ΙΑΤΡΟΦΥΣΙΚΑ.

THE HARVEIAN ORATION

—1887.—

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DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS,

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BY

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ΙΑΤΡΟΦΥΣΙΚΑ.

NOTHING would have better pleased me, Mr. President and brother Fellows, than to have revived the ancient and time-honoured custom of a Latin Oration, such as these walls have so often echoed to; and this the more gladly from my belief that the practice tended to maintain the dignity of our College and its reputation for learning. But there is a tide in popular opinion which seems just now to be setting somewhat strongly in a direction opposite to the older and traditional cultivation, and a prepossession abroad

that a knowledge of the ancient tongues on which our English language is founded is incompatible with ability to search out the secrets of Nature by way of experiment.

A striking refutation of the fallacy exists in the very man whom and whose labours we are met here to-day to commemorate, and whose honoured name as written in Latin by his own hand should stand in the forefront of my discourse as it does on the titlepage of his manuscript:

GULIELMUS HARVEIUS.

I say in his own hand for, thanks mainly to the energy and labours of Sir E. Sieveking, we have now before us a noble production of his manuscript lectures delivered in 1616; not merely the *αὐτὸς ἔιπεν*, but the *αὐτὸς ἔγραψε*, the very autograph sign manual of a great mind, wherein we can read not only his verbal utterances, but can, with a little care at the same time, trace character, education, and temperament. It is just ten years since the gentleman named above announced to the College the rediscovery of the first

Harveian lectures, and now the autotype copy with its transcript is fully before us.

My object therefore on the present occasion will be to endeavour briefly to comment on this most interesting and unique work, and to sketch the lineaments of Harvey, self-revealed, as a scholar, a lecturer, a physicist, and as a man of genial, not to say humorous, disposition.

In so doing we may gather from the *ipsissima verba* of one who "being dead yet speaketh"—two lessons, which I believe have not occupied the attention of my many far abler predecessors in this chair.

First, an instruction in the art and method of lecturing, and wherein in this age of printed books it may still be of service.

Secondly, what a large field of discovery and research still lies open to us, as it did to Harvey, on the borderground between physics and physiological medicine. For this reason I have ventured to give my oration the title of Ἰατροφυσικὰ, just such a word as he would, I fancy, have delighted to jot down, possibly in red ink with his cypher

appended, in some corner of his manuscript notes. For the discovery which has rendered Harvey's name famous was strictly physical, I may even say mechanical. It had, moreover, the one great element of accuracy in applied mechanics; it was computational and quantitative.

There can be little doubt that general ideas were abroad on the subject of the circulation, and that similar views, not indeed incorrect, but loose and inaccurate, had been entertained by others. Even Cœsalpinus, *pace* Dr. George Johnson, undeniably had glimpses of the truth. It was, however, Harvey who first saw and proved that the problem was one of hydrostatics, and that it must be solved and could be solved by mechanics, and proved by numerical relations.

There is a remarkable page in the lectures, one of the best written and most legible in the book, in which this is stated with absolute clearness, and which at once disposes of any claims advanced in other quarters. It runs as follows:

Constat per fabricam cordis sanguinem per pulmones in Aortam perpetuo transferri, as by two clacks of a water

bellows to rayse water. Constat per ligaturam transitum sanguinis ab arterijs ad venas, unde Δ perpetuum sanguinis motum in circulo fieri pulsu cordis.

The two hydrostatic conditions of the circulation are herein defined with geometrical accuracy, and read like the enunciation of a Theorem in Euclid. Indeed, it is remarkable what a strong mathematical element runs through the argument of both his great treatise and of the lectures; not of course mathematics as we now understand them, for at the date of Harvey's death, Newton was a boy of 15, but those of Euclid and of Archimedes. In the second page of the MS. work he speaks of form "ut trigonis in tetragonum," of proportion "ut diapente in diapason," the relation of the triangle to the square, of the fifth in music to the octave. An even more remarkable reference to musical ratios occurs a few lines later, "ut semiditonos diapaso," like a semitone to an octave.

Again in the ninth page we find "Proportio pectoris ad ventrem diapason ut 3.4 sesquitertia; pectoris ad caput $\frac{2}{3}$ diapente, pectoris ad alvum $\frac{2}{1}$ diapason; both these last two ratios being expressed as fractions.

