Address to the Department of Anatomy and Physiology of the British Association / by P.H. Pye-Smith.

ADDRESS

TO THE DEPARTMENT OF

ANATOMY AND PHYSIOLOGY

OF THE

BRITISH ASSOCIATION.

BY

P. H. PYE-SMITH, B.A., M.D.

VICE-PRESIDENT OF THE SECTION.

The Association to which we belong seeks to advance Natural Science, that is to say, accurate knowledge of the material world, by the following means:—

1st.—By bringing together men who are engaged in the various fields of science indicated by our several Sections, by promoting friendship between them, by giving opportunity for discussion on points of difference, by encouraging obscure but genuine labourers with the applause of the leaders whom they have learnt to venerate, and by fostering that feeling of respect for other branches of science, that knowledge of and interest in their progress, which chiefly marks the liberality of scientific study.

Secondly.—The Association provides funds, which, though small in amount, are great in worth, from the mode of their distribution; and serve in a limited degree as an encouragement, though not an endowment, of research. One proof of the value of this method of subsidising unremunerative work by small grants distributed by the master workmen themselves is given by the fact that the sum of 4,000*l.* annually contributed by the Government of the United Kingdom for the endowment of research is distributed on the same plan by a Committee of the Royal Society.

The Third most important aim of our Association is, 'to obtain a more general attention to the objects and methods of Science, and the removal of any disadvantages of a public kind which impede its progress.' It is for this reason that the Association travels from one to another of the great centres of population and intellectual activity of the kingdom. Local scientific societies and local museums are generated and regenerated in its path, local industries are for a time raised to a higher level than that of money-getting, and every artisan may learn how his own craft depends upon knowledge of the facts of nature, and how he forms part of the great system of applied science which is subduing the earth and all its powers to the use of man. We wish to make science popular, not by deceiving idlers into the belief that any thorough knowledge can be easy, but by exciting interest in its objects and appreciation of its methods. In the popular evening lectures you will

hear those who are best qualified to speak upon their several subjects, not preaching with the dry austerity of a pedant, but bringing their own enthusiasm to kindle a contagious fire in those who hear them.

Endeavouring to aid in these objects, I shall in this introductory address offer you some considerations upon the bearing of Biology in general, and Anatomy and Physiology in particular, upon national well-being and public interests.

Biology is the science of the structure, the functions, the distribution, and the succession in time of all living beings. If the proper study of mankind be man, he has learnt late in the inquiry that he can only understand himself by recognising that he is but one of a vast chain of organic creation; that intelligible human anatomy must be based upon comparative anatomy; that human physiology can only be approached as a branch of general physiology, and that even the humblest mould or seaweed may furnish help to explain the most important problems of human existence.

The branch of Physiology which is concerned with man, not as an individual, but a family, the branch which we now call Anthropology, is obviously related to practical Politics, and it was not without reason that the late illustrious pathologist Rokitansky began a speech in the Upper House of the Austrian Parliament on the Autonomy of the Bohemian nation with the words, 'The question really is whether the doctrine of Darwin be true or no.'

In another department, that of Psychology, the physiology of the nervous system has already thrown more light upon the mysterious phenomena of consciousness than was gained by the acutest minds of all ages without the help of anatomical methods.

All the improvements of modern Agriculture and stock-breeding rest upon more or less perfectly understood scientific principles, and the more perfectly the results have been first worked out in the laboratory the more safe and the more lucrative will be their application in the field.*

Still more important is the relation of Physiology to the national Health. The commonplaces of hygiene which are now, one may be thankful to say, taught, if not practised, in almost every schoolroom and factory in England, are the direct results of the abstruse researches of Boyle and Priestley, of Lavoisier and Pasteur. Ages of experience did not teach mankind the value of fresh air, or the innocence of clean water. Indeed, I have myself heard astonishment expressed by a German professor at the peculiar immunity with which English skins will bear the daily and unstinted application of soap and water.

