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THE INFLUENCE

OF

VIVISECTION ON HUMAN SURGERY

BY

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"VERE SCIRE, EST PER CAUSAS SCIRE."—*Lord Bacon.*

PREFACE.

THIS address was first printed as delivered in the Birmingham Medical Institute the 9th of last month. In this edition, some argumentative, and not strictly relevant, passages have been omitted or condensed, to make room for additional historical facts, with the least possible increase of bulk.

No attempt has yet been made to call in question the proofs already advanced in support of my statement that, "Without experiments on living animals, Scientific Surgery could not have been founded, and its present humane and safe practice would be impossible."

Many avowed opponents, and some advocates, of scientific experiments on living animals, have acknowledged, that they had never before considered the subject in the light of its practical usefulness to humanity, through operative surgery. The additional evidence now adduced, though far from exhausting the proofs at hand, may assist in spreading precise information, which is essential to the

formation of a correct judgment. It is thereby hoped to pave the way, with unprejudiced persons, for a reasonable compromise, on a question vitally affecting the best interests of science.

To practitioners and students of surgery this Address may I trust commend itself as a not unwelcome contribution to surgical history,—as a reminder of some of the works which have placed the masters of our art in the vanguard of the benefactors of mankind.

SAMPSON GAMGEE.

22, Broad Street,

Birmingham,

9th March, 1882.

THE INFLUENCE OF VIVISECTION ON HUMAN SURGERY.

Mr. President and Gentlemen,

So long as a Society supported by the Lord Chief Justice of England and other persons of distinction, is untiring in its efforts to suppress vivisection,* and to render amenable to criminal prosecution those who practise it, deep interest must attach to the question, What have scientific experiments on living animals done for the progress of Human Surgery?

I take for granted the purity of the intentions of those who so loudly denounce vivisection, and I intend no disrespect when I express a belief, that they would be a little more tolerant, if the extent and accuracy of their knowledge equalled the intensity of their zeal.

Since human surgery established any claim to be numbered amongst the sciences, its brightest ornaments and greatest practitioners have been amongst the boldest, and most indefatigable, experimenters on living animals.

Without such experiments Scientific Surgery could not have been founded, and its present humane and safe practice would be impossible.

To make good this statement in all its bearings would demand a review of the history of Surgery, and of those departments of Medical Science with which it is inseparably linked; but such a retrospect, at once comprehensive and

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*The Vivisection Abolition Bill stands for second reading in the House of Commons on the 28th of June.

impartial, is simply out of the question within the limits of an Address. Time will only allow me to produce a few proofs, but I vouch for their authenticity, and trust to your approving their cogency.

Let us glance at the state of Surgery in the middle of the last century, a date comparatively so recent, that the grandfathers of many of those I am addressing were then in ripe manhood. The year 1750 is memorable for the death of Jean Louis Petit, whose name will always live in surgical dressing rooms with his tourniquet, and whom ripe students of our art revere as a master, scarcely second to Ambroise Paré. In that same year Haller, Morgagni and the French surgical Academicians were at their zenith, and William Cheselden, stricken with paralysis, left Chelsea Hospital,—happily not before he had well assured his brightest title to enduring fame, with the first lessons in surgery which he imparted to John Hunter.

Born in 1728, John Hunter was 22 when he left Cheselden to enter as surgeon pupil at St. Bartholomew's, where Percival Pott, at 36, had been appointed to the full surgeoncy the preceding year. So that you see the epoch I have chosen was a golden one for surgical science and art, and, for our present purpose, it possesses another advantage. In 1750 appeared "A Critical Enquiry into the Present State of Surgery by Samuel Sharp, F.R.S., Surgeon to Guy's Hospital,"—a work which supplies an authoritative standard of the state of surgical knowledge at that period.

Of the means for arresting hemorrhage after amputations, Mr. Sharp says, "The actual cautery was certainly the most to be depended upon, and was therefore through a succession of ages down to our own days more frequently employed than any of the other means. . . . . But the horror created by a red hot iron begat in some men an invincible

antipathy to the method. Some surgeons applied arsenic and corrosive sublimate to the bleeding vessels, &c." There is an account of "nineteen men who, *only one excepted*, all died after amputations, and, as it was supposed, chiefly from the poisonous quality of the sublimate."*

This was the state of surgery in 1750, 158 years after the death of Paré. He it was, who revived the ancient practice of ligaturing blood vessels, but in such an imperfect manner as to exercise comparatively little influence. Dying in 1692, when William Harvey, a lad of 14, was scanning Latin verses in Canterbury Grammar School, the great Huguenot knew little or nothing of the circulation of the blood.

To tie an artery Paré transfixed the tissues from without, very much in the same fashion that an upholsterer quilts a mattress; or he included in the ligature muscular and other tissues, for the purpose of securing better hold.† His contemporary Fabricius ab Aquapendente, Harvey's teacher of anatomy, argues against the ligature of arteries, and prefers the cautery for the arrest of hemorrhage. Jean Louis Petit relates, that when he commenced to practise surgery, (more than a century after Paré's death), it was deemed a matter of indifference by some surgeons to tie the nerve with the artery, while others particularly enjoined such combined ligature, and for this reason; "to retain the blood it was necessary to tie the vessels, and no less so to tie the nerves in order to retain the animal spirit."‡

William Bromfeild, surgeon to Her Majesty's household and to St. George's Hospital, wrote in 1773 in praise of Mr. White's use of the sponge to restrain the bleeding of the large blood vessels, and expressed horror at the prevailing

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* Sharp op. cit. p. 279-80.

† Œuvres complètes d'Ambroise Paré par J. F. Malgaigne, tome 2, page 8, et 225.

‡ Traité des maladies chirurgicales et des opérations qui leur conviennent; ouvrage posthume de J. L. Petit, mis au jour par M. Lesne. Nouvelle édition corrigée, Paris, 1790, tome 3, page 175.

custom of enclosing nerve and muscle within the arterial ligature. Such was the state of practice, according to the most reputed text book, published by one of the surgeons to St. George's Hospital, five years after John Hunter was appointed on its staff.

It may give you a nearer and clearer perception of such barbarities, if I quote from a letter with which I have been favoured by our venerable brother Mr. Thomas Taylor, whose presence amongst us to-day is, I am sure, matter of general congratulation. Mr. Taylor, a pupil of Abernethy, had an uncle, his namesake, who was appointed apothecary to our General Hospital in 1785. From him he often heard of the horrors of amputation scenes,—dressers watching by the patient day and night, with buttons of lint dipped in flour on a plate, ready for application to any bleeding point that might appear.

