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Gull, William Withey, Sir, 1816-1890.
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Publication/Creation

[London] : [publisher not identified], 1882.

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THE ETHICS OF VIVISECTION.

It is to be regretted that the question of 'Vivisection'[1] should still call for further discussion. It was reasonably hoped that after the result of the inquiry by a Royal Commission, and the subsequent legislation, physiologists might have been permitted to pursue their investigations, hindered only by the law as it now stands. This expectation was the more reasonable inasmuch as physiologists have loyally accepted the restrictions of the Act in question. But the anti-scientific agitation continues. Some opponents of physiological inquiry maintain that experiments on living creatures are altogether cruel, immoral, and disgraceful, and should therefore be entirely suppressed; others, yielding to the evidence of the importance and usefulness of these inquiries, but misled by a laudable dislike to the infliction of pain, would limit much more the sanctions of the law, and reduce these studies almost to a nullity; others, uninfluenced by either of these considerations, are opponents of vivisection, as they would be of all other scientific progress.

Mr. Hutton, who tells us that a fair number of the articles in favour of a restriction more effective than that of the present law have proceeded from his pen, speaks of practical physiologists as 'a new scientific class'; and of the encouragement of the practical physiological method as 'a new departure,' 'a most significant and important new departure.' Other expressions of a similar kind occur in his article, as of practical physiology being 'a new profession,' 'a new movement.' We should hardly have expected from so liberal a writer objections against any course of study because it was *new*. But happily on this score we can easily satisfy any prejudice against novelty. Practical physiology has the *prestige* and sanction of ages. Whilst Bacon speaks but lightly of the disputatious wisdom of the Greeks of the time of Plato and Aristotle, he warmly commends the physiological studies of Democritus and his colleagues. Galen's

[1] This term is inaccurate and misleading; but the question to the discussion of which I contribute is whether it is justifiable to perform experiments upon the lower animals, with every precaution against preventible pain, in order to increase human knowledge and relieve human suffering.

experiments are notorious; and the most learned author of the *Anatomy of Melancholy* sets forth in his frontispiece Democritus searching for the seat of black choler :—

> Old Democritus under a tree,
> Sits on a stone with book on knee:
> About him hang there many features
> Of cats and dogs and such like creatures
> Of which he makes anatomy,
> The seat of black choler to see.

It is, however, true that for many centuries physiological inquiry, and indeed the study of natural science in general, was almost stifled by the logic of the schoolmen, which better commended itself to the prejudices of men than did the harder task of observing and questioning Nature. The commencement of a more prosperous era for physiology dates from the renaissance of science in the sixteenth century.

One of the earliest fruits of this revival was the discovery of the circulation of the blood, due, as Harvey himself informs us (though certain modern writers may wish to deny it), to 'having frequent recourse to vivisections, employing a variety of animals for the purpose, and collecting numerous observations.'

The contemporary discovery of the lymphatic system by Aselli, Bartholinus, and Pequet, the subsequent discovery of the capillary circulation by Malpighi, the great advances made by Boyle, and Mayow, and Lower, in the same century, were all the fruits of experiments upon animals; and ever since, physiology, no less than chemistry and physics, has depended on experiments.

The supposed novelty of physiological experiments does not therefore afford an argument against them either in fact or principle.

That during the last few years physiology has received a new impetus from the great progress of experimental physics in other lines is perfectly true.

Until to-day the theory that the living quality in us was due to a mysterious vital force, out of the reach of science, pre-occupied the mind, and stood in the way of observation and experiment. But now it has become the immovable standpoint of physiology, that a living creature is dependent for all its bodily functions upon the forces of inorganic matter; in other words, that our corporeal life is but the operation of material atoms and material forces within the reach of experimental inquiry. The clearing away of old hypotheses and suppositions, and the admission of physiology among the physical sciences, of course imposes upon her the same obligations of exact observation and experiment. She can no longer remain satisfied with specious explanations and fanciful hypotheses, any more than astronomy could accept the offices of the imagination for explaining the nature of eclipses or the causes of comets.