If the art of keeping a community in health is but the application of plain physiological laws, it is no less true that the art of restoring the health, curative, as distinct from preventive Medicine, rests upon the same basis. In former days the physician was one who recognised what he called the disease of his patient, who referred to his books of precedents as a lawyer to his statutes, and who prescribed a proper remedy to cast out the disease. We now know that dis-ease is, as the name implies, a purely subjective conception. The disease of a host is the health of the parasite, and we cure a human sufferer by poisoning the animals or plants which interfere with his comfort. The same changes which in the old man are the natural steps of decay, the absence of which after a certain age would be truly pathological, are the cause of acute disease in the young. Pathology has no laws distinct from those of Physiology.

When these now obvious considerations are thoroughly understood, it clearly follows that all 'systems of medicine' are in their very nature condemned. All that the art of Medicine can do is to apply a knowledge of natural laws, of mechanics and of hydrostatics, of botany and zoology, of chemistry and electricity, of the behaviour of living cells and organs when subjected to the influence of heat and of cold, of acids and alkalis, of alcohols and ethers, of narcotics and stimulants, so as to modify certain deviations from ordinary structure and function which are productive of pain, or discomfort, or death. It is, therefore, plain that rational medicine, or keeping right and setting right the human body must rest upon a knowledge of its

* I need only refer to the fruitful labours of Mr. Lawes and Dr. Gilbert in this direction.

structure and its actions, just as a steam-engine or a watch cannot be mended upon general principles, but only by one who is familiar with their construction and working, and who can detect the source of their irregularity.

An objector may say :—'Admitting that medicine is an art, it is a purely empirical art. You cannot detect the origin of many of the maladies which you are yet able to cure; your best remedies have not been obtained by scientific experiment, but by chance observation and accumulated experience; and if you doctors would give more time to practical therapeutics, that is, to finding out what is good for the several aches and pains we complain of, you would spend your time better than in abstruse researches into microscopic anatomy or the properties of a dead frog's muscle.'

The answer to the objection is an appeal to fact. For centuries, so called observation and experience left medicine in the condition it occupied at the end of the 17th century. The progress of therapeutics is to be marked, not by the labours of 'practical men,' (who, by the way, are of all the most theoretical, only that their theories are wrong), but by the, at first sight, unconnected studies of Descartes and Newton, of Hooke and Grew, of Lavoisier and Davy and Volta, of Marshall Hall and Johannes Müller.

The history of science proves that unconnected, unsystematic, inaccurate observations are worth nothing. For untold ages men have had ample opportunities of studying the indications of the weather, and have felt the utmost desire to obtain a knowledge of what they portend. Yet it may fairly be said that nothing had been done to the purpose, until combined and systematic observations were made in this country and America. The fact is, that popular notions do not rest upon experience or observation. They rest, with scarcely an exception, upon metaphysical theories. In dealing with uneducated persons, both of the lower and higher ranks, physicians find abundance of theories as to the nature and the origin of disease, and of suggestions as to its cure. The only thing which would be of value is what we can scarcely ever get, an accurate observation of what they see and feel. Every fallacy of popular medicine, every solemn medical imposture, is the ghost of some long defunct doctrine of the schools. Therefore, it is that common experience is almost absolutely useless in all practical arts which, without exception, depend for their progress upon the advance of science, that is, upon methodical, continuous and scrupulously accurate observations and experiments.

Many important advances in the practice of medicine have been gained by direct and intentional experiments instituted with a therapeutical object. Such was the Hunterian operation for aneurism, the process of skin-grafting, and subperiosteal operations, such was the administration of chloroform and the introduction of nitrite of amyl, chloral hydrate, and carbolic acid. Such direct experiments still go on, and among them deserve mention for the skill and the untiring patience with which they were carried out, those investigations upon the action of various drugs upon the secretion of bile for which we are indebted to Professor Rutherford and his coadjutors. Even apparently accidental discoveries were not made accidentally. Hundreds of country surgeons must have been familiar with the cow-pox, and have seen examples of the immunity it conferred from the more terrible variola, but he who discovered vaccination was no falsely called practical man. He was a man of science, the friend of Hunter and of Cavendish, an anatomist and natural philosopher. The fruits of Jenner's discovery are spread over the whole earth. This humble village doctor has saved more lives than the most glorious conqueror destroyed, but his name is little honoured and the only monument to his memory has been banished from association with vulgar kings and skilful homicides to an obscure corner of the great city, where his only homage is the health and beauty of the children who play around his statue.