Reflect on such a scene, and on the experiences of Petit and Bromfeild, as surgical realities in the second half of the last century.

Happily a brighter era was dawning. Constituted under the leadership of Lapeyronie in 1731, the French surgical academicians were the chief glory and mainstay of scientific Surgery in the pre-Hunterian epoch. It is of their works that Sir Benjamin Brodie said "There is no richer mine of surgical knowledge than that which is contained in the memoirs of the French Academy of Surgery."* To quote very briefly from their preface "There are two sources whence flow the truths which can enrich our art, clinical observation and experimental physics. . . The plan which the Academy proposes to itself is to raise Surgery on the basis of clinical observation, physical researches, and experiments."†

* On the studies required for the medical profession, or lectures illustrative of various subjects in pathology and surgery, by Sir B. Brodie, London, 1846. P. 26.

† Mémoires de l'Académie Royale de Chirurgie, 8vo. ed., Paris, 1774. Tome 1er, p.p. 10, 11 et xlv.

The Academy's memoirs, and collection of prizes, are replete with evidence of the importance they attached to, and the increase of knowledge derived from, experiments on living animals; but the time at my disposal will only allow of two examples being quoted.

The pathology and treatment of injuries of the skull was at that date most imperfectly understood. Such a primary fact as the paralysis of one half of the body opposed to the side of the skull injured, was inexplicable before the vivisections practised by Méhée de la Touche,* in connexion with injuries by contre-coup. The evidence he thus obtained of the passage of the nerves from one hemisphere of the brain to the other, stimulated further research, and the Academy gave out as one of the subjects for competition :— "To establish the theory of injuries of the head by contre-coup, and the practical conclusions to be derived therefrom." The prize was awarded to Saucerote's Essay, based on literary research, clinical observations, and 21 experiments on living dogs.† To prove the spirit of the enquiry, the author's consciousness of the painful nature of the experiments, and his desire to render them useful to practical surgery, only one passage from his essay need be quoted. "These are not chance conclusions; they are the results of painful facts, which may it is hoped form a luminous centre, the rays from which will diffuse the strongest light on practice,"‡ as they accordingly did.

Amputation at the hip-joint was only attempted after it was proved safe by vivisection. "The Academy is informed, says its Secretary General, that this operation has been performed with success on dogs."§ After

* Mémoires sur les sujets pour le prix de l'Acad. Roy. de Chir. T. IX P. LXIX.

† Mémoire sur les coutre-coups dans les lésions de la tête, par M. Saucerote; in Mémoires des sujets proposés pour le prix de l'Acad. R. de Chir. Octavo Ed., Paris, 1778. Tome 10, p. 282 et seq.

‡ Op. cit. p. 327,

§ Mémoires Ed. cit. Tome 9, p.p. 24—25.

relating the experimental proofs for that statement, the Secretary observes, "These memorable trials should awaken the desire to do as much on the higher animals, and to encourage Army Surgeons, who have the greatest opportunity, to undertake this operation after battles; for by it, probably, patients might be saved who are now left to their fate." Experiments on brutes enlightened and nerved to action the practitioners of human surgery, and amputation at the hip-joint, the direct outcome of vivisections, has resulted in saving many valuable lives, which otherwise must infallibly have perished. While Louis XV and his court were patronizing the Academy, a few Englishmen dotted over this country, but chiefly in the provinces, were by their own unaided efforts leading up to a surgical revival of unequalled brilliancy. Alanson in Liverpool, White in Manchester, Mynors in Birmingham, Hey in Leeds, Gooch in Norfolk, Cheselden and Pott in the metropolis, were unostentatiously doing their good and lasting work, while William Hunter laid the foundation of the experimental school, of which he and his brother John, Hewson and Cruikshank, were the chief corner stones. This is not the time to endeavour to do justice to the relative merits of these masters, some of whom have been undeservedly obscured in general estimation by the overpowering merits of John Hunter. But I cannot pass Hewson's and Cruikshank's names without brief reference. The principle of their working life was embodied in the former's favourite Baconian motto—"*Vere scire, est per causas scire.*"

Dying in 1774, at 36 years of age, from the effects of a dissection wound, William Hewson's chief labours were his experimental enquiries into the properties of the blood and the lymphatic system, and surgery is indebted to him for projecting the operation of paracenthesis thoracis for

pneumothorax. This he did on the basis of experiments on living dogs and rabbits.* Cruikshank's tying the carotids of dogs, guided M. Lynn in the ligature of the carotid artery in the human subject,—the first operation of the kind in Great Britain.†

But the epoch maker was John Hunter. He perceived, grasped, and to a great extent worked out, on the basis of clinical observation and experiments on living animals, the idea of comparative pathology, based on the scheme of uniformity of construction and action of organised beings. I shall not stop to enquire if Hunter's operation for aneurism was the direct result of any *one* experiment. His whole life's study was experimental, as every chapter in his writings, and hundreds of specimens in his museum incontrovertibly testify. His own work, vast and precise though it was, only represents the partial results of his method. It was the impetus which he gave to experimental enquiry, amongst his contemporaries and successors, that stamped his genius and inspired his school.

As an illustration of the fertility of a comparatively trifling experiment, take the division of the tendo achillis in dogs, which John Hunter practised, to study the process by which divided tendons are united. He was led to the research by rupture of his own tendo achillis, curiously enough while dancing, the very year of his election into the Royal Society. The experimental results so obtained led on to sub-cutaneous surgery, one of the most useful and life saving reforms in the art.‡

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* The operation of paracenthesis thoracis for air in the chest; with some remarks on the emphysema, and on wounds of the lungs in general, by Mr. William Hewson, reader of Anatomy. Communicated by Dr. Hunter, read June 15th, 1767. See Medical Observations and Enquiries by a Society of Physicians in London; 2nd edition, London, 1769, vol. III., p. 372, et seq.

† A collection of remarkable cases in Surgery, by Paul F. Eve, M.D., Philadelphia, Lippincott, 1857, p. 658.

‡ Palmer's edition of J. Hunter's works, vol. 1, p. 34. Chirurgie vor 100 jarhen von Dr. G. Fischer, Leipzig, 1876, p. 410—11.

No one laboured more successfully than did Antonio Scarpa to demonstrate and extend Hunter's teaching on aneurism, and we are expressly told by Scarpa,* that he experimented on living dogs, sheep, oxen and horses, and, on the information so obtained, he founded his practice and teaching in the surgical wards and lecture theatre of the University of Pavia.