Physiology having thus set herself free from mental hindrances, and comprehending the extent and intricacy of the problems before her, must, from the nature of the case, claim as much liberty as astronomers and other inquirers enjoy in their several researches. But to prevent misunderstanding, it may be added that while firmly maintaining that the actions in living things are objects for scientific inquiry, and reducible to law—have in fact an order as fixed and certain as the stars in their courses—we are not so presumptuous as to suppose that when all these *actions* in a living body are made plain, we shall have penetrated the mystery of life. The living spirit which manifests itself in these operations can only be known from the consciousness and from the conscience. The eye does not see, neither does the ear hear. The odour of the rose and of the violet are not chemical, although they are chemically caused. If, therefore, physiology has a wide range, it has also its proper limit.

Physiological experiments, then, are no novelties; they are as old as physiology. They correct erroneous doctrines, and are compatible with, nay they lead to, a reverent conviction of the limits of human knowledge.

The more reasonable and respectable opposition to the method of experiment in physiology rests partly on imperfect knowledge of its necessity and use, partly on exaggerated estimate of the sufferings involved.

If physiology were a cruel and immoral occupation, in which what is gained is out of all proportion to the penalties paid for it, there would be no more to say but to blot it out at once. But if it appear, as it undoubtedly does, that physiology investigates problems of the highest importance to mankind, and that the solution of these problems is within the scope of the human intellect, then the matter assumes a very different aspect. It becomes in a high sense a moral duty to press on the acquisition of knowledge, both for its own sake, and for the fruits which it will surely yield. What casuist can doubt the moral duty, with the parable of the talents before him? Is it not at once the prerogative and the duty of the intellect, essential to its very maintenance and development, that it should have free course for inquiry?

Instead, therefore, of counselling prohibition, it would seem to be the part of lovers of knowledge to foster physiological inquiries, subject only to such restrictions as I shall presently show our men of science had already imposed upon themselves before they were recommended by the Royal Commission. But it ought to be noted that there are two sorts of inquiry, which may be confounded together; and Lord Coleridge, in his attack on physiological experiments, does not avoid this confusion. There is the inquiry of idle, vulgar, and impertinent curiosity, which is at best selfish, and may be immoral and even criminal. But this has nothing whatever to do with the

inquiries of science, nor are its ways the same. Therefore, when Lord Coleridge says that 'liberty is claimed for experiment *in vacuo*, experiment on the chance, experiment in pursuit of nothing in particular, but of anything that may turn up in the course of a hundred thousand vivisections,' he misplaces the claims of science, and puts them in the mouth of a monster of his own imagining.

There is in the language and statements of the opponents of vivisection an almost unbroken harmony of exaggeration. A lady, writing of the title of Claude Bernard to be honoured by physiologists, says that such title is, at least partly, based on the invention of a stove which should enable him to watch the process of 'baking dogs alive.' Such a statement, without due context and explanation, and couched in such language, is calculated, if not intended, to convey a totally false impression both of the purpose and the details of the memorable experiments of Claude Bernard upon Animal Heat.

Baking dogs alive! How horrible and disgusting! would be a natural exclamation. What purpose could there be in anything so cruel? This we shall see directly.

Again, Lord Coleridge, apparently referring to these experiments on fever, says:—

> I deny altogether that it concludes the question to admit that vivisection enlarges knowledge [of course not, but it concludes one important step in our argument]. I do not doubt that it does, but I deny that the pursuit of knowledge is in itself always lawful; still more, I deny that the gaining knowledge justifies all means of gaining it. [Who ever pretended that it does?] To begin with, proportion is forgotten. Suppose it capable of proof that by putting to death with hideous torment three thousand horses, you could find out the real nature of some feverish symptom, I should say without the least hesitation, that it would be unlawful to torture the three thousand horses.

