable quantities, if we take as a fixed quantity that of one of them, that of the other then becoming variable, the quantities of the varying body are multiples or submultiples of the others.*

This law, which is the foundation of the atomic theory, is proved by this simple example, among a thousand others that could be given.

Oxygen and hydrogen form two combinations, namely, water, H_2O; secondly, peroxide of hydrogen H_2O_2.

In the first, two atoms of hydrogen are united with one of oxygen, and the respective weights are :—

Two atoms of hydrogen = 2
One atom of oxygen = 16.

In peroxide of hydrogen or oxygenated water :—

Two atoms of hydrogen = 2
Two atoms of oxygen = 32.

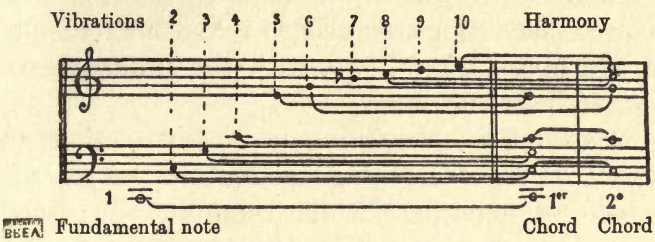
No less in harmony are other physical laws, as those of volume and pressure in gases, as formulated by Mariotte; that of the invariability of angles in the chemical crystallographic species; the electro-chemical laws of Faraday, and equilibria between electric unities.

To end these mere examples, the development of which would take me very far, in carrying me beyond the scope of the present work, I will close with a readily comprehensible example in acoustics.

In music, the harmonics are subject to numerical rhythmical proportions. Starting from the fundamental note "do," composed of 128 vibrations, and

considering it as unity, we get the following result:—

PRINCIPAL HARMONICS PRODUCED FROM ONE SOUND



1st. The 128 fundamental vibrations—the most perceptible—"do."

2nd. The note 2, which, having twice the number of vibrations, will give consequently 256 vibrations; that is, the upper octave "do."

3rd. The note, or $256 + 128 = 384$ vibrations, the product of which gives the fifth from the octave of note 1, or "sol."

4th. The note 4, or $384 + 128 = 512$ vibrations, which produce the fourth from note 3, or the second octave of note 1, a second "do."

5th. Note 5, or $512 + 128 = 640$ vibrations, producing the third above note 4, that is, "mi."

Whence comes the first perfect chord, do, do, sol, do, mi.

Then come the notes 6, 7, 8, 9, 10, increasing each time the same number of 128 vibrations, that

is, the coefficient 1, which give the series of notes sol, si flat, do, re, mi, succeeding one another at ever closer intervals (minor thirds and seconds), and producing, by the suppression of notes 2, 4, 6, 8, 10, a perfect chord, similar to that which results from the notes 1, 2, 3, 4, 5, with the difference of an octave between them.

It is seen that everything in Nature is subject to exact laws, everything in Nature represents elements of energies which combine in fixed numerical proportions, as fixed and precise as are invariable the angles in crystals of the same species, the designs on the feathers of birds or the spots on the skins of animals, and hence the harmonics in music, and the exactitude of the law of gravity. This same exactness should be found in man, but is not, as his social conditions prohibit it. These conditions of regularity in the human species would establish his complete health. But, on the contrary, of all animals, man is the most subject to illness to a depressing extent; and of animals, those which suffer most are those which are most associated with man.

The symmetry of form in crystals must be represented in animals by the regularity of their chemico-biological formation, which is what governs also the symmetry of plants and animals. Which leads to the following conclusion :—Man represents

a definite chemical combination, is a harmonic rhythm, or rather, he should be. Human physiology is subject to the laws of chemical mechanics, and these, in their turn, are subject to the great principles of force. Man receives from Nature his chemical composition, more complex than all others; but, in virtue of the same general principles, he must be of the same exactness as that of the best crystal, plant, or animal, or, as it were, of that of some physico-chemical law upon which he most closely depends; thus diseases, whether constitutional or infectious, are the natural consequences due to the worst conditions of existence. Diseases are changes that humanity has acquired in its chemico-biological relation, from its habitat in an unsuitable environment. We may say that it is a false chord in biological harmony.

Man has studied the improvement of his flowers, his garden growth, and his animals, and in consequence he has forgotten to improve himself. This, though an absurdity, has its explanation, namely, that man, in his present civilisation, cannot adapt himself to the natural conditions of life, as he is subject to economic conditions which are incompatible with the former. There is no social class, from the richest to the poorest, that concerns itself with the betterment of its species. What a sad condition that of man, who, having succeeded

in selecting his potatoes, his calves, his dogs and horses, cannot perfect his own offspring! For the unhappy children who are born monsters, those directly responsible are the parents, and indirectly, society as it is constituted. It is a sad statement, but far sadder is the fact.

No illnesses, whether infectious or constitutional, ought to exist, and yet their victims are counted by thousands. Cancer, tuberculosis, and typhus are terrible afflictions, for which nothing but palliatives, of no use, are offered; it is the vine-leaf offered to satisfy the public conscience.

Can we be unaware that bad economic and sanitary conditions bring with them physiological misery, and that they are the chief cause of the development and propagation of the tubercular bacillus?

What are the academies and all these medical and hygienic congresses then doing? Why do they not denounce, and exercise prohibitory action? Because we must all agree on one point, namely, that directly medical science points out the causes that originate the evil, and shows the means of avoiding it, there is no excuse for any class, not even the pretext of economic conditions, to justify such criminal delay. The life and health of the citizens are riches, and the money that is employed in diminishing mortality has profitable returns, for

health augments the well-being and material prosperity of the country; the continual refrain of the economic question is to unmask ignorance and apathy, and the former constitutes the real crime of outraged humanity (*lèse humanité*).

There are European peoples who have succeeded in reducing considerably their mortality, as Turin, for instance, which has from 45 per 1000 decreased to 11 per 1000, and Havana, which has just reduced its mortality from more than 40 to 17 per 1000. True, this has cost money; but the moral and material benefit vastly outweighs the sacrifice. In the island of Cuba, which is now one of the best examples of a model sanitation, they have, in less than three years, quite stamped out the terrible yellow fever as well as the small-pox, and have diminished the mortality of tuberculosis by one-half.

We say nothing of the moral duty of governments of watching over the public health, this being an obligation to be observed without any kind of restriction; but unfortunately a State that has no stimulus beyond moral obligation is very rare, only existing indeed among highly civilised nations. We therefore instance economic rather than moral pressure, certain that it is the only one that is regarded, despite other hypocritical excuses. Savages delight in decking themselves with feathers

and bright-coloured cloths; they wear necklaces, and even nose-rings, but are not seduced by intellectual gifts more useful to the individual and the race, because they do not *shine* so much. Between the psychology of some States and that of savages, it is only a question of degree, and evolution is the same—first sensory, then intellectual or moral.

In presence of these data, what idea have those countries whose mortality is so great as to be criminal? What excuse, if any, do they allege? The State cannot excuse itself with economic conditions, for civic life provides muscles for agriculture, industry, and even for the defence of their countries. So the State cannot screen itself behind a want of resources without perpetrating an absurdity; it cannot allege ignorance, for here are the facts and means of which other cities and nations have availed themselves to obtain such beneficial results, and against positive facts no discussion is possible. So if neither want of resources nor ignorance can be pleaded, we are in a position to accuse the State that submits to a mortality above the average of the crime of *lèse patrie.* All the medical academies and all the medical congresses that refrain from denouncing these facts fall short of their lofty mission.

Starting from the principle that we live in a

Christian civilisation, whose moral is, "*Love thy neighbour as thyself*," we arrive at an absurd conclusion, which I propose to prove.

Admitting that those who perish miserably are our neighbours, and that it is more logical to give bread to the hungry than to reduce him at the point of the bayonet when maddened by despair ; considering that it is better economy to bring the Mauser into action — among Christian and unchristian people—than to fulfil the great duty of human solidarity, it is clear that we arrive at the following conclusion : *This civilisation is not Christian, since it does not love its neighbour as itself; otherwise, it does not know what it is saying, or rather it does not know what it is doing.* But, as it can hardly be granted that a society should contradict its moral principles solely for the pleasure of violating them, and as it can equally less be admitted that a rational being should delight in being in continual contradiction with himself, I gather that the inevitable conclusion is that present civilisation is absurd, and that if we accept these consequences, such as they are, it is because, day by day, there are none better to be found, when we hear many persons say, though with the best wishes : "*All this is very sad, but there is no remedy.*"

To better understand the relation of health to the general laws of mechanics, and how it is ruined

by social organisation, let us examine some cases of experimental medicine that are highly instructive.

There exist some animals, like the hen, that are insusceptible to carbuncle. It was thought that this immunity was due to its higher temperature compared with that of man. Pasteur carried out a very simple experiment in order to show that the amount of heat might influence this immunity. He placed a hen with its claws constantly bathed in cold water, until he obtained a lower temperature; this once obtained, the carbuncle was developed and the hen sickened. The experiment appeared conclusive. Gibier, however, made with the frog, an animal also indisposed to carbuncle, a similar experiment. In order to raise the frog's temperature, he placed it in a bath at a temperature of 35° Cent., and under these conditions the animal lost its immunity, and was susceptible to the carbuncle bacillus.

Canalis and Morpurgo have made hens and pigeons lose their immunity, but in a different manner, to which we especially call attention, namely, *by means of hunger*. Submitting the creatures, the subject of the experiment, to a prolonged fast, the hens and pigeons also ended by being victims of those terrible bacteria; and, note well, under normal conditions these creatures are *entirely immune*.

White rats are also indisposed to this same infection; but subjecting them to *fatigue*, these little animals lose their immunity. Charron and Roger placed them in special cages, which obliged the rats experimented upon to be always moving, with the result that these little animals became victims, like the previous ones, to the carbuncular bacteria.

From these examples I think we can understand the relation health maintains with the general principles of mechanics, more especially with one of the thermo-chemical laws of Berthelot: *The amount of heat that is released in any reaction is the measure of the sum of the physical and chemical labour produced by it.* Thus stated, the problem seems to us far clearer and simpler, and more in harmony with the spirit of modern biological science, which can admit no other laws than the general laws of mechanics. The hen in its normal state represents a chemical combination, definite and concrete, that admits of no disintegration on the part of the infectious agent; in making the said bird lose its normal temperature one causes it to lose a great amount of heat. Well, then, according to the law of equilibrium of forces, this amount of heat lost by the hen presupposes an equal loss in chemical and electrical affinity, etc., and indeed we may say even in radio-activity. As all these

energies, which are transformed by virtue of that same law of equilibrium, are the sum of the physical and chemical labours of reaction, the inference is that a change has necessarily been produced in the cellular chemical mechanism of the hen, equivalent to the quantity of heat transformed. In this change in the equilibrium of the chemical mechanism lies the loss of immunity.

In the case of the frog the problem is the same; on raising the animal's temperature one upsets all the chemistry of its cells, since it is not possible to change the temperature in a chemical, and above all a chemico-organic, compound, without exciting a corresponding change in its molecular dynamics.

Humanity, in the absurd social regimen that it suffers, is like the hen in Pasteur's experiment, or the frog in that of Gibier, or like the hens, pigeons, and rats in the other experiments; that is, men lose forces which alter their definite chemical combination, so as to render them thereby susceptible to every kind of disease.

Living beings are machines with the property of transforming potential energy (nourishment) into useful force (life).

Let us suppose a chemical combination, N, of an animal, say a hen, as in the experiment cited, or rather man, in whom we are interested; but in

either case the formula N is typical, as are all natural laws, and composed of various elements (A, B, C, D). This formula of a sound individual has a dynamic value perfectly balanced; so that, supposing it to be a mechanical work equivalent to 100, distributed so as to transform a quantity of potential energy (nourishment) into living energy of a useful output of 75, and 25 of residue, the result will be that so long as he is in this true balance, man will preserve his health. All this must follow a regular routine, whilst the animal or the man lives in a normal medium—that is, one in which solid and liquid nourishment have the required consistency, and in pure air, and in which the human machine does not do violence to its system of forces; in this way only will equilibrium be maintained in formula N.

Bearing in mind that the chemical formula N aims at transforming potential energy into living energy, it will be easily understood that if the solid, liquid, and gaseous aliments, that is to say, the potential force, change, formula N will perforce have to be modified, and its mechanical equivalent, instead of 75, will be 60 (for example), and the residues 40; and consequently there will be an alteration in the normal formula, which will come to be N′ (A′, B′, C′, D′), having a less output in useful force and an increase in the residues.

This want of equilibrium in the output, with a loss of useful force and an increase in the residues, is the source of all the diseases called constitutional; the more so that the formula N′ (A′, B′, C′, D′), on increasing the residues, alters their quality also, which, from the very fact of their not being normal, is toxic. Arthritis, with its derivatives, gout, rheumatism, obesity, diabetes, etc., originate from the change of the chemical mechanics of the formula N.

The importance of constitutional diseases is all the greater in that, by avoiding these, the distribution of infectious complaints would be impossible.

Dr Roux of Lyons, and other illustrious pathologists, prove that it is not possible to admit the classical division of microbiology into saprogenous and pathogenous bacteria. The former, until recently considered innocuous, acquire virulence under certain conditions and become pathogenous.

The series of each of these, as well as a detailed acquaintance with their vital conditions, are not wholly known, as we are at present obliged to substitute the above-mentioned classification for the latter more sensible one and better suited to the facts, namely, pathogenous and non-pathogenous bacteria.

The important question of the specific cause of each disease seems to be at present less absolute,

but, as we have intimated, no less interesting. Let us note the following considerations :—

"The doctrine of the specific agent, so brilliantly supported by Trousseau, founded on typhoid fever in the works of Eberth, Gaffky, Chantemesse, and Widal, admits of some modifying circumstances.

"Microbiology enters upon a new phase in demonstrating the presence in the natural cavities of sound individuals of microbes capable of conversion into pathogenous, such as the microbes of suppuration, pneumonia, and diphtheria. If the investigations of Messieurs Rodet and Roux (of Lyons) are confirmed, that is, if it is shown that Eberth's bacillus is only a modification of the bacillus which habitually lives in the bowel, one cannot consider contact by water as the sole cause of typhoid; it will be necessary to admit cases in which the bacillus of the bowel has acquired its virulence in the human organism, whilst depending upon modifications in the internal environment. Now, then, is it not well known that excessive fatigue is one of the factors that greatly influence the internal organism? It may be alleged, then, that an individual undergoes, under the influence of auto-intoxication from excessive fatigue, such modifications that at any given moment he may become a victim to the *Bacterium coli.* Thus would be explained the different morbous series

that have been observed, series which lead from the simple touch of fever to the most characteristic typhoid."[1]

What is the origin of infectious diseases? Do they reveal their origin in the external medium or in the human organism itself? Facts, in the majority of cases and in diseases peculiar to man, appear to leave no room for doubt that in many cases the origin of the diseases that afflict man resides in man himself.

Microbes dwell inoffensively in the sound man, because the normal state of the secretions so requires it; but if wrong conditions of existence succeed in altering the chemical action, or the normal formula, the change which of necessity this causes the medium—man—to undergo, alters the normal state of these microbes and renders them virulent. This is what would result, according to Rodet and Roux, with the *Bacterium coli-comune* on producing typhoid; and this is what occurs in pneumonia and diphtheria.

The microbes that produce pneumonia and diphtheria may live normally in the mouth of a man, being completely harmless. But it may happen that some changes in the medium or in the subject so alter his chemical composition as to modify also the secretions of the glands of the

[1] Bouchard, *Pathologie générale*, p. 480.

mouth. This chemical disturbance of the medium in which the microbes of pneumonia and diphtheria and others live carries with it a modification of these kinds of microbes in order to adapt themselves to their new conditions of life, and in them resides the acquisition of properties which give them virulence, and which may produce pneumonia, for instance. In a sound individual, in the fullest acceptance of the term, such things do not happen; but there are many who, though apparently robust, are not healthy, as they have an organic disorder, as happens with all arthritic subjects. If, among these, causes supervene which increase the arthritic tendency, as excessive fatigue, moral depravity, or some other depressing cause, it may happen that the liquids of the mouth undergo the changes necessary for the microbe of pneumonia, which till then lived harmless, to acquire the virulence which converts it into the terrible agent of pneumonia. Take also into account that, when these circumstances occur in the case of an arthritic subject, not only are the juices of the mouth changed, but also all those of his organism, which increases predisposition to it, and aggravates the consequences.

What happens with the microbe of pneumonia, diphtheria, suppuration, etc., may be applicable to all infectious agents that are normal organisms

whilst man lives in sound health, but as soon as he changes his chemical conditions, the adaptation of these micro-organisms to a different chemical medium of health invests them with conditions of virulence, whence many infectious diseases are derived. Thus would result a complete dependence between infectious and constitutional states, the avoidance of the latter being the best way to combat the former.

Well now, just as the infectious agent depends on the chemical change in the medium—man—and he in turn on his social medium, it will not be possible to expel infectious or constitutional ailments until the economical regimen is changed from the inverse to the reverse.

It is sufficient to deprive the hen of heat to render it susceptible to the disease. This happens to man every day. A cooling in healthy individuals produces no effect, because the phenomena of vascularisation repair the alteration produced by the cold; but in arthritic subjects, that is to say, rheumatic, gouty, diabetic, obese, neurasthenic individuals whose chemical formula has lost its fixity, whose cellular chemical constituents are therefore less stable, a cooling will actually alter in them their formula N. This alteration consists in the consequent elimination by the cellular chemicals of products that are not normal, or

which, being normal, increase their production until they are noxious — for instance, the excess of uric acid, that which gives rise to rheumatic phenomena from its accumulation in the system.

Any loss of heat, which is also a loss of force, represents an equivalent alteration in the chemical mechanics, an alteration that will reveal itself in the blood under the form of a toxic product, proportional to the alteration of the chemical work. Such a momentary loss of heat without compensation will suffice to upset the formula N′ in a rheumatic person, and the kind of variation in this case will produce a great quantity of uric acid, which will alter all the secretions, and hence that series of disturbances of the mucous membrane which may give rise to both bronchial and intestinal catarrh, or to nephritis, according to the individual organic conditions or susceptibilities. It is equally clear that the uric acid accumulates in the articulations or the muscles, producing the pains peculiar to rheumatism. Here may be originated the vaso-motor phenomena to help the organism to recover its equilibrium; but as uric acid paralyses them, hence follow congestions which may vary from simple pulmonary hyperæmia to pneumonia. What is said of rheumatic subjects applies also to gouty, diabetic, and others.

Let us take the experience of *hunger*. Here the

problem is essentially the same; to deprive the hen of strength by subtracting heat, or by withholding of nourishment, is in substance the same thing. The waste of energy which the sole fact of living presupposes is equivalent to an equal consumption of energy, which is what must repair the loss of nourishment; if this is excluded, as in the experiments of Canalis and Morpurgo upon hens and pigeons, it is equivalent to a loss of energy, just as when they are deprived of heat through cold water. Animals thus deprived of nourishment will continue to live, first, on the organic accumulations, such as fat; then, when these are exhausted, their own chemical composition will have to supply strength in the form of heat, affinity, electricity, etc.; and these essential energies in the hen cannot proceed from any other part than its own biological chemicals of formula N, and this waste of energy presupposes an equal transformation of matter by alteration of the chemical formula, which will make possible the development of some disease or even death. Were it not so, the law of the equilibrium of forces would not be true. Its application to individuals who undergo excess of fatigue and live under bad hygienic conditions, and to those who do not eat sufficient food and suffer chronic hunger and its consequences, is perfectly clear, and needs no comment.

Let us examine the experiment as to *fatigue.* Charron and Roger, subjecting white rats to excessive fatigue, succeeded in depriving them of their immunity.

Let us not forget that in all these experiments the point is to get animals to contract a disease from which they are normally immune.

In this case, as in the previous ones, the matter reduces itself to an alteration in the chemical mechanics through loss of energy; there is an excessive amount of waste and a loss of repair, from which results a disorganisation in the normal biological formula, which formerly adjusted the balance of waste and repair; and all that is required to upset this equilibrium is to open the door to infectious diseases, among them tuberculosis, the victims of which are annually counted by thousands.

I cannot stop to detail case by case the thousands of times that the right of humanity is thereby violated; but whenever the air is impure, the water undrinkable and scarce, the nourishment insufficient or unwholesome, and where there is an abuse of human powers, then a crime is committed entailing an immense responsibility.

It is incumbent upon society, the State, and above all the medical faculty, to intervene, but unfortunately the time is still far off to which

Michelet referred in requesting that medicine should mean "justice and morality."

In the investigation of the subsoil through the unhealthy slavery of the miner, in the life of the poor agriculturist and field labourer, in workshops, in the main unsanitary, in the life of cities where abound whole districts the dwellings of which are hotbeds of infection, and in the majority of towns, small and great, where hygiene does not exist, is to be found an everlasting conspiracy against the health of man. Want of air and light, scarce or bad food, as well as excessive labour and fatigue, are so many more factors that vie with one another in altering the natural laws that should combine for the well-being of humanity.

Bear in mind the conditions that, according to Ramon y Cajal, contribute to proper mental function, and with what facility they may be disturbed, not forgetting that the nervous cell is the grand element, the origin of all psychic energy, and we shall understand how monstrous is the present state of society, subjected to an environment so arbitrary and brutal as is its economical condition, the sole base of the social edifice. Thus is human personality destroyed and denied the possibility of accomplishing its evolution.

The progress of humanity consists in the predominance of the psychic quality; but this require-

ment can only be realised on condition of the individual integrity of the *mens sana in corpore sano.*

The alteration of the nervous centres is subject to the same general laws as mechanics, and the slightest alteration in them is sufficient to modify their structure, and, consequently, the whole of their psychic life, whence are derived the changes that include the imbecile, the criminal, and the madman. All this is a consequence of present social organisation, because on interfering with the equilibrium of the organic chemical condition of the nervous centres there arises at once an alteration in the reticulum of the neurona, or rather the mielina of the nerve-tubes, or rather that of the interstitial cement; an alteration in the quality of the neuroglia, whose rule is the isolation and maintenance of the different nervous unities, or rather the fulness of the cerebral circulation; in a word, there arises the loss of mental balance, with all its sad consequences to the individual, the family, and the race.

Society is responsible for the health of the body and of the intelligence. Nervous, constitutional, and infectious diseases are so many more causes for the dissolution of the human species, which would disappear were it not that this, like all matter, is subject to the endless impulse of universal energy. It matters not that humanity

commits the insane folly of self-destruction; the infinity of force renews it without cessation, and man lives and multiplies in spite of his misery.

Humanity continues in virtue of the same energy that converts the grub into a butterfly, that develops the embryo in the bird's egg, that gives to plants their flower, and to the trees their fruit; the same energy that makes the water burst forth from the fountain, and lets loose all the terrors of the tempest.

Health is a case of the harmonious adaptation of the general law of mechanics.

CHAPTER VIII

NATURAL SELECTION—ARTIFICIAL SELECTION—PSYCHIC SELECTION

I. Natural Selection and the Struggle for Life

WHEN we reflect upon the great effort represented by an organism in its constant improvement, due to the general laws of matter; when we consider that this organism extends to form one whole with the organic world, whence all elements are derived; when we learn from the fruitful teaching of Lyell the periodic evolution of the earth; when we picture to ourselves how the latter spins along its ellipse with bewildering velocity; when we recall the perfect balance to which our little world is subject, we perceive the enormous amount of energy that impels us, the infinite power that holds us; and it seems the most natural thing that on this earth, thanks to universal mechanics, there should arise the chemical combination of man—a rhythm, in fine, of this indefinite harmony of force,

that, since the cosmos, continues to impel something reserved and internal, that attains to-day its maximum of progress in the human form, precarious it may be, but whose outlook is immense, in view of a boundless past and an illimitable future.

The whole theory of evolution in our planet is a very small part of this science of universal energy.

Medium, adaptation, selection, and heredity are, as it were, slight indicators that perhaps mark the tonality or beat ordained by time, in which this irresistible force is being developed.

Thus considered, let us see what is the value of natural selection, called by Darwin *struggle for life.*

Let us not forget that the theory of terrestrial evolution takes its origin from universal mechanics.

One of the things that has caused so much confusion and abuse is the somewhat unfortunate term given by Darwin to natural selection, as the *struggle for life.* This expression is so graphic and concise, and appeals so easily and widely to general imagination, that it was stereotyped immediately, absorbing and summing up, for most minds, the whole theory of evolution. So it happens that from a somewhat unhappy phrase, from that which was only one element to illustrate a theory, arose a series of errors, a false interpretation, which

reduces the whole theory of evolution to *the struggle for life.*

Apropos of this, I have selected some paragraphs from a letter addressed by Darwin to E. Haeckel on the 8th of October 1864:—

"In South America, three classes of phenomena made a great impression upon me: First, the way in which species closely related succeed and replace one another as one journeys from north to south. Secondly, the proximity of relationship of the species that inhabit the islands of the South American littoral, and those of this continent, a fact that caused me as much surprise as the great variety of species that live in the Galápagos Archipelago close to hand. Thirdly, the close relations that unite the toothless mammals and the rodents of that epoch with the extinct species of the same family. I shall never forget my surprise on disinterring some remains of a gigantic armadillo similar to that of the present day.

"Reflecting on these facts and comparing them with others of the same order, it seemed possible that the different species that preserve their relationship may very well have descended from a common ancestral form. But for several years I have been unable to understand how this form could also have adapted itself to such different conditions of life. I applied myself to the systematic study

of domestic plants and animals, and after a time I perceived perfectly that the most important modifying influence lies in the free choice open to man in selecting individuals for the propagation of species.

"Having often studied the mode of life and habits of animals, I was prepared to form a just idea of the *struggle for life*, being acquainted already, from my geological studies, with the vastness of bygone periods.

"Having read, therefore, by a happy chance, Malthus's work, *The Principle of Population*, I conceived the idea of natural selection." [1]

The title *struggle for life* is suggested by Malthus's theory of the law according to which aliments increase in arithmetical and animals in geometrical progression, and therefore a great number of those born are destined to die from want of nourishment. This law, however, offers great contradictions.[2]

Natural selection in the theory of evolution is an incentive that facilitates the predominance of this or that form, and the means of securing the victory to the most suitable, and, in the last resort, is a mechanical problem, for of two or more systems of conflicting forces the more powerful must prevail.

[1] E. Haeckel, *Hist. de la Création naturelle*, p. 119.
[2] *Ibid.*, p. 144.

Without these general conditions of force, tending to evolution, what would become of natural selection, deprived of the faculty that organic matter has of adapting itself to its medium? What would become of natural selection itself, without heredity?

Adaptation, selection, and heredity are the factors by which every organism is developed, and they are in intimate and direct dependence upon another great factor, medium, which in turn is bound to universal energetic. So that there is an immense difference between what is really the *struggle for life*, as one of the elements of evolution, compared with the enormous preponderance which usually is gratuitously ascribed to it.