An ardent admirer of John Hunter's teaching, Abernethy put it to the hitherto untried test of ligaturing the iliac artery for aneurism of the femoral close to Poupart's ligament.† His patient died, but George Freer performed the operation with success, on a young Scotchman, at the Birmingham General Hospital, 19th September, 1806.‡

Mr. Freer prepared himself for the great experiment on the human subject by tying the arteries of living dogs and horses; and he expressly tells us, that, at the most critical moment of tying James McDonald's iliac, he acted according to the experiments of Dr. Jones, who carried out and justified the most elaborate series of vivisections on the vascular system.

Mr. George Freer's monograph on Aneurism was illustrated by his pupil Mr. Joseph Hodgson, who rose to even greater repute, by his Treatise on the diseases of arteries and veins, containing the Pathology and Treatment of Aneurism and Wounded Arteries.§ Following the example of his master, and of Scarpa and Hunter, Mr. Hodgson deemed it necessary to the saving of human life and pain, to enlighten his mind and train his hand by experiments on

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* I buoni successi degli sperimenti da me fatti sopra grossi animali, mi fanno animo a dirvi con asseveranza." Degli aneurismi opera del Cavaliere Antonio Scarpa per cura del Dottore Pietro Vannoni, Firenze, 1845, pp. 705—739 et seq.

† Surgical Observations by John Abernethy, F.R.S., London, 1804, p. 210.

‡ Observations on Aneurism and some diseases of the arterial system, by George Freer; 4to, Birmingham: Hunt and Lloyd, 1807.

§ London, 1810.

living brutes; and the identical method was pursued by Astley Cooper, Benjamin Travers (*) and William Lawrence(†).

It was after ligaturing the carotid of a dog‡ and proving that the animal not only survived but regained his usual health, that Astley Cooper dared to try the same operation on man. His experimental demonstration§ that a dog could live for months in good health after ligaturing the same day both vertebral and carotid arteries, afforded the most convincing proof of the resources of the collateral circulation, and justified some of the boldest and most successful surgical innovations. Travers (loc cit) was not satisfied with experiments on animals for the purpose of perfecting the arterial ligature. To avoid even its minimum danger, he experimented on living dogs and horses with Assalini's compressor, and thus made another step towards a pain-and-life-saving reform in surgical practice.

Mr. Copland Hutchison in his Practical Observations on Surgery (¶) has expressly recorded that the experiments on the arteries of living dogs and horses performed by Dr. Jones, Mr. Travers, and himself "suggested a valuable improvement in the mode of tying arteries for the cure of aneurism, and justified a trial of it on the human subject."

Having incidentally alluded to the experimental treatise of Dr. F. D. Jones "On the process employed by nature in suppressing the hemorrhage," &c.,‖ a treatise cited as a text by all the great surgeons who succeeded him, I beg leave to quote the conclusion of Dr. Jones' preface, in defence of the practice of vivisection.

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* Med. Chir. Trans., vol. 6, p. 632.

† Med. Chir. Trans., vol. 6, p. 156, et seq.

‡ Medico Chirurg. Trans., vol. 2, p. 262.

§ Some experiments and observations on tying the carotid and vertebral arteries and the pneumogastric, phrenic, and sympathetic nerves, by Sir A. Cooper. Guy's Hospital Reports, London, 1836, vol. 1, p. 457. Sir Astley in this research operated on dogs and rabbits, noticing effects on the circulation, respiration and temperature.

¶ London, 1826, p. 352.

‖ London : Longman, 1810.

"He has only a few more words to say, addressed to men out of the pale of his profession, into whose hands this little book may fall, whose opinions he esteems and whose feelings he honours. He regrets the necessity of obtaining even this important knowledge by the sacrifice of brutes. But when we remember the incessant scourge of war which has followed man through all ages of his history,—not to mention the consequences of accident and disease,—it is not too much to assert, that thousands might have been, and may still be saved by a perfect knowledge of these subjects, which can only be directly obtained by experiments on brutes; indirectly and very slowly, by observations on the injured arteries of man, and even these cannot be made until he has fallen a sacrifice to the want of assistance, or to the imperfect knowledge of the Surgeon."

Much yet remained to be done to obtain our present knowledge of hæmostatics. The time arrived for the English-speaking race beyond the Atlantic to lend their powerful aid; and by experimental researches on the use of animal ligatures, and on the tolerance of the animal tissues for metallic substances, the Americans grafted important facts on the common stock.

The arterial ligature introduced by Paré had scarcely been perfected, and that chiefly by the experiments of British surgeons on living animals, when a method of superseding it was devised by another Frenchman. Impressed with the fact that torn arteries bleed little, if at all, Amussat instituted experimental researches on living animals, which led to his establishing the hæmostatic power of torsion. In addressing the Royal Academy of Medicine at Paris (July 7, 1838) Amussat expressly avowed, "All that I shall have the honour to say is the result of experimental research and vivisections." A

powerful defence of the absolute necessity of vivisections, for the advancement of experimental and operative surgery, concludes Amussat's Memoir* the full title of which epitomizes its purport. "New experimental researches on traumatic hemorrhages, followed by some considerations on the importance of vivisections in educating operating surgeons."

Torsion was hailed as a great discovery by continental surgeons, but it attracted little notice in England for some years; not until a paper on the subject was read before the Westminster Medical Society, by Mr. W. B. Costello, who had had the advantage of assisting Amussat in his vivisections in Paris.

At the meeting succeeding the one at which he read his paper, Costello gave a successful demonstration of torsion on living animals. The hæmostatic power of the process was completely proved, and the members of the Westminster Society loudly expressed their approval; but British surgeons failed to adopt the reform.

Just as John Hunter had found one of his most ardent admirers in the Italian University on the banks of the Ticino, so did Amussat find in Antonio Scarpa's successor a painstaking experimentalist, who took up his work and completed the chain of evidence. Luigi Porta's illustrated folio monograph, to which the French Academy awarded one of the Monthyon prizes, embodies the results of a great number of experiments on living animals, to test the relative merits of ligature and torsion with a variety of materials and methods.†

Porta's classical monograph appears to have remained practically unknown to the majority of British surgeons.

* Mèmoires de l'Académie Royale de Medicine, Paris, 1836, T. 5, p. 68.

† Delle Alterazioni Patologiche delle Arterie per la Legatura e la Torsione. Esperienze ed Osservazioni di LuigiPorta, pp. 337, con tredici Tavole in Rame. Milano, 1845.