Now, why, it may be asked, does Lord Coleridge, for the purpose of his argument, select *horses*, and why so large a number as three thousand? He must know that the horse has been but little experimented upon in the investigations respecting animal heat and fever, and then under the influence of ether, and therefore without suffering; the operation consisting in a division of the branches of the sympathetic nerve in the neck whilst the animal is insensible; so that the supposition of *three thousand horses* and *hideous torment* is an exaggerated supposition, out of proportion to facts—misleading, and in no way conducive to a fair judgment on the question at issue.

From the expression 'baking dogs alive' any one unacquainted with the subject would suppose that experiments upon animal heat and fever involved hideous torment, and from Lord Coleridge's expression, 'to find out the real nature of some feverish symptom,' that these dreadful doings were for a trifling object. But a few words of explanation will put this matter in a different light.

In the whole range of nature there is no more wonderful fact than the uniformity of the temperature of the blood in health in the

different warm-blooded animals. In man, dogs, cats, foxes, seals, &c., this temperature is uniform, whether they be living at the Equator or the Poles, whether in summer or winter, whether in activity or repose, whether fasting or recently fed, provided they are in health. In birds the natural temperature is higher by several degrees Fahrenheit than in warm-blooded quadrupeds; and it is a curious fact, that if the blood of the latter be raised to the temperature of the blood of birds, the result is fatal. For instance, if a dog be put into a heated chamber, and his blood be raised to ten degrees higher than in health (the natural temperature of, *e.g.*, a swallow's blood), the animal quickly dies; and the same happens to man, whether this increase of temperature arise through injury or disease. The animal or man is, under such circumstances, 'baked alive.' Now, yearly in this country, more than twenty thousand persons, children and others—mostly children—die of scarlet fever; and nearly twenty thousand more of typhoid fever; and one of the chief causes of this mortality is the high temperature of the blood, which results from the disturbance due to the fever process. To use Bernard's expression, 'le fait le plus important de tous, celui qui domine tous les autres, celui qui constitue le véritable danger, *c'est la chaleur*.' No wonder, therefore, that physiologists and physicians have anxiously and laboriously occupied themselves in investigating that mechanism of the living body which in health maintains so constant a temperature under varying circumstances, both internal and external, and which becomes so easily and fatally deranged in disease. Thanks to the very intelligent and exact experiments of Bernard, part of this complicated machinery has been traced out; but the whole matter is so beset with difficulties that the wonder is, not that physiologists have done no more, but that they have explained so much. Those who carp and cavil may perhaps ask why, if these experiments are so useful, have we not been able more certainly to control this fever state? The answer at present must be that the end is not the beginning; and that the complexity of one of the most wonderful of the many wonders of our bodily frame is not to be fully unravelled in twenty years. The subtlety of nature in a living organism demands the labours of many and various intellects before we can hope to obtain even a small instalment of the reward of their labours.[2] A living body is not a common piece of machinery, framed and fashioned from without; it is evolved from within, and every portion, even to the smallest, is a system in itself.

Bernard, in these experiments on fever, sacrificed two pigeons,

[2] This is the meaning of Bernard's modest estimate of his own labours which has been so often quoted. The 'legitimate promises' he made have been already in part fulfilled. No one can question the actual 'performances' of experiments on animals for medicine after reading the evidence taken by the Royal Commission, or the papers by Professor Humphry, Professor McDonnell, Professor Fraser, or those which appear in company with mine in this Review.

two guinea-pigs, less than twenty rabbits, and six dogs. One might think that the slaughter of even three thousand horses (if they were suitable for the purpose) by a process far less painful than that by which thousands are sacrificed in war, would not be unjustifiable if thereby the machinery for regulating animal heat could be fully discovered, and the power of controlling fever put into our hands. Granted that such a sacrifice of life would only be becoming under the sanction and direction of very high intelligence; that provided, it would not be an extravagant price to pay for the redemption of even a part of those who die annually of fever, as Miss Cobbe says, 'baked alive.'