We have, moreover, direct personal evidence to his studies in this direction; for Aubrey found him reading Oughtred's *Clavis Mathematica*, and working the problems when he was no longer a young man. Now his strongest and most irrefragable argument for the new view of the circulation is distinctly numerical. "Supponamus," he says, "quantum sanguinis sinister ventriculus in dilatatione quum repletus sit contineat, sive ℥ij; sive ℥jss; ego in mortuo reperi ultra ℥ij;" and further on the problem thus concisely proposed is continued:

"Ita in homine protrudi singulis cordis pulsibus, supponamus unciam semis, vel drachmas iij, vel drachmam unam sanguinis, qui propter impedimentum valvularum in cor remeare non potest. Cor unâ semihorâ plus quam mille pulsus facit. Jam mutiplicatis drachmis videbis unâ semihorâ, aut millies drachmas tres, vel drachmas duas aut uncias quinquies centum, per cor in arterias transfusam, quæ major est copia quam in universo corpore contingat reperiri. Quare concludendum si unciam transmissam contingere, libras 83 et ℥iv in unâ semihorâ transfusas esse de venis in arterias.

He saw distinctly that the heart was simply a double force-pump, propelling an incompressible fluid into an equally double system of tubes; that

it was the sole efficient cause of the motion thus engendered (indeed, he uses the phrase, "solum a corde"); that the lungs, although an air-pump of no inconsiderable power, both for compression and rarefaction, had nothing whatever to with this; that the valves of the heart acted equally as machines to make good the dynamical advantage thus obtained, and that the quantity of fluid thus raised was incomparably greater than had been before supposed. The conception is as distinctly mechanical as that of the steam engine, or of the mechanical equivalent of heat which were to arise in later centuries. Even of this last great generalisation in mechanics, he had no indistinct glimpse, for in the thirteenth page of the MS. he compares heat to a hammer. "Calor ut malleus instrumentum instrumentorum." With the working out of this complex but perfectly precise problem in hydrodynamics, came accuracy and certainty in place of theory and conjecture. "Flux and reflux" had had their day, and no more need be said of that unlucky Euripus which is fabled to have driven a great natural philosopher, Aristotle, to suicide,

and which had been an incubus on science ever since.

Only twenty-six short years after the first Harveian lectures were committed to paper, and fourteen after the treatise *De Motu Sanguinis* appeared, the wondrous boy was born who was destined in like manner to penetrate another of Nature's mechanical mysteries, the problem of universal gravitation. Newton was fifteen years old when Harvey died, and already studying Oughtred's *Clavis Mathematica*, the very work which Aubrey found Harvey engaged upon, as above stated.

As regards Harvey's classical scholarship, little needs to be added to what has already been well said. The scholar of Canterbury Grammar School and the pensioner of Caius College, Cambridge, was clearly well trained in classics, dialectics and physics. He evidently knew Aristotle thoroughly, und often quotes him, especially the grand treatise on *Metaphysics*, and the excellent book on the *Generation of Animals*, a quotation from which stands on the title sheet of the lectures. For it

must be remembered in these days of detraction, that Aristotle was no mean naturalist, and even comparative anatomist; many of his shrewd observations in this direction being sound even to the present time. "Naturæ diligentissimus investigator,' are the words. Harvey also quotes the *Gorgias* of Plato; and there is a passage in the preface to his treatise *De Generatione* which so completely recalls the myth of the cave in Plato's *Republic*, that it cannot be an accidental coincidence. "Hi," says he, "non veras ideas, sed falsa idola et phantasmata inania mente concipiunt; unde umbras quasdem et chimæras sibi fingunt." It is difficult also to believe that this metaphor had not been recalled to Harvey's memory by the use of it under the name of Eidola Specus, in a great book then recently produced, which overtly in its very title professed to be an extension of Aristotle's grand work on formal logic; namely, the *Novum Organon* of Bacon.