But after all, it is not so much by direct and immediate contributions to the art of healing that Physiology has vindicated her ancient title of the Institutes of medicine, numerous and important as these contributions have been. It is still more by the scientific spirit which has transformed the empty learning so justly ridiculed by Molière and Le Sage into the practical efficiency of modern surgery. Let me give an instance of what I mean. The notion of measuring the temperature of the body is simple enough, and the rough observation that in inflammation the

temperature is raised had led to the various terms by which it was denoted i ancient medicine, and to numberless theories now happily forgotten. But althoug the thermometer was well known, and had been applied by many scientifi physicians, notably by De Haen, by Dr. John Davy, and by Sir Benjamin Brodie yet the practical value of the clinical thermometer which now every practitione carries in his pocket was not understood until the other day. Those only who ha been trained in accurate physical and physiological investigations, who had learne the worse than uselessness of 'rough observation,' were able to see the enormou importance of clinical thermometry. This most practical of modern improvement in medicine would never have been dreamt of by 'practical men': we owe it to th scientific training of German laboratories.

If Physiology is of such great national importance, if the necessity of experi mental research is so vital to the common national wealth, to agriculture an commerce, to health and well-being, ought not its well-ascertained results to b taught in our common schools, and its prosecution directly encouraged by the State?

There is no question of the great importance of children being taught the rudi mentary laws of health, the bodily evils of dirt and sloth and vice, the excellence o temperance, the danger of the first inroads of disease. Such teaching now broadi cast in many excellent manuals as 'The Personal Care of Health, by the late Dr Parkes,' and Dr. Bridges' 'Catechism of Health' is no doubt extremely valuable and happily is daily more and more diffused. But when beyond the direct utility of such knowledge, we attempt to make it an intellectual discipline, there are, conceive, difficulties which will always prevent even elementary physiology from forming an important part of general education. First, there is the practica difficulty of the necessary dissections, next the impossibility of making physiology demonstrative, and thirdly, the abstruseness of the subject. It is impossible t have even an elementary knowledge of the laws of living beings without a very considerable familiarity with those of physics and of chemistry, and even in medica schools it requires all our efforts to prevent it degenerating into a mere dogmati statement of results, or a laboured repetition of hearsay statements. As an intel lectual discipline, for facility of demonstration, for the simplicity of the objects their beauty and interest, their associations with the green lanes and broad moor of England, with the poetry of Cymbeline and Lycidas, with fairy tales and loca folk-lore—Botany is to my mind the branch of natural science which is above al others to be chosen where one only can be taught. Next in importance I would place Elementary Physics, the knowledge of the simplest laws of masses at res and in motion, of heat and light. Its great recommendations are its precision, it constant and useful illustrations in daily life, the interest it gives to the handicraft and manufactures in which so large a number of English boys and girls are busied and the necessity of such knowledge as the first step in acquiring all other natura sciences.

First, then, I would that every Sheffield girl should love flowers with the deep and abiding affection of familiar knowledge, and that every Sheffield lad should know every common plant in your beautiful woods and find his purest pleasure on the heights of Bell Hag and the broad expanse of Stanage Edge. And next I would that your workmen and workboys should know so much of mechanics that they may take an intelligent pride in your vast factories, and that in some of them may be awakened the genius to which we trust to repeat in future generations the national services of Arkwright, and Watt, and Stevenson.

With regard to the endowment of research in Biology, I must confess that I should be sorry to see it undertaken by government funds. That such investigations are of public interest, that they are difficult and expensive, and that at present they languish for want of adequate support, is all true. But this country is not so poor nor our countrymen so wanting in public spirit, that we need appeal to the national purse to supply every ascertained want. Great as is the national importance of science, the nation is more important still; and even if that were the alternative, I would rather that we should indefinitely be dependent on Germany for our know

ledge than give up the local energy, the unofficial zeal which has made England what she is. Far better for the strength and the civilization of the nation that a thousand pounds were raised every year for the endowment of unremunerative researches in this wealthy town of Sheffield, than that ten thousand were paid you by a paternal monarch or an enlightened department.