The twenty thousand deaths from scarlet fever, and the twenty thousand from typhoid fever, constitute but a small part of the annual deaths in this country in which the high temperature of the blood is a fatal factor.

The febrile state must have arrested attention from the infancy of man. The mothers of a palæolithic age must have watched their children consumed to death in it, as do the mothers of to-day. The name of this fiery state is as old as literature. Physicians have never been weary of writing on the symptoms of it. The thermometer we now use at the bedside bears the name of Fahrenheit, who, a century and a half ago, in concert with the famous physician Boerhaave, made exact investigations upon the subject. But it is only during this century, through the labours of many observers both in this country and abroad, and prominently of Sir Benjamin Brodie, that the actual conditions producing and controlling animal heat are becoming known. This fiery furnace, with its uncounted millions of victims, science hopes to close. And it is quite reasonable to believe that the time will come when fever will be as much under our control as are the movements of a chronometer.

If sufficient cause could be shown for giving pain to animals for the purposes of medical science, there would be little opposition to experiment. The sufficient cause would largely, if not entirely, meet the moral difficulty. Mr. Hutton and Lord Coleridge object that such practices, for whatever purpose, are essentially demoralising, and tend to demoralise the community at large. These are strong statements, and would naturally require corresponding evidence to give them validity, especially as ordinary experience does not confirm them. If they were true, surgical operations would be demoralising, and a calling which is beneficent would rest upon moral degradation. The mother holds back the arm of the surgeon, and for the moment thinks him cruel, for the pain he is obliged to inflict on her child, but her calmer judgment acquiesces in the infliction of present pain for future good. Mr. Hutton thinks that the moral difficulty would be solved if we spared the lower animals, as we should expect to be spared ourselves were we in the power of a higher race. But it is impossible to conceive an order of nature in which intellectual creatures, having our moral relations, could stand to superior beings

as the lower animals stand to us, and hence the moral rule proposed for the solution of the difficulty is inapplicable. Our obligations to the lower creatures arise out of ourselves. It is due to ourselves that we should treat them with tenderness and kind regard. Dominion over them has been put into our hands, and that dominion, from the demands of our intellectual and moral nature, must be intelligent. In killing and eating an animal, we are on the same level as the carnivora; in using them for our sports, we are on the ordinary level of man; but in using them intelligently for the advancement of beneficent knowledge, provided that this be with a due sense of proportion between the benefit and the pain, we are justifying the highest purposes of our intelligence.

To ask why man should have to take such a course to acquire knowledge, is no more to the purpose than to ask why he is ignorant, or why he is placed here to subdue the world to his purposes.

That physiologists are not and have not been indifferent to or careless of inflicting pain is shown by the following resolutions, which have been already quoted by others, but will bear repetition. They were drawn up and accepted by the British Association in 1871:—

(1) No experiment which can be performed under the influence of an anæsthetic ought to be done without it.

(2) No painful experiment is justifiable for the mere purpose of illustrating a law or fact already demonstrated.

(3) Whenever, for the purpose of new truth, it is necessary to make a painful experiment, every effort should be made to ensure success, in order that the sufferings inflicted may not be wasted; etc.

These resolutions were signed by the President of the College of Physicians, the President of the College of Surgeons, and others interested in physiological inquiry. They make it sufficiently plain that the moral relations of science to animal suffering are not overlooked. And it is only in the case of *painful* experiments—a minority of the whole—that the moral question comes in.

It is no doubt a weak and unworthy argument, that the good we may obtain to ourselves by physiological experiment should outweigh the immorality of the process; that our moral susceptibilities ought to be bribed and silenced by our selfish gains. If it were an immoral thing to eat an animal, we ought not to eat it, even though our life were at stake; nor ought we to touch an animal for physiological experiment, if it were immoral to do so. It is therefore not true, as a prominent writer against vivisection asserts, that 'the sentiments of compassion and sympathy must retreat and disappear,' and be accounted of no consequence, in the presence of the requirements of physiology. Nor is 'the deliberate torture of God's harmless creatures' in any sense a true description of the work of the physiologist.