Aubrey says, in his *Lives of Eminent Persons*, that he understood Greek and Latin pretty well, but was

no critic, and wrote very bad Latin. We are, however, now in a position to judge of this for ourselves from the real autograph. The Greek words scattered freely through the lectures are well written and spelt, though in one or more instances the first part of a word begins in Greek and finishes in English characters. But this is only on a par with the whole work, which is a cento of Greek, Latin, and English, never intended to be seen by any eye besides that of the writer himself. Yet even thus in passages it rises almost to eloquence, as in p. 47, where, speaking of the maintenance of human species by generation, in spite of the death of the individual, he says:

> By the string tyed to eternity. Unde cum natura non potuit Individualem æternitatem, id quod potuit harum partium facultate speciem æternitatis generando sibi similem in secula. Unde sacris literis greatest blessing Issue, that thy seed shall remayne for ever.

And farther on:

> Apparet item maribus et fœminis qui moderate utuntur never more brave, sprightly, blith, valiant, pleasant, or bewtifull.

which cannot fail to remind us of the passage in the fourth Georgic of his favourite author Virgil:

Ergo ipsas quamvis angusti terminus ævi
Excipiat (neque enim plus septima ducitur æstas)
At genus immortale manet, multosque per annos
Stat fortuna domûs, et avi numerantur avorum.

But before leaving the loving commemoration of our great benefactor, I wish to point out some evidences of his genial and even humorous temper, which must have made the lectures pleasant to listen to.

P. 16. Speaking of the position of the abdominal organs, he says: "Situs omnium partium certus partim incertus." Then, breaking into familiar English, he notes: "Natura Romidges (*sic*) as she can best stow, as in ships." While still on the same topic, he points out that malposition of organs occurs in "yeoung (*sic*) girls by lacing; unde cutt there laces."

P. 53. In another place, in describing an irreducible hernia, he says it may be filled "cum maximâ quantitate aquæ et flatus." "The man behind Covent Garden 'Bil.'"

P. 35. The spleen is described in man "as washous to the kitchin," and its absence in lower organisms, "Inferior kitchins need noe washhous."

Lastly, "in quibus vitiatum temperamentum, Lien Major the washhous exceed ye kitchin."

P. 54. It is difficult to believe that the passage which follows, "Mas a vigore spiritus higher sett, unde Bastards brave men, quia magno fervore geniti vetito concubitu" is not a reflection of Shakespeare's bastard, Faulconbridge, a character which Harvey may have seen represented, even by its creator himself, at any time in the eighteen previous years.

P. 50. But perhaps the quaintest entry is one speaking of some rather controvertible anatomical assertions which he thus records "W. H., a little staggerum in these."

He describes the thymus gland as follows:

Thimus, sweete bread, nutt of veale, corpus glandosum molle, heare they sticke the piggg.

And a little farther on, speaking of some idle controversy of previous writers, he describes it "est de lanâ capriâ," which is obviously a note jotted down from the Horatian line, "Alter rixatur de lanâ sæpe caprinâ." In an excellent account of the signs of asphyxia, he says:

Soe curst children by eager crying, grow black and suffocated, non deficiente animali facultate,

which again recalls to our memory Kate the Curst in the *Taming of the Shrew*. There is, however, one page of this remarkable volume which requires more than cursory notice, as beyond illustrating the character of our distinguished benefactor, which I am specially directed to do, it affords us from his example a valuable lesson for our own instruction. These are the canones anatomiæ generalis, rules which he evidently laid down to himself, and in which he has left us a precious legacy of advice. They are twelve in number, hastily, but evidently after mature thought, jotted down in the strange mixture of Latin and English which is throughout the book adopted (p. 4).

Canones Anatomiae Generalis

1 ſheW as much Bno intuitu as can Be
Bf de toto Bentre: Bel toto aliquo quae accidunt
deinde diBidere (propter ſitus et conexiones
2 demonſtrare propria illius CadaBeris
NoBa Bel NoBiter inBenta
3 to ſupply only By ſpeech What cannot Be ſheWn
on your oWn credit and By authority