Certain it is that the new hæmostatic process did not influence their practice, until after Sir James Simpson's researches on acupressure, published in a collected form in 1864.* His experiments on living animals were numerous, and resulted in establishing, firstly, the law of tolerance of living structures for the presence of metallic bodies, secondly the merely temporary, and relatively slight, physical compression, by which arterial hemorrhage may be arrested. The experiments on living animals by which these results were achieved, had indirect, and still greater consequences, through the experimental researches which they prompted. Dr. Lionel Beale and Mr. Henry Lee† re-investigated, on horses and donkeys, the repair of arteries and veins after injuries, and Mr. Thomas Bryant ‡ instituted an experimental enquiry on living dogs and horses, which definitely established arterial torsion in British surgical practice. It has since gained steadily in favor, and has proved a powerful factor in wound treatment reform. In evidence of the confidence warranted by experiment, it may be stated that in his original communication on torsion, published in 1868, Mr. Bryant gave the results of numerous successful experiments in twisting the arteries of living animals, but he had only tried the practice once, and that on the the brachial artery successfully, in the human subject. Six years later he was able to publish this statement. § "Up to the end of 1874 we have had 200 consecutive cases of amputations of the thigh, leg, arm and forearm, in which all the arteries had been twisted (110 of them having been of the femoral artery) and no case of secondary hemorrhage—

* Acupressure : A New Method of Arresting Surgical Hemorrhage and of Accelerating the Healing of Wounds, by James Y. Simpson. Edinburgh : Adam and Charles Black, 1864.

† Medico-Chir. Trans., London, 1867, p. 477.

‡ Med. Chir. Trans., Second Series, vol. 33, London, 1868, p. 199.

§ A Manual for the Practice of Surgery, by Thomas Bryant, London 1879, 3rd Edition, vol. 2, p. 575.

indeed, our house surgeons never expect to be called to cases of secondary hemorrhage now that torsion is the general practice of the hospital."

Thanks to indefatigable researches on living animals, guiding and encouraging the practitioners of human surgery, blood has lost its terrors for them. Death from hemorrhage is now so rare, that I have only lost one patient in consequence of it in thirty years hospital and private practice; and many surgeons can doubtless relate a similar experience. To what have our patients owed their safety? Recall the state of things a century ago. Empiricism had had unbroken sway for ages, and countless human beings had bled to death, and suffered martyrdom by the application of vitriol and the red hot iron for the arrest of hemorrhage. But the secrets of nature were only discovered by the experimentalists, step by step, scalpel in hand. So gradual indeed has been the process, that it would be difficult to point to any researches more laborious and protracted, than those which have led to the present practically perfect knowledge of hæmostatics. Living animals of all kinds were operated upon, repeatedly and in a great variety of ways, before the arrest of hemorrhage and the treatment of aneurism became matters of quasi-mathematical certainty, and before the ablest men could attack the great arteries with success. Let those who sorrow for the many brutes at whose expense these triumphs have been achieved, reflect how many thousand human lives were sacrificed before, how many thousands saved since, the knife of the experimental scientist laid bare the truths, which ages of speculative scholasticism had only shrouded.

Vitally important as were the researches on living animals whence flowed the knowledge of blood pressure and velocity, —matters of the first importance to the surgeon—I

am precluded entering upon them as they lie outside my immediate object of practical surgical illustration. On the borderland between, and inseparable from pathology, medicine, and surgery is the large and intricate question of blood poisoning. It teems with fertile illustrations of the absolute necessity of experiments on living animals, but time and space will only admit of reference to one phase of the subject. John Hunter published no essay more strictly original and, as the event proved, more practically important, than his "Observations on the inflammation of the Internal Coats of Veins."* "That the inside of veins as well as of all other cavities, may be a seat of inflammation and abscess" was at that date a new proposition in pathology; and Hunter was enabled to establish and illustrate it, by the study of comparative pathology. After noting that veins of horses like those of men sometimes become inflamed and the seat of abscesses after blood letting, he observed, "Many horses die of this disease, but which is the particular circumstance which occasions their death I have not been able to determine. It may either be that the inflammation extends itself to the heart, or that the matter secreted from the inside of the vein passes along that tube in considerable quantity to the heart, and mixes with the blood." The conjecture proved prophetic, but the demonstration of the truth was of very slow growth. Abernethy and Hodgson contributed important clinical studies, but they made no single addition to the anatomical knowledge of the subject so suggestive as the one for which we are indebted to my respected old master Mr. James Moncrieff Arnott,† assisted by Mr. John Field, veterinary surgeon, of Oxford Street. They noted that where a venous trunk is inflamed, "the

* The works of John Hunter. Ed. Palmer cit., vol. 3, p. 581.

† A pathological enquiry into the secondary effects of inflammation of the veins. Medico Chir. Trans., 1829, vol. 15, p. 1, et seq.

boundary of the diseased change, is the entrance of a branch and where a branch is concerned the boundary is the junction of this with the trunk." This observation was confirmed on dissecting a horse affected with phlebitis and destroyed by pithing. Through a series of the most painstaking experiments on living animals over a period of half a century has the knowledge of blood poisoning, its causes, prevention, and cure, grown step by step to its present state of comparative perfection.

Of the utmost surgical interest were the researches on blood transfusion, initiated in the second half of the 17th century by Dr. Lower, of Oxford, and the Honourable Robert Boyle.* They proved by vivisection before the Royal Society, what had indeed been imperfectly known to the ancients, that an animal dying from hemorrhage, may be revived by the transfusion of blood into its vessels from another animal. The practice had chequered success; and it was only after further appeal to vivisection, that faith in it was so far restored as to warrant new trials on the human subject.

In evidence of the manner in which the process of transfusion was revived, allow me to quote from Dr. James Blundell's "Experiments on the Transfusion of Blood," published in the ninth volume of the Medico-Chirurgical Transactions.† "A few months ago I was requested to visit a woman who was sinking under uterine hemorrhage. The discharge had stopped before my arrival, but her fate was decided, and notwithstanding every exertion of the medical attendants she died in the course of two hours. Reflecting on this melancholy scene I could not forbear considering that the patient might very propably have been saved by transfusion."

* Philosophical Transactions of the Royal Society of London. Abridged Edition. London 1829. Vol. 1, p. 128.

† 1818, p. 56, et seq.

Dr. Blundell put the matter to the test of experiment, bled a dog to extreme fainting, and then injected into it six ounces of blood from another dog. "So sudden and complete was the resuscitation, that the animal seemed rather to awaken from sleep than arise from apparent death." Dr. Blundell made similar experiments, and his results having been substantially confirmed by many other enquirers in Europe and in America, transfusion has won its place amongst the resources of human surgery, for saving life in imminent peril. One of the most recent writers on the subject (Dr. Roussel), after fully acknowledging vivisections as the origin and warrant for transfusion of blood in man, relates fifty cases in which it was performed, with twenty-six complete recoveries and fourteen prolongations of life. In each of the patients the circumstances were extremely urgent, and all other means had failed.