But surely there is no need for us to go to Parliament for such sums as we require. In the first place, scientific men themselves show a good example of not asking before they give. There is the modest sum which we raise in this Association, there are the funds for helping research of the Royal Society, the Chemical Society, the British Medical Association, the Iron and Steel Institute, the Whitworth Scholarships. Next we have the resources of our Universities, which have scarcely begun to apply themselves to the task. I need do no more than allude to the Cavendish Laboratory, or to the Physiological School, at Cambridge, where a simple College tutor, of rare ability, and of still more rare sympathy and energy, has, in ten years, achieved results which we need not shrink from comparing with those of the great continental laboratories. The magnificent Museum of Anatomy, maintained by the College of Surgeons almost entirely out of their own funds, is another instance of private care for science to which we find no parallel abroad; and the Zoological Society wisely spends a large part of its income in prosecuting Comparative Anatomy, and publishing its beautifully illustrated Memoirs.

But beside the efforts of scientific bodies and the wealth of our national Universities, we may surely look to the public spirit of ancient companies and corporations to do something for the cause of science. In the middle ages our country was covered with parish churches by private munificence: in the sixteenth century most of our public and grammar schools were endowed; in later times our great religious and charitable societies were founded. May we not hope that, before the close of the present century, the discriminating knowledge which alone prevents gifts of money from being a curse instead of a blessing to a community, may lead to the establishment of libraries, and museums, and laboratories by universities and towns, which shall bear comparison, I will not say with those of Paris, or Leipzic, or Bonn, but with the poorer but scarcely less distinguished schools of Heidelburg and Göttingen, of Würzberg and of Utrecht?

Here and there we have institutions already under Government control and patronage. Let them be maintained as efficiently and liberally as possible. The British Museum, and its Library, the Royal Observatory at Greenwich, and the Royal Gardens at Kew (happily preserved for the present from the short-sighted eagerness of those who would destroy their scientific value), these are great national institutions of which we are justly proud. Successive Governments will have enough to do to maintain their efficiency and to guard them from incompetent interference.

Whatever may be thought of the duty of the State directly to encourage the pursuit of Animal and Vegetable Physiology, one would have supposed that at least what diplomatists call a benevolent neutrality, would be shown to a pursuit so laborious and costly, which demands trained workmen and the devotion of a lifetime, which is so important for the national wealth and health, and which, by reason, by experience, and by testimony, we know to be the only guarantee for advance in the various branches of the healing art. Why is it then that institutions which owe nothing to government assistance, and men who spend their time and talents in self-denying and unremunerative service for the public good, are not suffered to pursue their beneficent work in peace? You know that certain persons who profess to be shocked by the methods of physiological research have succeeded in placing this branch of science under as great disabilities as that sense of humour would allow, which so often redeems British ignorance from its most mischievous results.

The method that has given rise to so much excitement is the performance of experiments upon living animals. Now, if this were injurious to the greatest good of the greatest number of the community, or if freedom to perform these experiments interfered with the freedom of other persons to abstain from them, or if such experiments were forbidden by any religious or moral authority, by the Ten Commandments, or by Mr. Matthew Arnold, of course they must be given up; but

equally, of course, the science of Physiology must also come to a stop, and th farmer, the cattle-breeder, and the physician must be content with such knowledg or such ignorance as he at present possesses. I know it has been asserted that th science of the functions of living organs is quite independent of experiment upo living organs. But this is said by the same persons who have denied that th art of setting right the functions of the body when they go wrong has anything t do with the knowledge of what those functions are.

If you could be persuaded that Chemistry can make progress without retorts an balances, that a geologist's hammer is a useless incumbrance, or that engineers ca build bridges just as well by the rule of thumb as by the knowledge gained in workshop, then you might believe that Physiology also is independent of experi ment.

It is absurd to object to the difficulties of the research or even the contradictor results sometimes obtained. The functions of a muscle or a gland are more com plicated than those of water or gas, and their investigation needs greater skill, mor caution, and more frequent repetition. Imperfect experiments can lead to nothin but error; criticism from other physiologists, or from scientific men experienced i other branches of research, is not wanting and is always valuable. But vagu assertion that further progress is impossible by the very means which have led t all our present knowledge, coming from those 'who are not of our school'—or an school, is undeserving of serious notice.