The limits of our rights over the lower animals, and even over the

lives of our fellow-men, can only be clearly discerned by the light of the purposes for which those rights are exercised—as in war and capital punishment, for the welfare of the State; in sport, for amusement and health; and in eating animal food, to give us energy. They are each defensible on their own grounds, and to deny them a reasonable sanction is to raise a cry against defensive war, field sports, and animal diet. There are delicate and sensitive natures, whose prejudices in these matters ought to be respected as regards themselves; but it would be a woeful time for a country if their rule were to be made the rule of the State.

The far smaller sufferings inflicted by science are morally justified by similar considerations. That they ARE beneficent we have many proofs in daily life, and none perhaps more curious than the ground from which has sprung the very opposition itself to physiological experiment. This opposition is fostered by the larger and truer views of living things which physiology itself has taught. The improved feeling of even careless persons towards the lower animals, and the more enlightened sympathy which is felt towards them, is largely due to a better knowledge of their nature, and of the common tie of life which binds us to them.

It will appear to anyone who will be at the trouble to inquire even cursorily into the order of nature, that this order does not always accord with human views of benevolence; often it seems contrary to them. Our scope is necessarily limited, and the limit depends not only upon the benevolent feelings of the person, but upon his capacity for a comprehensive knowledge of the divinely-ordered system of nature.

It has been urged that it would be better to leave the progress of physiological knowledge to passive observation, and to give up experiments altogether. But it would be more reasonable to hope to make out the machinery of a watch by looking at it, than to hope to understand the mechanism of a living animal by mere contemplation. The movements and the value of the levers in the limbs and joints might no doubt be largely made out by inspection; but the deeper and more complicated machinery, part of which has been hinted at in the remarks on animal heat, could not be learned without the most elaborate inquiry into, and analysis of, combined living actions. This has always been strongly felt by those capable of forming a true judgment. Hence Harvey instituted an oration, to be delivered annually before the Royal College of Physicians in London, one of the conditions of which was that it should contain 'an exhortation to the members to study and search out the secrets of nature *by way of experiment.*' These orations have been continued from the middle of the seventeenth century to the present time. An unbroken testimony by those most capable of judging has been borne ever since to the value and necessity of physiological experiments. I will only

quote the latest, and perhaps the most striking testimony; which also refutes the slander that physiologists are reckless of inflicting pain. When the International Medical Congress met in London last year the following resolution was adopted at one of its general meetings:—

> That this Congress records its conviction that experiments on living animals have proved of the utmost service to medicine in the past, and are indispensable to its future progress. That accordingly, while strongly deprecating the infliction of unnecessary pain, it is of opinion that it is not desirable, in the interests of man and animals, to restrict competent persons in the performance of such experiments.

While the course of scientific medicine lies only in the track of discovered facts, those systems of cure which largely rest on theory are more independent of experiment; and this may in some degree account for the indifference, and even opposition, which some medical writers have felt to experimental inquiry.

Let me offer two or three of the many instances which justify Harvey and the Medical Congress.

At Oxford, in February 1665, there being present Dr. John Wallis, Savillian Professor of Mathematics, Dr. Thomas Millington, Doctor of Medicine, and other members of the University, Dr. Richard Lower made the following experiment. Having by him a small dog and a mastiff, he opened the jugular vein of the smaller dog, and allowed the blood to flow until the animal was faint, and at the point of death. Then, to supply this loss of blood, he connected the carotid artery of the mastiff with the vein, and allowed the blood to flow into it until the fainting animal was restored. At the end of the experiment the vein was closed, the dog leaped from the table, forgetful of what had happened, rolled itself in the grass, and showed no sign of inconvenience. This experiment was a natural corollary to Harvey's discovery of the circulation, and has been the means of saving many lives. If it stood alone, it would be sufficient proof of the value of experiments on animals. The knowledge it afforded could not possibly have been obtained by passive observation or by fancy, and it rested upon the plainest demonstration. Moreover, the pain inflicted on the dogs by bleeding is a fair sample of a large number of the 'hideous torments' of vivisection.