Amongst the serious injuries to which the human body is liable, none afford a better illustration than do wounds of the intestines, of the advantages which have resulted from scientific experiments upon animals.

It was Shipton,* an English student of surgery, who in the early part of the last century made the following experiment. He cut away a portion, equal to two fingers breadth, of the ileum of a dog, connected the extremities by an uninterrupted suture, and closed the external wound. The dog recovered, but the experiment bore little if any fruit until it was taken up by Benjamin Travers, who, through his master Astley Cooper, was a direct descendant of John Hunter's school.

Mr. Travers, acknowledging his indebtedness to Shipton, instituted a series of experiments on living animals, and with the results so obtained, sought to reform the practice of

* Observatio de Portione intestini Canis feliciter abscissâ, in *Phil. Transactions*, vol. xxii. 1703.

human surgery. In his own words, "The benefit which has of late years resulted to practical surgery from a diligent study of those secret processes by which nature accomplishes her operations, furnishes, I conceive, an irresistible argument for the necessity of experiments on brutes."* The monograph in which Mr. Benjamin Travers recorded his observations was at once accepted as an authority. It led to immediate reform of surgical practice, and stimulated further experimental enquiries, which in their turn have borne the happiest results in saving human life and misery. Mr. Travers' first and most illustrious pupil was his old master Sir Astley Cooper. He tells us, "I practised gastroraphy in consequence of the results of the following experiments (on living dogs). As far as a judgment can be formed from these experiments, it will be seen that this operation is in them both safe and effectual; for I have made the experiment of dividing the intestine, and afterwards sewing its extremities together and found it succeed."† Jobert (de Lamballe),‡ Samuel D. Gross,§ of Philadelphia, and Bouisson, ¶ of Montpellier, have repeated those researches, and the results have been so far confirmed and extended, that Shipton's original experiment, of removing a portion of the whole circumference of the alimentary canal, is now an established operation, against otherwise mortal disease in the human subject. In wounds of the intestine and operations for hernia, the experimental researches referred to have very materially lessened danger.

As the knowledge and reputation of Astley Cooper and Scarpa grew step by step with their researches on living

* An enquiry into the process of nature in repairing injuries of the intestines, illustrating the treatment of penetrating wounds and strangulated hernia. London, 1812. P. 3.

† The anatomy and surgical treatment of abdominal hernia, by Sir Astley Cooper, 2nd Ed. by C. Aston Key, London, 1827, p. 51.

‡ Entéroplastie on Autoplastie du Canal Intestinal. Traité de Chirurgie Plastique par A. J. Jobert (de Lamballe). Paris, 1849, T. 2, p. 80 et seq.

§ A System of Surgery, by S. D. Gross, London and Philadelphia, 1872. Vol. II, p. 663.

¶ Tribut à la Chirurgie ou mémoires sur divers sujets de cette science par E. F. Bouisson, Paris, Montpellier, T. 1er, p. 139, et seq.

animals, and with their clinical experience, so did that of their great contemporary Baron Dupuytren. Educated at the commencement of the century under Fourcroy, and with Thénard, following closely in the steps of Bichât, few surgeons ever enjoyed greater opportunities for scientific culture than Dupuytren did. He profited by them to the full, became a good practical chemist and an experimental physiologist, and prepared himself by numerous researches on living animals for that one on artificial anus, which remains one of his brightest titles to surgical renown. Before his time persons who had had the misfortune, as the result of injury or disease, of discharging the contents of the bowel through an artificial opening, were condemned to a wretched existence and early death. Bed-side observations on cases of wounds of the intestines had suggested to Dupuytren some notions for possible relief, but "those ideas were as yet only founded on clinical observation; I wished to confirm them by experiments on living animals; *(je voulus leur donner la sanction de l'expérience sur les animaux vivants.")**

Many experiments on the intestines of living dogs suggested to Dupuytren his well-known operation for artificial anus. His researches occupied him several years before an opportunity presented itself for testing the merits of his discovery on the human subject. It was on the 17th May, 1813, that Aucler, *at* 36, was admitted at the Hôtel Dieu in Paris with strangulated hernia, under such circumstances that artificial anus was the inevitable result. Human surgery at that date had no relief; but the facts elicited by his researches on living animals led Dupuytren to apply them in an operation for the relief of his patient,

* Mèmoire sur une Méthode Nouvelle pour traiter les anus accidentels, lu à l'Académie des Sciences dans les Séances des Lundi, 3 et, Lundi, 10 Janvier, 1824, par M. le Baron Dupuytren, in Mémoires de l'Académie Royale de Médécine, T. 1er., Paris 1828, p. 259;

who at the end of a week had relief by the natural passage. The case established a principle and a practice, and proved the forerunner of a series of equally successful ones.

The fertile suggestiveness of young Shipton's experiment did not exhaust itself in the labours of Travers, and of his contemporaries and successors. When the anti-vivisectionists exclaim against the cruelty and uselessness of an English medical student excising a portion of a dog's intestine and proving its survival, I invite them to reflect, on the successful removal by the knife of the upper extremity of the human stomach blocked with cancer; a disease which, in that situation at any rate, has never been proved curable by other means. Before attacking it, Péan of Paris, operated experimentally on brutes, then on man. His patient died; but Billroth, and his assistant Wölfler, of Vienna, succeeded. My good friend Nicolaysen, of Christiania, followed; but in spite of his well-known skill, his patient died in fifteen hours. Nothing daunted Czerny, of Heidelberg, returned to the charge. His patient had been greatly reduced in weight by ten weeks constant vomiting. The enormously distended stomach reached actually to the pubes, and contained a tumour near the pylorus as large as a child's fist. Czerny opened the abdomen, then made an exploratory incision into the stomach, and removed the cancer. The operation lasted more than two hours. The wound healed without a sign of inflammation. There was no vomiting—no pain. The patient took some soup on the second day, meat on the fifth, got up the twentieth day, gained eleven pounds in weight the next fortnight, and then returned to his usual occupations.* Warranting, as such cases do, the placing of cancer of the stomach amongst diseases curable by the knife,

* Transactions of the London International Medical Congress, 1881, vol. II, p 232-3

do they not also justify the vivisection of dogs by Shipton and Travers, who, by their experiments, laid the first scientific foundation of intra-abdominal surgery?

