BRITISH MEDICAL JOURNAL

LONDON SATURDAY DECEMBER 23 1944

THE SUPPLY OF BODIES FOR DISSECTION: A HISTORICAL REVIEW*

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The subject falls naturally into three periods: from the Middle Ages until the revival of dissection as part of the general training of medical students in the mid-eighteenth century; from then until the passing of the Anatomy Act of 1832; and from 1832 until the present time.

First Period

The first date of importance is 1231, when the Emperor Frederick II decreed that a human dissection should be performed at Salerno at least once in five years; but, although dissection was legalized in various parts of the empire in the 13th and 14th centuries, no statutory requirement seems to have been made to provide subjects until, in 1387, we find that the Statutes of the University of Florence request the authorities to see to the delivery of the bodies of three alien criminals each year for this purpose. The connexion between dissection and the punishment of crime was to last for 450 years.

In England and Wales the claims of anatomical dissection were recognized by the Charter given in 1540 by Henry VIII to the United Company of Barbers and Surgeons, which enacted that "the sayd maysters or governours of the mistery and comminaltie of barbours and surgeons of Londō & their successours yerely for ever after their sad discrecions at their free liberte and pleasure shal and maie have and take without cotradiction foure persons condemned adjudged and put to deathe for feloni by the due order of the Kynges lawe of thys realme for anatomies" . . . and so on.

Scotland had been somewhat earlier in the field, the Town Council of Edinburgh having given in 1505 the Incorporation of Surgeons and Barbers "once a year a condemned man after he be dead, to make anatomy of, wherethrough we may have experience to instruct others. And we shall do suffrage for the soul." In 1694 this grant was extended to include "those bodies that dye in the correction-house; the bodies of fundlings who dye betwixt the tyme that they are weaned and thir being put to schools or trades; also the dead bodies of such that are stiflet in the birth, which are exposed, and have none to owne them; as also the dead bodies of such as are felo de se; likeways the bodies of such as are put to death by sentence of the magistrat." This was granted subject to dissections being made only in the winter months and the intestines being buried within 48 hours and the rest within ten days. Although in Ireland no specific provision for anatomical subjects seems to have been made, eight persons are mentioned as Readers of Anatomy in the Charter to the Barbers, Surgeons, Apothecaries, and Periwig Makers of 1687. In France, by the middle of the 17th century, dissection was practised so openly that Molière makes a lover ask his mistress to come and see the dissection of a woman, provoking the maid's comment that "some people take their mistresses to a comedy, but to take them to a dissection is far more gallant!"

Here, the official arrangements for dissection soon proved inadequate, and by the first half of the 18th century "private anatomies" were becoming so common that it was clear that the attempts to put them down were hopeless; already the prevalence of body-snatching had led to riots in Edinburgh in

1725 and 1742. In 1752 the official supply was somewhat augmented by an Act (25 George II, Cap. 37) which gave the bodies of murderers executed in London and Middlesex to the Surgeons' Company, and those of murderers executed outside this area might be given to local surgeons chosen by the judge or hung in chains at his discretion.

The revival of anatomy about 1750 under the Hunters in London and the Monros in Edinburgh rapidly increased the number of students and still more the demand for bodies, since formal demonstration by the lecturer no longer sufficed and students carried out many dissections for themselves. The number of medical students in Edinburgh was 57 in 1720, about 340 in 1780-90, and over 400 after 1800. In London the number of students of anatomy was 300 in 1798 and 1,000 in 1823.

Second Period: The Resurrectionists

This brings us to our second period—the Golden Age of the Resurrectionists. These were of two types: the students themselves, often led by the professors' assistants; and professional body-snatchers, who worked at first singly or in pairs, but later were organized into rival gangs. The professional body-snatchers depended mainly on disinterment, but used other tricks, such as impersonation of relatives and stealing before burial. At first prosecutions were rare—indeed, the law on the subject was doubtful, and the body-snatchers themselves were convinced that they could not be indicted unless they removed the grave-clothes or a portion of the coffin—but in *Rex v. Lynn* in 1788 the King's Bench decided it to be a misdemeanour to carry away a dead body from a churchyard even for dissection, as being an offence *contra bonos mores* and common decency, and it was later decided by the courts that a person would be indictable if he was a party to the non-interment as well as to the disinterment of a dead body (*Rex v. Young*, and *Rex v. Cundick*).