Magendie discovered by his experiments a way of medicating the body which will be practised till the time arrives when 'there shall be no more pain.' He demonstrated that foreign substances in solution, put into the tissues, as for instance under the skin, were immediately absorbed, and so at once passed into the general circulation. This means of introducing remedies into the system is daily practised; sometimes, indeed, we have no other means, and when we have, this often affords the readiest and the quickest method of giving relief. No mere passive observation could have taught us this.

There are probably few symptoms more distressing and alarming in the course of common life than severe attacks of giddiness. By

experiments on animals and birds it has been proved that these 'vertiginous' affections are dependent upon irritation at the roots of certain nerves; and by the light of these experiments, and by observations on man, we have not only been able more exactly to appreciate the value of such symptoms, but to direct the use of our remedies.

Man is liable to convulsions from childhood to old age. Until Dr. Marshall Hall's vivisections, at the beginning of this reign, nothing was really known of the convulsive state, but his experiments made it clear that a convulsion is a mechanical nerve-process, the beginning of which may be some trifling and removable irritation, which propagates itself along nervous lines to their centres, to issue again in various directions to the muscles and other parts; much after the manner of the electrical force telegraphed to a central office, and thence outward in different lines. And all this may go on in our nerves, without our being in the least conscious of it, until the convulsion begin. Now, prior to Marshall Hall's vivisections, or, to speak more exactly, the vivisections of De Witt, who preceded him in 1751, it was more or less generally supposed that convulsions were due to the disturbance of some spiritual force within us; and, indeed, all the bodily movements in health were referred to this spiritual source. The very language we use conveys the thoughts of ancient times in respect of these matters—a 'seizure,' an 'attack,' a 'stroke,' point to some agency external to the body. It is true that philosophers, like Descartes and Willis, contemplating the bodily movements and studying their own consciousness, had arrived at the conclusion that a large number of our actions were as mechanically performed as those of an automaton, but they had no idea to what extent and in what way this occurred in us until the discoveries made by experiment.

The subject is far from exhausted as yet. When the automatic laws of nervous action are fully explored, not only (as hinted above) may we control fever, but, more fully than at present, those convulsive affections, for which much has already been done.

Even if no practical results had followed experiments on the nervous system, they might have been defended upon the ground of the lessons they have taught us of our own constitution. Even superficially considered they increase the wonder of our being. Those who have studied the structure of the eye with its various media nicely adapted for the refraction of light, have justly marvelled and admired. But what if they could view before them the mechanical arrangements of the nervous system, whereby day and night, waking and sleeping, the work of life is done for us?—here maintaining an equable temperature of the body, there governing the chemical actions in digestion; from one centre controlling the action of the heart, from another the frequency of the breathing—and these actions carried on quite unconsciously to ourselves, and all the better without our attention.

Happily, experiments on the nervous system are far from being usually painful. The great majority are performed on decapitated frogs, or on other animals under the influence of anæsthetics.

As if this controversy on the rights of vivisection had not already had enough of feeling imported into it, Mrs. Kingsford would raise the cry of Atheism. She sees in the pursuit of physiological science a concealed attack upon all religious and sympathetic sentiment, and a repudiation of man's moral responsibility.