4 cutt Vp as much as may be in presentia ut cum
Historia peritia innotescat
5 obserVationes proprias et alienas recensere
ad confirmandam propriam opinionem Vel obsignatis
tabulis in alijs Animalibus agere
secundum Socratis regulam: Where it is farer Written
Vnde obserVationes exoticas
1 ob causas Morborum: Medicis praecipue utilissimas
2 ob Varietatem Naturae philosophicae
3 ad refutandos errores et proinde solVendos
4 ob Vsus et actiones InVeniendas dignitates
et propter inde Colectanea
Anatomiae enim finis partis Cognitio propter quid
Necessitas et Vsus
philosophis praecipue qui inde sciunt
ad Vnamquamque actiones quae requiruntur quod praestat
Medicis item qui inde constitutionem naturalem
regula quo diducendi aegrotantes
et inde Quid agendum morbis
6 Not to prayse or dispraysé. all did Well
and beHoWlding ijs qui perperam quia occasio
7 Not to dispute confute alias quam argumentis
ostensis quia plus quam iij dies requiruntur
8 Vrefly and playnly: yett not letting
pas any one thing Vnspoken of Which
is subiect to the beW
10 Not to speake anything Which With outt the carcase
may be deliVered or read att home
11 Non nimium curiose pertinet enim particularibus
dissectionibus et tempus non patitur
12 to serVe in their iij courses according to the glass
1° Ventris inferni nasty yet recompensed by ++ admiry ++
admirable Variety
2° the parlor 3° diVine Banquet of the brayne

It is singular how much of this is still valuable, though written at a time when printed books were scarce, oral lectures the chief mode of teaching, and primers, text-books, compendia, with all the artillery of cram, unknown. Indeed, a direct answer is given to the paradox which has of late obtained some vogue, and which has been fostered by examining machines miscalled universities, that lectures are useless, and that it is only necessary to ascertain that a student knows certain prescribed facts without asking how and where he learned them. Those of us who are teachers and examiners, and I am aware I am speaking before the most learned body of teachers and examiners in this kingdom, know the fallacy; it is a fallacy, moreover, chiefly in the higher branches of thought, where absolute certainty is unobtainable, and where tact, experience, and the exercise of a judicial function of the mind are necessary. It is a fallacy still more where acutely cultivated sense—the memory of the eye, of the ear, and of the touch—have to be added to these characters.

As an examiner myself to this College of over

seven years' standing, I feel I can often detect book knowledge and parrot-like iteration of catch-words learned by rote but not thought out in some voluble but superficial candidate. Indeed, Charles Dickens and Albert Smith (the latter a medical student himself, both acute observers of human nature) have each pilloried flagrant offenders in this direction with the severity and incisiveness of real humour. To these book-read anatomists and school-board paradoxists an admirable answer is given in the words, "Cutt vp as much as may be in præsentiâ, ut cum Historiâ peritia innotescat." That, with the description, practical experience should arise.

But it is not only the superficial and sciolistic learner who may gather lessons from this remarkable page; there is much that we as lecturers and teachers may take to heart with advantage. "To supply only by speech what cannot be shewn on your own credit and by authority"; also, "observationes proprias et alienas recensere, ad confirmandam propriam opinionem."

There is often, even at the present day, much

difficulty in the full performance of the duty here so lucidly and tersely set forth—that, namely, of comparing our own with other observations. It occurs to a great extent in the department to which the present speaker's chief attention has been devoted, that, namely, of physics. Much valuable work and information is stored away in papers read before learned societies, in small detached pamphlets, in foreign and scientific periodicals, and similar places very hard to reach for purposes of consultation. Hence follows no little repetition of labour in rediscovery, and the consequent disappointment of perfectly conscientious observers who have unwittingly gone over the same ground as their forerunners in science. It is, moreover, from comparison of one's own views with those of previous labourers, if it be performed in a conscientious and thorough manner, that new views and ideas often arise.

It is not, however, so much in the seeking out of new facts in Nature that these canones help us, as in the suggestions for the communication of knowledge, a function especially important in the

art of medicine, because at the end of our educational chain there hangs suspended a human life. There can be no hesitation in calling this pregnant collection of maxims a treatise on the art of imparting knowledge, an art too much neglected even in the present age. For, sooth to say, Englishmen fall, I fear, somewhat behind their French and German rivals in the practice of this important function. Even their speech and articulation are often inferior, as anyone who has listened to Trousseau, Claude Bernard, or Virchow must be well aware. "Brefly and playnly, yett not letting pas any one thing vnspoken of which is subiect to the vew," says our thoughtful monitor. Then again, 'Not to dispute alias quam argumentis," a quiet sarcasm on obtrusive controversialism which may go home to many a pulpit beyond this from which I have the honour to address you.