The *struggle for life* of itself would be nothing, had it not, as inseparable complementary companions, adaptation and heredity; and these, in their turn, would not exist without the general laws of mechanics, which include equally crude matter and live matter. And this, which is commonly the key that claims to explain even social phenomena, passes on to a third term, as it depends not only on the cosmic environment, but is also subordinated to adaptation and heredity, and in its last term to the rhythms of force, from which start all initial energies.

Note the case of the Mexican axolotl, quoted

in "Adaptation," p. 27, in which these animals suddenly, without the intervention of any kind of *struggle for life*, change from aquatic, as they were, to terrestrial beings. I do not think there is a better example for explaining evolution and the relative insignificance of the struggle for life; wherefore I insist that the law of evolution is the same universal energy, and thus we can understand its true significance in each case.

This must not be forgotten, in order that we may not be led away by an argument of scientific nature but exaggerated form, for which, in the first instance, was responsible the phrase *struggle for life*, which is far from being comprehensive.

As the wrong interpretation of the law of the *struggle for life* has been much abused, and in order to illustrate my explanation, I will cite an example, the analogy of which will make my meaning clear.

A watch contains a number of parts that unite in forming a connected system to make the hands move. In order to set in motion the entire connection, one requires the initial force of the metal spring, the elasticity of which sets the watch going.

Applying the analogy to the domain of evolution, we may consider that the connected system is in this case the medium, adaptation, selection, and

heredity, needing also, however, for its motion an initial force, that of energy.

Well, then, in this *tout ensemble* of evolution, we will call one of the parts which go to form the system the *struggle for life.*

The progress of mechanical industry allows the watchmaker to perfect and adjust the system of connections, and to suppress or substitute one part for another more simple, lighter, and more precise.

In the system of evolution something similar may occur. Whilst the animal world cannot differentiate its psychic element sufficiently for man to make himself intelligent, this part of the connection which we have agreed to call *struggle for life* works in the system of evolution; but when humanity becomes intelligent and begins to practise artificial selection, as horticulturists and cattle-breeders have done for some time past, even before Darwin came upon *natural selection,* mistakes are no longer possible, since it is easy to understand that natural and artificial selection are the same part of the connection taking part in evolution: the one, coarse, brutal, and unconscious, peculiar only to the brute; the other, the same part polished by the work of the intelligence, that knows how to render it more precise and delicate.

The important thing, then, in sociology is not the struggle for life, but, on the contrary, *natural*

selection. Till now this last has only been tried with flowers, vegetables, and animals, because natural human discrimination has not extended further.

To complete the analogy of this instance, we will say that without the initial force there would be no starting either of the struggle for life in the brutes nor artificial selection for the man of the future; just as the watch would not go without the elasticity of the spring.

We think, therefore, that we can understand the true value of the law of the *struggle for life,* which is only a complementary, never a principal, factor, much less, as has been claimed, an essential one. The tragic aspect of this law, and its analogy to the struggle for life as far as concerns the human element, were the reason that the economists and writers on social science have allowed themselves to be led astray, and even ventured judgments and commentaries that do not apply to the biological meaning of the *struggle for existence.*

The first generic idea of the theory of evolution was held by Lamarck, who considered that all plants and animals descend, by successive development, from one simple ancestral form.

But note that, before Darwin spoke of the *struggle for life,* as a means of natural selection, man already practised what is called artificial

selection, and in such a manner that the means used by horticulturists and cattle-breeders for the improvement of their stock was what chiefly suggested the celebrated law to the clever English naturalist, as he himself intimates in his letter to Haeckel. The knowledge of how a gardener, a horticulturist, or a stock-rearer obtained in a short time species that differed from one another through newly acquired conditions much more than the natural species, taught Darwin that in Nature things would proceed on similar lines, although not so exactly, since man obtained a greater difference in an infinitely shorter space of time. Hence it is inferred, too, that the operation of artificial selection is much superior to the natural one, the *struggle for life*; that man disposes or accumulates his resources so that he does, in a comparatively short space of time, what Nature needs an unlimited period to perform. In a word, the selection created by man is very superior to natural selection, and the struggle for existence is a great spring in savage Nature, but always an unconscious means, and one that disappears before the efficacy of selection manipulated by man with the same object. Darwin studied the problem of natural selection so completely, with such wealth of data, and succeeded in showing that selection is a complement to adaptation and heredity, that his ideas triumphed, and

with them the theory of evolution. To give to the *struggle for life* a preponderance over the other factors of evolution is an error of conception and interpretation that gives rise in sociology to perverse and inadmissible conclusions.

The struggle for life only remains in force until man appears, and is a factor that does not count when civilisation begins. To claim the existence of a law with resources inferior to those employed by man to improve plants and animals, is to demonstrate so complete an ignorance of the subject as to provoke the derision of horticulturists and cattle-breeders. What can we say, then, of those who would apply the said law to man himself? It is quite incomprehensible that economists and their followers should mean that man makes use of a means of selection, of the principle of the *struggle for life,* which is an inferior method, solely to improve his pigs and garden stuff.

Organisms are perfected with all the greater rapidity the greater their differentiation. Thus man is more rapidly perfected, and humanity, as a super-organic organism, is incomparably more capable of perfection than all other beings, and all the more readily that he is infinitely more differentiated. Japan is an eloquent and convincing example of this truth.

Humanity is still the theatre of a mean and

brutal struggle, which perhaps may have some analogy with the struggle for existence in Nature; but it does not centre, however, as in evolution, in an indefinite perfection, that crowns its work with man. In the battle that is set on foot in human society, the result is not improvement, it is deterioration; its aim is not happiness, it is money; and as this is a restrictive means of enjoyment, one places man in the same situation as the wild beast; one makes him a selfish barbarian, or a coward and hypocrite, since, like the beast, he has to scent his prey, not knowing whether in future or to-morrow he will find his rations. So that natural selection, which in Nature is a means of improvement, in reaching man, in society is converted into an energy for ruining what he has done, which is an absurdity.

As one sees, it is only a shallowness of conception that has confounded what in Nature is a means of selection, the spirit of which was surmised by the sagacity of the great naturalist Charles Darwin, who gave it the name of *struggle for existence*, a law which they claim to apply improperly to social phenomena.

Psychic life guarantees physical life; intelligence assures animal life.

Plants or animals have a very limited correspondence with the external medium. The brute, by instinct alone, limits its relation to the atmosphere

and to a small portion of time and space; the animal consumes for itself, but produces nothing for itself in return, the moment of necessity arriving when its resources will be exhausted. In man the case is very different, since with intelligence his action extends considerably over time and space. Besides, the law of correspondence of the external to the internal, much more perfect in man than in animals, makes him the lord of Nature; he disposes of his natural forces, and constructs machines with which he multiplies his power indefinitely, and natural science offers him energies such as radio-activity. To sum up: man consumes as a unit, but has the productive power of a thousand. How can we thus think of the struggle for life? Can we compare the unconscious capital which the brute has at his disposal in natural selection, with the boundless capital—natural forces—placed at the service of man through his intelligence? Would not inquiry have been made of Malthus or his followers, now that his famous law has been the point of support of the pseudo-economists, in order to justify the unjustifiable? If sustenance increases in arithmetical, and animals in geometrical progression, in what progression does the intelligence increase, and the resources it creates? What is the meaning of intelligence? When will men understand the

meaning of what they carry on their shoulders? The perfecting of man consists in the perpetual improving of his intelligence, and this can be done only by a wise and methodical application that secures the correspondence of the internal to the external. Of what use could an unconscious force such as the struggle for existence be to humanity? Of only one: to justify its continuance in barbarism.

There are other contradictions, truly puerile. I refer to what in natural selection is included in the struggle against climate, inclemency, cold, storms, rains, or drought, and a thousand circumstances in which is brought into play, as one of the many factors, what we have agreed to call the *struggle for life.* It is man who can best support all climates; he is the only animal that has been able to adapt himself for life from the equator to the poles; considering man as an organism, and comparing him as an animal with all other animals, the advantage lies with man; but to stop at this sole comparison, forgetting the significance of intelligence, would be to incur an error like Malthus. Man conquers the inclemencies of climate, not only through being able to adapt himself to them better than all other animals, but chiefly because his industry provides him with shelter against the rigours of cold, rain, etc. The proof of this is that it is not the healthiest countries that have the best

climate, but the most intelligent, that is, those in which industry hygienically applied favours the life of man. There are temperate zones, enjoyed by nations like Spain and Turkey, in which the climate seems ordained to form the life of man under better conditions than in cold and moist climates, as is the case in Sweden and Norway; and yet quite the contrary is the case, since the latter have less than half the mortality of the former. Then, the *struggle for existence* is all the less applicable in the matter of climate since the proof is to the contrary—the worse the climate, the greater the vitality. Nature affords us, thanks to intelligence, every possible means of resisting inclemency; but, on the other hand, society does not give us the means, resources or money, to protect ourselves against their severities. Human beings killed by misery, hunger, unhealthy conditions do not fall victims to the *struggle for life*, but to social organisation, which is more stupid than selfish.

Economists are the chief culprits in this matter, with their senseless application of the *struggle for life*, because, being ignorant of the spirit of the natural laws, they have taken *capital* as synonymous with *nourishment* or feeding-grounds, and thus, subject to a limited means, such as money, a struggle of humanity, similar to that of the *struggle for life* in Nature, is possible.

There is another essential difference that brings into relief the great antagonism this law implies when applied to sociology. In animals and plants it is a factor in their improvement, and therefore has its justification, and the end of its operation is to assist the appearance of man upon the earth.

In society, as it is organised, it constitutes the only, or at least the primordial, end of life, the accumulation of wealth. This is the key that opens all doors, and with that view all intelligences are awakened, all incentives are aroused. Thus, according to the law we are discussing, a selection will be made; but when applied to the amassing of wealth, perfection will only be attained by those best adapted to that end. That this neither is nor should be the final aim of man upon the earth, all the world knows; but of all those very persons who have succeeded in amassing capital and who live and die victims to their efforts, being as unfortunate as the rest, and leaving an unlucky offspring—Maudsley says that the sons of men who have made great fortunes by dint of sacrifices and fatigue are degenerate, the miserable issue of those who are now called heirs of weariness, afflicted with neurosis, a disease in direct conflict with the selection that the *struggle for existence* implies.

On the contrary, the law of evolution teaches us

that the formal object of humanity is constant progress ; that this is only acquired by the best adaptation of the intelligence to Nature, in which man has an inextinguishable treasure for the increase of his well-being, and that in this progress will be found true happiness.

To resume, Darwin's so-called *struggle for life* is not a law applied to man, for it is not possible that intelligence for its development should make use of an unconscious expedient, and one that man does not use even for his animals. For man by his method of artificial selection commands much more easily the plastic nature of organic matter, giving to animals the fat, the flesh, or the bone that they require, according to the needs of trade; and he changes or modifies at his whim the primitive form, obtaining types as different as those of the thoroughbred racehorse, with its special anatomy and physiology, and the Suffolk punch, which is quite another type. With dogs he has obtained as much—veritable marvels of form and fitness beyond the wildest fancy. It is therefore an absurdity to think that the *struggle for life* is a principle applicable to humanity, when man in this case triumphs over Nature.

In wild animals the struggle for existence is an incentive to favour the survival of the fittest, but this incentive loses much of its importance when

one remembers that the initial energy resides already in the organism as its essential condition, and that, without this activity which binds it to the universal mechanics, the influence that at stated times urges the creatures to the *struggle for life* would be impossible. The famous law is a factor of value only in the rude state, and that as an element, though not the chief one, in the system of evolution. From all this one infers that far greater weight has been given to the principle of the *struggle for life* than it really possesses, and that it has been much abused in interpreting it, and wishing to apply it to humanity, since Darwin only thought of animals and plants in a primitive state, and as impelled to what man performed by artificial selection.

I have shown that the part that is attributed to the *struggle for existence* in society is due to the analogy to which we assimilate the wish to consider money as synonymous with nourishment or feeding-ground; and that, as both are limited terms, the struggle for the possession of money is analogous to the conflict maintained by animals for their feeding-grounds, with the sole and chief difference that what serves to help in animals their improvement or selection, for want of a better, in the human species turns out quite the contrary, because in this case money is not such a method of selection; on

the contrary, the wish to prove the prevalence of this law in sociology would be tantamount to ignoring its spirit.

Natural selection has its initial force in the science of universal energy.

II. Artificial Selection

This selection alone has importance in these points, namely, that it may be better understood how man manipulates the plastic nature of live matter, and in what way he changes its form and structure, in obedience to a fixed plan and aim.

I will cite some cases in which one sees clearly how man modifies the form and substance of animals when and as he wishes, increasing or diminishing the skeleton, muscles, or fat, or rather increasing the length and quality of the wool, and in others the quality of the milk, and still more, modifying even their moral conditions.

The breed of Mauchamp sheep has an origin that proves to what extent man can avail himself of artificial selection. On an estate of Mr Graux, at Mauchamp, where a flock was being reared, a sickly, misshapen ram was born; but it had as a set-off a fine, silky, long fleece. The owner understood the full importance of this fact, and took the

greatest care of that specimen. Having reached the suitable age, he used it for breeding purposes, and by successive skilfully selected pairings he succeeded, after several years, in obtaining a healthy flock, but with the same excellent wool of that sickly, rickety ram.

Robert Bakewell, in Leicestershire, was the creator of the breed of Dishley sheep. He reduced the carcase of this sheep, and in exchange increased its flesh and fat considerably, so that when one of these animals falls it is necessary to raise it. They add to these qualities, acquired artificially, a great propensity for fattening, that is, they attain the maximum development in the shortest possible time.

In the Durham breed of cattle, the brothers Colling have achieved the same result, obtaining veritable flesh-making machines.

The thoroughbred horse is a wonderful creation—all the more if compared, as an artificial production, with those already cited. Here selection has been entirely on opposite lines; in it the two extremes of the breed of cattle on the one hand, and the single-hoofed animal on the other, are represented.

Thus it is demonstrated how life yields to modification by the hand of man to form two kinds of energy, in one of which figure the flesh-producers, in the other, specimens of great speed.

The dog offers another clear proof of the same problem.

Take the following apropos of moral conditions: Lord Oxford had some greyhounds that would have been excellent had they possessed the necessary energy and staying power; and to give them these qualities it occurred to their owner to cross them with the bulldog. The result of this crossing was that at the seventh generation the greyhounds recovered their lost form, and besides gained the pertinacity of the bulldog.

On this point Victor Meunier says as follows:—"Thus pertinacity is given to a breed of dogs, as to a breed of sheep fine silky wool, or as a breed of cattle is deprived of its horns. An animal can be shorn of its moral qualities as a plant of its essential principles. The former, as the latter, are obtained in a pure state, by isolation, separation from the mass of matter in which they are. Real extracts are obtained: *extract of energy*, *extract of perseverance*; the desired effect is furnished and obtained. Has science produced anything more wonderful?

"I do not wonder so much at the fact as the future that it promises."[1]

I take these cases of artificial selection as demonstrating how man might attain self-selection,

[1] *Selection et perfectionnement animal.*

taking into account that organisms are rendered more perfect, and in a shorter time, the greater their differentiation. And let it not be forgotten that man was, is, and will be the most perfectible of all animals.

Natural and artificial selection receive their impulse from the same energy that causes a simultaneous renewal of all vegetation in the spring, and natural selection lost all its importance when civilised man began to practise artificial selection. As for psychic or intellectual selection, it is enough to enunciate it to understand that it does not exist, and never has existed, but that it is the selection of the future.

Consequently, it follows that Nature has practised and does practise natural selection; that man employs artificial selection for plants and animals; but, on the contrary, psychic selection is entirely to be initiated, it being an absurdity that man has devoted himself to improving his kitchen garden and his cattle, and has done nothing whatever for his own selection.

Social organisation, past and present, is what is called a false evolution, that is, has no possible development or solution, and, deviating from natural laws, constitutes an absurdity. Man is an exception to all biological laws; he has not the organic adaptation that allows of his complete enjoyment of

health ; neither does he manifest psychic adaptation, since he has only lately begun to study Nature and to understand that intelligence is the result of conformity with natural facts. Man cannot, therefore, put into practice the law of selection or the law of heredity, which are natural consequences of adaptation, due to his having deviated from the natural course of things, and to the fact that, the present conception of property not being a natural law, its finality and true significance in nature are changed, and there arises the series of monstrosities and absurdities that we all see and condemn.

III. Psychic Selection

It is enough to enunciate it to understand that it does not and cannot exist : psychic selection requires, in the first place, psychic adaptation, and that this may continue to be selected and transmitted by heredity, the individual must be *healthy.*

Society has never concerned itself with the rational cultivation of the intelligence, for until lately it was ignorant of cerebral structure and physiology. Imbeciles, criminals, or madmen are cases that denounce the stupidity with which man deals with the noblest of his faculties. These are cases that ought not to be, and will not exist when society is established on a normal basis.

Men of genius should not be considered simply as exceptions, but, on the contrary, as a witness of what intelligence is capable. This is still a virgin soil, in which everything has to be created. Remember the opinion of Ramon y Cajal to which I referred above (p. 96), in which he says that the human brain is still in full evolution by the progress of its psychic neuronas, whether in number or quality, and we shall understand that, if human ingenuity left to its own resources has accomplished such wonders, of what would it not be capable upon the development of all the powers of which it is susceptible? Happy the humanity that comes to see the day when the brain is cultivated by a proper adaptation, and is selected and perpetuated by heredity! This, which for some primitive brains incapable of the smallest induction appears a Utopia, is as certain as that by means of the cultivation and selection of flowers have been obtained species incomparably more beautiful than the natural ones.

In the second part I shall deal with psychic selection as one of the indispensable biological conditions for the progress of super-organic evolution; it will suffice for the present to know that not only it does not exist, but that in a society organised like the present such relation is impossible.

We shall now better understand what I have said above, that in sociology alone can one treat of artificial and psychic selection; that to interpret humanity as availing herself of the *struggle for life* is a grave error, so far as it concerns the interpretation of the spirit of the law of evolution.

CHAPTER IX

THE CONFLICT OF CLASSES AND CONCEPTIONS OF EQUALITY

CHARLES DARWIN'S *Origin of Species* and Charles Marx's *Criticism of Political Economy* appeared almost at the same moment.

The former helped to interpret evolution, with its law of the *struggle for life*; the latter gave the economic interpretation of history, with its law of the *conflict of classes.* One cannot but wonder that both coincide in the term *struggle,* impressed upon their respective laws; but knowing that the perusal of Malthus's book gave Darwin his ideal, the thought strikes one that Marx may have yielded to the same suggestion. Presumably, too, the faithful interpretation given by Marx of economic evolution through the conflict of classes has influenced in its turn his claim to extend the law of the *struggle for life* to sociology, when one considers that, if Marx's law is accurate in economic interpretation, Darwin's is not in extending it to

society. Those who have applied it to sociology have been guilty of a false interpretation.

Nature has a logical mode of procedure which gives regularity to phenomena, and therefore it is possible, by examining a series of facts that form a system, to establish a law. The struggle for life is inspired or inferred from a chain of observations of Nature, and therefore is only applicable to natural causes, but not to present society, in obedience to an organisation that turns or evolves entirely upon one base, recognising no law or natural principle, but an arbitrary principle, contrary to natural law, as is the case with *capital.*

In saying this, and not recognising as a natural right the right of private property, I am very far from saying with Proudhon that property is robbery. I think that, in view of present social organisation, humanity could not be otherwise than it is, but that of necessity it must be selfish, a conception required by the possession of property. Property is absurd, though it be not robbery; and legal, though it be not legitimate. Humanity, that has for ages accepted private property as *natural,* believes in this conception as an article of faith. Religions, philosophies change, are modified, or disappear whenever new ideas, fairer or more logical, can take their place, and this is the

meaning of Comte's proposition that everything that is destroyed finds something to take its place. Religions and philosophies have succeeded one another, whereas the economic questions, those of capital and labour, seem to have in human consciousness deeper roots, since they endure, whilst around them gods and genii are born and die, rule and disappear.

I do not consider that any class has the right to tell men of this or that religion or philosophy different from our own that they are liars, because the ideas that form their social ambient crystallise or mould the cerebral structure precisely as their chemical composition modifies the form and structure of crystals. No; ideas obey the law of inertia, as rocks, and if humanity does not advance or prosper, it is because the number of inert brains is very much greater than the active ones, and the balance inclines always to the side of the greater weight. Revolutions spring up and inevitably triumph when ideas, the force of some brains, overcome the inertia of some and the indifference of the mass. The progress of humanity is in direct ratio to the force of ideas.

The economic question has resisted the shocks of time and revolution, because the formula of the future has not been established. If the economic question is as ancient as the world, sociology, on

the other hand, is a science of yesterday, because it is a branch of the science of biology, as this is, in its turn, of the physico-chemical sciences, and it was necessary that the former should progress that the latter might follow.

Sociology has not yet had time to be integrated in the great law of evolution. Neither A. Comte, the true founder of sociology, nor H. Spencer, who has completed the best synthesis, has succeeded in interpreting this new science as a stated theory, simply because their brains could not dissever themselves from the dead-weight which the conception of property, accumulated during so many years, represents in the human intelligence.

I do not think more can be said than what Marx has stated, as to his criticism on capital, nor that human aspirations will find their solution with the capitalist or collectivist system; I have therefore asserted, in reference to this period of evolution, with which all this economic organisation is concerned, that it is a false evolution, like some that exist in biology, and that they will ultimately disappear, when the time arrives when their conditions are inadaptable to their surroundings.

"Other false groups," says Laloy, "are those which, after rising to a fixed organic level, return to the state that their ancestors had long abandoned. We have already quoted the example

of snakes that lost their paws, having to return to creeping. Others, mammals, suited to a terrestrial existence, have again lived in water, by undergoing more or less serious modifications, while preserving their lungs; such are the web-footed (seals and walrus) and the cetacea (whales, cachalots, etc.). The former are marine butchers united to real butchers by means of *Lutra vulgaris.*"[1]

The economic conditions of life have divided men into shepherds and warriors, patricians and plebeians, burgesses and proletariat — that is, divisions dependent on the age and ignorance; from which it happened, and happens, that the lesser part of humanity lives at the expense of the other part; whence arises a very natural antagonism, that constitutes the *conflict between classes.* This antagonism is not the fruit of perversion but of the errors of the age, and if they have not been remedied before, it is not for want of will, but because we were not, and are not, acquainted with the mode of accomplishing this change; and proposals up till now are vague and confusing, as no clear image exists of the society of the future.

But on the day when such a vision shall exist, the day when the majority of mankind will be able

[1] Dr Laloy, *L'évolution de la vie*, p. 223.

to perceive what it is and how it can be effected, then, just as one religion has substituted another, and one philosophy another philosophy, to our present misery will succeed a happier state. To improve, and to free oneself from such misery, is a constant longing. Scepticism and pessimism are due to the painful expectation of times dreamed of but unrealised; but humanity desires nothing else but guidance towards a new life, and in its eagerness for happiness to arrive at a better solution.

On saying this, we must not forget what has already been said in the Introduction apropos of routine, namely, that there will be a great number of brains in which the peculiar ideas they inherited from their ancestors never allow of their reaching a conception of a situation differing from the present, because the associations formed by the protoplasmic elongations of the neuronas are still invariable, and it will not be possible for them to form another chain of associations in order to adapt new ideas. It is useless to rely upon these brains, not from ill-will, but from lack of ability to adapt themselves.

This, far from being an inconvenience, will be an advantage, since they will be accepted only by those possessed of an appropriate temperament or education; that is, there will be a selection, the

selection of disinterestedness and that of the most active brains.

In the society of the future the man who obeys no other motive but that of his own dignity, and who cannot feel the solidarity of the organisation under which he lives, so far as to take advantage of nothing that does not redound to his own gain, will be a superfluity, and will constitute a stumbling-block. He is quite content with present society, and it is useless to convince him. For that of the future he would be a hindrance and a source of disturbance.

When capital disappears, the conflict of classes will disappear also.

Men cannot be equal in intelligence, nor in taste or ability, and in these differences progress chiefly is found, since the different conditions will cause the formation of new organs in the super-organic organism, in order to assist progress by differentiation, which is a biological law of all organic progress; thus there will be painters, sculptors, musicians, writers, as well as chemists, physicians, engineers, naturalists, etc.

What may be admitted scientifically, and will no doubt happen, is that man, in time, when really healthy, will attain a degree of intelligence of a very high order, and that intelligences, generally considered, will approximate one another in value;

that then the organisms of the engineer, musician, painter will be more differentiated from their respective advance in each of these lines; and thus what man will have gained, on the general intellectual plane, will be differentiated by his especial aptitudes being still more pronounced: the painter will be a better painter, the musician more musical, the engineer more expert, and the intellectual level will be rising indefinitely.

So that, if difference in intellect or ability is a necessary means of progress, there will be, however, another condition that will make men equal, in order to feel more thoroughly their solidarity, namely, education.

Politeness must rise to the level of art; in a society in which there is no restraint but that of one's own or another's dignity, respect for others must be absolute, and relations between individuals must be those of perfect courtesy, which is the artistic part of education. Scrupulous cleanliness of person and care of dress must form part of a sound discipline, the sole condition upon which men can and should be equal, and one which, after economic distinctions, will eliminate class distinctions. This is the more easy to understand, that we see every day persons of humble station who, by their bearing and manners, seem to be a privileged class; and, on the contrary, persons

who by birth should be models of correctness are by no means so. There are other arguments which are too obvious to allege.

Whilst psychic adaptation will help to make men every day different, and to carry on the work of *selection* according to their capabilities, education will every day make them more equal and united.

I cannot define, nor does it concern us to know, why the claim is advanced for the social equality of the mankind of the future: it seems to me such statements are made and repeated without anyone taking the trouble to reflect upon them. Some superior spirits, naturally scandalised by such a utopian idea, speak of this equality, but go no further than to pass slight comments upon it. The claim or statement that men can, or should be, or wish to be equal, is as great a physical impossibility as the impenetrability of bodies. Men never will be equal, as that represents different stages in the development of force at different points of time and space. It is impossible that men of southern and northern parts should be equal; the man born by the sea-shore will not be the same as he who is born at the top of a mountain, since, *inter alia*, this assumes a different mode of life, of sustenance, of scenery, etc.

And remembering what has been said of psychic adaptation, how could it be possible that in the

infinite variety that Nature presents homogeneity among men is conceivable? Nature, becoming ever better known and revealing herself under new and varied aspects, must lay under contribution all human brains, as one, in order to deposit a note of her infinite harmonies in each separate part of thought—a note that will be different according to time and space; that the note of day will not be that of night, that of to-morrow the same as that of yesterday, that of yesterday and to-morrow as that of to-day.