No operations are a source of greater regret to surgeons than amputations of the limbs. No advance has been more welcome than the substitution for them of excisions. The mortality attending these is very slight, and experience has demonstrated that a shattered or diseased joint may be resected, and a very useful limb retained. The clinical experience which has brought about these results has been enlightened and powerfully assisted by vivisection, notably so in all that concerns the process of repair after injuries and diseases of bones*. Mr. Syme, to whom this department of surgery is under special obligations, read a paper on the 6th of March, 1837, before the Royal Society of Edinburgh, "On the power of the periosteum to produce new bone."† The question which he proposed to consider was, "Whether the periosteum, or membrane that covers the surface of the bones, possesses the power of forming new osseous substance, independently of any assistance from the bone itself?"

Duhamel had answered in the affirmative, nearly a century before, on the basis of vivisections and other experiments; but Haller contested the matter, and professional opinions remained divided in regard to the ossific power of the periosteum. The point in dispute being not merely a

* The repair of fractures, Lectures on Surgical Pathology, by James Paget, F.R.S., Revised and Edited by William Turner, F.R.S.E., London, 1863, chap. 11, p. 179. In addition to facts and bibliographical references in this chapter, the reader is referred to,—An Experimental Inquiry respecting the process of reparation after simple fractures of bones, by Bransby B. Cooper (with experiments on rabbits and cats), Guy's Hospital Reports, vol. 2, 1837, p. 1879, vol. 3, 1838, p. 111.—Observations on the Mode of Union of Fractures of Flat Bones by R. H. Meade. Medico-Chirurg. Trans., vol. 23, p. 390. This research is based on experiments on live guinea pigs and rabbits.—On Necrosis: being an Experimental Inquiry into the agency ascribed to the absorbents, in the removal of the sequestrum, with some observations concerning the adhesion of living to dead bone, by George Gulliver, Med. Chir. Trans., vol. 21, et seq., contains experiments on men, dogs and rabbits. On the absorption of dead bone, by William Scovell Savory, Med. Chir. Trans., vol. 47, p. 102, (with experiments on donkey and rabbits). Handbuch der Lehre von den Knobhenrüchen von Dr. E. Gurlt Hamm. 1862 Erster Theil p. 20. Die allgemeine chirurgische Pathologie und Therapie von S. Theodor Billroth. Achte vermehrte Auflage Berlin 1876 p. 207 et seq.

† Contributions to the Pathology and Practice of Surgery, by James Syme, F.R.S.E. Edinburgh, 1848, p. 30, et seq.

matter of curiosity, but one of great practical importance, Mr. Syme thought it very advisable that the truth should be ascertained. Clinical experience appeared to him to bear out the experimental results of the French naturalist, but with the view of settling the matter, he resected the bones of a number of living dogs, with and without the periosteum. The evidence thus obtained put beyond all question the power of the periosteum to form new bone, independently of any assistance from the old one. Still the subperiosteal method of resection made but little way, in spite of abundant clinical experience. Another and still more laborious series of vivisections was required, before the problem was definitely solved. These results achieved by Ollier of Lyons, were published in 1867 in two volumes, under the title "Experimental and Clinical Treatise on the Regeneration of Bones and on the Artificial Production of Osseous Tissue."* The first volume is experimental, the second clinical. Ollier dedicated them to Claude Bernard and Velpeau in these words, "When I left experimental physiology for the practice of surgery, I wished to tread the paths you have marked out, the one in determining the methods of scientific medicine, the other, in showing, during forty years, the fertility of its applications." In his introduction (p. 2) Ollier lays down that "experiments on living animals are of the greatest utility to surgery."

Chassaignac's invention of the écraseur has proved of the utmost utility to operating Surgeons. How the crushing instrument was perfected, and how the rules for its safe and comparatively painless employment were determined, is best told in a condensed translation of his own words.† "Physio-

* Traité Expérimental et Clinique de la Régéneration des Os et de la Production artificielle du Tissu osseux, par L. Ollier. Paris, 1867.

† Traité Thorique et Pratique des Opérations Chirurgicales, par E. Chassaignac. Paris, 1861. T. ler, p. 75, et seq. See also Traité de l'Ecrasement linéaire Nouvelle Méthode pour prévenir l'Effusion du Sang dans les Opérations Chirurgicales, par M. E. Chassaignac. Paris, 1856.

logical experiments concerning linear crushing (écrasement linéaire).

"In the course of the winter, 1854, I made a series of experiments on living animals in the laboratory of M. Fluorens at the Jardin des Plantes. The crushing instrument applied to the dog's tongue, completely divided it in its thickest part. In experiments on the lingual tissue of living animals, we obtained this constant result,—when the crushing was conducted slowly, the solution of continuity was dry, and there was no hemorrhage, neither primary nor secondary, and healing was rapid. But when the crushing was done quickly, hemorrhage occurred. "In experiments performed at the Grenelle slaughter-house with Veterinary-Surgeon Charlier, the 1st October, 1854, we found that the carotid artery of a sheep could be divided without hemorrhage. Section of the ovarian arteries of a cow, by the same process, yielded the same results. It was very important to know what was the effect of linear crushing on the sensibility of living tissues; theory pointed to intolerable pains, experience belied them. After the first efforts of the pinching, produced by the pressure of the nerves in the instrument, the strangled part swells and loses all sensibility."

These results have been constantly verified in operations on the human subject. In obtaining that evidence, pain was doubtless inflicted on many brutes; but it is scarcely possible to conceive how any surgeon could have dared to inflict, how any man could have had the fortitude to endure, the pain necessary for gaining experience with the crushing chain on the human subject. Against the pain suffered by brutes in this research, may cheerfully be set the saving of pain and life which has resulted to countless human beings; for, since Chassaignac perfected it, the écraseur has been constantly in use by surgeons in all parts of the world.

This recital of the beneficial influence of vivisections on the improvement effected in surgical operations and instruments, admits of very great extension; but it may be useful and interesting, at this stage, briefly to review the influence of the school of experiment generally, and of scientific experiments on living animals in particular, on the progress of surgery through the education of some of its leaders.

Surgery was only a tangled mass of empirical knowledge, handed down by tradition, until it came to be studied as a branch, and with the aid, of other departments of experimental science.

Reverting to our date of 1750, the quarter of a century which preceded and followed was singularly productive of naturalists and surgeons, physicists, chemists and astronomers, assisting each other and advancing on the same lines of observations and inductions.