With the increase of the traffic, more frequent and open disinterment led to public odium, and the extraordinary state of affairs is best described in the sober words of the Report of the Parliamentary Select Committee on Anatomy of 1828:

"In proportion as the public became vigilant, the laws relating to sepulture were interpreted and executed with increasing rigour: and as the price of subjects rose with the difficulty of obtaining them, the premium for breaking the laws increased with the penalty. The exhumators increased in number, and, being now treated as criminals, became of a more desperate and degraded character. The parties of daring men who now took to raising bodies, did it happen (as was frequently the case) that, while in pursuit of the same spoil, they fell in one with another, actuated by vindictive feeling, and regardless of the caution and secrecy on which the successful continuance of their hazardous occupation must depend, had contests in the places of sepulture—left the graves open to public gaze, or gave information to magistrates, or the relatives of the disinterred, against their rivals." The public were excited against the teachers of anatomy by these outrageous acts; "and this to such a degree, that of late, in many cases, individuals, out of solicitude to guard the dead, have taken upon themselves to dispense with the laws of their country, and have fired upon parties attempting disinterment."

By 1820 the matter had become a public scandal. In 1828, of 800 students in London, about 500 actually dissected. Since the optimum number of subjects per student was then said to be three—two for dissection and one for operative surgery—

* Abridged from an Arris and Gale Lecture, 1944.

about 1,500 bodies were annually required. Students were resorting to Paris, Dublin, and other foreign schools. Sir Astley Cooper stated to the Select Committee in 1828 that about 450 subjects were actually dissected in the London schools in one season. The price was 8 to 10 guineas, and had been as high as 16 guineas, as compared with 1 to 2 guineas thirty years previously. The state of public opinion was such that, according to Sir Astley Cooper, there was practically no chance of obtaining bodies from London burial grounds by disinterment, and the chief source of supply was importation from abroad, mainly from Dublin. These might be seized by the Customs if detected, and were often so putrefied as to be unfit for use. An ingenious ex-naval captain in Dublin not only organized the export of bodies from that city but raised a public fund to pay watchers to prevent exhumation; with the fund he paid his own agents, ostensibly as watchers but actually as resurrectionists. In Edinburgh the situation was even worse. Well-to-do persons hired watchers with loaded blunderbusses at 6d. a night, with free liquor, to guard the graves of relatives until putrefaction was too far advanced for the bodies to be worth exhuming, and I have seen mort safes—iron cages to prevent exhumation—still existing in graveyards more than fifty miles from Edinburgh.

I wish that space allowed me to quote more of the macabre evidence of the surgeons, magistrates, police officers, and resurrection men who appeared before the Select Committee. A resurrectionist—probably the notorious Ben Crouch—admitted to having made a complete corner in the supply for London between 1809 and 1813. According to his book, in 1890 "the number in England was 305 adults and 44 small subjects under three feet; but the same year, there were 37 for Edinburgh and 18 we had on hand that were never used at all." Other matters dealt with in the evidence included the extraction of teeth as a profitable side-line; the importation of subjects from Ireland; the attitude of Home Secretaries—Robert Peel and the Marquis of Lansdowne—and of the police; and the easier position and arrangements made for subjects in Dublin, Paris, Göttingen, and Italy.

Many petitions had been received by Parliament, uniformly praying for an amendment of the existing law. One from the Royal College of Surgeons pointed out that they had a legal duty to examine students, especially as regards surgeons for the Army and Navy. For this purpose dissection was necessary. But the Regulations of the College on this point tended to encourage violation of the law and establish "in the procurers of dead bodies a set of men living by practices which are revolting to the feelings of Society, exposed to the hatred and contempt of those around them, and likely, by the joint operation of these causes, to become trained and gradually habituated to the commission of still greater crimes": the law "which, at the same time that it declares the student to be guilty of a misdemeanour if he attempts to obtain anatomical knowledge, renders him also, when afterwards engaged in practice, liable to a civil action on account of any mistake which his ignorance of anatomy may lead him to commit."

Many suggestions were made, including the establishment of a public fund to pay volunteers, while living, for the right to claim their bodies for dissection after death. Apart from the doubtful legality of the transaction, there is the obvious objection that hardly any of them would be traceable when the time came. To this day, the Anatomy Offices have to refuse a number of such offers every year. Enlightened persons—not only or, I regret to say, mainly of our profession—tried to overcome prejudice and augment supplies by bequeathing their own bodies for anatomical purposes. Jeremy Bentham was a notable example, and Dr. James Macartney of Trinity College, Dublin, obtained the signatures of 99 respectable persons in Dublin in a fortnight to an agreement to give their bodies for dissection.