Cerebral structure yields to and combines with the model of Nature, as water to the form of the vessel that holds it. The progress of human society, as we shall see elsewhere, consists chiefly in the continually increasing differentiation of intelligences, which will imply a greater correspondence with the external. By the ever-widening differentiation, however, of mankind I do not mean that they are therefore any less consolidated, but, on the contrary, will feel more united, since the same solidarity that exists in the natural laws will exist in their own consciousness, the outcome of such laws.

Intelligence will end by adapting herself to Nature, allying herself to, and even confounding herself with her, as our planet is surrounded and impregnated by the atmosphere that encloses it.

The human species will be more uniformly beautiful in form, but infinitely more varied in its adaptability, and ever more *One,* until there is only one feeling and loving being on the earth across the bounds of time and space, perceiving all vibrations of the ether, to translate them into ideas, the supreme law of our nerves.

Economic conditions are not limited to producing the conflict of classes, but, as we have seen elsewhere, change the health, at their will; hence come other divisions, which, like the former, recognise the same origin. Thus there are strong and weak, stout and thin, tall and short, happy and sad, intelligent or imbecile, criminal or mad, tuberculous or arthritic, etc.; and this great variety is due to the changes which every loss of strength imposes on formula N, causing its degeneration and deviation from its normal equilibrium.

When the economic question disappears as the basis of present society, then men will be healthy, organic and psychic adaptation will be fully realised, and man will reproduce the harmony of the natural laws without one single exception.

CHAPTER X

HEREDITY

When the sea is calm one sees in the sand near the shore the same undulations that ripple the surface of the water, that in its turn reproduces the undulation of the air that strikes and blows upon its surface. We cannot test the undulations of the air, these not being sensible to the touch; but their impression on the water or the sand is readily perceptible by the organs of vision. Here sight is an amplification and complement of touch, just as the microscope enlarges the power of vision.

In the same way every organism, crystal, plant, or animal reflects, like the sand of the sea, the impression that the indefinite rhythm of universal mechanics makes on every organic substance. Men cannot perceive the rhythm of this mechanics any more than the rhythm of the undulations of the air on striking the surface of the water. But as observation reveals to us in a thousand instances this concomitance of undulations in sand, water,

and air, we cannot doubt its mutual relationship, any more than we can doubt the relation of the cosmic medium, in which all rhythms vibrate, in its relation to organic substance. Organised beings reproduce the rhythms of indefinite mechanics, as the sand reproduces the air rhythms as it glides over the sea. From the infinitely small to man, is constituted the crescendo of a rhythm.

Our senses unfortunately cannot register all movements. Thus the sight can perceive only colours the vibrations of which are capable of being felt, such as those that come from the red to the violet, forming part of a great scale of forces, vibrations, or rhythms that keep increasing from the red, that represents the heavy waves, to the violet, that presents the maximum of vibrations perceptible by actual beings. Beyond the red and the violet follow other rhythms, which are also energies, and would be, perhaps, so many other colours if our sight could perceive them. The cathode rays represent a rhythm of such rapidity that it crosses the majority of bodies without being reflected, and the colours are perceptible, because their light is reflected.

There exist, then, an infinite number of rhythms that man cannot directly perceive, although subject to them. Man, as an apparatus or receiver of natural energies, has a very limited field of action,

and therefore the progress of the physico-chemical sciences has been necessary for man to increase or enlarge his senses, which he has attained, in the matter of sight, by the use of the microscope and by spectral analysis, which allow him to extend his knowledge of things from the infinitely little to the infinitely great.

The thermo-electric pile enables man to appreciate changes of temperature that appear unlikely ; add the searching powers of chemistry, which is capable of perceiving and discovering substances even in infinitesimal quantities. One must consider all these resources as extensions of man's senses, thanks to which he has found means of gathering all these energies in order to marshal and exploit them, and which, from their being beyond his sphere of action, seemed foreign to human intelligence. Who supposed some years ago that, among the multitude of rhythms that exist in the atmosphere, there was one of which man would one day avail himself in order to transmit his thoughts to a distance ? If this is now only the beginning of new discoveries, what will be the limit of human progress ?

Whilst man had no means of observation beyond his own senses, the world for him was very limited, and his intelligence, that counted upon no further resources, was also restricted. The instruments of

physics and chemistry, by narrowing the field of observation and increasing the registering power of the senses, have enlarged the intelligence; and if, whilst man was ignorant of these resources, his intelligence could be considered sadly limited, now that his new means of investigation have no precise limits, but continue to increase from day to day, we may affirm that the intelligence of man, his psychic cells, as Ramon y Cajal calls them, will continue every day and in the same measure to increase and register with the greatest precision his relation with the external; in the same way errors will be rectified, and in this indefinite progress we see neither the goal of intelligence nor the limit of Nature, and the parallelism or agreement of the internal with the external will last for an indefinite time, and with ever-increasing accuracy.

By all these methods human consciousness will continue to perceive and reflect all the rhythms of universal mechanics, while Nature reproduces her organisation, as the sands produce the undulations of the air as it glides over the water, as the clear or stormy sky is reflected on the surface of the sea.

In the time of Linnæus it was thought that the conception of *species*, animal or vegetable, was somewhat invariable and absolute. Linnæus said: "There exists a number of species equal to those that the infinite Being originally created."

Lamarck, Bory de Saint-Vincent, and, above all, Darwin, who reproduced and made complete the idea of his predecessors, entirely modified the idea of species, admitting, according to the theory of transformism, that all beings come from one simple ancestral form. To-day the denomination of species is admitted into natural history as a conventional and relative value.

In chemistry the same thing is going on with the so-called elements or simple bodies, which, until a short time ago, were considered the definitive term of matter. As things are going, there will soon happen in chemistry what has happened in natural history : we shall return to the old conception of the transmutation of bodies. The transformation and equilibrium of force includes, as a necessary corollary, the transformation and equilibrium of matter, since force and matter form one unity, are two complementary terms.

Evolution, in coming to consider matter in all its varieties as proceeding from one and the same substance, has already its predecessors, as in zoology and botany before the complete theory of transformism appeared.

See what Sir William Crookes says of this in *The Genesis of the Elements* :—

" When I venture to state that the elements generally accepted as such are not simple and

primordial, that they are not the offspring of chance, that they are not an isolated creation, but have sprung by evolution from simpler materials, or perhaps from one single species of matter, I formulate an idea of which it may be said in the scientific world that it is an idea that has long been in the air. Some of the most intelligent chemists, physicists, and philosophers proclaim explicitly their belief that the seventy elements now recognised by chemistry are not the columns of Hercules, which were once thought the limit of investigation."

Almost at the same moment when Darwin published his theory of transformism appeared, in 1863, a classification of bodies which may be regarded as the first attempt to show the continuity of matter; that is to say, how one chemical element differs from another, in the manner of a rhythm, of something that recalls what we have quoted apropos of music, in which all the sounds start from one initial "do," the others being, as it were, a periodical function of this unity, equivalent to 128 vibrations per second.

To Beguyer de Chancurtois is due the first attempt in chemistry of a classification of this kind, which consists in arranging simple bodies in the increasing order of atomic weight, so that they describe a screw, which the author calls "teluric

tornilla." This first attempt was followed by the table of Mendeleef, which, as the reader will see further on, is the revelation and hope that we shall soon see the demonstration that those which are now known under the name of simple bodies are the evolution, the rhythmic development of one single substance—that, for example, which Crookes indicates by the name of protilus, similar to what is called protoplasm in the organic world.

Note what A. Étard[1] says in reference to the table of Mendeleef:—

"It is noticed that bodies are ingeniously distributed in a constant series, but in groups of seven, forming vertical columns, I., II., III., IV., ... in which the elements present a maximum of similarity, reproducing the classification in families of Dumas: Fl, Cl, Br, I, etc.

"Studying the bodies, following the order in which they are placed in the vertical columns, one observes that they are characterised by the formation of a typical oxide. The metals of the vertical column I., for example, give the oxides of the type R^2O and are, following the order of said column, Li^2O, Na^2O, K^2O, Cu^2O, Rb^2O, Ag^2O . . . . These are the monatomic metals."

The same thing happens in the other columns, in which all the metals included in each one of them

[1] A. Étard, *Nouvelles theories chimiques.*

TABLE OF MENDELEEF

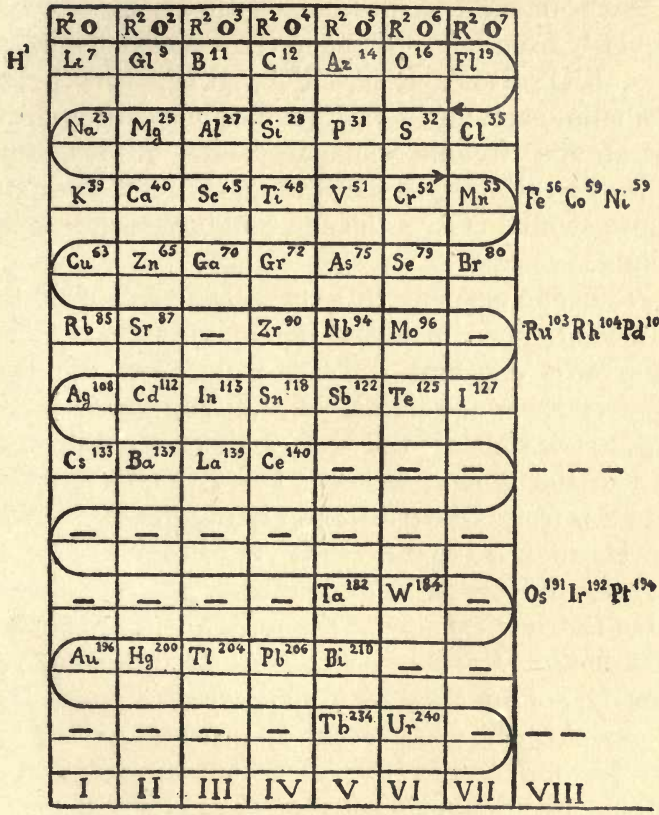


FIG. 21.

combine with oxygen, according to the typical formula, R^2O^2, R^2O^3, R^2O^4, R^2O^5, R^2O^6, R^2O^7; that is, the elements of one and the same column form

combinations whose power of oxygenation is equal in each one of them, and continues to increase regularly from left to right in the vertical columns: thus, R^2O^2, R^2O^3, R^2O^4, R^2O^5, R^2O^6, R^2O^7. The symbol of each metal bears a coefficient to indicate its atomic weight, compared, as always, with hydrogen; thus we see the first metal, lithium, whose symbol is Li^7; the seven indicates the atomic weight.

From one element to another, and following the columns that are arranged horizontally, there exists an almost constant difference between the consecutive atomic weights. From Li, which is the first, to Gl, which is the second, there is a difference of 2 in the atomic weight: Li = 7 to Gl = 9, difference 2; from Gl = 9 to B = 11, difference 2; from B = 11 to C = 12, difference 1. From C = 12 to Az = 14, difference 2; and so on.

On the vertical side of the table there are similar differences. From Li = 7 to Na = 23, difference 16; from Gl = 9 to Mg = 24, difference 15; from B = 11 to Al = 27, difference 16; from Al = 27 to Sc = 45, difference 18. But this apparent consistency in differences between the several elements is not always complete. One part of the table is subject to a net, formed by regular lines, and if at the crossing of one of these lines—for instance, between Ga = 70 and In = 113—there is an un-

expected difference, equal in this case to 43 units, it is because in this interval one fails to discover a simple body. When the illustrious chemist Mendeleef published his table some bodies were unknown, such as Sc = 45, Ga = 70, and Gr = 72; but he had foretold their discovery in describing their properties, and having already marked in the table the appropriate places.

On studying Mendeleef's table one sees, both in the vertical and in the horizontal order, bodies are arranged regularly, and each element has systematically its destined place: this is truly wonderful, and one understands the great success this table obtained on presenting all the simple bodies in an ordered plan. Now, this can only be understood by the rhythm of force, here quoted to prepare the reader's mind, so that, by means of an analogy (since it is not possible at the present stage of science to give a proof), we may understand that in organised bodies there also exists a rhythm, and these beings, like simple bodies, are reproduced under the same form, because, as in Mendeleef's table, they also have their place and rhythm marked. Simple bodies and all organised beings are the concrete form, the potential force, the echo, as it were, of that other living force whose rhythm they reproduce, as the sands the vibrations of the air. We regard embryology and comparative

anatomy as a demonstration of the rhythm that governs the animal world. Sons are like fathers because they are notes of one and the same rhythm, and the rhythms are repeated under normal conditions.

In spectral analysis are shown the same rhythms, for not only has each body its lines regularly invariable, but in some spectra, as in that of hydrogen, the disposition of their lines is according to a formula of perspective.

To further justify what I have said—and what still remains to be said—I am about to refer here to the diagram of Sir William Crookes.

This professor says in *The Genesis of the Elements*: "I must crave your attention to my diagram, in which I have slightly modified the primitive tracing of Professor Reynolds. I have represented the oscillation of the pendulum decreasing gradually according to a mathematical law. Moreover, I have interposed between cerium and lead another semi-oscillation of the pendulum, which makes the oscillations more symmetrical and brings gold, mercury, thallium, lead, and bismuth to the side where they are completely in harmony with the elements of the first group.

"The chemical elements are arranged, according to their atomic weights, on a central vertical axis, equally divided.

TABLE OF SIR WILLIAM CROOKES

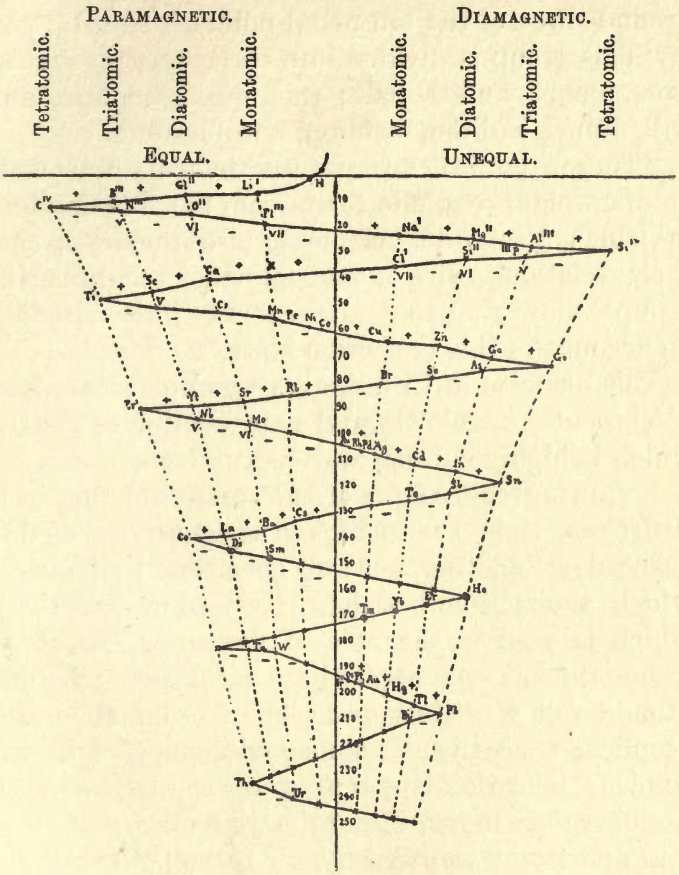


Fig. 22.

"Following the curve from hydrogen along the zigzag, one notes that the elements that form the

eighth group in Mendeleef's system [1] are situated around three of the ten nodal points.

"This group is divided into three ternary series: iron, nickel, and cobalt; rhodium, rutenium, and palladium; iridium, osmium, and platinum.

"These bodies are interperiodical, for their atomic weights exclude them from the short periods in which the other elements are included, and their relations with some of the neighbouring groups show that they are probably interperiodical on account of this transition state."

This diagram of Crookes is very explanatory, and discloses the regularity and real function of matter, which is highly curious and instructive.

Following the course of the screw, starting from hydrogen, it is surprising to see how the bodies succeed one another, not only according to the order which their atomic weight marks out for them, which is seen in the axis of the screw, but at the same time keep appearing according to their atomic values. Thus proceed in order the monatomics; then the diatomics, triatomics, and tetratomics; following the curve of the screw, their atomic values increase, and the triatomics, diatomics, and monatomics appear, so as to stop, in this flux

[1] This group is outside of the said table, and includes Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, forming three groups that answer to the second, third, and fifth horizontal columns.

and reflux of atomic values, the monatomics, which are always in the centre of this movement, from which spring, on each side of the axis, four columns that from the centre to the circumference appear ranged in the order of their atomic values. Note the original arrangement of those that are positive and those that are negative bodies, those that are good and those that are bad conductors of electricity, the former being on the right, the latter on the left.

This new aspect of crude matter, subjected to a periodical working of force, acquires new life and significance. Comparing this aspect of the inorganic world with the aspect under which the organic world reveals itself in transformism, one better understands the law of evolution. Everything appears as a function of an infinite unity. The tables of Mendeleef and Crookes recall the classifications of natural history. In comparative anatomy and embryology, in phylogeny and ontogeny, marking the different times and methods in which the cellular organism comes to be transformed into human organisms, we seem to see one of the above-mentioned tables, that of the organic world being much more mysterious, but no less regular.

And Sir William Crookes adds further: "The more I study the arrangement of this zigzag curve, the stronger is my conviction that the man who

succeeded in discovering its complete signification would possess the key to one of the greatest mysteries of creation."

Nature reveals herself as a harmony from the mechanics of atoms to the mechanics of worlds; but human society, the super-organic organism, as to-day constituted, is an exception to this universal harmony.

Organisation is a special rhythm of universal mechanics. From the amœba to man there is a force that is ever adapting and rendering itself more complex; it is a variable quantity that every day becomes more constant, ever progressing by virtue of its dependence upon and relation to the cosmic environment.

Vegetable and animal organisation has its unity, its "do," whence is derived in ever-increasing complexity all this great harmonic organisation, that passes from organisms the most elementary to man; just as in mathematics all the endless combinations of quantity are also a function of one unity.

Let it be noted that, though we speak of adaptation, selection, and heredity, strictly these three things constitute one single one, that obeys another still greater, on fixed principles, to which they are absolutely subject, namely, universal mechanics.

Selection is an adaptation most pronounced, and heredity is the continuity of the same adaptation: so that the great problem of evolution is reduced to two terms, *adaptation* and *medium*, which is the parallelism through which it happens that all organised beings are the reflex, the echo of natural mechanics. Without light, sight would not exist, as without sound there is no hearing. The bronchial tubes, divided and subdivided in order that the blood and air may effect the necessary contact, obey the same principles by which the roots of trees cross large tracts of land in order to reach water.

So long as the cosmic medium, upon which the world in which we live depends, undergoes no change, as little subject to change will be the organisation of the bodies that depend upon it, for they are its natural and direct consequence.

Animals on reproduction repeat the same form and structure, in the first place because the same conditions persist in the medium; because the parallelism is the same, the rhythm continues, and they continue as the faithful reproduction of universal mechanics. Medium and organisation are two terms that are reinforced by a parallelism of millions of ages, whose energy obeys the principle of continuity and rhythm of force.

Silk, which constitutes a most important industry,

not only depends upon the worm that elaborates it, but on the mulberry tree that serves as its nutriment; if this tree disappeared, the said worm would disappear, and with it the silk and its industry, and ladies' dresses would be less attractive. If the earth approached nearer to the sun, or, on the other hand, went further away, man would at once be changed, as well as all earthly organisms, those only surviving that were able to adapt themselves to the new conditions; organisation then perhaps would immediately reproduce the new forms peculiar to the new conditions of the medium. Heredity and adaptation are one and the same thing; in each generation the same organisation is inherited, because the adaptation to the medium is the same, and both existences are similar, because they reproduce organic rhythms that serve them as guide and master.

To regard heredity, selection, or adaptation as one and the same essential phenomenon, brings about a simplification and better understanding of biological phenomena.

All the organisation cannot be formed by a single being, constituting a single conglomeration, just because it obeys natural laws, and rhythm is an essential condition of force. Thus, as each colour or musical note represents a fixed number of vibrations, without which the sound would not

exist, nor the light and colours, so beings, on reproduction, obey the rhythm of force, and each being is a vibration of the rhythm to which it owes its origin.

Nature reproduces indefinitely plants and animals just as the sea impels its waves. From the infinitely small to man, there exist as many classes of rhythms as of organisms.

Bearing in mind what I have said in speaking of health in its relation to the general laws of mechanics, man, in order to live in a normal medium, will keep the equilibrium of his harmonic cellular mechanics in consonance with the laws of universal harmony, and the sons will reproduce the same equilibrium of formula N as their progenitors, for they will be the reproduction of the same force, adjusting itself to the same rhythm.

Man is born, lives, and dies in a limited portion of time and space, since he represents only one vibration, like other rhythms destined to vibrate and die away, being subsequently renewed in the universal energy.

In the present state of social organisation, among the members of which formula N (A, B, C, D) is altered, the children are ever tending to modify and lose the parent form, until in many cases, as in certain families, in the third or fourth generation they are either not reproduced or die off prematurely.

In such cases it may be said that the rhythm is broken.

Reproduction is continuity of nutrition—in fact, the formula N (A, B, C, D) reproduced in another being, a new vibration of the same rhythm. The more equally balanced the formula N is, the more the children are like the parents; and, on the contrary, the children will differ all the more, the less equally balanced the said formula N.

We may define heredity as the perpetuation in the children of the formula N of their progenitors.

Charrin says:[1] "If one wishes to explain the action of nutrition reduced to its elementary phase, one will note that it consists in the penetration to the cell itself of the plasmatic principles of aliments, and of their assimilation in the inside of the cell, excluding what is useless.

"Well then, the nervous system, that great dominating apparatus, on distending or contracting the size of the vessels which form the capillary net, and producing changes in them, whether in the pressure or the speed of the current, controls the presence of elements fit for assimilation and excludes the harmful ones; this nervous apparatus can at its will invite hunger or infect with poison. Stated otherwise: its nutritive power over the tissues and their powers of tension may cause

[1] Charrin, *Poisons de l'organisme.*

changes in the skin or in the muscles, in the bones and cartilages, or accumulate in the blood products highly necessary, as sugar, having power to retard or accelerate their consumption."

This paragraph will facilitate our comprehension of the theory of heredity, and remind us of the great prominence the nervous system has in the action of nutrition, not of the tissues, but of the cells themselves.

In the glands the nerve-endings reach the glandular cells, and have a direct influence upon the process of secretion; they can, as Charrin states, excite hunger or infect with poison according to the state of the nerve apparatus: thus joy and well-being give a sound feeling of life, happiness, and health; on the contrary, serious mental disappointments, the worries and upsets of existence, in altering the normal state of the nutritive changes in the cells and the glandular secretions, poison life and predispose to or aggravate disease.

Observe the curious instances taken from the excellent work of Dr Marfau,[1] which explain the rôle of the nervous system, and which we quote also to assist the comprehension of the theory of heredity:—

"The wife of a rich merchant married her

[1] Bouchard, *Pathologie générale*, "Fatigue et surmenage," p. 509.

daughter to an aristocrat. After the ceremony the mother tried to show her affection and thankfulness towards her son-in-law; the latter repulsed her, drily informing her that he did not relish such demonstrations of affection, and that she must keep her distance and not forget class distinctions. The unhappy woman felt overwhelmed. The night following she began to feel an insatiable thirst, and to pass water in large quantities: the urinal vessels, on examination a few days after, contained 100 grams of sugar per litre.

"A man, as Ch. Feré observed, lost in a short time several members of his family, who died of consumption; a girl, his child, sickened and also died; after these griefs he began to get fat, and from 60 kilos attained a weight of 106."

One sees very clearly from these examples how the nervous system, the great dominating apparatus, not only serves for the faculty of thought, but has in strict dependence upon it all the chemistry of the cells upon which depend nutrition, and, as we shall see, reproduction also.

A curious thing that gives us an idea of the control of the nervous system, and how this holds, so to speak, the guiding rein, is in observing how the nerve-fibres terminate inside the glands, and once within divide and subdivide, in order to

extend their meshes so as to enclose the cells and keep them under their immediate influence, communicating to them their mode of working, increasing, diminishing, or paralysing their working.

Two words only to explain the mode of innervation in the glands, and see at the same time how all social phenomena have their origin in biological conditions, and how it is known that these depend upon physics and chemistry, to evidence the unity of the cosmos.

The progress of humanity depends strictly upon physiology, as the action of the lungs upon the air.

Fig. 23 is taken from a note of MM. Ramon y Cajal and D. Claudio Sala y Pons,[1] its object being to demonstrate the nerve-terminations in the interior of the glands. These authors state: "*After several operations of dichotomy and being reduced to fine varicose branches they constitute a tight nerve-plexus around the acini, the very delicate stems of which touch the outside of the glandular corpuscules* (*fig.* 23, *a*). *From the periacinous filaments start fine little threads which, penetrating into the separative cement of the epithelium, end freely a little further off, by means of a granulation* (*fig.* 23, *b*),

[1] I avail myself of this opportunity to thank Dr D. Claudio Sala y Pons for his kindness in drawing the figures in this book, and at the same time to express my gratitude, for his knowledge of neurology has been of great service to me in completing the chapters relating to the phylogeny and ontogeny of the neurona.

an arrangement already pointed out for the salivary glands by Retzius, Fusari, and Panasci."

There are other authors, spoken of in the Mnemonic Reference,[1] who point to a very close connection between the nerve-element and the

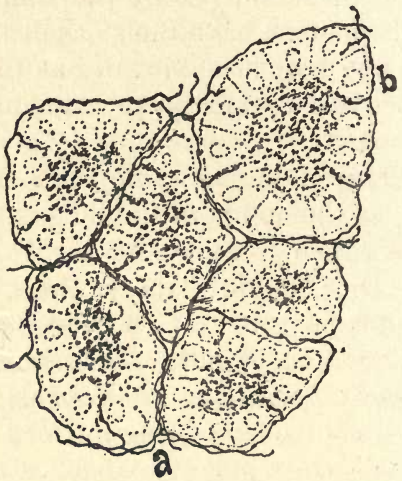


FIG. 23.

glandular cells, admitting *a substantial union between the last nerve-fibres and the protoplasm or nucleus of the glandular corpuscules.* Amongst these authors are included such authorities on the subject as Pflüger, Mayer, Paladino, Kupffer,

[1] S. Ramon y Cajal and Claudio Sala, *Terminations of the Nerves and Glandular Tubes of the Pancreas of Vertebrates.*

Ch. Ronget, and, more recently, Navalichin and Kytmanoff.

That is to say, the nerve-stems (fig. 23, *b*), according to these authors, would not terminate as those represented by the said figure, which are intercellular, but, when once placed between cell and cell, the dichotomy of the nerve-fillets would continue passing them into the very interior of the cell, in order to place itself in connection with the protoplasm and nucleus; there would be consequently consubstantiality between the nervous and glandular elements.