The real contention of course is a moral one, that we ought to relinquish th advantage of all experiments which are accompanied with pain to the creatur experimented on. The botanist may serve his plants as he pleases, and even th animal physiologist may cut, or starve, or poison all sentient organisms whic happen not to possess a backbone, and he may try experiments with all backbone animals, including himself and his friends, so long as they do not hurt, but tha must be the limit. On the most extreme humanitarian views no objection can b made to experiments upon animals in a state of insensibility to pain, and as thes constitute, happily, the vast majority of physiological experiments, the question i narrowed to comparatively restricted limits. Is it wrong to inflict painful experi ments upon animals for the sake of Science? In the absence of any authority t appeal to, we can but judge of the matter by analogy. Now it has been the prac tice of all mankind, and is still allowed by the common consent both of law an feeling, that we should destroy by more or less painful means, that we shoul enslave and force to work, and mutilate by painful operations, and hunt to death and wound, and lacerate, and torture the brute creation for the following objects:— for our own self-preservation, as when we offer a reward for the killing o tigers and snakes in India; for our comfort, as when we poison or otherwis destroy internal parasites, and vermin, and rats, and rabbits. Our safety, ou food, our convenience, our wealth, or our amusement: all these objects have bee and are regarded by the great mass of mankind, and are held by the laws o every civilised country, to be sufficiently important to justify the infliction of pain or death upon animals in whatever numbers may be necessary. The onl restriction which Christian morality or in certain cases recent legislation impose upon such practices is, that no more pain shall be inflicted than is necessary for th object in view. Killing or hurting domestic animals when moved by passion o by the horrible delight which some depraved natures feel in the act of inflictin pain was until lately the only recognised transgression against the law of England I trust I need not say that it is only under such restrictions that physiologists desir to work.* Anyone who would inflict a single pang beyond what is necessary for scientific object, or would by carelessness fail to take due care of the animals h has to deal with, would be justly amenable to public reprobation. And, remembe it is within these limits that the whole controversy lies, for after a long and patien examination of all that could be said by our accusers, the Royal Commission whic was nominated for the purpose unanimously reported that in this country at leas scientific experiments upon animals are free from abuse.

What is deliberately asserted is that within the restrictions which all humane

* They are, in fact, the very limits that were put on record by this Associatio long before the agitation against Physiology began. See Report for 1871, p. 144.

persons impose upon themselves, it is lawful to inflict pain or death upon animals for profit or for sport, for money or for pastime; that property and sport are in England sacred things; but that the practices which they justify are unjustifiable when pursued with the object of increasing human knowledge or of relieving human suffering.

Of those persons who answer that they consider vivisection for the sake of sport to be almost as detestable as vivisection for the sake of duty, I would only ask first that they should deal impartially with both offences, and secondly that since in the one case their opinions are opposed to the practice of genteël society, and in the other to the convictions of all who are qualified to judge, they should at least contemplate the possibility of being mistaken. Putting the question of field sports altogether aside, you know perfectly well that in every village in England an extremely painful mutilation is constantly performed upon domestic animals in no registered laboratory, under no anæsthetics, and with no object but the convenience and profit of the owner. You remember how when an epidemic threatened the destruction of valuable property, every booby peer now eager to stop, so far as in him lay, the advance of knowledge, was no less eager to have carried out at the public expense any slaughter and any experiments, painful or otherwise, which would save his pocket.

But you will say: all this seems reasonable enough; but if so, how do you account for the prejudice against you, what has induced so many amiable and otherwise sane persons to join in the outcry against Physiology?

First, I answer, it is due to the most frequent cause of folly—Ignorance. Many persons supposed to be educated are so destitute of the most ordinary conceptions of natural science that they do not understand the necessity for experiments. So little do they appreciate the difference between formal knowledge and real knowledge, that a distinguished statesman once assured me that he would as soon have his leg set by a man who had gained what he called his knowledge from books, as by one who had 'walked the hospitals.' Next, there is the vulgar dislike of whatever is not obviously and immediately useful. When knowledge for its own sake is in question, those of the baser sort are always ready to cry with equal ignorance of literature and of science, '*Cui bono?*'