In 1728 John Hunter and Joseph Black were born. In the next five years followed Lazzaro Spallanzani (1729), Henry Cavendish and Joseph Priestley (1733). Lavoisier saw the light in 1743, and in the succeeding lustre Desault (1744), Volta (1745), Scarpa (1747), Jenner and La Place (1749). The five years 1764—69 were even more prolific, with Abernethy (1764), Larrey (1766), Astley Cooper, Humboldt and Cuvier (1769),—the epoch year which also gave the world Napoleon and Wellington, Brunel and James Watt. Only three years later commenced the brief but brilliant career of Xavier Bichât, to be followed closely by an accession of some of the world's greatest physiologists, surgeons and physicists, to wit Charles Bell (1774), Delpech and Dupuytren (1774), Humphrey Davy (1778), and Berzelius (1779). One and all were original observers, working out the results of experiments according

to the rules of the inductive philosophy. Everyone of the great surgeons named did some of his best work, in widening and solidifying the foundations and raising the edifice of human surgery, by experiments on living animals. The one surgeon amongst them who did the least in that direction, illustrates in a particular manner the great value of such research. To Charles Bell, experiments on living animals were specially abhorrent; yet, without them, it would have been impossible for him to discover that sensory and motor impulses travel along different routes of spinal nerves, and that ganglions are not intended to cut off sensation as was universally held up to his day. To those who doubt the influence of vivisections on Charles Bell, I would suggest the reading of only eight pages of his numerous works. From page 29 to 36 inclusive, of the introduction to "The Nervous System of the Human Body," embracing the papers delivered by Charles Bell to the Royal Society on the subject of the nerves,* is a succinct account of the substance of his chief discoveries, and of the processes by which he arrived at them. Vivisections were absolutely indispensable to him, and he performed them. Had he possessed sufficient firmness of resolve to subjugate his emotions to his reason, he would have experimented more, and speculated less. So doing he could not have failed to forestall Marshall Hall, and to have achieved a position amongst discoverers not inferior to William Harvey's.†

Through Everard Home and Dr. Baillie, John Abernethy, Astley Cooper and William Lawrence,—through the Hunterian Museum and its worthy conservator and commentator Richard Owen, the influence of John Hunter's work has come down, by unbroken links, to the first Sir Benjamin Brodie and Sir James Paget, the leaders of British surgery

* London: Longman's, 1830.

† See Dr. Michael Foster's address on Physiology in Int. Med. Con. Transactions, London 1881, vol. 1, page 207 et seq.

for the last half century. If you want to know what Brodie thought of scientific experiments on living animals in laying the foundation of a Surgeon's knowledge, read his Physiological Researches, which, so late as 1851, when full of wisdom and honours, he deemed it worth while to collect, in the original papers published forty years previously in the Philosophical Transactions. If Sir James Paget's recent article in the *Nineteenth Century* leave you in any doubt as to his opinion on the matter in question, be good enough to read his Lectures on Surgical Pathology, edited by Professor Turner, of Edinburgh.

If you want to know what Germany thinks on the subject read Professor Virchow's address before the late International Medical Congress ("Ueber den werth des Pathologischen Experiments").* With illustrious individual exceptions, the Germans were backward in the race for Medical fame. They had nothing to compare with the French Academy of Surgery. Our Pre-Hunterian Surgeons were incomparably superior to their Pre-Hallerians. They had no match for Morgagni and his pupil Scarpa. But once they perceived the great truth, once they set out on the high road of experiment, their impetus was overwhelming and their conquests have brought them to the fore all along the line.

When I undertook to deliver this address, I did not merely propose to recall historical evidence of the saving of pain and life to man, which experiments on brutes have exercised on human surgery. I felt deeply, as the vast majority of the medical profession do, all the world over, the strait in which our colleagues are placed, who are charged with the study and teaching of physiology in Great Britain. As a group, they are in our front scientific rank, for merit and

*For Professor Virchow's latest deliverance on the subject, see Stenographischer Bericht der 32 Sitzung des Deutchen Reichstages, vom 23 Januar, 1882, betreffend MISSBRAUCH DER VIVISEKTION. Erste Beilage Zur Deutschen Medizinal—Zeitung, No. 8, 1882.

responsibility. The knowledge which they possess and promote, is essential to all who practise our difficult profession. Their teaching is the very foundation of the training of the pupils who enter our surgical wards.

British Physiologists stand before the country accused of cruelty, dogged by spies, and liable to criminal prosecution for doing that, which some of the wisest and best men of the world have done for the lasting benefit and honour of mankind. It is only right that we who have benefited so largely, and yet hope so much from their labours, should stand forward, and take our place by their side with complete solidarity.

What are many of the operations which every surgeon performs but experimental? Take the every day case of a strangulated hernia. Once diagnosed, we tell the patient that the bowel is tied down by a string, which will have to be cut if the obstruction cannot be relieved under ether. Patient and friends say "we are in your hands, do as you think best."

The painless sleep produced, we apply the taxis; that failing, we divide the skin and subjacent structures, and, in the absence of special contra-indications, strive to reduce without opening the sac. We may still fail, open the sac and fail again. Then gently turn out the contents, and within a mass of omentum find a knuckle of blue-red bowel. Most carefully, the stricture is divided, the contents returned, and the patient allowed to wake, perhaps to ask for the first question, "when are you going to begin?" to hear in reply that all is safely over; and to be assured of recovery, which, all cutting surgical operations included, surgeons can now guarantee with an average mortality of about two per cent.

If anyone try to conceive the thousands upon thousands of human lives saved by surgical operation, he must re-

member that the computation is not one of simple addition. An unknown quantity has to be discovered, and allowed for; the hundreds and hundreds of lives that are shortened by the surgeon's knife. Where is the operator of large experience who cannot recall lives that, but for his intervention, might have been prolonged for months or years? Once a disease is diagnosed, which in all human probability must prove fatal if left to its course, and which internal remedies cannot relieve, only let a chance of complete recovery be held out by the surgeon, and how anxious for it, in the majority of instances, are patients and friends.

Every precaution is taken, every wise counsel sought, all possible skill employed, and yet how often within a few hours the undertaker follows the surgeon. Is not that an awful yet inevitable human vivisection? How many such results have been saved by the experience acquired in the vivisection of brutes?

Some persons fear that scientific experiments on living animals may brutalize, by hardening the experimenter. They would think otherwise, if they knew more of physiology and psychology. As the power for hate, jealousy, and lust, increases with exercise, so by the Divine Providence do the best and noblest aspirations of our nature. None more so than does the power of sympathy with those who suffer.