To a certain extent we should conclude that in the superior animals there exists inside their tissues the same consubstantiality as is found in the organic kingdom in the inferior animals, the consubstantiality of which we have spoken between the sensitive element and the motor in the actiniarii (see p. 42, fig. 2). This gives a clear idea of the unity and solidarity of the different systems in one and the same organism.

In the case before us it will suffice to refer to the state of the matter as represented in fig. 23, upon which there is a consensus of opinion, waiting until the progress of technical knowledge confirms beyond dispute the termination of the nerve-fillets in the interior of the cells.

Every sensation contains a double nervous current: first, from the periphery of the body to the nerve-centres; this one, from the direction of the current, is called centripetal, and, from its quality, sensitive; when once this current reaches the point of its central localisation there is relief, and from centripetal the current becomes centrifugal, and from sensitive, motive. If one of these currents is missing the nerve-process becomes nil. The life of the nerve, its importance and delicacy, can be understood throughout its extent; knowing how all external sensations from light, heat, electricity, degree of moisture, etc.—in a word, all kinds of rhythms registered and carried to their respective centres by the sensitive and centripetal currents—are transformed at the last term (fig. 23, *b*) into a peculiar reaction upon the chemistry of each cell.

This gives an idea of the significance of the theory of evolution, the relation of the external to the internal, how the cosmic agents, the universal energy, dominate the organisation of all beings, and how every organisation is an echo of the science of energy, in virtue of that exquisite quality of organic matter for which all sensation is converted into action, whether psychical, glandular, or muscular.

The Spanish proverb, "It makes one's mouth water," is well known.

One of the reactions that nourishment produces on the palate is to awaken the activity of the salivary glands. These sensitive nerves advise the nervous centres, by means of thin centripetal currents, of the organic irritability produced in them by the presence of nourishment, and these centres immediately send to the glands, by thin centrifugal fillets, an amount of energy proportionate to the sensation received; a reflex action, the *modus operandi* of which is understood on noting in fig. 23 how the centrifugal nerve-terminations reach the cells, in order to be transformed immediately on their arrival into chemical work, the result of which is the secretion of the saliva.

The contact of the aliment with the palate is not indispensable in order to excite the glandular activity. The idea is the motive force; a proof of which, though it may be deemed trivial, is that the sight of a toothsome article of food is sufficient to produce an effect whereby the mental representation, that is, the idea, which in this case is the initial energy, may provoke in the sensitive nerves of the salivary glands the action necessary to increase the secretion of saliva; and hence the proverb above mentioned.

We have quoted this example because in the male and female genital glands the spermatoblasts and ovoblasts are cells, and, like all the other glands,

suffer and change under the action of all influences, cosmic, social, or individual, both in the physical and moral plane; and one can understand how easily are changed the functions of reproduction, which is a glandular secretion.

Immense are the responsibilities that weigh upon humanity for having neglected the natural laws. All its overthrows, its pains, its miseries, and its crimes are the result of the violation of these laws, which give as a result a ridiculous, monstrous, and absurd ethics, and at the same time a sick humanity, that perpetuates in its offspring its miseries, aggravating and multiplying them.

Between these three terms, the cosmic medium, the man, and the glands that preside over the reproduction of the species, there should exist a complete relation and unity. To break this unity and dependence is to neutralise the work of Nature, whose organic beings are wonderful harmonies. And intelligent man, in whom these harmonies should converge, brings about the exact opposite.

We can consider the nervous element of every gland as above stated, and, as the testicle and the ovary are two glands, we can regard their cells as spermatoblasts, or rather ovoblasts. Nerve-fibrils surround them and control them, in order to communicate to them the kind of nutrition which

suits the individual, that is, to impress on the male and female germinating cells the formula N (A, B, C, D). And, as we have already seen in another place that this formula is, in normal conditions, a harmonic equilibrium in relation to other harmonic laws, the repetition of this formula N would be a natural consequence. If, on the other hand, the formula has lost its normal application and is N′ (A′, B′, C′, D′), then the offspring will be all the less like their parents the greater the disproportion of the cellular chemicals; that is, when once their harmonious relation with the natural laws is lost, the offspring will have a greater tendency to degenerate and wane.

In families that have many offspring there are some of the same type; these are born in normal times. At others it happens that in the same family there are sons that are unlike; these must correspond to the periods of ill-health of the parents, or of struggle, of upset, of worries and difficulties which unfortunately are so rife in our life, and contribute to change the normal condition of formula N, that is, to neutralise adaptation, and hence heredity.

Of the theories about heredity, the most scientific, and that which best accounts for the facts, is that of Hillemand and Petrucci:—[1]

[1] *Manuel de pathologie générale*, L. Moynac, p. 109.

"According to our views, the nervous system is not only limited to securing organic solidarity (an action evidenced by pathology), but its influence is much more important. According to us, it is the principal agent of the action that each organism exercises upon its descendants, or, if you will, of each individual upon the species, and by its means the one has influence over the other.

"The heredity of acquired characteristics, consequently of functional adaptations and differences, suited to each organism, is reduced, according to us, to one special cerebro-medullar reflex action upon the germinating cells; by means of the nervous system are transmitted to this cell all the impressions acquired and developed by the individual. We conceive that the impressions perceived by the organism and registered by the cerebro-spinal axis determine two modes of reflection; one includes the reflections designed to assure the adaptation of the organism to changes in the internal or external conditions of its existence; the other mode includes those designed to prepare the adaptation of the descendants, represented here by the germinating cells, in regard to these changes. This means that the modifications of the organism, whatever they may be, react upon the germinating cells and are susceptible consequently of disclosing themselves in the descendants. If these modifications are

advantageous for the preservation of the species, they are transmitted with their qualities; just as, if they constituted phenomena of disease, they would then represent equally numerous cases of pathological heredity.

"With regard to the manner in which the nervous system assures the transmission of characteristics, we believe that impressions felt and received by the reflex centres of the grey substance of the brain are transmitted by means of the centrifugal nervous cords to the genital centre of the medulla, condensed and concentrated by it, and finally reflected upon the spermatoblasts and ovoblasts by the nerve-fillets, which, starting from this centre, are distributed in the testicles and ovaries."

Let us recall the paragraphs relating to the way in which the great dominating apparatus, as Charrin calls the nervous system, takes part with marvellous minuteness, carrying its action to the cell itself, capable, according to normal or other circumstances, of creating hunger or destroying, that is, maintaining in a normal and healthy state the chemical processes of the cell, or, on the other hand, of throwing them out of gear. When the individual is healthy the germinating cells, male and female, receive the impression, the tone of the nutrition of the organism to which they belong,

by means of the nervous system, and if the moment of reproduction arrives they repeat the same formula N which is peculiar to them. On the contrary, if the formula N is altered, as the germinating cells receive every moment the impressions of the organism, the latter will undergo modification, following the same oscillations as the nervous system; and as soon as the moment of reproduction arrives, if the alteration is not so serious as to have neutralised the fertilising power, they will reproduce the same type of alteration in the organism at the moment of its release, that is, will reproduce the formula N′ (A′, B′, C′, D′), which is pathological heredity.

Adding these ideas to those explained in the chapter on health and the general laws of mechanics, we shall understand that, if the absurd social medium in which we live alters the organic constitution so far as to weaken it, the descendants of one sick generation must be just another sick generation.

The index of organic resistance in man is enormous; the aberration that his chemical mechanism can undergo oscillates within considerable limits, and thus it is explained how humanity resists so many calamities and outrages. The disturbance of the formula N′ (A′, B′, C′, D′) always tends to recover its rhythm, to return to its normal state, to the formula N (A, B, C, D),

because organisation will obey these rhythmic forces which impel the whole of Nature, and these energies possess enormous powers of tension and are always ready on the first occasion to recover their true equilibrium or synchronism with the rhythms of which they are an echo.

Thus it is explained how man has that surprising vital resistance, because his powers of tension, which have been necessary in order to build up the structure of an organic and intelligent being, are immeasurable, and only to be compared to the energies from which they proceed. The force of tension stored up by the psychic nerve, the potential energy enclosed in the molecular mechanism, constituting the substance of each one of these cells, from the living force of which thought is derived, is only understood by knowing the close bond of dependence that they have with the infinite rhythms of force.

Let it not be thought, then, on expressing these ideas on molecular equilibrium, that man's health and resistance are somewhat fragile, but that, on the contrary, his equilibrium is of immense tenacity and stability, and the alteration of formula N is only understood in the presence of the opposition and violence, the pain and misery to which from time immemorial the human race is subject.

If man always found in the medium in which he

lives the forces to nourish and repair his organic losses, that is, from light, air, all nourishment, and the necessary medium, he might expend vast energy without detriment to his health. A sound man is a great transformer of forces, but provided that formula N be intact, for then his affinity and activity would easily transform the cosmic forces that surround him; but if, on the contrary, the formula is N′, he has neither the same activity nor affinity as before, and transforms and produces less force, because formula N′ has in its structure less potential force, produces less living force, but, on the contrary, more toxic products, that diminish the vital forces. Weak people in human life are those in whom the violence of what is wrongly called the *struggle for life* has altered the normal rhythm of nutrition in their progenitors, their offspring being weak or wearied heirs.

Here we may repeat that, so long as an absurd regimen prevails, monstrous consequences must result.

The economic condition does not choose its victims only among those who have been disinherited by fortune, but also among the moneyed classes. Money is of so perverse a nature that it wrecks the most beautiful and natural feelings.

The dramas and tragedies caused by money are innumerable. Love often prostitutes itself, and in

love the physiological conditions are sacrificed to the economical, and with them the future of the family. Money often alters the conditions and affection between parents and children, brothers or friends. For money, states declare war, which, as has been said, has robbery as its object and murder as its method. But monstrosities are not merely moral but physical also, and reach all social classes. Nature is relentless towards those who trample under foot her laws, and social consolidation is so great that often it is the innocent offspring that condemns social violence. How often in the streets, in the hospitals, or in families do we see poor, innocent beings, sickly, weak, and at times with such deformities that they look like the grimace by which suffering humanity reveals the martyrdom of her womb! Here it may be said that man is the slave of his own guilt.

Psychic Heredity

We have already seen in psychic adaptation that it is a reflex of the outside world, and that from the lowest animal to man the *ego* has always been progressing and trying to acquire an ever closer contact with the external. In this increasing adaptation present man has not reached his term of evolution; he represents only a moment in the

ascending scale of psychic perfectibility, and counts upon an indefinite period to continue his progress.

Psychic heredity is the continuation of psychic adaptation. Healthy parents produce a healthy offspring, and the latter must necessarily be like the former, for as individuals they are the product of one and the same cause, correspondence with the external. Strictly, heredity is not a fault essential to the individual, but the healthy child is the reproduction of the healthy parent, since every organisation is under the inductive power of Nature, and represents different periods of the same thing.

We say healthy parents, because the phenomenon of induction of natural forces on to the organism can alone engender similar beings when the organisms are well constituted, that is to say, when formula N represents molecular equilibrium, and there can be no further difference between parents and children than the slight alteration which a greater adaptation to the external presupposes for a new generation. That is to say, the psychic progress attained by the parent serves for the child, who in his turn will produce other adaptations, from which his descendants will benefit.

Humanity, considered as a whole, is the representation of a force. Each one of its individual parts or generations marks the fullness of the wave

that constitutes the movement, and which, considered as a series, is the rhythm of this force.

Those who are born now and become familiar with the daily use to which electricity is applied have a great advantage over those who were born fifty years ago. The man born to-day in a civilised town and in a large capital (I am, of course, speaking of a healthy individual) has a very great advantage over one born in an uncivilised country. The brain of him who lives in an atmosphere of high culture acquires a large amount of knowledge, which by its stimulus influences the associations established by the neuronas among themselves, and influences also the increase in the number of the collateral ones, that in their turn extend the degree of association of some ideas with others; and this constant stimulus will in its turn influence the successive development of humanity, increasing in successive generations the number of the neuronas, which is what happens from the inferior animals to man. The normal difference that must exist between parents and offspring is that variable quantity that supposes the greater adaptation to the external, and which may be acquired from one generation to another.

Sick parents, or those who have altered the normal state of their formula N, through overfatigue, alcoholic excess, or any other cause, or

through living in unhealthy conditions, in reproducing under such conditions establish the bankruptcy of the family, susceptible, however, of regeneration if the want of equilibrium has not passed certain limits, but provided a strict regimen is observed as regards nutrition and reproduction; then the same primitive N formula of the family or of the individual can be reproduced, that is to say, when this again recovers its state of greater equilibrium.

CHAPTER XI

MEDIUM

In the former chapters we have already stated how adaptation, selection, and heredity were one and the same thing, studied separately for greater clearness; but provided we do not forget that they are different periods of one phenomenon; that is, selection is the same adaptation, but journeying towards a fixed end; heredity is the repetition of adaptation, which cannot vary, because it is the reflex of the universal mechanics, and heredity repeats the same organisation by the immutability of the laws of Nature. Adaptation and heredity repeat one and the same organisation, at different periods, just as selection defines this organisation by a fixed meaning.

On studying the medium separately we make another artificial division, for the mutual dependence that exists between the medium (universal mechanics) and organisation (adaptation, selection, and heredity) is very plain. And we come to the

result that, even by reducing the elements of evolution to two, there exists between these two the same unity as between an organ and its function. Thus one sees the dependence and relation of all the phenomena of the cosmos, and how we have arrived at the monist conception.

In writing this chapter we shall take into account the unity of phenomena, and on connecting some with others, we shall see the relation of the cosmic medium, the social medium and man.

If man, the result of organic evolution, depends on general mechanics, humanity, a super-organic organism, for the same reason is also governed by universal laws. Every time that humanity separates herself from these, she decays or sickens, to again recover if she approaches normal conditions.

In the future there will arise from this unfortunate humanity a happy one, that, adapting itself to natural laws, will develop in an indefinite progression, in which misery and diseases will be unknown.

Let us recall the experiment of Tyndall, of which we have already spoken, according to which, on making a crystal bell to sound by means of a violin bow, the vibration of the bell arranges the sand in a regular form ; which means that the vibrations, whose rhythmic energy induces the symmetrical form in which the sand keeps placing itself, are

also regular, since they represent a relation of cause and effect; the sand arrangement is the *organic* expression of acoustic energy.

This pretty experiment enables us to foresee that in the world everything that has a regular form obeys an energy, regular also.

Where are these energies and rhythms?

Cosmic Medium

It is now known that all energies are modes of movement, different degrees of vibration.

Vibrations have their scale, and, beginning with the least number of vibrations, we find the musical sound, which is perceptible when the vibrations reach 128, which is the *ut* or initial *do* (see p. 125).

Light is another mode of vibration, much more intense than the vibrations that constitute sound. Colours are vibrations of reflected light, whose number of vibrations permits of their being perceived by the sense of sight.

We have already seen in another part of this book (p. 23 ff.) how the crystalline lens in inferior animals took its lenticular aspect from the fact that light, on crossing the coloured spots, accommodates its index of refraction and its ray to the law of optics, without which vision would not be possible.

Let us examine now the scale of vibrations of the solar spectrum, including the visible and invisible part, which is outside the red on one side, and the action of which produces heat instead of light, and that which is outside the violet, the mode of whose vibration does not allow of its appearing coloured, but which makes itself felt as chemical energy.

The unity employed is ten-millionths of a millimetre :—

	Length of the Wave.	Vibrations per second in Trillions.
Beyond the red	1940 to 734	
Extreme limit of the red . . .	734	400
Limit between the red and the orange	647	490
„ between the orange and the yellow	587	558
„ between the yellow and the green	535	590
„ between the green and the blue	492	596
„ between the blue and the indigo	456	675
„ between the indigo and the violet	424	700
Extreme limit of the violet . .	397	756
Beyond the invisible violet . .	397 to 295	

—sufficient for our explanation, with regard to light and sound, in order to make clear our proposition; that is, that there exist rhythms, in colours and sound, of which the senses of sight and sound are conscious, and other rhythms, like those in the invisible spectrum, beyond the red and the violet, that exist, though not consciously perceptible, but whose influence is positive. As we shall

now see, the number of rhythms that we do not directly perceive is much greater than that of the others.

The illustrious astronomer and scientist Camille Flammarion reproduces, by application, a table in which the learned English chemist Sir William Crookes tries to give an idea of the continuity and unity of the phenomena of the universe. With this object, let us imagine a seconds pendulum. By doubling the oscillations in one unit of time, one obtains the table which will be seen below (p. 224).

In commenting on the table, Flammarion says: "Starting from the fifth degree, with 32 vibrations per second, we enter the region in which the vibration of the atmosphere reveals itself as a sound. There is found the lowest musical note. If among musical sounds one chooses a very low one—for instance, the lower octave on the organ—one perceives elementary sensations, though they form a continuous whole, a condition indispensable to produce a musical sound. 'The deeper the sound,' says Helmholtz, 'the better the ear perceives the successive pulsations of the air.'

"In the ten degrees following the vibrations per second rise from 32 to 32,768; every time the vibrations are doubled the same note in the upper octave is reproduced. . . .

"We then reach a region in which the velocity

of the vibrations increases rapidly, and the vibratory medium is not the atmosphere but a medium

1st degree	2	
2	4	
3	8	
4	16	Sound.
5	32	
6	64	
7	128	
8	256	
9	512	
10	1,024	
15	32,768	
20	1,047,576	Unknown.
25	33,554,432	
30	1,073,741,824	Electricity.
35	34,359,738,368	Unknown.
40	1,099,511,627,766	
45	35,184,372,088,832	
48	281,474,976,710,656	Light.[1]
49	562,949,953,421,312	
50	1,125,890,906,842,624	
55	36,028,797,018,963,968	Unknown.
56	72,057,594,037,927,936	
57	144,115,188,075,855,872	
58	288,230,376,151,711,744	X-Rays.
59	576,460,752,303,423,488	
60	1,152,921,504,606,846,976	
61	2,305,843,009,213,693,952	
62	4,611,686,018,427,387,904	Unknown.
63	9,223,372,036,854,775,808	

infinitely more subtle, called ether. This is the region of electric vibrations.

[1] Luminous, caloric, and chemical rays, beyond the red and beyond the violet.

"Then comes a region extending from 35 to 45 degrees, including per second from 34 thousand 359 millions to 35 trillions 183 millions. This is an unknown region. We are ignorant of the functions of these vibrations, but it is difficult to admit that they have no action in the universe.

"Next we enter the region of light, with velocities contained between 48 and 50 degrees. The sensation of light, that is, the vibrations that transmit visible signs, is included within approximately narrow limits from 400 trillions (red light) to 756 trillions (violet light), less than a degree."

To understand the immensity of these velocities it is necessary to recall in imagination celestial velocities and spaces—figures that have something of the infinite, from which they come.

All these rhythms form part of the cosmic environment; their action is constant, invariable; everything that exists is in relation with these vast forces.

If we compare this table of ethereal rhythms with the tables of Mendeleef (p. 189) and with that of Sir W. Crookes (p. 193), we find a great and significant analogy that needs no comment. Regularity and harmony increase in the one by the multiplication of the vibrations, and in the others according to the atomic weight.

But there is another and, to me, a still more

interesting one for strengthening and making more comprehensible the monist conception. If we compare the significance that the atomic weight has in the inorganic world with the mode of structure in the organic world, we shall find that comparative embryology and anatomy are alike the tables that demonstrate the same periodic function of organic matter. Everything in Nature, from the cell to man, from hydrogen to Uranus, from the vibration that begins to make itself perceptible in sound to that of radio-activity, continually proclaims universal harmony.

Social Medium

Man and society, through ignorance of them, are exceptions to these laws of harmony—man and society, the products of harmonious laws, which by reason of this very organisation should create a well-balanced social organism, are in complete discord. Social organisation, like sight and harmony, is a function of Nature, and happiness should reign in it.

Humanity, the *résumé* and compendium of all energies, should have followed in its development the increasing progression, like everything else in Nature. On this basis, we said elsewhere that this flux and reflux in human progress had no *raison*

d'être, but were due to defects of organisation. The same thing happens to humanity as in the case of any machine out of gear. These changes of civilisation, believing them to be caused by a cyclic evolution, are an error of interpretation, which is countenanced by such men as J. W. Draper (*History of the Intellectual Development of Europe*), who tries to turn history into physiology, dividing it into five parts : " (1) epoch of credulity ; (2) epoch of inquiry ; (3) epoch of faith ; (4) epoch of reason ; (5) epoch of decrepitude." These are periods through which individual man passes, and as humanity presents changes which may be compared to these periods, an analogy has been established. But taking heed and considering organisation as a whole, and as such, humanity, we shall see in reproduction or heredity that the children are, with regard to their parents, a form of the rhythm of force. Humanity, considered as a force, has its rhythm, and may be compared to the undulations and vibrations of sound, colour, light, etc. Men or generations represent units of this great force. Then civilisations cannot decay, as is supposed, by regarding as an inevitable law what is the consequence of an evil organisation, because that is contrary to all laws. If there are periods in history in which man decays, it is due to an organisation that develops on a false basis, and which is a misguided

evolution, destined to die. On the *morrow* this progress will be, like all others, indefinite. Humanity is not only a rhythmic force, but is subject to the great laws of energy, continuity, and persistence.

Money—the curse of so many, even of those who have it and feel its objections, because they see every day the anxieties it causes, the inconsistency and instability that follow as a basis of the family and of society, the immoralities to which it lends itself, the vexations it causes to the most worthy, who turn to suicide as a last resource—money and property are what change the course of history by retrograding it; they are the very things that change man's health; civilisations decline and fall for the same reason that man degenerates—from not finding a suitable medium for his development. (See "Health and General Laws of Mechanics," p. 120.)

The progressive and harmonious development of the human super-organism requires conformity to natural laws.

I do not propose to enumerate one single instance of the infinite ills and sufferings of this social medium; that these lie in the ambient, everything proclaims; every kind of literature, the novel, the stage, the press, and, best of all, medicine itself, all this constitutes an inexhaustible arsenal

of pain and crime. My intention was only to try to explain that the harmonious laws of evolution cannot be complied with because the present social environment is incompatible with them.

Cities, as to-day constituted, answer the requirements of capitalist ascendancy, and are therefore incompatible with the society of the future. Of present-day cities the least than can be said is that they are ugly, dirty, and foul-smelling. As for their sanitary conditions, they are a veritable disgrace, seething cauldrons of human flesh—to say nothing of the frightful mortality caused by infectious diseases, such as tuberculosis and typhus.

In order to realise the state of things set out in another place ("Health and the General Laws of Mechanics"), it is indispensable for future communities to reconstruct their cities on sanitary principles, in order that man may live in a perfect state of health, and be for ever exempt from the numerous diseases that torment him. Some have already disappeared, as the black plague, leprosy, small-pox, cholera, etc., and others are decreasing as civilisation advances.

Houses and lodgings suffer from the same defect. and these are hard to eradicate, since they follow the natural selfishness of private ownership. He who owns a house or builds it, as a rule fixes the

amount of rent. The house is not sanitary. Good, but "What does it matter?" the owner will say; "it brings me in my rent, which is the only question."

There are places where mortality is criminally excessive: "What shall we do?" say the authorities, with folded arms.

There are cities, districts, houses, hotbeds of infection, causing the deaths of thousands of our fellow-creatures. In these cases there are local authorities that have passed laws and regulations of health and sanitation; but these laws cannot be complied with, for they would entail an amount of expense injurious to capital. Hence arises a conflict, in which the *authority fulfils its mission* in taking the side of the stronger.

Manufactories and workshops are guilty of the same original sin, a point which I cannot stop to analyse, as this would be mere waste of time.

Suffice it to say that cities and all their buildings in their present state are the result of an absurd social organisation, that revolutions should not rely upon any of these resources of present society, for they are unsuited to a society based on natural laws. In a word, the whole of the present social medium is incompatible with the society of the future. A new social machine requires new organs.

Man

Knowing that colours are different modes of vibration, one can understand Dr Ramon y Cajal's meaning when he says that the senses, especially the hearing and the sight, are definite collectors of undulatory movements, and why Max Nordau calls them registering apparatus.

Hence one can see with all its consequences the relation between the external and internal, and that man is a product of universal mechanics.

Let us take the case of a painter: in order that he may be able to reproduce colour with accuracy it is necessary that his eyes be good specific collectors of those different rhythms that constitute all the varied scale of colours, without which requirement he will not be able to represent these colours as they are. A painter will be all the more accurate in his colours the better his adaptation to light, that is, the external to the visual centres of the artist, the internal. To be a good colourist depends on this aptitude of the eyes to be good specific collectors of movements.

Man, to be healthy, must live in harmony with the natural laws; otherwise he degenerates as an individual and as a species.

It is established to-day in biological science that

each special cell, the product of one preceding it, whether epithelial, muscular, or conjunctive, must always reproduce the same cellular type, or, in default, one of the ancestral forms, or one to correspond with one of the forms of its embryonic period.

According to that, when a tumour, an epithelioma for instance, develops in an individual, the cellular elements of which the said tumour is composed will reproduce one of the ancestral or embryonic forms that have preceded the development and formation of the epithelial tissue. Thus regarded, a tumour is the degeneration of an element peculiar to the tissue, but in a state of retrogression and monstrous growth.

Making use of Pascal's simile, who compares humanity, considered as a great unity, to a *man* who is always learning, the closeness of the analogy will appear still more striking on comparing individual men in the *social structure* with what are cells in the structure of animal tissue, and one infers that the unities, man, during the whole of present history constitute a real serial degeneracy. Men are still forms of disease, and in different stages of ancestral retrogression; but by no means the normal type man.

Neither man as an individual, nor man in the vast conception of Pascal, will free himself from his

degeneracy so long as he lives in opposition to the harmony of universal laws.

Two words more, and I have done.

The social problem does not reduce itself merely to an economic question, a question of rich and poor, but it is the most beautiful and profoundly human of all that need solution.

New ideas, as much dreaded as they are unknown, far from tending to a retrograde step in the history of humanity, aim at its indefinite perfection and happiness.

PRINTED BY NEILL AND CO., LTD., EDINBURGH.

A Catalogue

of

Williams & Norgate's

Publications

Divisions of the Catalogue

For Full List and Particulars of Educational Works, see separate Catalogue.

London

Williams & Norgate

14 Henrietta Street, Covent Garden, W.C.

I. Theology and Religion.

THEOLOGICAL TRANSLATION LIBRARY.
New Series.

A Series of Translations by which the best results of recent Theological Investigations on the Continent, conducted without reference to doctrinal considerations, and with the sole purpose of arriving at the truth, are placed within reach of English readers.

Vols. I.–XII. were edited by the Rev. T. K. Cheyne, M.A., D.D., late Oriel Professor of Interpretation in the University of Oxford, and the late Rev. A. B. Bruce, D.D., late Professor of Apologetics, Free Church College, Glasgow.

Vol. XIII. was edited by Rev. Allan Menzies, D.D., Professor of Divinity and Biblical Criticism in the University, St Andrews.