In another class of persons, less ignorant and less stupid than these two, opposition to physiological experiments appears to spring from what may fairly be stigmatised as Sentiment, that is to say, excitable, rather than deep feeling, uncontrolled by reason. People first gratify their fancy by calling cats and dogs our fellow creatures, which, in one sense, undoubtedly they are, and then, by the familiar fallacy of an ambiguous middle term, argue that it is cruel to put our fellow creatures to pain; or, as some would add, to reduce them to slavery, or to use them in any way for our own, rather than their good. Such persons compel their fellow creatures to drag them through the streets, they eat their fellow creatures when sufficiently vivisected to be palatable, and they find philosophical excuses for those who kill their fellow creatures for fun. But they are properly shocked when their fellow creatures are hurt or killed for the benefit of mankind. Such persons have been accused of feminine weakness; but I mustsay that I have never found an intelligent woman who could not see the rights of the case when fairly explained to her, whereas I have met a few men who on this, as in other matters, consistently refuse to give up to argument the notions which were formed by prejudice.

This sentiment is, I admit, the degradation of just feeling. To many unaffectedly compassionate hearts there is a peculiar pang in thinking of suffering which is deliberately inflicted, with only the justification of duty, instead of the excuse of ignorance or passion. They see in the helplessness of the dumb animals an appeal for pity, almost like that of childhood, and are justly indignant with the selfish cruelty so often exercised upon them. All honour to the efforts which have banished so many cruel sports from England; all honour to the Society which seeks to prevent cruelty to animals. If it can point to any additional means by which the sufferings of animals in the cause of Science can be diminished, we shall be anxious to adopt them. If it can point to any abuse in one of our laboratories, we

will hasten to correct it. This Society has honourably declared that they know of none. That physiologists have been heedless, or even callous, in their experiments upon animals in past times, when men were strangely insensible even to human suffering, or in countries where a healthy result of Christian civilisation has not yet been seen in habitual gentleness to animals, I need not deny. Such cases have been eagerly sought and sometimes most unfairly judged. Only lately a learned body felt itself not strong enough to retain the admittedly invaluable services of an eminent foreigner who had once admitted that when absorbed in scientific and beneficent researches he lost sight of any pain that might be inflicted.* Is not this the very excuse which is held valid in the case of sport? Doubtless we ought to be ever mindful of every branch of duty, but such occasional forgetfulness does not show hardness of heart. It is an excusable weakness for a student of medicine to shudder or to faint at the sight of blood, but he learns that this merely physical sensibility becomes selfish and mischievous if indulged: he is taught to suppress all such exhibition of emotion, and to let it stimulate without interfering with his efforts to relieve. But no one surely would think the hysterical youth more truly humane than the surgeon whose compassion is shown in the very firmness with which he inflicts a temporary pain for an ultimate good.

I have hitherto rested the whole argument upon the lawfulness of inflicting pain and death upon the lower animals for the sake of science and humanity, but as a matter of fact I may again assure those who, while assenting to the justice of the plea, yet shrink from what it may involve, that the great majority of experiments upon animals are rendered painless, and that the remainder are mostly those experiments which are most immediately and directly subservient to medical art and which happily are generally productive rather of discomfort than of pain. Let me give you an example of such a vivisection, far more painful than the immense majority of those of the laboratory. Suppose a country surgeon were sent for late at night to some case of urgent peril; knowing that his ride is for life or death, and unsparing of himself or his horse, he rides him to the utmost limits of endurance, and beyond: who would not applaud the action? Those only who appear deliberately to believe that our life is worth less than that of many sparrows; those legislators only who look forward to the time when wars will cease, not because of human slaughter, of devastated homes, of all the horrors which the world has endured for centuries, but because of the cruelties to which the horses in the artillery are subjected. We, who are familiar with human suffering and sorrow, which our knowledge is all too feeble to prevent, best understand how in testing some new remedy on a less precious fellow-creature than a man, one who is truly humane may be tempted to forget the comparatively trivial suffering of a rabbit or a frog.