Natural endowments, sense of duty, severity of discipline, may enable a strong man to seem unmoved amidst scenes of the direst woe. But if interrogated, he will often answer in the heroic anguish of Dante's Ugolino,

"I wept not: so all stone I felt within."*

The subjugation of emotion by reason, of instinct by volition, is one of the most signal triumphs of intellectual culture. Any one may imagine the possibility of its being

* "Io non piangeva; si dentro impietrai." La Divina Commedia di Dante Alighieri. Dell 'Inferno. Canto 33, v. 49.

some day his misfortune to need the good offices of an operating surgeon. If so, would he prefer a sentimental or a resolute one,—a philantrophic *doctrinaire*, or a man trained to fight the battle for life, knife in hand, light handed and impassible? Would he prefer that his surgeon instead of gaining some of his experience on brutes, should acquire it all on men, the patient himself included?

It is unanimously conceded that legally qualified members of the medical profession are the proper judges of the treatment to be adopted for the relief of those who repose confidence in them. Yet, the surgeons who are trusted with the most responsible, nay holy, work, and their brother physiologists who are gentlemen at least as able, as cultured, and as kindly as themselves, are not to be trusted with the vivisection of a rat or a toad, for the purpose of discovering something to prevent the vivisection of a man or woman, or to lessen its pain and ensure its success when it has become inevitable.

If to-morrow I saw a case the parallel of Czerny's, and resolved to excise a man's pylorus, the poor creature, threatened with otherwise certain death, might grasp at the remotest chance of life. If I operated, and he died in a few hours, death would be looked upon as a natural result after the great risk incurred, and no one would say anything, assuming of course that I had used all reasonable care and diligence. But if before operating on that man, I resolved to gain experience on Czerny's "Zwei reihige Naht" (double row suture), and put a brute animal to sleep, to try it on his pylorus, for perfection and safety in operating on the man, I should be liable to be brought up at a Police Court under a charge of cruelty to animals.

All I can say is, that under those circumstances, I should not hesitate an instant as to my course of action. I should

sacrifice the brute in the interests of my patient, and leave the Act of Parliament to its official custodians.

Lest it might be supposed that I have put an extreme case, let me remind you of the fact, that Professor Fraser, of Edinburgh, and Dr. Lauder Brunton, of London, two of the foremost authorities on therapeutics in Great Britain and in Europe, have been stopped in their experimental enquiries by the formalities of the necessary legal license. Nay more, in the still pending case of aconite poisoning, where a man is charged with murder, the very experts for the Crown had to wait for days, before they could obtain permission to inject a drop of the suspected poison under a mouse's skin.

Let us have no equivocation. If the law is to be administered in that spirit, there is an end to the British school of experimental and comparative physiology, pathology, and therapeutics, on the lines of investigation which give the greatest hope for the progress of human medicine and surgery.

Is a compromise impossible?

As a profession who have done so much for the public, whose labours are so ill-requited, and who are now exposed to such undeserved contumely, we have a grievance, and a very grave one. But are we blameless? Has there been no excess of zeal, no indiscretion on our side?

Zeal, notwithstanding Talleyrand's protest, is an essential in all great work; but like other virtues, it is unhappily apt to develop into a vice, when indefinitely produced. But assuming, nay admitting, errors, are we the only profession chargeable with mistaken zeal and erring judgment? Is the spirit of the old Puritan quite dead? Is the story of Calvin and Servetus forgotten? Is the "Index Expurgatorius," in spirit if not in letter, a Vatican monopoly? Is it all charity under and around the Ecclesiastical Titles

Act? Are the Irish gaols, with their five hundred unheard suspects, no proof of mistaken statecraft? When Lord Coleridge condescends to elaborate in a magazine article the cynicism "When doctors differ," it may be permissible to ask if judges are always unanimous and never wrong? Is the Royal prerogative never invoked on behalf of the victims of judicial miscarriage? Are such close divisions as three to two quite unknown in the High Court of Appeal?

The fact is, every pursuit of life teaches the fallibility of human opinion, and the necessity of exhausting all possible means to banish error and unveil the truth. No one denies that experiment is the very essence of physical research, and no valid reason has been adduced why animal physics should be an exception. Under anæsthetics it is possible to carry out the majority of scientific experiments on living animals without pain; but how is it supposed that operating surgeons can practise their difficult, delicate, and most anxious art without inflicting pain upon, and sometimes at the cost of the life of, human beings? It is surely wise economy and enlightened charity to sacrifice a few guinea pigs and rats, if it is thereby possible to spare pain and life to some of God's best and noblest creatures.

The love of animals, which is one of the prime movers in the breasts of those who oppose vivisection, is deeply to be cherished. As Englishmen we yield for it to no nation. The alleged horrors of Alfort and of the Florence laboratory are not practised in Great Britain. We hold scientific experiments on animals are indispensable. Let us reassure all kindly persons, by giving every possible guarantee that only essential experiments shall be performed, and in the most humane manner possible. Vivisection might be re-

stricted to licensed public institutions, such as medical schools or other scientific colleges, and then under the control of their teaching and governing bodies. If in something like this spirit a truce be agreed upon, and the Act temperately administered, I feel quite confident that the medical profession will act in the matter, in the same spirit of benevolence and honour in which they discharge all their public duties. But, if spies are to track every scientific enquirer, and such prosecutions, as the recent one of Doctor Ferrier, to be renewed, I would venture to make an observation. Laws which are too stringent and uncompromising inspire their own violation. Smugglers are the outcome of oppressive fiscal laws, as body-snatchers were of prohibited human dissection.

When philanthropists outside the medical profession evince so much anxiety for the prevention of cruelty to animals, and by implication, if not explicitly, accuse us of being indifferent to it, they may be reminded that the discoverers of vaccination and anæsthetics, the chief promoters of sanitary reforms and the founders of conservative surgery, have one and all been members of the medical profession, without rivals beyond its pale. The duty of sometimes inflicting pain for the relief of greater suffering, or for the prolongation of life, is an unfortunate necessity. But in what spirit, with what success, that duty is discharged by those on whom it devolves, may be inferred from the fact, that the humanity of our operating surgeons is scarcely ever called in question. A great part of their practice is in public. Wards full of men and women witness their procedure ; and it may safely be stated that in every city and town in the Empire, in the army and in the navy, no men are more popular with the masses, none enjoy more fully the confidence and respect of the

thoughtful, than operating surgeons. Are such men not to be trusted to perform scientific experiments on brutes, with the minimum of suffering, when they consider them essential to obtaining information for the saving of life, or for demonstrating the means of saving it to those who adopt the medical profession as their vocation ?

The predominant judgment of history and of the civilised world answers in the affirmative.