Vols. XV., XVII., XVIII., and XXI.–XXVI. are edited by Rev. W. D. Morrison, M.A., LL.D.

Vols. XIX. and XX. are edited by Rev. James Moffatt, B.D., D.D., St Andrews.

The Price of Vols. I.-XXI. is 10s. 6d.;
Vol. XXII. and after, 10s. 6d. net.

Subscribers to the Series obtain three volumes for **22s. 6d.** carriage free, payable before publication, which only applies to the current year's volumes, viz., XXV.–XXVII., which are as follows.

In Active Preparation.

THE OLD TESTAMENT IN THE LIGHT OF THE EAST. By Alfred Jeremias, Professor of Old Testament History in the University of Leipzig. The translation will be edited by Professor C. H. W. Johns of Cambridge. The work will be profusely illustrated.

Vol. XXV. Ready. 10s. 6d. net.

ETHICS OF THE CHRISTIAN LIFE. By Theodor Haering, Professor of New Testament Dogmatics and Ethics at Tübingen.

Vol. XXVI.

PRIMITIVE CHRISTIANITY: Its Writings and Teachings in their Historical Connections. By Otto Pfleiderer, of Berlin. Vol. II. The Historical Books.

Vol. XXII. Ready. 10s. 6d. net.

PRIMITIVE CHRISTIANITY, Vol. I.: Its Writings and Teachings in their Historical Connections. By Otto Pfleiderer, Professor of Practical Theology in the University of Berlin.

THEOLOGICAL TRANSLATION LIBRARY—Continued.

Vol. XXIII. Ready. 10s. 6d. net.

THE INTRODUCTION TO THE CANONICAL BOOKS OF THE OLD TESTAMENT. By Carl Cornill, Professor of Old Testament Theology at the University of Breslau.

Vol. XXIV. Ready. 10s. 6d. net.

HISTORY OF THE CHURCH. By Hans von Schubert, Professor of Church History at Kiel. Translated from the Second German Edition. By arrangement with the author, an Additional Chapter has been added on "Religious Movements in England in the Nineteenth Century," by Miss Alice Gardner, Lecturer and Associate of Newnham College, Cambridge.

The following Volumes are published at 10s. 6d. per Volume, excepting Vols. XIX. and XX.

Vol. XXI.

ST. PAUL: The Man and his Work. By Prof. H. Weinel of the University of Jena. Translated by Rev. G. A. Bienemann, M.A. Edited by Rev. W. D. Morrison, M.A., LL.D.

"Prof. Weinel may be described as the Dean Farrar of Germany; the work is quite equal to Dean Farrar's work on the same subject. In some respects it is better."—*Daily News.*

Vols. XIX. and XX.

THE MISSION AND EXPANSION OF CHRISTIANITY IN THE FIRST THREE CENTURIES. By Adolf Harnack, Ordinary Professor of Church History in the University, and Fellow of the Royal Academy of the Sciences, Berlin. Second, revised and much enlarged edition, 25*s.* net.

Vol. XVIII.

CHRISTIAN LIFE IN THE PRIMITIVE CHURCH. By Ernst von Dobschütz, D.D., Professor of New Testament Theology in the University of Strassburg. Translated by Rev. G. Bremner, and edited by the Rev. W. D. Morrison, LL.D.

"It is only in the very best English work that we meet with the scientific thoroughness and all-round competency of which this volume is a good specimen; while such splendid historical veracity and outspokenness would hardly be possible in the present or would-be holder of an English theological chair."
—Dr RASHDALL in *The Speaker.*

Vol. XVI.

THE RELIGIONS OF AUTHORITY AND THE RELIGION OF THE SPIRIT. By the late Auguste Sabatier, Professor of the University of Paris, Dean of the Protestant Theological Faculty.

"Without any exaggeration, this is to be described as a great book, the finest legacy of the author to the Protestant Church of France and to the theological thought of the age."—*Glasgow Herald.*

THEOLOGICAL TRANSLATION LIBRARY—Continued.

Vols. XV. and XVII.

THE BEGINNINGS OF CHRISTIANITY. By Paul Wernle, Professor Extraordinary of Modern Church History at the University of Basel. Revised by the Author, and translated by the Rev. G. A. Bienemann, M.A., and edited, with an Introduction, by the Rev. W. D. Morrison, LL.D.

Vol. I. The Rise of the Religion.

Vol. II. The Development of the Church.

Dr. Marcus Dods in the *British Weekly*—"We cannot recall any work by a foreign theologian which is likely to have a more powerful influence on the thought of this country than Wernle's *Beginnings of Christianity*. It is well written and well translated; it is earnest, clear, and persuasive, and above all it is well adapted to catch the large class of thinking men who are at present seeking some non-miraculous explanation of Christianity."

The Earlier Works included in the Library are:—

HISTORY OF DOGMA. By Adolf Harnack, Berlin. Translated from the Third German Edition. Edited by the Rev. Prof. A. B. Bruce, D.D. 7 vols. (New Series, Vols. II., VII., VIII., IX., X., XI., XII.) 8vo, cloth, each 10*s.* 6*d.*; half-leather, suitable for presentation, 12*s.* 6*d.*

ABBREVIATED LIST OF CONTENTS:—Vol. I.: INTRODUCTORY DIVISION:—I. Prolegomena to the Study of the History of Dogma. II. The Presuppositions of the History of Dogma. DIVISION I.—The Genesis of Ecclesiastical Dogma, or the Genesis of the Catholic Apostolic Dogmatic Theology, and the first Scientific Ecclesiastical System of Doctrine. BOOK I.:—*The Preparation.* Vol. II.: DIVISION I. BOOK II.:—*The Laying of the Foundation.*—I. Historical Survey.—*I. Fixing and gradual Secularising of Christianity as a Church.—II. Fixing and gradual Hellenising of Christianity as a System of Doctrine.* Vol. III.: DIVISION I. BOOK II.:—*The Laying of the Foundation*—continued. DIVISION II.—The Development of Ecclesiastical Dogma. BOOK I.:—*The History of the Development of Dogma as the Doctrine of the God-man on the basis of Natural Theology. A. Presuppositions of Doctrine of Redemption or Natural Theology. B. The Doctrine of Redemption in the Person of the God-man in its historical development.* Vol. IV.: DIVISION II. BOOK I.:—*The History of the Development of Dogma as the Doctrine of the God-man on the basis of Natural Theology*—continued. Vol. V.: DIVISION II. BOOK II.:—*Expansion and Remodelling of Dogma into a Doctrine of Sin, Grace, and Means of Grace on the basis of the Church.* Vol. VI.: DIVISION II. BOOK II.:—*Expansion and Remodelling of Dogma into a Doctrine of Sin, Grace, ana*

THEOLOGICAL TRANSLATION LIBRARY—Continued.

Means of Grace on the basis of the Church—continued. Vol. VII.: DIVISION II. BOOK III. :—*The Threefold Issue of the History of Dogma.*—Full Index.

"No work on Church history in recent times has had the influence of Prof. Harnack's *History of Dogma.*"—*Times.*

"A book which is admitted to be one of the most important theological works of the time."—*Daily News.*

WHAT IS CHRISTIANITY? Sixteen Lectures delivered in the University of Berlin during the Winter Term, 1899–1900. By Adolf Harnack. Translated by Thomas Bailey Saunders. (New Series, Vol. XIV.) Demy 8vo, cloth, 10*s.* 6*d.*; can only be supplied when complete set of the New Series is ordered.

Prof. W. Sanday of Oxford, in the examination of the work, says :—"I may assume that Harnack's book, which has attracted a good deal of attention in this country as in Germany, is by this time well known, and that its merits are recognised—its fresh and vivid descriptions, its breadth of view and skilful selection of points, its frankness, its genuine enthusiasm, its persistent effort to get at the living realities of religion."

"Seldom has a treatise of the sort been at once so suggestive and so stimulating. Seldom have the results of so much learning been brought to bear on the religious problems which address themselves to the modern mind."—*Pilot.*

"In many respects this is the most notable work of Prof. Harnack. . . . These lectures are most remarkable, both for the historical insight they display and for their elevation of tone and purpose."—*Literature.*

THE COMMUNION OF THE CHRISTIAN WITH GOD: A Discussion in Agreement with the View of Luther. By W. Herrmann, Dr. Theol., Professor of Dogmatic Theology in the University of Marburg. Translated from the Second thoroughly revised Edition, with Special Annotations by the Author, by J. Sandys Stanyon, M.A. (New Series, Vol. IV.) 8vo, cloth. 10*s.* 6*d.*

"It will be seen from what has been said that this book is a very important one. . . . The translation is also exceedingly well done."—*Critical Review.*

"We trust the book will be widely read, and should advise those who read it to do so twice."—*Primitive Methodist Quarterly.*

"Instinct with genuine religious feeling; . . . exceedingly interesting and suggestive."—*Glasgow Herald.*

A HISTORY OF THE HEBREWS. By R. Kittel, Ordinary Professor of Theology in the University of Breslau. In 2 vols. (New Series, Vols. III. and VI.) 8vo, cloth. Each volume, 10*s.* 6*d.*

Vol. I. **Sources of Information and History of the Period up to the Death of Joshua.** Translated by John Taylor, D.Lit., M.A.

THEOLOGICAL TRANSLATION LIBRARY—Continued.

Vol. II. **Sources of Information and History of the Period down to the Babylonian Exile.** Translated by Hope W. Hogg, B.D., and E. B. Speirs, D.D.

"It is a sober and earnest reconstruction, for which every earnest student of the Old Testament should be grateful."—*Christian World.*

"It will be a happy day for pulpit and pew when a well-thumbed copy of the *History of the Hebrews* is to be found in every manse and parsonage."—*Literary World.*

"It is a work which cannot fail to attract the attention of thoughtful people in this country."—*Pall Mall Gazette.*

AN INTRODUCTION TO THE TEXTUAL CRITICISM OF THE GREEK NEW TESTAMENT. By Professor Eberhard Nestle, of Maulbronn. Translated from the Second Edition, with Corrections and Additions by the Author, by William Edie, B.D., and edited, with a Preface, by Allan Menzies, D.D., Professor of Divinity and Biblical Criticism in the University of St. Andrews. (New Series, Vol. XIII.) With eleven reproductions of Texts. Demy 8vo, 10*s.* 6*d.*; half-leather, 12*s.* 6*d.*

"We have no living scholar more capable of accomplishing the fascinating task of preparing a complete introduction on the new and acknowledged principles than Prof. Nestle. This book will stand the most rigorous scrutiny; it will surpass the highest expectation."—*Expository Times.*

"Nothing could be better than Dr. Nestle's account of the materials which New Testament textual criticism has to deal with."—*Spectator.*

"We know of no book of its size which can be recommended more cordially to the student, alike for general interest and for the clearness of its arrangement. . . . In smoothness of rendering, the translation is one of the best we have come across for a considerable time."—*Manchester Guardian.*

THE APOSTOLIC AGE. By Prof. Carl von Weizsäcker. Translated by James Millar, B.D. 2 vols. (New Series, Vols. I. and V.) Demy 8vo, cloth. Each 10*s.* 6*d.*

"Weizsäcker is an authority of the very first rank. The present work marks an epoch in New Testament criticism. The English reader is fortunate in having a masterpiece of this kind rendered accessible to him."—*Expository Times.*

". . . No student of theology or of the early history of Christianity can afford to leave Weizsäcker's great book unread."—*Manchester Guardian.*

"In every direction in this work we find the mark of the independent thinker and investigator . . . this remarkable volume . . . this able and learned work. . . ."—*Christian World.*

"The book itself . . . is of great interest, and the work of the translation has been done in a most satisfactory way."—*Critical Review.*

THEOLOGICAL TRANSLATION FUND LIBRARY.

Old Series.

Uniform Price per Volume, 6*s*.

BAUR (F. C.). CHURCH HISTORY OF THE FIRST THREE CENTURIES. Translated from the Third German Edition. Edited by Rev. Allan Menzies. 2 vols. 8vo, cloth. 12*s*.

—— PAUL, THE APOSTLE OF JESUS CHRIST, HIS LIFE AND WORK, HIS EPISTLES AND DOCTRINE. A Contribution to a Critical History of Primitive Christianity. Edited by Rev. Allan Menzies. 2nd Edition. 2 vols. 8vo, cloth. 12*s*.

BLEEK (F.). LECTURES ON THE APOCALYPSE. Translated. Edited by the Rev. Dr. S. Davidson. 8vo, cloth. 6s.

EWALD'S (Dr. H.) COMMENTARY ON THE PROPHETS OF THE OLD TESTAMENT. Translated by the Rev. J. F. Smith. [Vol. I. General Introduction, Yoel, Amos, Hosea, and Zakharya 9–11. Vol. II. Yesaya, Obadya, and Mikah. Vol. III. Nahûm, Ssephanya, Habaqqûq, Zakhârya, Yéremya. Vol. IV. Hezekiel, Yesaya xl.–lxvi. Vol. V. Haggai, Zakharya, Malaki, Jona, Baruc, Daniel, Appendix and Index.] 5 vols. 8vo, cloth. 30*s*.

—— COMMENTARY ON THE PSALMS. Translated by the Rev. E. Johnson, M.A. 2 vols. 8vo, cloth. 12*s*.

—— COMMENTARY ON THE BOOK OF JOB, with Translation. Translated from the German by the Rev. J. Frederick Smith. 8vo, cloth. 6*s*.

HAUSRATH (Prof. A.). HISTORY OF THE NEW TESTAMENT TIMES. The Time of Jesus. Translated by the Revs. C. T. Poynting and P. Quenzer. 2 vols. 8vo, cloth. 12*s*.

The second portion of this work, "The Times of the Apostles," was issued apart from the Library, but in uniform volumes; *see* p. 18.

KEIM'S HISTORY OF JESUS OF NAZARA: Considered in its connection with the National Life of Israel, and related in detail. Translated from the German by Arthur Ransom and the Rev. E. M. Geldart. [Vol. I. Second Edition. Introduction, Survey of Sources, Sacred and Political Groundwork. Religious Groundwork. Vol. II. The Sacred Youth, Self-recognition, Decision. Vol. III. The First Preaching, the Works of

THEOLOGICAL TRANSLATION FUND LIBRARY—Continued.

Jesus, the Disciples, and Apostolic Mission. Vol. IV. Conflicts and Disillusions, Strengthened Self-confidence, Last Efforts in Galilee, Signs of the Approaching Fall, Recognition of the Messiah. Vol. V. The Messianic Progress to Jerusalem, the Entry into Jerusalem, the Decisive Struggle, the Farewell, the Last Supper. Vol. VI. The Messianic Death at Jerusalem. Arrest and Pseudo-Trial, the Death on the Cross, Burial and Resurrection, the Messiah's Place in History, Indices.] Complete in 6 vols. 8vo. 36*s.*

(Vol. I. only to be had when a complete set of the work is ordered.)

KUENEN (Dr. A.). THE RELIGION OF ISRAEL TO THE FALL OF THE JEWISH STATE. By Dr. A. Kuenen, Professor of Theology at the University, Leiden. Translated from the Dutch by A. H. May. 3 vols. 8vo, cloth. 18*s.*

PFLEIDERER (O.). PAULINISM: A Contribution to the History of Primitive Christian Theology. Translated by E. Peters. 2nd Edition. 2 vols. 8vo, cloth. 12*s.*

—— PHILOSOPHY OF RELIGION ON THE BASIS OF ITS HISTORY. (Vols. I. II. History of the Philosophy of Religion from Spinoza to the Present Day; Vols. III. IV. Genetic-Speculative Philosophy of Religion.) Translated by Prof. Allan Menzies and the Rev. Alex. Stewart. 4 vols. 8vo, cloth. 24*s.*

RÉVILLE (Dr. A.). PROLEGOMENA OF THE HISTORY OF RELIGIONS. With an Introduction by Prof. F. Max Müller. 8vo, cloth. 6s.

PROTESTANT COMMENTARY ON THE NEW TESTAMENT. With General and Special Introductions. Edited by Profs. P. W. Schmidt and F. von Holzendorff. Translated from the Third German Edition by the Rev. F. H. Jones, B.A. 3 vols. 8vo, cloth. 18*s.*

SCHRADER (Prof. E.). THE CUNEIFORM INSCRIPTIONS AND THE OLD TESTAMENT. Translated from the Second Enlarged Edition, with Additions by the Author, and an Introduction by the Rev. Owen C. Whitehouse, M.A. 2 vols. (Vol. I. not sold separately.) With a Map. 8vo, cloth. 12*s.*

ZELLER (Dr. E.). THE CONTENTS AND ORIGIN OF THE ACTS OF THE APOSTLES CRITICALLY INVESTIGATED. Preceded by Dr. Fr. Overbeck's Introduction to the Acts of the Apostles from De Wette's Handbook. Translated by Joseph Dare. 2 vols. 8vo, cloth. 12*s.*

THE CROWN THEOLOGICAL LIBRARY.

The volumes are uniform in size (crown octavo) and binding, but the price varies according to the size and importance of the work.

Vol. I. **BABEL AND BIBLE.** By Dr. Friedrich Delitzsch, Professor of Assyriology in the University of Berlin. Authorised Translation. Edited, with an Introduction, by Rev. C. H. W. Johns. Crown 8vo, with 77 illustrations, cloth. 5*s.*

Vol. II. **THE VIRGIN BIRTH OF CHRIST: An Historical and Critical Essay.** By Paul Lobstein, Professor of Dogmatics in the University of Strassburg. Translated by Victor Leuliette, A.K.C., B.-ès-L., Paris. Edited, with an Introduction, by Rev. W. D. Morrison, LL.D. Crown 8vo. 3*s.*

Vol. III. **MY STRUGGLE FOR LIGHT: Confessions of a Preacher.** By R. Wimmer, Pastor of Weisweil-am-Rhein in Baden. Crown 8vo, cloth. 3*s.* 6*d.*

Vol. IV. **LIBERAL CHRISTIANITY: Its Origin, Nature, and Mission.** By Jean Réville, Professeur adjoint à la Faculté de Théologie Protestante de l'Université de Paris. Translated and edited by Victor Leuliette, A.K.C., B.-ès-L. Crown 8vo, cloth. 4*s.*

Vol. V. **WHAT IS CHRISTIANITY?** By Adolf Harnack, Professor of Church History in the University, Berlin. Translated by Thomas Bailey Saunders. Third and Revised Edition. Crown 8vo. 5*s.*

Vol. VI. **FAITH AND MORALS.** By W. Herrmann, Professor of Systematic Theology at the University of Marburg; Author of "The Communion of the Christian with God." Crown 8vo, cloth. 5*s.*

Vol. VII. **EARLY HEBREW STORY.** A Study of the Origin, the Value, and the Historical Background of the Legends of Israel. By John P. Peters, D.D., Rector of St. Michael's Church, New York; author of "Nippur, or Explorations and Adventures on the Euphrates." Crown 8vo, cloth. 5*s.*

Vol. VIII. **BIBLE PROBLEMS AND THE NEW MATERIAL FOR THEIR SOLUTION. A Plea for Thoroughness of Investigation, addressed to Churchmen and Scholars.** By the Rev. T. K. Cheyne, D.Litt., D.D., Fellow of the British Academy; Oriel Professor of Interpretation in the University of Oxford, and Canon of Rochester. Crown 8vo. 5*s.*

THE CROWN THEOLOGICAL LIBRARY—Continued.

Vol. XXIII. **THE SAYINGS OF JESUS.** By Adolf Harnack, D.D. Being Vol. II. of Dr Harnack's New Testament Studies. Crown 8vo, cloth. 6*s*.

Vol. XXIV. **ANGLICAN LIBERALISM.** By Twelve Churchmen. Rev. Hubert Handley, Prof. F. C. Burkitt, M.A., D.D., Rev. J. R. Wilkinson, M.A., Rev. C. R. Shaw Stewart, M.A., Rev. Hastings Rashdall, D.Litt., D.C.L., Prof. Percy Gardner, Litt.D., LL.D., Sir C. T. Dyke Acland, Rev. A. J. Carlyle, M.A., Rev. H. G. Woods, D.D., Rev. A. Caldecott, D.Litt., D.D., Rev. W. D. Morrison, LL.D., Rev. A. L. Lilley, M.A. Crown 8vo, cloth. 5s.

"This is a stimulating volume, and we are glad to see an able body of writers uniting to claim the free atmosphere as the condition of spiritual progress."—*Westminster Gazette.*

Vol. XXV. **THE FUNDAMENTAL TRUTHS OF THE CHRISTIAN RELIGION.** By R. Seeberg, Professor of Systematic Theology in Berlin. Sixteen Lectures delivered before the Students of all Faculties in the University of Berlin. Crown 8vo, 350 pp. 5*s*.

Vol. XXVI. **THE ACTS OF THE APOSTLES.** By Adolf Harnack, D.D. Being Vol. III. of Dr Harnack's New Testament Studies. Crown 8vo, cloth. 6*s*.

Vol. XXVII. **THE LIFE OF THE SPIRIT.** By Rudolf Eucken, Professor of Philosophy in Jena. Second Edition. 8vo, cloth. 5*s*.

Vol. XXVIII. **MONASTICISM: Its Ideals and History; and THE CONFESSIONS OF ST. AUGUSTINE.** Two Lectures by Adolf Harnack, D.D. Translated into English by E. E. Kellett, M.A., and F. H. Marseille, Ph.D. Crown 8vo, cloth. 4*s*.

"One might read all the ponderous works of Montalembert without obtaining so clear a view or so rare a judgment of this immense subject as are offered in these luminous pages."—*Christian World.*

Vol. XXIX. **MODERNITY AND THE CHURCHES.** By Prof. Percy Gardner, Litt.D., of Oxford. Crown 8vo, cloth. 5*s*.

Vol. XXX. **THE OLD EGYPTIAN FAITH.** By Edouard Naville, Hon. LL.D., Ph.D., Litt.D., Fellow of King's College, London, Professor of Egyptology at the University of Geneva. Translated by Colin Campbell, M.A., D.D. Illustrated.

THE HIBBERT LECTURES.

Library Edition, demy 8vo, 10*s.* 6*d.* per volume. Cheap Popular Edition, 3*s.* 6*d.* per volume.

ALVIELLA (Count GOBLET D'). LECTURES ON THE ORIGIN AND THE GROWTH OF THE CONCEPTION OF GOD AS ILLUSTRATED BY ANTHROPOLOGY AND HISTORY. Translated by the Rev. P. H. Wicksteed. (Hibbert Lectures, 1891.) Cloth. 10*s.* 6*d.* Cheap Edition, 3*s.* 6*d.*

BEARD (Rev. Dr. C.). LECTURES ON THE REFORMATION OF THE SIXTEENTH CENTURY IN ITS RELATION TO MODERN THOUGHT AND KNOWLEDGE. (Hibbert Lectures, 1883.) 8vo, cloth. 10*s.* 6*d.* Cheap Edition, 3rd Edition, 3*s.* 6*d.*

DAVIDS (T. W. RHYS). LECTURES ON SOME POINTS IN THE HISTORY OF INDIAN BUDDHISM. (Hib. Lec., 1881.) 2nd Ed. 8vo, cloth. 10*s.* 6*d.* Cheap Ed., 3*s.* 6*d.*

DRUMMOND (Dr.) VIA, VERITAS, VITA. Lectures on Christianity in its most Simple and Intelligible Form. (The Hibbert Lectures, 1894.) 10*s.* 6*d.* Cheap Edition, 3*s.* 6*d.*

HATCH (Rev. Dr.). LECTURES ON THE INFLUENCE OF GREEK IDEAS AND USAGES UPON THE CHRISTIAN CHURCH. Edited by Dr. Fairbairn. (Hibbert Lectures, 1888.) 3rd Edition. 8vo, cloth. 10*s.* 6*d.* Cheap Edition, 3*s.* 6*d.*

KUENEN (Dr. A.). LECTURES ON NATIONAL RELIGIONS AND UNIVERSAL RELIGION. (The Hibbert Lectures, 1882.) 8vo, cloth. 10*s.* 6*d.* Cheap Edition, 3*s.* 6*d.*

MONTEFIORE (C. G.). ORIGIN AND GROWTH OF RELIGION AS ILLUSTRATED BY THE RELIGION OF THE ANCIENT HEBREWS. (The Hibbert Lectures, 1892.) 2nd Edition. 8vo, cloth. 10*s.* 6*d.* Cheap Edition, 3*s.* 6*d.*

PFLEIDERER (Dr. O.). LECTURES ON THE INFLUENCE OF THE APOSTLE PAUL ON THE DEVELOPMENT OF CHRISTIANITY. Translated by the Rev. J. Frederick Smith. (Hibbert Lectures, 1885.) 2nd Edition. 8vo, cloth. 10*s.* 6*d.* Cheap Edition, 3*s.* 6*d.*

RENAN (E.). ON THE INFLUENCE OF THE INSTITUTIONS, THOUGHT, AND CULTURE OF ROME ON CHRISTIANITY AND THE DEVELOPMENT OF THE CATHOLIC CHURCH. Translated by the Rev. Charles Beard. (Hibbert Lectures, 1880.) 8vo, cloth. 10*s.* 6*d.* Cheap Edition, 3rd Edition, 3*s.* 6*d.*

ALPHABETICAL LIST—Continued.

COIT (STANTON, Ph.D.). NATIONAL IDEALISM AND A STATE CHURCH.

"No one reading this book could miss its interest and ability. . . . Criticises existing Christianity along lines almost literally opposite to those of Herbert Spencer and the majority of the critics. . . . Great clearness and eloquence."—G. K. CHESTERTON in *The Nation.*

—— **NATIONAL IDEALISM AND THE BOOK OF COMMON PRAYER.** An Essay in Re-Interpretation and Revision. Demy 8vo, cloth. 10*s.* 6*d.* net.

COMMON PRAYER FOR CHRISTIAN WORSHIP: in Ten Services for Morning and Evening. 32mo, cloth. 1*s.* 6*d.* Also in 8vo, cloth. 3*s.*

CONWAY (MONCURE D.). CENTENARY HISTORY OF THE SOUTH PLACE ETHICAL SOCIETY. With numerous Portraits, a facsimile of the original MS. of the hymn, "Nearer, my God, to Thee," and Appendices. Crown 8vo, half vellum, paper sides. 5*s.*

CORNILL (Prof. CARL). INTRODUCTION TO THE CANONICAL BOOKS OF THE OLD TESTAMENT. Demy 8vo, cloth. 10*s.* 6*d. net.* *See* Theological Translation Library, New Series, p. 3.

DAVIDS (T. W. RHYS). LECTURES ON SOME POINTS IN THE HISTORY OF INDIAN BUDDHISM. *See* The Hibbert Lectures, p. 13.