This accusation needs little reply. We need not here, in the cause of science, discuss the grounds of religious belief, nor the relation of scientific knowledge to religious conviction. We have it on the highest authority that 'the kingdom of God is within' us, and from the earliest time it stands recorded that we cannot 'by searching find out God.' Science has to do with that which is external to us, with our material nature, its forces and their relations; with what is ponderable and measurable. What lies beyond or beneath is relegated to other evidence and other tests, of which it may be said that they afford more certainty than even science can give us. There cannot be anything atheistic in knowledge, and science is nothing but exact knowledge. It would be as reasonable to assert that the south pole contradicts the north, as that science affords in any of her regions a negation to religion: on the contrary, as our views of nature expand, our conceptions of the First Cause become more and more reverent. This may, of course, not be true in every case; but on the whole, and taking humanity throughout, it is a certain and unquestionable result. But science cannot be too watchful against the intrusion of theory into her operations. The imagination, which in some minds is stronger than in others, is a dangerous ally in the investigation of facts. The exclusion of this airy spirit from the laboratory is a different thing from a denial of the religious and sympathetic sentiments, or a repudiation of man's moral responsibility. Of natural philosophy in general Bacon asserts that 'it is, after the Word of God, the most approved support of Faith.' If he had known what experimental physiology has taught us of our internal mechanism and the deeper conditions of life, he would have had additional reason for his assertion.

It seems to have been supposed by some persons that medical students, from mere wantonness and for the practice of the hand, are in the habit of cutting up living animals. Those who are informed on the matter know that such a supposition is utterly groundless; and this was fully proved by the inquiry of the Royal Commission. One witness, indeed, hinted at such a fact; but when pressed for evidence declined to give it. No operations on living animals for the purpose of obtaining surgical dexterity have been or are performed at any medical school in the kingdom. No vivisectional experiments can be performed anywhere but in a licensed laboratory. In their Report the Commissioners state, after a full inquiry: 'We

have great satisfaction in assuring your Majesty that at the present time a general sentiment of humanity on this subject appears to pervade all classes in this country.' They quote the words of several witnesses, which are to the effect that, 'in a medical school, anything like cruelty or indifference to suffering would be scouted by the public opinion of the students.' To fix the charge of cruelty upon physiologists, the evidence had to be drawn from what is reported to have occurred in foreign countries or in distant times. In matters of daily life this would not be considered admissible. Not that English physiologists would wish it to be understood that they surpass their foreign colleagues in benevolence and compassion; but they would maintain that to draw a trustworthy conclusion from what happens in other countries, an exact and full inquiry ought to be made.

The sum of the matter seems to be that human life and the relief of human misery are objects which justify the infliction of pain upon animals, provided always that the suffering be no more than is necessary for the ends in view.

There is no doubt (and our more reasonable opponents, Lord Coleridge and Mr. Hutton, admit it) that physiological experiments are useful, useful for animals as well as for man. They are therefore justifiable, within the limits which were laid down by physiologists for themselves, and have been since enforced by legislation. Physiologists would unreservedly subscribe the principle, *nihil utile quod non honestum*. To the accusation of cruelty they may fairly reply, supported by all past experience, that nothing is so cruel as ignorance. For how many centuries had human sufferers to bear pain which is now preventible by better knowledge? How many thousands festered to death in small-pox before the discovery of vaccination? How many are now dying of tubercle and scrofula whom a better knowledge of these conditions might rescue? Yet the pursuit of this knowledge is hindered in England by the outcry of cruelty—the cruelty being no more than the inoculation of some of the lower animals with tubercular and scrofulous matter, in order to study the course of the disease and the modes of prevention. The cruelty obviously lies, not in performing these experiments, but in the hindering of progressive knowledge. Genuine scientific investigation should, in the interest of the nation, be fostered, not repressed by penal statutes. The welfare of all, from the highest to the lowest, is dependent at some time or another upon the knowledge which it brings. If to-day it inflict temporary pains, it annihilates their causes and their necessity in the future. It works to no selfish end, and for the most part its only reward is the fulfilment of its own high instincts. 'The spirit of man,' says Solomon, 'is the lamp of God, wherewith He searcheth the inwardness of all secrets.'

WILLIAM W. GULL.