We are now in a position to gather in the fruit of our author's teaching; and first as to the utility of lecturing. We have it in his quaint language that it is justly a combination of what a book can give; namely, knowledge; with what

it cannot, namely, intuitus or demonstration. In many subjects, in none certainly more than general anatomy, this is a point of no mean importance. The eye can assist the ear; two inlets are afforded at once to the sentient brain instead of one, and two forms of memory can be called forth. For it is a fact, though one seldom insisted on, that memory has at least as many forms as there are senses. The memory of the ear is perhaps the commonest but also the least intellectual, unless applied to harmonious sounds and melodies. Unfortunately, the mere reproduction of the dry husks of thought termed words is too much cultivated in these days of overpressure, and too little care is taken to secure the essential nucleus of the grain of thought. To the anatomist, the surgeon, and the man of science generally the memory of the eye transcends the former. A geometrical memory, which can reproduce forms healthy or diseased, is an acquirement especially to be cultivated by the student of medicine and pathology. This is far better done in lectures than by books.

Secondly, the lecturer can keep himself abreast of all things "Nova vel Noviter inventa," whereas the book even if at first up to date, as it seldom is, soon falls back in the race and becomes ancient. There are, indeed, books like the *Metaphysics* of Aristotle, the *Republic* of Plato, and the *Aphorisms* of Hippocrates; more lately the *Principia* of Newton, the *Religio Medici* of Sir Thomas Browne, and the work *De Sedibus et Causis Morborum*, by Morgagni, which will never grow old; but when we come to the new philosophy, and wrest daily fresh secrets from Nature, the case is different. Here also the lecture far transcends the book; especially if the lecturer, standing on the brink of the precipice which separates the known from the unknown, can detail facts or deductions which he can vouch for and prove "on his own credit and authority," as saith our teacher. It is a severe labour indeed, but a labour of love in these days of scientific progress, to keep oneself informed of all fresh truths as they arise, so as to impart them "brefly and playnly" to younger and still thirsty minds. If

to these he can add "observationes proprias," original facts and investigations, the lecture reaches a pitch of individual interest which none but the greatest books, certainly no handbooks or manuals, can ever attain.

Lastly, the lecture, well delivered, has a greater point and flexibility than the written volume. The lecturer, like the actor, can study his audience, and wake their attention by a judicious or even humorous allusion. The manuscript before us teems with these, indeed several have been already cited; perhaps, however, the quaintest of all occurs in the description of the diaphragm. After giving its function as a septum or partition, he mentions the old English name midrefe, and this he compares to the shere or shire reva or reeve, a well known county officer at the time, and says, "his office serving to both belly and lungs he is stickler between them." There can be little doubt but that a smile passed over the grave countenances of the assembled physicians at this homely allusion.

Thus did the first Harveian lecturer, as we see

from the veriest *editio princeps* possible of the first lectures, fulfil the precept to "make these dry bones live," to give the vivifying force of character, fancy, and originality to the general facts of anatomy. Since then two hundred and seventy-one years have run their course, and still the sacred fire of thought and genius burns in them undimmed by time.

There yet remains one part, perhaps the most important, of my prescribed task to be performed, and that is to draw a practical conclusion from the essentially physical and mechanical character of Harvey's great discovery. That he himself fully knew this has been already shown in his own words; it is also by his division of anatomy into three parts, philosophica, medica, and mechanica. Now at the present time investigation and research is abundantly carried on in the pathological, physiological and therapeutical aspects of medicine, but the physical or mechanical side is somewhat neglected. For hundreds of ardent questioners of Nature who are labouring with the microscope, in the biological and the bacteriological

laboratories, those who attack medicine from its physical side may be counted on the fingers of one hand. Nor indeed are the written treatises on this subject abundant, in this country at least. The *Animal Mechanics*, of the Rev. Dr. Haughton, of Trinity College, Dublin, is an exceptional work of great value, which has hardly received the attention it deserves from the medical profession, but it stands almost alone as the representative of its class. On the Continent, however, and in America the case is very different. The admirable *Medical Physics* of Professor Wundt, of Heidelberg, has been translated from the German into French, with valuable additions by Dr. Ferdinand Monayer, who regularly lectures on medical physics at the Lyons Faculty of Medicine, and affords a storehouse of information of the highest value to the medical practitioner.