DELITZSCH (F.). BABEL AND BIBLE. Two Lectures delivered before the Deutsche Orient-Gesellschaft in the presence of the German Emperor. 5*s.* *See* Crown Theological Library, p. 9. *See also* Harnack, A., "Letter to *Preuss. Jahrbücher,*" p. 18.

DOBSCHÜTZ (E. VON). CHRISTIAN LIFE IN THE PRIMITIVE CHURCH. Demy 8vo. 10*s.* 6*d.* *See* Theological Translation Library, New Series, p. 3.

DOLE (CHARLES F.). THE ETHICS OF PROGRESS, or the Theory and the Practice by which Civilisation proceeds. Small demy 8vo, cloth. 6*s. net.*

DRIVER (S. R.). *See* Mosheh ben Shesheth, p. 22.

DRUMMOND (JAMES, M.A., LL.D., Hon. Litt.D., late Principal of Manchester College, Oxford). AN INQUIRY INTO THE CHARACTER AND AUTHORSHIP OF THE FOURTH GOSPEL. *New Edition in Preparation.*

"The book is not only learned, but also reverent and spiritual in tone, and ought to find its way into the libraries of students of all shades of belief, as a very notable attempt to solve one of the most important of New Testament problems."—*Christian World.*

—— **VIA, VERITAS, VITA.** *See* The Hibbert Lectures, p. 13.

—— **PHILO JUDÆUS.** *See* p. 28.

ALPHABETICAL LIST—Continued.

ECHOES OF HOLY THOUGHTS: Arranged as Private Meditations before a First Communion. 2nd Edition, with a Preface by Rev. J. Hamilton Thom. Printed with red lines. Fcap. 8vo, cloth. 1*s.*

EUCKEN (Prof. RUDOLF). THE LIFE OF THE SPIRIT. 5*s.* *See* page 12.

EWALD (H.). COMMENTARY ON THE PROPHETS OF THE OLD TESTAMENT. *See* Theological Translation Library, Old Series, p. 7.

—— COMMENTARY ON THE PSALMS. *See* Theological Translation Library, Old Series, p. 7.

EWALD (H.). COMMENTARY ON THE BOOK OF JOB. *See* Theological Translation Library, Old Series, p. 7.

FARNELL (L. R.). THE EVOLUTION OF RELIGION. An Anthropological Study. By L. R. Farnell, D.Litt., Fellow and Tutor of Exeter College, Oxford. 5*s.* *See* Crown Theological Library, p. 10.

FIGG (E. G.). ANALYSIS OF THEOLOGY, NATURAL AND REVEALED. Crown 8vo, cloth. 6*s.*

FORMBY (Rev. C. W.). RE-CREATION: A New Aspect of Evolution. Large Crown 8vo, cloth. 5*s.*

FOUR GOSPELS (THE) AS HISTORICAL RECORDS. 8vo, cloth. 15*s.*

GILL (C.). THE EVOLUTION OF CHRISTIANITY. By Charles Gill. 2nd Edition. With Dissertations in answer to Criticism. 8vo, cloth. 12*s.*

—— THE BOOK OF ENOCH THE PROPHET. Translated from an Ethiopic MS. in the Bodleian Library, by the late Richard Laurence, LL.D., Archbishop of Cashel. The Text corrected from his latest Notes by Charles Gill. Re-issue, 8vo, cloth. 5*s.*

HARNACK (ADOLF). ACTS OF THE APOSTLES. 6*s.* *See* Crown Theological Library, p. 12.

—— MONASTICISM: Its Ideals and History; and THE CONFESSIONS OF ST. AUGUSTINE. Two Lectures by Adolf Harnack. Translated into English by E. E. Kellett, M.A., and F. H. Marseille, Ph.D., M.A. Crown 8vo, cloth. 4*s.*

"The lectures impart to these old subjects a new and vivid interest which cannot but win this faithful version many admiring readers."—*Scotsman.*

"One might read all the ponderous volumes of Montalembert without obtaining so clear a view or so rare a judgment of this immense subject as are offered in these luminous pages. . . . The translation is excellent, and gives us Harnack in pure and vigorous English."—*Christian World.*

ALPHABETICAL LIST—Continued.

HARNACK (ADOLF). LETTER to the "Preussische Jahrbücher" on the German Emperor's Criticism of Prof. Delitzsch's Lectures on "Babel and Bible." Translated into English by Thomas Bailey Saunders. *6d.* net.

—— LUKE, THE PHYSICIAN. *6s.* *See* Crown Theological Library, p. 11.

—— HISTORY OF DOGMA. 7 vols., 10*s.* 6*d.* each. *See* Theological Translation Library, New Series, p. 4.

—— THE SAYINGS OF JESUS. *6s.* *See* Crown Theological Library, p. 12.

—— WHAT IS CHRISTIANITY? *See* Theological Translation Library, New Series, p. 5. *Also* Crown Theological Library, p. 10. *5s.* *See* Saunders (T. B.), "Professor Harnack and his Oxford Critics," p. 24.

—— MISSION AND EXPANSION OF CHRISTIANITY IN THE FIRST THREE CENTURIES. By Adolf Harnack, D.D., Berlin. Entirely new edition, re-written, with numerous additions and maps. 2 vols. demy 8vo, cloth. *25s.* net.

—— and HERRMANN (Dr. WILHELM). ESSAYS ON THE SOCIAL GOSPEL. *4s. 6d.* Translation edited by Maurice A. Canney, M.A. *See* Crown Theological Library, p. 11

HATCH (Rev. Dr.). LECTURES ON THE INFLUENCE OF GREEK IDEAS AND USAGES UPON THE CHRISTIAN CHURCH. *See* The Hibbert Lectures, p. 13.

HAUSRATH (Prof. A.). HISTORY OF THE NEW TESTAMENT TIMES. The Time of the Apostles. Translated by Leonard Huxley. With a Preface by Mrs Humphry Ward. 4 vols. 8vo, cloth. *42s.* (Uniform with the Theological Translation Library, Old Series.)

—— NEW TESTAMENT TIMES. The Times of Jesus. 2 vols. *12s.* *See* Theological Translation Library, Old Series, p. 7.

HEBREW TEXTS, in large type for Classes:

Genesis. 2nd Edition. 16mo, cloth. *1s. 6d.*
Psalms. 16mo, cloth. *1s.*
Isaiah. 16mo, cloth. *1s.*
Job. 16mo, cloth. *1s.*

HENSLOW (Rev. G.). THE ARGUMENT OF ADAPTATION; or, Natural Theology reconsidered. 8vo, cloth. *1s.*

—— SPIRITUAL TEACHINGS OF BIBLE PLANTS; or, The Garden of God. 8vo, cloth. *1s.*

—— THE AT-ONE-MENT; or, The Gospel of Reconciliation. 8vo, cloth. 1s.

ALPHABETICAL LIST—Continued.

HENSLOW (Rev. G.). THE SPIRITUAL TEACHING OF CHRIST'S LIFE. 8vo, cloth. 5*s.* net.

—— CHRIST NO PRODUCT OF EVOLUTION. 8vo, cloth. 1*s.*

—— VULGATE, THE: The Source of False Doctrines. A work specially applicable to the Clergy, Bible Teachers, and other exponents of the Gospel of Christ. Crown 8vo, cloth. 2*s.* 6*d.* net.

HERFORD (R. TRAVERS, B.A.). CHRISTIANITY IN TALMUD AND MIDRASH. Demy 8vo, cloth. 18*s.* net.

CONTENTS:—Introduction. Division I. Passages from the Rabbinical Literature: A. Passages relating to Jesus. B. Passages relating to Minim, Minuth. Division II. General Results. Appendix containing the Original Texts of the Passages translated. Indices.

"It is no exaggeration to say that it will prove indispensable not only to scholars interested in Talmudic literature, but to all who study the subject of the evangelical tradition. It will introduce the reader into a new world—that of Jewish thought in the centuries after Christ."—*Cambridge Review.*

HERRMANN (W.). THE COMMUNION OF THE CHRISTIAN WITH GOD. 5*s.* *See* Theological Translation Library, New Series, p. 5.

—— FAITH AND MORALS. 5*s.* *See* Crown Theological Library, p. 9.

—— and HARNACK (ADOLF.). ESSAYS ON THE SOCIAL GOSPEL. 4*s.* 6*d.* *See* Crown Theological Library, p. 11.

HIBBERT JOURNAL: A Quarterly Review of Religion, Theology, and Philosophy. Edited by L. P. Jacks and G. Dawes Hicks. Vol. I. Royal 8vo, 856 pp. Vol. II., 864 pp. Vol. III., 869 pp. Vols. IV., V., VI., and VII., 960 pp. Cloth. Each 12*s.* 6*d.* net. Annual Subscription, 10*s.* post free.

HIBBERT JOURNAL SUPPLEMENT, 1909, entitled JESUS OR CHRIST? Containing Essays by the following writers:—The late Rev. George Tyrrell, The Bishop of Southwark, Professor H. Weinel, Professor Percy Gardner, Professor P. Schmiedel, Professor Henry Jones, The Rev. Richard Morris, B.D., Sir Oliver Lodge, Canon H. Scott Holland, The Rev. Father Joseph Rickaby, S.J., Professor Nathan Söderblom (Upsala)., Rev. Principal A. E. Garvie, D.D., The Rev. R. J. Campbell, M.A., The Rev. James Drummond, D.D., Professor B. W. Bacon, D.D., Rev. Principal J. E. Carpenter, D.D., Mr James Collier, The Rev. R. Roberts. Super-royal 8vo, cloth. 5*s.* net.

HOERNING (Dr. R.). THE KARAITE MSS., BRITISH MUSEUM. The Karaite Exodus (i. to viii. 5) in Forty-two Autotype Facsimiles, with a Transcription in ordinary Arabic type. Together with Descriptions and Collation of that and five other MSS. of portions of the Hebrew Bible in Arabic characters in the same Collection. Royal 4to, cloth, gilt top. 20*s.*

ALPHABETICAL LIST—Continued.

MITCHELL (Rev. A. F.). HOW TO TEACH THE BIBLE. 2nd Edition, thoroughly revised and reset. Crown 8vo, cloth. 2*s.* 6*d.*

"The lectures are marked by much insight and moderation. The book is notable also for its gracious and cultured note, and for the quiet persuasiveness with which a revolutionary reform is advocated."—*Sunday School Chronicle.*

MONTEFIORE (C. G.). ORIGIN AND GROWTH OF RELIGION AS ILLUSTRATED BY THE RELIGION OF THE ANCIENT HEBREWS. *See* The Hibbert Lectures, p. 13.

MOSHEH BEN SHESHETH'S COMMENTARY ON JEREMIAH AND EZEKIEL. Edited from a Bodleian MS., with a Translation and Notes, by S. R. Driver. 8vo, sewed. 3*s.*

MÜNSTERBERG (Prof. HUGO). THE AMERICANS. 12*s.* 6*d.* net. *See* p. 29.

NESTLE (E.). INTRODUCTION TO THE TEXTUAL CRITICISM OF THE GREEK NEW TESTAMENT. *See* Theological Translation Library, New Series, p. 6.

OTTO (R.). NATURALISM AND RELIGION. 6*s.* *See* Crown Theological Library, p. 11.

PERCIVAL (G. H.). THE INCARNATE PURPOSE. Essays on the Spiritual Unity of Life. Crown 8vo, cloth. 2*s.* 6*d.* net.

PERRIN (R. S.). THE EVOLUTION OF KNOWLEDGE. A Review of Philosophy. Crown 8vo, cloth. 6*s.*

PERSONAL AND FAMILY PRAYERS. 8vo, buckram. 1*s.* net.

PETERS (JOHN P.). EARLY HEBREW STORY. A Study of the Origin, the Value, and the Historical Background of the Legends of Israel. 5*s.* *See* Crown Theological Library, p. 10.

PFLEIDERER (Dr. O.). LECTURES ON THE INFLUENCE OF THE APOSTLE PAUL ON THE DEVELOPMENT OF CHRISTIANITY. *See* The Hibbert Lectures, p. 13.

—— PAULINISM: A Contribution to the History of Primitive Christianity. 2 vols. 12*s.* *See* Theological Translation Library, Old Series, p. 8.

—— PHILOSOPHY OF RELIGION ON THE BASIS OF ITS HISTORY. 4 vols. 24*s.* *See* Theological Translation Library, Old Series, p. 8.

ALPHABETICAL LIST—Continued.

PFLEIDERER (Dr. O.). THE EARLY CHRISTIAN CONCEPTION OF CHRIST: Its Significance and Value in the History of Religion. 3*s.* 6*d.* *See* Crown Theological Library, p. 10.

—— PRIMITIVE CHRISTIANITY. Vols. I. and II. Demy 8vo, cloth. 10*s.* 6*d.* net each. *See* Theological Translation Library, New Series, p. 2.

PICTON, (J. ALLANSON, M.A., Lond.). MAN AND THE BIBLE. A Review of the Place of the Bible in Human History. Demy 8vo, cloth. 6*s.* net.

POOLE (REG. LANE). ILLUSTRATIONS OF THE HISTORY OF MEDIÆVAL THOUGHT IN THE DEPARTMENTS OF THEOLOGY AND ECCLESIASTICAL POLITICS. 8vo, cloth 10*s.* 6*d.*

PROTESTANT COMMENTARY ON THE NEW TESTAMENT. 3 vols. 18*s.* *See* Theological Translation Library, Old Series, p. 8.

RENAN (E.). ON THE INFLUENCE OF THE INSTITUTIONS, THOUGHT, AND CULTURE OF ROME ON CHRISTIANITY AND THE DEVELOPMENT OF THE CATHOLIC CHURCH. *See* Hibbert Lectures, p. 13.

RENOUF (P. LE PAGE). ON THE RELIGION OF ANCIENT EGYPT. *See* Hibbert Lectures, p. 14.

RÉVILLE (A.). THE SONG OF SONGS, Commonly called the Song of Solomon, or the Canticle. Translated from the French. Crown 8vo, cloth. 1*s.* 6*d.*

—— ON NATIVE RELIGIONS OF MEXICO AND PERU. *See* Hibbert Lectures, p. 14.

—— PROLEGOMENA OF THE HISTORY OF RELIGIONS. 6*s.* *See* Theological Translation Library, Old Series, p. 8.

RÉVILLE (JEAN). LIBERAL CHRISTIANITY. 4*s.* *See* Crown Theological Library, p. 10.

RIX (HERBERT). TENT AND TESTAMENT. A Camping Tour in Palestine, with some Notes on Scripture Sites. With 61 Illustrations, Frontispiece, and Maps. Demy 8vo, cloth. 8*s.* 6*d.* net.

"His narrative of travel is that of an intelligent and well-informed traveller who went without prepossessions and was both able and willing to weigh evidence. . . . Mr. Rix's contribution is one that must be taken into account." —*Spectator.*

"The result is a thoughtful, well-written, even learned work, far from the vain outpourings of the tourist. The narrative, though heavily charged with information, is wonderfully unembarrassed, and the word-pictures which abound are true to life."—*Athenæum.*

ALPHABETICAL LIST—Continued.

RIX (HERBERT). A DAWNING FAITH. Crown 8vo, cloth. 5*s.*

ROBINSON (ALEX., M.A., B.D.). A STUDY OF THE SAVIOUR IN THE NEWER LIGHT. 2nd Edition. Revised and partly re-written. Demy 8vo, cloth. 5*s.* net

—— OLD AND NEW CERTAINTY OF THE GOSPEL: A Sketch. Crown 8vo, cloth. 2*s.* 6*d.*

SABATIER (AUGUSTE). THE RELIGIONS OF AUTHORITY AND THE RELIGION OF THE SPIRIT. With a Memoir by Professor J. Réville. 10*s.* 6*d.* *See* Theological Translation Library, New Series, p. 3.

—— THE DOCTRINE OF THE ATONEMENT AND ITS HISTORICAL EVOLUTION; and RELIGION AND MODERN CULTURE. 4*s.* 6*d.* *See* Crown Theological Library, p. 10.

SADLER (Rev. Dr.). PRAYERS FOR CHRISTIAN WORSHIP. Crown 8vo, cloth. 3*s.* 6*d.*

—— CLOSET PRAYERS, Original and Compiled. 18mo, cloth. 1*s.* 6*d.*

SAUNDERS (T. BAILEY). PROFESSOR HARNACK AND HIS OXFORD CRITICS. Crown 8vo, cloth. 1*s.* 6*d.* net.

"It gives thoughtful and acutely reasoned support to the great historical student of Christianity who represents Berlin in theology against the pigtailed opposition which Oxford has offered to his learning. A spirited piece of controversial writing, it cannot but prove stimulating to readers interested in modern divinity, no matter to which side of the debate their private prepossessions incline them."—*Scotsman.*

"Mr. Saunders writes with sobriety and with a knowledge of the points at issue. Readers of 'Harnack and his Critics' will do well to read his comments."—*Sheffield Daily Telegraph.*

SAVAGE (M. J.). BELIEFS ABOUT THE BIBLE. 8vo, cloth. 7*s.* 6*d.*

SAYCE (A. H.). ON THE RELIGION OF ANCIENT ASSYRIA AND BABYLONIA. *See* Hibbert Lectures, p. 14.

SCHRADER (E.). CUNEIFORM INSCRIPTIONS AND THE OLD TESTAMENT. 2 vols. 12*s.* *See* Theological Translation Library, Old Series, p. 8.

SCHUBERT (HANS VON). OUTLINES OF CHURCH HISTORY. *See* Theological Translation Library, New Series, p. 3.

ALPHABETICAL LIST—Continued.

SCOTT (Rev. E. F., M.A.). THE APOLOGETIC OF THE NEW TESTAMENT. 5*s*. *See* Crown Theological Library, p. 11.

SCULLARD (Rev. Prof. H. H., M.A., D.D.). EARLY CHRISTIAN ETHICS IN THE WEST, FROM CLEMENT TO AMBROSE. Large crown 8vo, cloth. 6*s*.

SEEBERG (R.). THE FUNDAMENTAL TRUTHS OF THE CHRISTIAN RELIGION. By R. Seeberg, Professor of Systematic Theology in Berlin. 5*s*. *See* Crown Theological Library, p. 12.

SEVERUS (Patriarch of Antioch). THE SIXTH BOOK OF THE SELECT LETTERS OF SEVERUS, PATRIARCH OF ANTIOCH, in the Syriac Version of Athanasius of Nisibis. Edited and translated by E. W. Brooks. Vol. I. (Text), Part 1, and Vol. II. (Translation), Part 1. 2 vols. 8vo, cloth. 42*s*. net. Vol. I. (Text), Part 2, and Vol. II. (Translation), Part 2. 2 vols. 8vo, cloth. 42*s*. net. *See* Text and Translation Society, p. 37.

SHARPE (SAMUEL). CRITICAL NOTES ON THE AUTHORISED ENGLISH VERSION OF THE NEW TESTAMENT. 2nd Edition. 12mo, cloth. 1*s*. 6*d*.

SODEN (H. von, D.D.). THE BOOKS OF THE NEW TESTAMENT. 5*s*. *See* Crown Theological Library, p. 10.

STEPHEN (Rev. Canon REGINALD, M.A.). DEMOCRACY AND CHARACTER. Being the Moorhouse Lectures for 1908. Crown 8vo, cloth. 5*s*.

"Canon Stephen's book is much too clear and thoughtful to be neglected in this country. Within the narrow limits of seven lectures he has discussed some important issues of politics in a democratic country with strong practical common sense and the right kind of theoretical learning."—*Athenæum*.

THE STATUTES OF THE APOSTLES. The hitherto unedited Ethiopic and Arabic Texts. Edited, with an Introduction and Translations of the Ethiopic, Arabic, and Coptic Texts, by Rev. G. Horner, M.A. With an Appendix—a recently discovered variant of the Coptic Text. 18*s*. net.

TAYLER (Rev. JOHN JAMES). AN ATTEMPT TO ASCERTAIN THE CHARACTER OF THE FOURTH GOSPEL, especially in its Relation to the First Three. 2nd Edition. 8vo, cloth. 5*s*.

TAYLOR (Rev. C.). THE DIRGE OF COHELETH IN ECCLES. XII. DISCUSSED AND LITERALLY INTERPRETED. 8vo, cloth. 3*s*.

II. Philosophy, Psychology.

BACON (ROGER), THE "OPUS MAJUS" OF. Edited, with Introduction and Analytical Table, by John Henry Bridges, Fellow of Royal College of Physicians, sometime Fellow of Oriel College. Complete in 3 vols., 31*s.* 6*d.*; Vol. III. sold separately, 7*s.* 6*d.*

BREWSTER (H. B.). THE THEORIES OF ANARCHY AND OF LAW. A Midnight Debate. Crown 8vo, parchment. 5*s.*

—— THE PRISON. A Dialogue. Crown 8vo, parchment. 5*s.*

—— THE STATUETTE AND THE BACKGROUND. Crown 8vo, parchment. 4s.

COLLINS (F. H.). AN EPITOME OF THE SYNTHETIC PHILOSOPHY. By F. Howard Collins. With a Preface by Herbert Spencer. 5th Edition. The Synthetic Philosophy Completed. 8vo, cloth. 21*s.*

DRUMMOND (Dr.). PHILO JUDÆUS; or, The Jewish Alexandrian Philosophy in its Development and Completion. By James Drummond, LL.D., late Principal of Manchester New College, Oxford. 2 vols. 8vo, cloth. 21*s.*

HODGSON (S. H.). PHILOSOPHY AND EXPERIENCE. An Address delivered before the Aristotelian Society. 8vo, sewed. 2*s.*

—— THE REORGANISATION OF PHILOSOPHY. Address. 8vo, sewed. 1*s.*

JORDAN (HUMFREY R., B.A.). BLAISE PASCAL. A Study in Religious Psychology. Crown 8vo, cloth. 4*s.* 6*d.* net.

JESUS OR CHRIST? The Hibbert Journal Supplement for 1909. Containing Essays by the following writers :—The late Rev. George Tyrrell, the Bishop of Southwark, Professor H. Weinel, Professor Percy Gardner, Professor P. Schmiedel, Professor Henry Jones, The Rev. Richard Morris, B.D., Sir Oliver Lodge, Canon H. Scott Holland, The Rev. Father Joseph Rickaby, S.J., Professor Nathan Soderblom (Upsala), Rev. Principal A. E. Garvie, D.D., The Rev. R. J. Campbell, M.A., The Rev. James Drummond, D.D., Professor B. W. Bacon, D.D., Rev. Principal J. E. Carpenter, D.D., Mr. James Collier, The Rev. R. Roberts. Super-royal 8vo, cloth. 5*s.* net.

LAURIE (Professor SIMON). ETHICA: or, The Ethics of Reason. By Scotus Novanticus. 2nd Edition. 8vo, cloth. *6s.*

—— METAPHYSICA NOVA ET VETUSTA: A Return to Dualism. 2nd Edition. Crown 8vo, cloth. *6s.*

LODGE (Sir O.). LIFE AND MATTER. *2s. 6d.* net. *See* Religion, p. 21.

MACCOLL (HUGH). MAN'S ORIGIN, DESTINY, AND DUTY. Crown 8vo, cloth. *4s. 6d.* net.

Professor A. E. TAYLOR in *Mind*:—"On the main issues involved the writer of the present notice must avow himself entirely on the author's side, and would unreservedly express his admiration for the skill and luminosity with which the chief points are made, and the happiness of the illustrations.

"Would that some public-minded society would provide the funds for circulating a book like the present in a sixpenny edition as a counterblast to the sorry stuff which the secularist press is providing as spiritual pabulum for the inquiring artisan.

"The tenth essay, on the 'fallacies of Haeckel,' in particular, is a most admirable piece of work, at once clear, untechnical, and unanswerable."

MÜNSTERBERG (HUGO, Professor of Psychology at Harvard University). THE AMERICANS. Translated by Edwin B. Holt, Ph.D., Instructor at Harvard University. Royal 8vo, cloth. *12s. 6d.* net.

PERRIN (R. S.). EVOLUTION OF KNOWLEDGE, THE. A Review of Philosophy. *6s.* *See* Religion, p. 22.

PIKLER (JUL.). THE PSYCHOLOGY OF THE BELIEF IN OBJECTIVE EXISTENCE. Part I. 8vo, cloth. *4s. 6d.*

PROCEEDINGS OF THE ARISTOTELIAN SOCIETY FOR THE SYSTEMATIC STUDY OF PHILOSOPHY. Proceedings. Vol. I., 4 Nos., 1890–91. 8vo, *12s.* Discontinued after Vol. III. Part 2. Or each Part separately. Vol. I. No. 1, *2s. 6d.*; No. 2, *2s. 6d.*; No. 3, Part 1, *1s. 6d.*; Part 2, *2s.*; No. 4, Part 1, *1s. 6d.*; Part 2, *2s.* Vol. II. No. 1, Part 1, *1s. 6d.*; Part 2, *2s.*; No. 2, Part 1, *1s. 6d.*; Part 2, *2s.*; No. 3, Part 1, *2s.*; Part 2, *2s.* Vol. III. Part 1, *2s. 6d.*; Part 2, *2s.* NEW SERIES, Vols. I.–IX. Demy 8vo, buckram, each *10s. 6d.* net.

SALEEBY (C. W., M.D., F.R.S.). INDIVIDUALISM AND COLLECTIVISM. Crown 8vo, cloth. *2s.*

SCHURMAN (J. GOULD). KANTIAN ETHICS AND THE ETHICS OF EVOLUTION. 8vo, cloth. *5s.*

—— THE ETHICAL IMPORT OF DARWINISM. Crown 8vo, cloth. *5s.*

SCRIPTURE (EDWARD W., Ph.D.). STUDIES FROM THE YALE PSYCHOLOGICAL LABORATORY. Vols. I.-VI., each 4*s.* 2*d.* net.

SCULLARD (Rev. Prof. H.H., M.A., D.D.). EARLY CHRISTIAN ETHICS IN THE WEST, FROM CLEMENT TO AMBROSE. Large crown 8vo, cloth. 6*s.*

SHEARMAN (A. T., M.A.). THE DEVELOPMENT OF SYMBOLIC LOGIC. A Critical Historical Study of the Logical Calculus. Crown 8vo, cloth. 5*s.* net.

From the Contents.

Symbols as representing Terms and as representing Propositions —Symbols of Operation—The Process of Solution—Concerning a Calculus Based on Intension—The Doctrines of Jevons and of Mr. MacColl—Later Logical Doctrines—The Utility of Symbolic Logic.

"Its style is smooth, pleasant, and lucid."—*Athenæum.*

SPENCER (HERBERT). AN AUTOBIOGRAPHY. 2 vols. demy 8vo. With Portraits. Popular Edition, 12*s.* 6*d.* net. Library Edition, 28*s.* net.