But some enthusiastic opponent will say, 'I cannot pretend to doubt that these experiments are in every sense of the word useful, but we ought not to purchase the benefit they confer by inflicting pain upon innocent creatures. I would sign a petition to-morrow to put down all field sports by law, I would allow no operation upon domestic animals, and I will abstain from all animal food until I am certain that I can eat creatures which have been killed without suffering pain. But if I were lying at the point of death, and you brought an animal to my bedside and assured me that by putting it to pain my life could be saved, I would refuse to purchase it on such cruel terms.' We may hope that the excellent person who made this heroic profession would in the hour of trial be better advised, but if not we may surely reply, 'Right reverend sir, you are the best judge of the value of your own life, and if you think proper to sacrifice it to the comfort of a guinea-pig we must submit to the loss with such resignation as we can muster, but when you say that in obedience to this silly whim you will let your dearest friend suffer, allow the sacrifice of the most important life, and forbid those studies which have already

* Fortunately, Dr. Klein, whose researches in microscopic anatomy and pathology are so well known and appreciated, knows that he retains the confidence and respect of his scientific brethren, and we hope that his honourable connection with the largest school of medicine in London, will strengthen other and closer ties in binding him to England.

rescued multitudes from deformity and misery and death, then those of us who have to do with the real responsibilities of life, and on whom presses the awful sense of impotence to which our defective science too often leaves us, answer that we too have duties to fulfil, and to the best of our power we mean conscientiously to fulfil them.

There is, I fear, another reason which animates much of the opposition to physiological experiments. It is nothing else than aversion from the methods and the results of science. It may be that an excuse for this dislike has been furnished by the pretence of false science, and the arrogance of much even which is true. But surely, no reasonable creature, from such trivial irritation, can deliberately wish to check the progress of accurate knowledge by observation and experiment. There are, indeed, some who, fearing (as I think prudently) that, while a little knowledge inclineth men to Atheism, greater knowledge turneth them round again to religion,' and desiring to subject the human mind to a bondage as hard and more degrading than that of mediæval Rome, would gladly call off interest from the unremunerative labours which are prompted only by the thirst for knowledge and faith in the possibility of learning more and more of the divine order of the world, to pursuits which bring obvious and material utility. There are those again, who, fearing (as I think foolishly) that increasing knowledge of this Divine order will lower our admiration of its beauty, or that the better a man understands the laws of God the more likely he is to break them, have an unfeigned dislike for natural science in general, and for Biology in particular. They repeat over again the error of which the Dominican friars with far greater excuse were guilty when they imprisoned Galileo. If any such are here, may I venture to tell them—in quietness and in confidence is your strength: the vast fabric of Christian morals is in no danger of being overturned by the discovery of a new chemical method in the laboratory, or of a hitherto undescribed animalcule. If noisy attacks are made in the injured name of science, you have only to wait, and you will see these attacks repelled by the true leaders of science themselves, or, at the worst, by the next generation. But if, leaving your secure fortress of defence, you come down with your rhetoric and your sentiments, your *petitio principii*, your *ignoratio elenchi*, and all your familiar fallacies and tropes, thinking that with such weapons you can meet on their own ground men who have spent their lives in the study of science, then no wonder if you suffer grievous defeat. Happy for you if you learn, like another discomfited pilgrim, to betake yourselves to another 'weapon.'

But I imagine that some of my audience are saying: 'This defence would have been necessary before the Royal Commission made their report; but when that was made, and affirmed the necessity of physiological experiments, and the groundlessness of accusations of cruelty against physiologists, when an Act was passed which licenses physiological laboratories, under the very restrictions which you had already imposed upon yourselves, may we not regard the controversy as closed, and the result as satisfactory?'

I answer that I have taken up your time with this defence of physiological experiments partly because I would fain help, however feebly, in the enlightenment of the public conscience, but also because the result of recent legislation is *not* satisfactory.

Science does not work readily in fetters. A system of licenses and certificates, numerous and complicated, obtained with trouble and delay, and revocable at the will of a Minister who may, by the accidents of party, be at any time amenable to anti-scientific influences, such a system adds serious difficulties to those already in the way of experiments.