Dr. John C. Draper, Professor of Chemistry and Physics in the Medical Department of the University of New York, has also made an excellent contribution to the literature of this subject in his *Textbook of Medical Physics*, published the year be-

fore last. There is indeed a small but scanty manual by Dr. McGregor Robertson, the Muirhead Demonstrator of Physiology in the University of Glasgow, published in Cassell's Student's Series, but it is entirely unfit to compete with the two exhaustive treatises named before.

As with the bibliography, so with the teaching. With the exception of a course of lectures which the present speaker has delivered since 1871 in St. Thomas's Hospital, I am not aware of any systematic attempt in London to teach the medical student the vast mass of physical facts which underlie the daily practice of medicine. This College, however, forms an honourable exception, for it has on two occasions kindly given me the opportunity to bring before my brother physicians some few of what our Harvey terms "Nova vel Novita inventa,"—respecting the Physical Basis of Auscultation in the Croonian, and the Electrical Conditions of the Human Body in the Lumleian, lectures of a few years back.

It is true that the University of London in its Preliminary Scientific Examination for the

degree of Bachelor of Medicine requires students to satisfy their examiners in physics by means of a written paper. But this paper is the same as that set to Bachelors of Science not medical. It is a terrible stumbling block to the rising medical generation; it bristles with what the late genial Professor De Morgan, himself a mathematician of the highest order, delighted to call mathematical conundrums. It is set by pure physicists, who know nothing, and probably care little, for the problems which interest us as medical men. It contributes a large percentage to the slaughter of innocent aspirants to the higher degrees in medicine, on which one of their most distinguished graduates, now Censor of this College, has feelingly and righteously commented. In the sixteen years during which I have carefully read the papers there set, I have never once seen a question directly or indirectly bearing on the physics of medicine.

The fact is that the large, difficult, and somewhat heterogeneous branch of knowledge connoted by the word physics is rapidly splitting

into several independent portions. There are now distinctly molecular, mathematical, industrial, and physiological physics. It is the last of these with which we are concerned. The third or industrial branch has been enormously developed of late by the technical colleges at Bristol, Manchester, the City guilds, at Kensington, and elsewhere. The mathematical branch is well cared for by the two old Universities of Oxford and Cambridge, but the physiological section has been hitherto hardly enough recognised by our teaching bodies. Surely an earnest student should be able somewhere to obtain information as to the natural laws on which the stethoscope, the microscope, the ophthalmoscope and the sphygmograph are founded without having to wade through interminable problems on the C. G. S. system of units, or vortex theories of matter, or—chimera of chimeras—the possibility and advantages of four-dimensional space.

It is to the promotion of this particular branch of study by means of experiment that it is this day my duty to exhort the College. An admirable opportunity exists, for in April of the present

year the Committee of Delegates appointed by this College and the Royal College of Surgeons of England reported:

1. That it is desirable to utilise the vacant ground adjoining the Examination Hall for scientific purposes, under the control and management of the two Colleges.

2. That the "scientific purposes" be, in the first place, the investigation and exposition of such branches of science connected with medicine and surgery as the two Colleges may from time to time determine.

The College has subsequently adopted the report.

Now I submit with the utmost respect, but with the greatest earnestness, to those here assembled that a course of physiological physics to be delivered in the new college of science would be a real boon to all students of medicine, whether they had succeeded in obtaining their diploma or not. The human body is a mass or congeries of separate machines, susceptible of mechanical explanation; but, setting aside the heart and lungs

already named, how many students have their attention specially drawn to Donders's and Landolt's optical researches on the eye and eyesight, or to Helmholtz's account of the mechanism of the ear Such a course, moreover, would in no way clash with other courses given elsewhere on different branches of the same great subject, and it would eminently fulfil the exact purpose even to the very words of the great man whom we are to day met to commemorate.