"It is not too much to say that we close this book, the most interesting, and certainly one of the most important we have ever opened, feeling better, wiser, and humbler for having thus hastily read it."—*Academy.*

"It is a book for all men and for all time. In its pages the thinker may trace, step by step, the synthesis of synthetic philosophy. Here the poet will find not only a worthy inspiration, but a possibly surprising vein of sympathy. The statesman, the inventor, the litterateur, the man of theory, and the man of practice will find alike, within the covers of these two massive volumes, an almost inexhaustible treasury of interest and constructive thought. There is suggestion and instruction for all the world, and an almost indefinable fascination—whether it be due to the mere intrinsic beauty of the picture itself, or to the dignity of its execution, or to the sense of its almost laborious faithfulness, or to the combined attraction of all three."—*St. James's Gazette.*

—— A SYSTEM OF SYNTHETIC PHILOSOPHY——

Vol. I. **First Principles.** With an Appendix and a Portrait. Finally revised. New Edition, large crown 8vo, cloth. 7*s.* 6*d.*

Vols. II. and III. **The Principles of Biology.** 6th Thousand. 8vo, cloth. Revised and greatly enlarged. Vols. I. and II. 18*s.* each.

Vols. IV. and V. **The Principles of Psychology.** 5th Thousand. 2 vols. 8vo, cloth. 36*s.*

Vol. VI. **The Principles of Sociology.** Vol. I. Part 1, The Data of Sociology; Part 2, The Inductions of Sociology; Part 3, Domestic Institutions. 4th Thousand, revised and enlarged. 8vo, cloth. 21*s.*

A SYSTEM OF SYNTHETIC PHILOSOPHY—Continued.

Vol. VII. **The Principles of Sociology.** Vol. II. Part 4, Ceremonial Institutions; Part 5, Political Institutions. 3rd Thousand. 8vo, cloth. 18*s.*

Vol. VIII. **The Principles of Sociology.** Vol. III. Part 6, Ecclesiastical Institutions; Part 7, Professional Institutions; Part 8, Industrial Institutions. 2nd Thousand. 8vo, cloth. 16*s.*

Vol. IX. **The Principles of Ethics.** Vol. I. Part 1, The Data of Ethics; Part 2, The Inductions of Ethics; Part 3, The Ethics of Individual Life. 2nd Thousand. 8vo, cloth. 15*s.*

Vol. X. **The Principles of Ethics.** Vol. II. Part 4, Justice; Part 5, Negative Beneficence; Part 6, Positive Beneficence; Appendices. Demy 8vo, cloth. 12*s.* 6*d.*

Also to be had separately:

SPENCER (HERBERT). **DATA OF ETHICS.** Reset uniform with popular edition of "First Principles." Sewed, 2*s.* 6*d.* net; cloth, 3s. net.

—— **JUSTICE.** Being Part 4 of the Principles of Ethics. 2nd Thousand. 8vo, cloth. 6*s.*

Other Works.

—— **THE STUDY OF SOCIOLOGY.** Library Edition (21st Thousand), with a Postscript. 8vo, cloth. 10*s.* 6*d.*

—— **EDUCATION: Intellectual, Moral, and Physical.** Cheap Edition. Entirely reset. 46th Thousand. Crown 8vo, cloth. 2*s.* 6*d.*

—— **ESSAYS: Scientific, Political, and Speculative.** A new Edition, rearranged, with additional Essays. 3 vols. 8vo, cloth. (Each 10*s.*) 30*s.*

—— **SOCIAL STATICS.** Abridged and revised, together with "The Man *v.* The State." 8vo, cloth. 10*s.*

—— **VARIOUS FRAGMENTS.** Uniform in Library binding. Demy 8vo, cloth. Enlarged Edition. 6*s.*

—— **FACTS AND COMMENTS.** Demy 8vo, cloth. 6*s.*

—— **THE MAN *versus* THE STATE.** 14th Thousand. Sewed. 1*s.*

—— **A REJOINDER TO PROFESSOR WEISMANN.** Sewed. 6*d.*

SPENCER (HERBERT). REASONS FOR DISSENTING FROM THE PHILOSOPHY OF M. COMTE. Sewed. *6d.*

—— **DESCRIPTIVE SOCIOLOGY; or, Groups of Sociological Facts.** Compiled and abstracted by Professor D. Duncan of Madras, Dr. Richard Scheppig, and James Collier. Folio, boards.

No. 1. **English.** 18*s.*
No. 2. **Ancient American Races.** 16*s.*
No. 3. **Lowest Races, Negritto Races, Polynesians.** 18*s.*
No. 4. **African Races.** 16*s.*
No. 5. **Asiatic Races.** 18*s.*
No. 6. **American Races.** 18*s.*
No. 7. **Hebrews and Phœnicians.** 21*s.*
No. 8. **The French Civilisation.** 30*s.*

In Preparation.

Edited by Henry R. Tedder, Secretary and Librarian of the Athenæum Club.

Chinese. Compiled and abstracted by E. T. C. Werner, H.M.'s Consular Service, China.
Ancient Egyptians.
Hellenic Greeks. By Rev. Dr J. P. Mahaffy, and Professor W. A. Goligher, Trinity College, Dublin.
Hellenistic Greeks. By the same.
Romans. By Mr E. H. Alton, F.T.C.D., and Professor W. A. Goligher.

—— **COLLINS (F. H.). AN EPITOME OF THE SYNTHETIC PHILOSOPHY.** By F. Howard Collins. Being a Digest of Mr. Herbert Spencer's Works. 5th Edition, the Synthetic Philosophy Completed. With a Preface by Herbert Spencer. 8vo, cloth. 21*s.*

SPINOZA: Four Essays. By Professors Land, Van Vloten, and Kuno Fischer, and by E. Renan. Edited by Professor Knight, of St. Andrews. Crown 8vo, cloth. 5*s.*

STUDIES FROM THE YALE PSYCHOLOGICAL LABORATORY. Edited by Professor E. W. Scripture. With many Illustrations. 8vo, sewed. 4*s.* 2*d.* each net. Vol. I. 1892–93, 100 pages. Vol. II. 1894, 124 pages. Vol. III. 1895, 110 pages. Vol. IV. 1896, 141 pages. Vol. V. 1897, 105 pages. Vol. VI. 1898, 105 pages.

WUNDT (WILHELM). OUTLINES OF PSYCHOLOGY. Translated, with the co-operation of the Author, by Charles Hubbard Judd, Ph.D., Instructor in the Wesleyan University. 3rd Enlarged Edition Demy 8vo, cloth. 8*s.* net.

III. Oriental Languages, Literature, and History.

ABHIDHANARATNAMALA (THE) OF HALAYUDHA. A Sanskrit Vocabulary (120 pp.). Edited, with a Sanskrit-English Glossary (180 pp.), by Dr. T. Aufrecht. 8vo, cloth. (Published at 18*s.*) 10*s.*

AVESTI, PAHLAVI, and ANCIENT PERSIAN STUDIES in Honour of the late SHAMS-UL-ULAMA DASTUR PESHOTANJI BEHRAMJI SANJANA, M.A., Ph.D. Paper cover, 12*s.* 6*d.* net; cloth, 13*s.* 6*d.* net.

BERNSTEIN and KIRSCH. SYRIAC CHRESTOMATHY AND LEXICON (Chrestomathia Syriaca cum Lexico). 2 vols. in 1. 8vo, cloth boards. 7*s.* 6*d.* I. Chrestomathia, separately. Sewed. 3*s.*

DAVIDS (T. W. RHYS). LECTURES ON SOME POINTS IN THE HISTORY OF INDIAN BUDDHISM. *See* The Hibbert Lectures, p. 13.

DELITZSCH (Prof. F.). ASSYRIAN GRAMMAR. With Paradigms, Exercises, Glossary, and Bibliography. Translated by the Rev. Prof. A. R. S. Kennedy. Crown 8vo, cloth. 15*s.*

—— **THE HEBREW LANGUAGE VIEWED IN THE LIGHT OF ASSYRIAN RESEARCH.** Demy 8vo, cloth. 4*s.*

—— **BABEL AND BIBLE.** 5*s.* *See* Crown Theological Library, p. 9.

DILLMANN (A.). ETHIOPIC GRAMMAR. Translated from C. Bezold's Second German Edition. By Rev. J. A. Crichton, D.D., with Index of Passages, Philological Tables, etc. 1 vol., Royal 8vo. 25*s.* net.

DÎPAVAMSA (THE): A Buddhist Historical Record in the Pali Language. Edited, with an English Translation, by Dr. H. Oldenberg. 8vo, cloth. 21*s.*

The "Dipavamsa" is the most ancient historical work of the Ceylonese; it contains an account of the ecclesiastical history of the Buddhist Church, of the conversion of the Ceylonese to the Buddhist faith, and of the ancient history of Ceylon.

ERMAN'S EGYPTIAN GRAMMAR. Translated, under Professor Erman's supervision, by J. H. Breasted, Professor of Egyptology in the University of Chicago. Crown 8vo, cloth. 18*s.*

EVANS (GEORGE). AN ESSAY ON ASSYRIOLOGY. With 4to Tables of Assyrian Inscriptions. 8vo, cloth. 5*s.*

FAIZULLAH-BHAI (Shaikh, B.D.). A MOSLEM PRESENT. Part I., containing the famous poem of Al-Busaree. With an English Version and Notes. 8vo, cloth. 4*s.*

—— AN ESSAY ON THE PRE-ISLAMITIC ARABIC POETRY, with special reference to the Seven Suspended Poems. 8vo, sewed. 4*d.*

FLINDERS PETRIE PAPYRI. *See* Cunningham Memoirs, pp. 43, 44.

FRANKFURTER (Dr. O.). HANDBOOK OF PALI: Being an Elementary Grammar, a Chrestomathy, and a Glossary. 8vo, cloth. 16*s.*

FUERST (Dr. JUL.). HEBREW AND CHALDEE LEXICON TO THE OLD TESTAMENT. 5th Edition, improved and enlarged. Translated by Rev. Dr. Samuel Davidson. Royal 8vo, cloth. 21*s.*

HEBREW TEXTS. Large type. 16mo, cloth.

Genesis. (2nd Edition. Baer and Delitzsch's Text.) 1*s.* 6*d.*
Psalms. 1*s.*
Job. 1*s.*
Isaiah. 1*s.*

KENNEDY (Rev. JAS.). INTRODUCTION TO BIBLICAL HEBREW, presenting Graduated Instruction in the Language of the Old Testament. By James Kennedy, B.D., Acting Librarian in the New College, and one of the additional Examiners in Divinity at the University, Edinburgh. 8vo, cloth. 12*s.*

—— STUDIES IN HEBREW SYNONYMS. Demy 8vo, cloth. 5*s.*

LYALL (C. J., M.A., K.C.I.E.). ANCIENT ARABIAN POETRY, CHIEFLY PRÆ-ISLAMIC. Translations, with an Introduction and Notes. Fcap. 4to, cloth. 10*s.* 6*d.*

MACHBEROTH ITHIEL. By Yehuda ben Shelomoh Alcharizi. Edited from the MS. in the Bodleian Library, by Thomas Chenery, M.A. 8vo, cloth. 3*s.*

MILANDA PANHO, THE: Being Dialogues between King Milanda and the Buddhist Sage Nāgasena. The Pali Text, edited by V. Trenckner. 440 pp. 8vo, sewed. 21*s.* *See also* "Pali Miscellany."

MOSHEH BEN SHESHETH'S COMMENTARY ON JEREMIAH AND EZEKIEL. *See* p. 22.

MUSS-ARNOLT (W.). A CONCISE DICTIONARY OF THE ASSYRIAN LANGUAGE (Assyrian—English—German). By W. Muss-Arnolt. Completed in 19 parts. Each 5*s.* net.; or bound in 2 vols., £5 net.

NEW HEBREW SCHOOL of POETS of the SPANISH-ARABIAN EPOCH. Selected Texts with Introduction, Notes, and Dictionary. Edited by H. Brody, Ph.D., Rabbi in Nachod (Bohemia), and K. Albrecht, Ph.D., Professor in Oldenburg (Grand Duchy). English translation of the Introduction, etc., by Mrs Karl Albrecht. Cloth. 7*s.* 6*d.* net.

NOLDEKE (THEODOR, Professor of Oriental Languages in the University of Strassburg). COMPENDIOUS SYRIAC GRAMMAR. With a Table of Characters by Julius Euting. Translated (with the sanction of the author) from the second and improved German Edition by Rev. James A. Crichton, D.D. Royal 8vo. 18*s.* net.

—— DELECTUS VETERUM CARMINUM ARABICORUM GLOSSARIUM CONFECIT A. MULLER. Crown 8vo, cloth. 7*s.* 6*d.*

NORRIS (E.). ASSYRIAN DICTIONARY. Intended to further the Study of the Cuneiform Inscriptions of Assyria and Babylonia. Vols. I. to III. 4to, cloth. Each 28*s.*

OLDENBERG (Prof. H.). BUDDHA: His Life, his Doctrine, his Order. By Dr. Hermann Oldenberg, Professor at the University of Berlin. Translated by W. Hoey, M.A. 8vo, cloth gilt. 18*s.*

PALI MISCELLANY. By V. Trenckner. Part I. The Introductory Part of the Milanda Panho, with an English Translation and Notes. 8vo, sewed. 4*s.*

PLATTS (J. T.). A GRAMMAR OF THE PERSIAN LANGUAGE. By John T. Platts, Hon. M.A. (Oxon.), Teacher of Persian in the University of Oxford ; late Inspector of Schools in the Central Provinces of India. Part I. Accidence. Broad crown 8vo. 10*s.* 6*d.*

RENOUF (P. LE PAGE). LECTURES ON THE RELIGION OF ANCIENT EGYPT. *See* Hibbert Lectures, p. 14.

SADI. THE GULISTAN (ROSE GARDEN) OF SHAIK SADI OF SHIRAZ. A new Edition of the Persian Text, with a Vocabulary, by F. Johnson. Square royal 8vo, cloth. 15*s.*

SAYCE (Prof. A. H.). LECTURES ON THE RELIGIONS OF ANCIENT BABYLONIA AND SYRIA. *See* the Hibbert Lectures, p. 14.

SCHRADER (E.). THE CUNEIFORM INSCRIPTIONS AND THE OLD TESTAMENT. 2 vols. 12*s.* *See* Theological Translation Library, Old Series, p. 8.

SHIHAB AL DIN. FUTŪH AL-HABASHAH ; or, The Conquest of Abyssinia. By Shināb al Din Ahmad B. 'Abd al Kādir B. Sālim B. 'Uthman. Edited, from an Arabic MS., by S. Arthur Strong. Part I. 8vo, sewed. 3*s.* net.

SÖRENSEN (S., Ph.D.), Compiled by. AN INDEX TO THE NAMES IN THE MAHABHARATA. With short explanations. Royal 4to, in twelve parts, which are not sold separately, at 7*s.* 6*d.* per part net. Parts I. and V. now ready.

STATUTES, THE, OF THE APOSTLES. The hitherto unedited Ethiopic and Arabic Texts, with translations of Ethiopic, Arabic, and Coptic Texts, by G. Horner, M.A. See p. 25.

TEXT AND TRANSLATION SOCIETY. *Established for the purpose of editing and translating Oriental Texts chiefly preserved in the British Museum.*

THE SIXTH BOOK OF THE SELECT LETTERS OF SEVERUS, PATRIARCH OF ANTIOCH, in the Syriac Version of Athanasius of Nisibis. Edited and translated by E. W. Brooks, M.A. Vol. I. Text, Parts I. and II. Vol. II. Translation, Parts I. and II. 84*s.* net.

THE CANONS OF ATHANASIUS OF ALEXANDRIA, in Arabic, Ethiopic, and Coptic. Edited and Translated by Prof. W. Riedel (Griefswald) and W. E. Crum. 21*s.* net.

TEXT AND TRANSLATION SOCIETY—continued.

Volumes already issued—

A RABBINIC COMMENTARY ON THE BOOK OF JOB, contained in a unique MS. at Cambridge. Edited, with Translation and Commentary, by W. Aldis Wright, LL.D. 21*s.* net.

AN ANCIENT ARMENIAN VERSION OF THE APOCALYPSE OF ST JOHN; also **THE ARMENIAN TEXTS OF CYRIL OF ALEXANDRIA, SCHOLIA DE INCARNATIONE** and **EPISTLE TO THEODOSIUS UPON EASTER,** the former incompletely preserved in Greek, the latter unknown in Greek or Latin. All edited, with English versions, etc., by F. C. Conybeare, formerly Fellow of University College, Oxford.

REMNANTS OF THE LATER SYRIAC VERSIONS OF THE BIBLE. Part I. (Sixth Century). The Four Minor Catholic Epistles. Reconstructed Text, with Apparatus Criticus. Part II. (Seventh Century). Extracts, hitherto unedited, from the Syro-Hexaplar Text of Chronicles, Nehemiah, etc. All edited, with Greek versions, etc., by John Gwynn, D.D., Regius Professor of Divinity, Dublin.

In the Press.

THE REFUTATION OF MANI, MARCION, AND BARDAISAN OF ST EPHRAIM. Edited by the Rev. C. W. Mitchell.

TURPIE (Dr. D. McC.). MANUAL OF THE CHALDEE LANGUAGE. Containing Grammar of the Biblical Chaldee and of the Targums, and a Chrestomathy, with a Vocabulary. Square 8vo, cloth. 7*s.*

VINAYA PITAKAM: One of the Principal Buddhist Holy Scriptures. Edited in Pali by Dr. H. Oldenberg. 5 vols. 8vo, cloth. Each 21*s.*

WALLIS (H. W.). THE COSMOLOGY OF THE RIG-VEDA: An Essay. 8vo, cloth. 5*s.*

IV. Modern Languages & Literature.

A complete list of Messrs. Williams & Norgate's Educational Publications on Modern Languages may be had on application.

ARMY SERIES OF FRENCH AND GERMAN NOVELS.

Edited, with short Notes, by J. T. W. Perowne, M.A.

This series is equally well adapted for general reading, and for those preparing for the Army, Oxford and Cambridge Certificates, and other Examinations—in fact, for all who wish to keep up or improve their French and German. The notes are as concise as possible, with an occasional etymology or illustration to assist the memory. The books selected being by recent or living authors, are adapted for the study of most modern French and German.

LE COUP DE PISTOLET, etc. Prosper Merimée. 2*s.* 6*d.*

"A book more admirably suited to its purpose could not be desired. The Editors deserve to be congratulated."—*National Observer.*

VAILLANTE. Jacques Vincent. 2*s.* 6*d.*

"The books are well got up, and in *Vaillante* an excellent choice has been made."—*Guardian.*

AUF VERLORNEM POSTEN AND NAZZARENA DANTI. Johannes v. Dewall. 3*s.*

"Well printed, well bound, and annotated just sufficiently to make the reading of them sure as well as easy."—*Educational Times.*

CONTES MILITAIRES. A. Daudet. 2*s.* 6*d.*

"These stories are mainly culled from a series called *Contes du Lundi*, originally contributed by their author to the *Figaro*. Written at fever heat immediately after the great 1870 war, they show Daudet's power in many ways at its highest. . . . We therefore do more than recommend—we urge all readers of French to get the stories in some form, and the present one is both good and cheap."—*The Schoolmaster.*

ERZÄHLUNGEN. E. Höfer. 3*s.*

"The series has brought fascinating examples of fiction under the eyes of English readers in a neat and handy form. Besides having the military flavour, they are models of style."—*Scotsman.*

BAYLDON (Rev. G.). ICELANDIC GRAMMAR. An Elementary Grammar of the Old Norse or Icelandic Language. 8vo, cloth. 7*s.* 6*d.*

BOÏELLE (JAS.). FRENCH COMPOSITION THROUGH LORD MACAULAY'S ENGLISH. Edited, with Notes, Hints, and Introduction, by the late James Boïelle, B.A. (Univ. Gall.), Officier d'Académie, Senior French Master, Dulwich College, etc., etc. Crown 8vo, cloth. Vol. I. Frederick the Great. 3*s.* Vol. II. Warren Hastings. 3*s.* Vol. III. Lord Clive. 3*s.*

—— *See* Victor Hugo, "Les Misérables" and "Notre Dame."

DELBOS (L.). NAUTICAL TERMS IN ENGLISH AND FRENCH AND FRENCH AND ENGLISH. With Notes and Tables. For the use of Naval Officers and Naval Cadets. By Leon Delbos, M.A., of H.M.S. *Britannia*, Dartmouth. 4th Edition, thoroughly revised and considerably enlarged, with additional Plates. Crown 8vo, cloth. 7*s.* 6*d.* net.

—— **THE STUDENT'S GRADUATED FRENCH READER.** Remodelled and rewritten. Edited, with Notes and a Complete Vocabulary. First Year—Part I. Anecdotes, Tales, and Exercises. Part II. Tales, Historical Pieces, and Exercises. 1*s.* 6*d.* each. Second Year—Parts I. and II. in the Press.

EUGENE'S STUDENT'S COMPARATIVE GRAMMAR OF THE FRENCH LANGUAGE, with an Historical Sketch of the Formation of French. For the use of Public Schools. With Exercises. By G. Eugène-Fasnacht, late French Master, Westminster School. 23rd Edition, thoroughly revised. Square crown 8vo, cloth, 5*s.*; or separately, Grammar, 3*s.*; Exercises, 2*s.* 6*d.*

GOETHE (W. v.). ANNOTATED TEXTS. *See* Educational Catalogue.

HAGMANN (J. G., Ph.D.). REFORM IN PRIMARY EDUCATION. Translated from Second German Edition by R. H. Hoar, Ph.D., and Richmond Barker, M.A. Cr. 8vo, cl., 2*s.* 6*d.* net.

HUGO (VICTOR). LES MISÉRABLES: Les Principaux Episodes. Edited, with Life and Notes, by the late J. Boïelle. 2 vols. 6th Edition. Crown 8vo, cloth. Each 3*s.* 6*d.*

—— **NOTRE DAME DE PARIS.** Adapted for the use of Schools and Colleges. By the late J. Boïelle. 2 vols. 2nd Edition. Crown 8vo, cloth. Each 3*s.*

KYRIAKIDES (A.). MODERN GREEK-ENGLISH DICTIONARY. With a Cypriote Vocabulary. 2nd Edition, revised throughout. Medium 8vo. 920 pages. Cloth. 15*s.* net.

LEABHAR BREAC. The "Speckled Book," otherwise styled, "The Great Book of Dun Doighre": a Collection of Pieces in Irish and Latin, transcribed towards the close of the Fourteenth Century. "The oldest and best Irish MS. relating to Church History now preserved" (*G. Petrie*). Now first published, from the original MS. in the Royal Irish Academy's Library. In imperial folio, on toned paper. In one vol., half-calf, £4, 4*s*. (200 copies only printed.)

LEABHAR NA H-UIDHRI. A Collection of Pieces in Prose and Verse, in the Irish Language, transcribed about A.D. 1100; the oldest volume now known entirely in the Irish language, and one of the chief surviving native literary monuments—not ecclesiastical—of ancient Ireland; now for the first time published, from the original in the Library of the Royal Irish Academy, with account of the Manuscript, description of its contents, index, and facsimiles in colours. In folio on toned paper, half-calf. £3, 3*s*. (200 copies only printed.)

LILJA (The Lily). An Icelandic Religious Poem. By Eystein Asgrimson. Edited, with Translation, Notes, and Glossary, by E. Magnusson. Crown 8vo, cloth extra. 10*s*. 6*d*.

LODGE (Sir O.). SCHOOL TEACHING AND SCHOOL REFORM. A Course of Four Lectures on School Curricula and Methods, delivered to Secondary Teachers and Teachers in Training at Birmingham during February 1905. 3*s*.

"The work of a sensible iconoclast, who does not pull down for the sake of mere destruction, but is anxious to set up something more worthy in place of the mediævalism he attacks."—*Outlook*.

"Let me commend this wise volume not only to teachers but to all concerned in national education. And especially to the politician. Half an hour with Sir Oliver Lodge would make him realise that there are problems on the inner side of the school door not dreamt of in his philosophy—would make him feel that the more he knows of these the better will he be able wisely to handle those others about which he is glibly talking every day."—Dr MACNAMARA in the *Daily Chronicle*.

MAORI. NEW AND COMPLETE MANUAL OF MAORI CONVERSATIONS. Containing Phrases and Dialogues on a variety of Topics, together with a few general rules of Grammar, and a comprehensive Vocabulary. 4*s*. net. *See also* Williams.

MARKHAM (Sir CLEMENTS, K.C.B.). VOCABULARIES OF THE GENERAL LANGUAGE OF THE INCAS OF PERU. Crown 8vo, cloth. 7*s*. 6*d*. net.

NIBELUNGENLIED. "The Fall of the Nibelungens," otherwise "The Book of Kriemhild." An English Translation by W. N. Lettsom. 5th Edition. 8vo, cloth. 5*s*.

O'GRADY (STANDISH H.). SILVA GADELICA (I.–XXXI.). A Collection of Tales in Irish, with Extracts illustrating Persons and Places. Edited from MSS. and translated. 2 vols. royal 8vo, cloth. 42*s.* Or separately, Vol. I., Irish Text; and Vol. II., Translation and Notes. Each vol. 21*s.*

OORDT (J. F. VAN, B.A.). CAPE DUTCH. Phrases and Dialogues, with Translations, preceded by short Grammatical Notes. Crown 8vo, cloth. 2*s.* 6*d.* net.

PHILLIPPS (V., B.A.). A SHORT SKETCH OF GERMAN LITERATURE, for Schools. By Vivian Phillipps, B.A., Assistant Master at Fettes College, Edinburgh. 2nd Edition, revised. Pott 8vo, cloth. 1*s.*

ROGET (F. F.). AN INTRODUCTION TO OLD FRENCH. History, Grammar, Chrestomathy, and Glossary. 2nd Edition. Crown 8vo, cloth. 6*s.*

—— FIRST STEPS IN FRENCH HISTORY, LITERATURE, AND PHILOLOGY. For Candidates for the Scotch Leaving Certificate Examinations, the various Universities Local Examinations, and the Army Examinations. 4th Edition. Crown 8vo, cloth. 5*s.*

ROSING (S.). ENGLISH-DANISH DICTIONARY. New Edition. Large 8vo, strongly bound, half-roan. 11*s.* 6*d.*

SCHILLER (F. VON). ANNOTATED TEXTS. *See* Educational Catalogue.

SULLIVAN (W. K.). CELTIC STUDIES FROM THE GERMAN OF EBEL. With an Introduction on the Roots, Stems, and Derivatives, and on Case-endings of Nouns in the Indo-European Languages. 8vo, cloth. 10*s.*

VELASQUEZ. LARGER SPANISH DICTIONARY. Composed from the Dictionaries of the Spanish Academy, Terreros and Salva. Spanish-English and English-Spanish. 1279 pp., triple columns. 2 vols. in 1. Imp. 8vo, cloth. 24*s.*

VIGA GLUMS SAGA. Translated from the Icelandic, with Notes and an Introduction, by Sir Edmund Head, Bart. Fcap. 8vo, cloth. 5*s.*

WEISSE (T. H.). ELEMENTS OF GERMAN. With a Course of Exercises instructing in Simpler Composition. Crown 8vo, cloth. 3*s.*

CUNNINGHAM MEMOIRS—Continued.