Suppose, as an illustration, that certain persons opposed on various grounds to learning, and especially hostile to Greek, had attacked the study of Plato. They would point out the danger of modern ladies becoming as well read in his writings as was Lady Jane Grey. They would show that the laxity of modern manners was coincident with the popularity of the *Symposium*, and that the notorious increase of infanticide was the result of the teaching of the *Republic*. Associations for the total suppression of Plato would be formed, with hired advocates, and anonymous letters, and 'leaflets,' spreading a knowledge of his most objectionable

passages. Scholars would be threatened with eternal punishment, and schoo masters with the withdrawal of their pupils. Then a Royal Commission wou be appointed—a great Latin scholar, a Whig and a Tory statesman (who, havin taken a B. Sc. degree at Oxford, would be impartially ignorant of Greek) the mo intelligent despiser of Plato who could be found, the master of a gramm school on the modern side, and (perhaps the most efficient of all) a lawyer, wh knew nothing about Greek but hated cant. This Commission would take eviden that the Platonic writings were not all immoral, that they had been quoted wit approval by Fathers of the Church, that they were of great importance to liter ture and philosophy, and even to the elucidation of the Sacred Writings. It wou also be proved that the Platonic Dialogues were far less immoral than multitudes other widely circulated books, and even than a French novel which one of th Royal Commissioners happened to be reading, and, lastly, that the morals of Gree scholars, and of clergymen who had read Plato at college, were not obvious degraded below those of other people. On the other hand, witnesses would depo that a knowledge of Plato was of no consequence to a student of philosophy; that if were, the text was in so corrupt a condition that no two scholars agreed as to a sing chapter, and that, after all, philosophy was of no practical use, least of all to clerg men. Others would affirm that though they had never read a line of him, they kne that his style was as vicious as his sentiments; and perhaps some cross-graine scholar might be found who, having once edited a Greek play, would declare th all studies in Greek literature ought to be restricted to the tragedians, and that f his part he had never opened any other authors and had never felt the want them.

At last the Commission would report that there was no question of the valu of the works of Plato, that it would be mischievous and impracticable to prohib their study, and that there was no evidence that schoolmasters habitually cho the least edifying passages as lessons for boys. Then what is called a compromi would be made. It would be enacted that Plato might be read, but only in college annually licensed for that purpose; that everyone wishing to read must have general certificate signed by certain professors, and setting forth his object, also be renewed every year; and that special certificates might be severally obtain for reading certain excepted dialogues, for copying from them, for publishing the or, in rare cases, for translating them.

However reasonably such a system might be administered, who can doubt th the result would be a diminution of the number of scholars, and a check to t progress of learning?

Now this is what legislation has done for physiological experiments. The A 39 & 40 Victoriæ was hastily drawn and hurriedly discussed; for noble lords a honourable gentlemen who had been taught from childhood to vivisect for u scientific purposes were eager to hurry off to their own merry vivisections, f which they were ready provided with license and certificates. And it works might be expected. Some shrink from seeing their names figure in disreputab newspapers, and receiving more or less savagely abusive anonymous letters. Othe have no laboratories, and find difficulty in licensing their houses. Others are refuse the certificates they require.

In one case two thoroughly qualified men were anxious to carry out an importa investigation on the treatment of snake-bites. They procured venomous snak from a distance, and applied for the special certificates necessary. Considerab delay ensued; various objections were raised, and set at rest; and at last all th certificates were obtained; but meantime the snakes had died.

I must apologise for having detained you so long. The whole history of th controversy is melancholy but instructive.

To those of my audience who wish well to Science, I hope that I may hav made more clear the grounds on which vivisection is necessary and right, and thus fu filled one of the chief objects of the Association—'to obtain the removal of an disadvantage of a public kind which impedes the progress of science.'

To those working physiologists who have honoured me by their presence I woul

express the assurance that they have the confidence and the gratitude of the medical profession, witnesses at once competent and impartial, who know the difficulties and the value of such labours; and as to present discouragements, looking back to the obstacles which so long retarded the progress of our kindred science, Anatomy, I may say

O passi graviora, dabit Deus his quoque finem.

When, in the earliest years of the Royal Society, Sir Christopher Wren and Dr. Lower made those experiments on transfusion of blood which have at last proved so beneficent, there were not wanting shallow witlings who scoffed at their researches. It was of them that Cowley wrote with a just indignation—

Whoever would deposed Truth advance
Into the throne usurped from it,
Must feel at first the blows of ignorance
And the sharp points of envious wit.

You have at least escaped the latter penalty.

Dishonour fall on those
Who would to laughter or to scorn expose
So virtuous and so noble a design,
So human for its use, for knowledge so divine!

You wish your culminators no greater dishonour than failure to do mischief. You wish for yourselves no other reward than 'the wages of going on.'

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