5. **The Red Stars.** Observations and Catalogue. New Edition. Edited by Rev. T. Espin, M.A. 4to, sewed. 3*s.* 6*d.*

6. **On the Morphology of the Duck Tribe and the Auk Tribe.** By W. K. Parker, F.R.S. 9 Plates. 4to, sewed. 3*s.* 6*d.*

7. **Contribution to the Surface Anatomy of the Cerebral Hemispheres.** By D. J. Cunningham, M.D. With a Chapter upon Cranio-Cerebral Topography by Victor Horsley, M.B., F.R.S. 4to, sewed. 8*s.* 6*d.*

8. **On the Flinders Petrie Papyri.** Part I. Out of Print.

9. **On the Flinders Petrie Papyri.** Part II. With 18 Autotypes. 4to, sewed. 42*s.* net. Appendix to 8 and 9. 5*s.* net.

10. **The Decorative Art of British New Guinea.** A Study in Papuan Ethnography. By Alfred C. Haddon, M.A. With 12 Plates, and numerous other Illustrations. 4to, sewed. 14*s.* net.

11. **On the Flinders Petrie Papyri.** With Transcriptions, Commentaries, and Index. By John P. Mahaffy, D.D., and Prof. J. Gilbert Smyly. With 7 Autotypes. 4to, sewed. 42*s.* net.

EMERY (F. B., M.A.). ELEMENTARY CHEMISTRY. With numerous Illustrations. 8*s.* 6*d.* net.

ENGELHARDT (V.). THE ELECTROLYSIS OF WATER. 8vo. Pages x+140. 90 Illustrations. 5*s.* net.

FISCHER (Prof. EMIL, of Berlin University). INTRODUCTION TO THE PREPARATION OF ORGANIC COMPOUNDS. Translated with the author's sanction from the new German edition by R. V. Stanford, B.Sc., Ph.D. With figures in the text. Crown 8vo, cloth. 4*s.* net.

HANTZSCH (A.). ELEMENTS OF STEREOCHEMISTRY. Translated by Wolf. 12mo. Pages viii+206. 26 Figures. 6*s.* 6*d.* net.

HARDY. ELEMENTS OF ANALYTICAL GEOMETRY. 8vo. Pages iv+365. 163 Figures. 8*s.* 6*d.* net.

—— **INFINITESIMALS AND LIMITS.** Sm. 12mo, paper. 22 pp. 6 Figures. 1*s.* net.

HARNACK (AXEL). INTRODUCTION TO THE ELEMENTS OF THE DIFFERENTIAL AND INTEGRAL CALCULUS. From the German. Royal 8vo, cloth, 10*s.* 6*d.*

HART (EDWARD, Ph.D.). CHEMISTRY FOR BEGINNERS. Small 12mo.

Vol. I. **Inorganic.** Pages viii+188. 55 Illustrations and 2 Plates. Fourth Edition. 4*s.* 6*d.* net.

Vol. II. **Organic.** Pages iv+98. 11 Illustrations. 2*s.* net.

Vol. III. **Experiments.** Separately. 60 pages. 1*s.* net.

—— **SECOND YEAR CHEMISTRY.** Small 12mo. 165 pages. 31 Illustrations. 5*s.* net.

HOFF (J. H. VAN'T). STUDIES IN CHEMICAL DYNAMICS. Revised and enlarged by Dr. Ernst Cohen, Assistant in the Chemical Laboratory of the University of Amsterdam. Translated by Thomas Ewan, M.Sc., Ph.D., Demonstrator of Chemistry in the Yorkshire College, Leeds. Royal 8vo, cloth. 10*s.* 6*d.*

HORNELL (JAMES, F.L.S.). REPORT TO THE GOVERNMENT OF BARODA ON THE MARINE ZOOLOGY OF OKHAMANDAL IN KATTIAWAR. With Supplementary Reports on Special Groups by other Zoologists. Demy 4to, cloth, with full-page Plates. Part I. 15*s.* net.

HOWE (J. L.). INORGANIC CHEMISTRY FOR SCHOOLS AND COLLEGES. By Jas. Lewis Howe, Washington and Lee University. Being a Second Edition of "Inorganic Chemistry according to the Periodic Law." By F. P. Venable and J. L. Howe. Demy 8vo, cloth. 12*s.* 6*d.* net.

JOHNSTONE (J.). BRITISH FISHERIES: Their Administration and their Problems. A short account of the Origin and Growth of British Sea Fishery Authorities and Regulations. 10*s.* 6*d.* net.

JONES (J. T. SHARE-). SURGICAL ANATOMY OF THE HORSE. To be completed in 4 Parts. With above 100 Illustrations, a number being in colour. Part I. Head and Neck. Part II. Fore Limb. Part III. Hind Limb. Price per part, 15*s.* net, sewed; cloth, 16*s.* 6*d.* net.

—— **LIFE-SIZE MODELS, Illustrating the Superficial Anatomy of the Limbs of the Horse.** Price per set of four models, £21; or separately—**Fore Limb, Inner and Outer Aspects,** £6, 16*s.* 6*d.* each; **Hind Limb, Inner and Outer Aspects,** £6, 6*s.* each.

JONES. THE FREEZING POINT, BOILING POINT, AND CONDUCTIVITY METHODS. 12mo. Pages vii + 64. 14 Illustrations. 3*s.* net.

JOURNAL OF THE LINNEAN SOCIETY. Botany. At various prices. Index to Journal (Botany), 20*s.* **Zoology.** At various prices. General Index to the first 20 vols. of the Journal (Zoology) and the Zoological portion of the Proceedings, 20*s.*

JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY, containing its transactions and Proceedings, with other Microscopical information. Bi-monthly. Previous to 1893 at various prices; after that date bi-monthly, each 6*s.* net.

JOURNAL OF THE QUEKETT MICROSCOPICAL CLUB. Nos. 1–26, 1*s.* net; Nos. 27–31, 2*s.* 6*d.* net. 1893, No. 32, and following Nos., half-yearly, 3*s.* 6*d.* net.

PHILLIPS (FRANCIS C.). METHODS FOR THE ANALYSIS OF ORES, PIG IRON AND STEEL. Second Edition. 8vo. Pages viii + 170. 3 Illustrations. 4*s.* 6*d.* net.

PIDDINGTON (HENRY). THE SAILORS' HORN-BOOK FOR THE LAW OF STORMS. Being a Practical Exposition of the Theory of the Law of Storms, and its uses to Mariners of all Classes in all Parts of the World. Shown by transparent Storm Cards and useful Lessons. 7th Ed. Demy 8vo, cloth. 10*s.* 6*d.*

PRAY (Dr.). ASTIGMATIC LETTERS. Printed on Millboard, size 22 by 14 inches. 1*s.*

PROCEEDINGS OF THE OPTICAL CONVENTION, No. 1, 1905. Crown 4to, cloth. 10*s.* net.

RANSOM (W. H., M.D., F.R.S., F.R.C.P.). THE INFLAMMATION IDEA IN GENERAL PATHOLOGY. Demy 8vo, cloth. 7*s.* 6*d.*

RAY (Prof. P. C.). A HISTORY OF HINDU CHEMISTRY FROM THE EARLIEST TIMES TO THE MIDDLE OF THE SIXTEENTH CENTURY A.D. With Sanskrit Texts, Variants, Translation, and Illustrations. Vol. I. Second Edition, Revised and Enlarged. Crown 8vo. 10*s.* 6*d.* net. Vol. II. Cloth. 10*s.* 6*d.* *net.*

SANG'S LOGARITHMS. A new Table of Seven-place Logarithms of all Numbers continuously up to 200,000. 2nd Edition. Royal 8vo, cloth. 21*s.*

SCHREBER (D. G. M.). MEDICAL INDOOR GYMNASTICS, or a System of Hygienic Exercises for Home Use, to be practised anywhere, without apparatus or assistance, by young and old of either sex, for the preservation of health and general activity. Revised and Supplemented by Rudolf Graefe, M.D. With a large plate and 45 illustrations in the text. Royal 8vo, cloth. 3*s.* net.

"The exercises described, when efficiently used, will undoubtedly be of value in strengthening and developing the muscular system. The descriptions of the exercises and the figures in the text are excellent."—*Physician and Surgeon.*

"Well worthy of the attention of those who go in for regular physical training as a means for the preservation of health."—*Scotsman.*

"A very sensible little treatise."—*Glasgow Herald.*

SCHROEN (L.). SEVEN-FIGURE LOGARITHMS OF NUMBERS from 1 to 108,000, and of Sines, Cosines, Tangents, Cotangents to every 10 Seconds of the Quadrant. With a Table of Proportional Parts. By Dr. Ludwig Schroen, Director of the Observatory of Jena, etc., etc. 5th Edition, corrected and stereotyped. With a description of the Tables by A. De Morgan, Professor of Mathematics in University College, London. Imp. 8vo, cloth, printed on light green paper. 9*s.*

SEGER. COLLECTED WRITINGS OF HERMAN AUGUST SEGER. (Papers on Manufacture of Pottery.) 2 vols. Large 8vo. £3, 3*s.* net per set; per volume, 31*s.* 6*d.* net.

SNELLEN'S OPHTHALMIC TEST TYPES. Best Types for the Determination of the Acuteness of Vision. 14th Edition, considerably augmented and improved. 8vo, sewed. 4*s.* Single Sheets: E T B, M O V, B D E, Ш Ш Ш, and Large Clock Sheet. 8*d.* each. Small Clock Sheet and R T V Z. 4*d.* each.

SNYDER (HARRY, B.Sc.). SOILS AND FERTILISERS. Second Edition. 8vo. Pages x + 294. 1 Plate. 40 Illustrations. 6*s.* 6*d.* net.

SONNTAG (C. O.). A POCKET FLORA OF EDINBURGH AND THE SURROUNDING DISTRICT. A Collection and full Description of all Phanerogamic and the principal Cryptogamic Plants, classified after the Natural System, with an artificial Key and a Glossary of Botanical Terms. By the late C. O. Sonntag, the Royal High School, Edinburgh; formerly Secretary of the Microscopical Society of Glasgow, etc. Fcap. 8vo, limp cloth, round corners, with Map of the Environs of Edinburgh. 3*s.* 6*d.* net.

STILLMAN (THOS. B., M.Sc., Ph.D.). ENGINEERING CHEMISTRY. Third Edition. 8vo. Pages x + 597. 139 Illustrations. 19*s.* net.

TOWER (O. F., Ph.D.). THE CONDUCTIVITY OF LIQUIDS. 8vo. Pages iv + 190. 20 Illustrations. 6*s.* 6*d.* net.

TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH. Vol. XXXVIII. Part 1, 40*s.* Part 2, 25*s.* Part 3, 30*s.* Part 4, 7*s.* 6*d.* Vol. XXXIX. Part 1, 30*s.* Part 2, 19*s.* Part 3, 43*s.* Part 4, 9*s.* Vol. XL. Part 1, 25*s.* Part 2, 32*s.* 6*d.* Part 3, 26*s.* Part 4, 20*s.* Vol. XLI. Part 1, 20*s.* Part 2, 29*s.* 6*d.* Part 3, 45*s.* Vol. XLII. 42*s.* Vol. XLIII. 42*s.* Vol. XLV. Part 1, 29*s.* Part 2, 27*s.* Part 3, 33*s.* 9*d.* Part 4, 4*s.* 6*d.* Vol. XLVI. Part 1, 21*s.* 10*d.* Part 2, 25*s.* 8*d.* Part 3, 27*s.* 3*d.* General Index to First Thirty-four Volumes (1783–1888), with History of the Institution. 4to, cloth. 21*s.*

TRANSACTIONS OF THE ROYAL IRISH ACADEMY, DUBLIN. Vols. I.–XX. 4to. £22, 5*s.* 6*d.* Vols. XXI.–XXXI. Various prices.

TRANSACTIONS OF THE ROYAL DUBLIN SOCIETY. Various volumes at various prices.

VEGA. LOGARITHMIC TABLES OF NUMBERS AND TRIGONOMETRICAL FUNCTIONS. Translated from the 40th, or Dr. Bremiker's Edition, thoroughly revised and enlarged, by W. L. F. Fischer, M.A., F.R.S., Fellow of Clare College, Cambridge; Professor of Natural Philosophy in the University of St. Andrews. 75th Stereotyped Edition. Royal 8vo, cloth. 7*s.*

VENABLE (T. C., Ph.D.). THE DEVELOPMENT OF THE PERIODIC LAW. Small 12mo. Pages viii + 321. Illustrated. 10*s.* 6*d.* net.

—— **THE STUDY OF THE ATOM.** 12mo. Pages vi + 290. 8*s.* 6*d.* net.

—— **and HOWE. INORGANIC CHEMISTRY ACCORDING TO THE PERIODIC LAW.** Second Edition. *See under* Howe, p. 45.

WILEY (HARVEY W., A.M., Ph.D.). PRINCIPLES AND PRACTICE OF AGRICULTURAL CHEMICAL ANALYSIS. 3 vols. 8vo. New Edition in preparation. Vol. I. Soils. Ready. 18*s.* net. Vol. II. Fertilizers.

WYSOR (HENRY, B.S., Assistant Professor of Analytical Chemistry, Lafayette College). METALLURGY. A Condensed Treatise. Demy 8vo, cloth. 12*s.* 6*d.* net.

VI. Miscellaneous.

ANTHROPOLOGY—SOCIOLOGY—MYTHOLOGY—BIBLIOGRAPHY—BIOGRAPHY, ETC.

AVEBURY (Lord, D.C.L., F.R.S., etc.) (Sir John Lubbock). PREHISTORIC TIMES, as Illustrated by Ancient Remains and the Manners and Customs of Modern Savages. 6th Edition, revised, with 239 Illustrations, a large number of which are specially prepared for this Edition. Demy 8vo, cloth, gilt tops. 18*s.*

"To anyone who wishes to obtain a succinct conspectus of the present state of knowledge on the subject of early man, we recommend the perusal of this comprehensive volume."—*Jour. Brit. Archæolog. Assoc.*

"The fact that this well-known standard work has reached a sixth edition is evidence of its value to ethnologists and archæologists. The many and beautiful illustrations are most helpful in better understanding the plain but accurate letterpress. Lord Avebury is to be congratulated on the new edition, which is sure to further popularise a fascinating subject for investigation by cultured people."—*Science Gossip.*

"It is necessary to compare the present volume with the fifth edition in order to see how much it has been improved. The illustrations to this sixth edition are immeasurably superior to the fifth."—*Knowledge.*

BLACKBURN (HELEN). WOMEN'S SUFFRAGE. A Record of the Women's Suffrage Movement in the British Isles, with a Biographical Sketch of Miss Becker. Portraits. Crown 8vo, cloth. 6*s.*

—— *See also* Vynne, Nora, and Blackburn, "Women under the Factory Acts."

CATALOGUE OF THE LONDON LIBRARY, St James's Square. By C. T. Hagberg Wright, L.L.D., etc. xiv + 1626 pp. 4to, cloth. 42*s.* net. **Supplement I.,** 1902–3. Buckram, 1 vol., 196 pp. 5*s.* net. **Supplement II.** 198 pp. 1903–4. Buckram. 5*s.* net. **Supplement IV.** 1905–6. 5*s.* net.

"The present catalogue is essentially a working catalogue. . . . The general level of accuracy in the printing and editing of the work appears to us to be an unusually high one. . . . We heartily applaud the work, both as a landmark in library land, and as a monument standing upon a firm foundation of its own." —*The Times.*

ENGELHARDT (C.). DENMARK IN THE EARLY IRON AGE. Illustrated by recent Discoveries in the Peat-Mosses of Slesvig. 33 Plates (giving representations of upwards of a thousand objects), Maps, and numerous other Illustrations on wood. 1866. 4to, cloth. 31*s.* 6*d.*

GOLDAMMER (H.). THE KINDERGARTEN. A Guide to Fröbel's Method of Education. 2 vols. in 1. 120 pp. of Illustrations. 8vo, cloth. 10*s.* 6*d.*

GRIEBEN'S ENGLISH GUIDES. Practical and handy; size, suitable for the pocket, 6¼ × 4¼, and bound in cloth.

Switzerland. A practical guide with seven maps. Cloth. 3*s. net.* Ready.

Norway and Copenhagen. With six maps. Cloth. 3*s. net.* Ready.

Ostend and other Belgium Watering Places. With two maps. Cloth. 1*s.* 6*d. net.* Ready.

Lakes of Northern Italy. With maps. Cloth. 3*s. net.* Ready.

The Rhine. With maps. Cloth. 3*s. net.* In the press.

North Sea Watering Places. Cloth. 3*s. net.* In the press.

Belgium. With maps. Cloth. 3*s. net.* In the press.

Brussels and the Universal Exhibition 1910. With maps. Cloth. 1*s.* 6*d. net.* In the press.

Holland. With maps. Cloth. 3*s. net.* In the press.

The Riviera. With maps. Cloth. 3*s. net.* In the press.

Dresden and Environs. With maps. Cloth. 1*s.* 6*d. net.* In the press.

HENRY (JAMES). ÆNEIDEA; or, Critical, Exegetical and Æsthetical Remarks on the Æneis. With a personal collation of all the first-class MSS., and upwards of 100 second-class MSS., and all the principal editions. Vol. I. (3 Parts), Vol. II. (3 Parts), Vol. III. (3 Parts), Vol. IV. (1 Part). Royal 8vo, sewed. £2, 2*s.* net.

HERBERT (Hon. A.). THE SACRIFICE OF EDUCATION TO EXAMINATION. Letters from "All Sorts and Conditions of Men." Edited by Auberon Herbert. Half-cloth boards. 2*s.*

—— and WAGER (HAROLD). BAD AIR AND BAD HEALTH. Dedicated to Professor Clifford Allbutt. Reprinted from the "Contemporary Review." 8vo, cloth, 1*s.* 6*d.*; sewed, 1*s.*

JOHNSON (E.). THE RISE OF ENGLISH CULTURE. With a brief account of the Author's Life and Writings. Demy 8vo, cloth. 15*s.* net.

KIEPERT'S NEW ATLAS ANTIQUUS. Twelve Maps of the Ancient World, for Schools and Colleges. Third hundred thousand. 12th Edition, with a complete Geographical Index. Folio, boards. 6*s.* Strongly bound in cloth. 7*s.* 6*d.*

—— WALL-MAPS OF THE ANCIENT WORLD—

Wall-map of Ancient Italy. Italia antiqua. For the study of Livy, Sallust, Cicero, Dionysius, etc. Scale 1 : 800,000. Mounted on rollers, varnished. 20*s.*

General Wall-map of the Old World. Tabula orbis terrarum antiqui ad illustrandam potissimum antiquissimi ævi usque ad Alexandrum M. historiam. For the study of ancient history, especially the history of the Oriental peoples: the Indians, Medes, Persians, Babylonians, Assyrians, Egyptians, Phœnicians, etc. Scale 1 : 5,400,000. Mounted on rollers, varnished, 20*s.*

General Wall-map of the Roman Empire. Imperii Romani tabula geographica. For the study of the development of the Roman Empire. Scale 1 : 300,000. Mounted on rollers, varnished. 24*s.*

Wall-map of Ancient Latium. Latii Veteris et finitimarum regionum tabula. For the study of Livy, Dionysius, etc. Scale 1 : 125,000. With supplement: Environs of Rome. Scale 1 : 25,000. Mounted on rollers, varnished. 18*s.*

Wall-map of Ancient Greece. Græciæ Antiquæ tabula. For the study of Herodotus, Thucydides, Xenophon, Strabo, Cornelius Nepos, etc. Scale 1 : 500,000. Mounted on rollers, varnished. 24*s.*

Wall-Map of the Empires of the Persians and of Alexander the Great. Imperia Persarum et Macedonum. For the study of Herodotus, Xenophon, Justinian, Arian, Curtius. Scale 1 : 300,000. Mounted on rollers and varnished. 20*s.*

Wall-Map of Gaul, with portions of Ancient Britain and Ancient Germany. Galliæ Cisalpinæ et Transalpinæ cum partibus Britanniæ et Germaniæ tabula. For the study of Cæsar, Justinian, Livy, Tacitus, etc. Scale 1 : 1,000,000. Mounted on rollers and varnished. 24*s.*

Wall-Map of Ancient Asia Minor. Asiæ Minoris Antiquæ Tabula. For the study of Herodotus, Xenophon, Justinian, Arian, Curtius, etc. Scale 1 : 800,000. Mounted on rollers and varnished. 20*s.*

LONDON LIBRARY SUBJECT INDEX. To be issued about the end of November. A quarto volume of about 1200 pages in three columns, bound in buckram. 31*s.* 6*d. net.*

Opinions of some of those who have read through the proof-sheets:

". . . My admiration for the Index increases daily. . . ."—Professor BURY, Regius Professor of Modern History, Cambridge.

". . . I feel certain that this Index will become a standard book of reference, and will be a *vade mecum* to every man of letters. . . ."—FREDERIC HARRISON.

". . . This Index will have a signal educational value. There never was a piece of work better worth doing, or, I think, better done. . . ."—Dr WARD, Master of Peterhouse, Cambridge.

". . . As far as I have seen the proof-sheets I am satisfied that the new Subject Index will be one of the best Catalogues of the kind ever produced. . . ."—H. R. TEDDER.

". . . The specimen page is exceedingly neat. A good Catalogue is one of the few human works that can do no harm. . . ."—Sir FREDERICK POLLOCK, Bart.

". . . I am more than surprised at its accuracy and fulness. . . ."—Sir FRANK MARZIALS, C.B.

MARCKS (ERICH, Professor of Modern History at the University of Leipzig). ENGLAND AND GERMANY: Their Relations in the Great Crises of European History, 1500–1900. Demy 8vo, stiff wrapper. 1*s.*

PEDDIE (R. A.). PRINTING AT BRESCIA IN THE FIFTEENTH CENTURY. A List of the Issues. 5*s.* net.

RING OF POPE XYSTUS, THE. A Collection of Aphorisms and Short Sayings in use among the Christian Communities as early as the Second Century of our Era. There is no question that it was widely read, for Latin, Syriac, and Coptic versions are known besides in the original Greek. The original Greek was discovered at the end of last century, and is now translated into English for the first time. Beautifully printed on hand-made paper, and bound suitable for presentation.

SCHLOSS (DAVID F.). METHODS OF INDUSTRIAL REMUNERATION. 3rd Edition, revised and enlarged. Crown 8vo, cloth. 7*s.* 6*d.* Popular Edition, 3*s.* 6*d.*

"In its new as in its old form the book is well nigh indispensable to the student who desires to get some insight into the actual facts about the various methods of industrial remuneration, and the degree of success with which they have been applied in the various trades."—*Manchester Guardian.*

"More useful than ever to the students of the labour problem."—*Political Science Quarterly.*

SPENCER (HERBERT). AN AUTOBIOGRAPHY. *See* p. 30.

SPENCER (HERBERT). PRINCIPLES OF SOCIOLOGY. *See* p. 30.

—— STUDY OF SOCIOLOGY. *See* p. 31.

—— DESCRIPTIVE SOCIOLOGY. *See* p. 31.

STEPHENS (GEORGE). PROFESSOR BUGGE'S STUDIES ON NORTHERN MYTHOLOGY EXAMINED. Illustrations. 8vo, cloth. 8*s.*

—— THE RUNES, WHENCE CAME THEY? 4to, sewed. 6*s.*

—— OLD NORTHERN RUNIC MONUMENTS. Vol. IV. Folio. 20*s.* net.

VEILED FIGURE (THE), and Other Poems. Large post 8vo, buckram, gilt, cover designed by Mr. T. Blake Wirgman. 2*s.* 6*d.*

VYNNE (NORA) and HELEN BLACKBURN, and with the Assistance of H. W. ALLASON. WOMEN UNDER THE FACTORY ACTS. Part 1. Position of the Employer. Part 2. Position of the Employed. Crown 8vo, cloth. 1*s.* net.

WELD (A. G.). GLIMPSES OF TENNYSON AND OF SOME OF HIS FRIENDS. With an Appendix by the late Bertram Tennyson. Illustrated with Portraits in photogravure and colour, and with a facsimile of a MS. poem. Fcap. 8vo, art linen. 4*s.* 6*d.* net.

"This is a delightful little book, written by one who has all the qualifications for the task—the opportunities of observation, the interest of relationship, and the sympathetic and appreciative temper. . . . . We do not attempt to criticise, but only to give such a description as will send our readers to it."—*Spectator.*

"Everyone who reads the book will understand Tennyson a little better, and many will view him in a new aspect for the first time."—*Daily Chronicle.*

"It is quite worthy of a place side by side with the larger 'Life.'"—*Glasgow Herald.*

LIST OF PERIODICALS, REVIEWS, AND TRANSACTIONS AND PROCEEDINGS OF LEARNED SOCIETIES

PUBLISHED BY WILLIAMS & NORGATE.

THE HIBBERT JOURNAL: A Quarterly Review of Religion, Theology, and Philosophy. Single numbers, 2*s.* 6*d.* net. Subscription, 10*s.* per annum, post free.

JOURNAL OF THE FEDERATED MALAY STATES MUSEUMS. Issued quarterly. Single numbers, 1*s.* 6*d.* net. Subscription, 5*s.* per annum.

JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY, containing its Transactions and Proceedings, with other Microscopical Information. Bi-monthly. 6*s.* net. Yearly subscriptions, 37*s.* 6*d.*, post free.

JOURNAL OF THE QUEKETT MICROSCOPICAL CLUB. Issued half-yearly, April and November. Price 3*s.* 6*d.* net. 7*s.* 6*d.* per annum, post free.

LINNEAN SOCIETY OF LONDON. Journal of Botany and Journal of Zoology. Published irregularly at various prices. Also Transactions, published irregularly.

ROYAL SOCIETY OF EDINBURGH. Transactions. Issued irregularly at various prices.

LIVERPOOL MARINE BIOLOGY COMMITTEE. Memoirs. I.–XIX. already published at various prices. Fauna of Liverpool Bay. Fifth Report written by Members of the Committee and other Naturalists. Cloth. 8*s.* 6*d.* net. *See* p. 47.

ROYAL ASTRONOMICAL SOCIETY. Memoirs and Monthly Notices. Yearly volumes at various prices.

ROYAL IRISH ACADEMY. Transactions and Proceedings issued irregularly; prices vary. Cunningham Memoirs. Vols. I.–XI. already issued at various prices. *Vide* pp. 43–44.

ROYAL DUBLIN SOCIETY. Transactions and Proceedings. Issued irregularly at various prices.

INDEX UNDER AUTHORS & TITLES

PRINTED BY NEILL AND CO., LTD., EDINBURGH.