Mr. Warburton's Two Anatomy Bills

Finally, as a result of public agitation and discussion—in which a high place must be given to Dr. Southwood Smith's article, "The Use of the Dead to the Living," first published anonymously in the *Westminster Review* of 1824 and reprinted several times and distributed to Members of Parliament—the House of Commons was induced to set up a Select Committee

on Anatomy, already referred to, under the chairmanship of Mr. Henry Warburton, M.P. The Select Committee began its sittings on April 22, 1828, and reported on July 22. Its report did not make specific recommendations, but strongly urged legislative action. At this time Parliament was intensely preoccupied with debates on the repeal of the Test and Corporation Acts and with the state of Ireland consequent on the election of O'Connell for Co. Clare. Nevertheless, its obligations with regard to anatomical supply were brought unexpectedly and forcibly to the notice of the whole nation by the discovery of the sixteen murders of Burke and Hare in Edinburgh, the details of which are too well known to recall here. Suffice it to say that the murders created intense popular excitement and indignation; ruined, in Dr. Knox, the country's leading teacher of anatomy; and gave a new word to the language.

On April 4, 1829, the Catholic Relief Bill passed the Lords, and on the 7th Mr. Warburton moved for a Select Committee to give effect to the recommendations of the Committee on Anatomy of the previous year. As a result, Mr. Warburton's first "Bill for preventing the unlawful disinterment of human bodies, and for regulating Schools of Anatomy," was introduced on May 5. The main features of the Bill were, broadly, those embodied in the Act of 1832—viz., the licensing and control of places and persons for carrying on human dissection; the legalization of bequests for dissection purposes; and the handing over for dissection of bodies of persons dying in prisons, hospitals, and workhouses, if unclaimed within 72 hours, to licensees, who were responsible for burial and the keeping of records. The Bill also laid down specific penalties for disinterment. But it contained a number of features which caused strong opposition, and it also failed to repeal the clause of the 1752 Bill which gave up the bodies of murderers for dissection—an amendment to this effect being defeated by 40 votes to 8. The Royal College of Surgeons petitioned against the Bill on the ground that the appointment of seven Commissioners, of whom a majority were not to be physicians, surgeons, or apothecaries, to control medical schools and places of dissection, would infringe the privileges of the College. The proprietors of private anatomy schools were afraid that the phrasing of the Bill would lead to their extinction, and the *Lancet* supported the opposition because it feared an adverse effect on the study of anatomy outside London and the Universities. Also the Bill did not apply to Ireland, and it was thought that it might increase the traffic in human bodies from that country. The Bill had a second reading in the Commons, but was dropped on June 5, 1829, in the Lords, although its principles received general support.

Nothing more was done in the following 12 months, and on June 26, 1830, George IV died and Parliament was dissolved. In November, following the elections, the long Tory reign of some 50 years was broken and Earl Grey's Whig administration assumed office. Still nothing was done, until in the following November a second notorious crime completed the work of rousing public opinion which Burke and Hare had begun. On Nov. 5 Bishop and Williams (or Head) tried to sell the body of a boy of 14 to King's College. Its appearance raised in the porter's mind a suspicion of foul play, and the Demonstrator of Anatomy, Mr. Partridge, detained the men with the excuse of getting change for a £50 note—the agreed price was 9 guineas—until the police arrived. A post-mortem examination showed fractures of the cervical vertebrae, and it transpired that the body was that of an Italian boy, Carlo Ferrari, who had been lured by the murderers to an empty house in Nova Scotia Gardens, off the Hackney Road, drugged with opium, overpowered after a struggle, and drowned by hanging head downwards in a well. Bishop and Williams also confessed to the murder of a woman and a boy for the same purpose, and these confessions were magnified in the popular imagination until the victims of "burking" were believed to number hundreds. They were hanged on Dec. 5, 1831, and on Dec. 15 Mr. Warburton introduced into the Commons his second Anatomy Bill, which, after many changes in committee, received the Royal Assent on Aug. 1, 1832, as "An Act for regulating Schools of Anatomy," Gul. IV, 2 & 3, Cap. 75. This is the Act which governs anatomical supply to-day.

It is not necessary to consider in detail the changes made in committee. Originally the Bill closely resembled Warburton's

first Bill of 1829, but most of the features which had roused the greatest opposition were removed in committee. The preamble may be quoted.

"Whereas a Knowledge of the Causes and Nature of sundry Diseases which affect the Body, and of the best Methods of treating and curing such Diseases, and of healing and repairing divers Wounds and Injuries to which the Human Frame is liable, cannot be acquired without the Aid of Anatomical Examination: And whereas the legal Supply of Human Bodies for such Anatomical Examination is insufficient fully to provide the Means of such Knowledge: And whereas, in order further to supply Human Bodies for such Purposes, divers great and grievous Crimes have been committed, and lately Murder, for the single Object of selling for such Purposes the Bodies of the Persons so murdered: And whereas, therefore, it is highly expedient to give Protection, under certain Regulations, to the Study and Practice of Anatomy, and to prevent, as far as may be, such great and grievous Crimes and Murder as aforesaid: be it therefore enacted . . ."

The Anatomy Act of 1832

The substance of the Act may be summarized as follows: Clause I gives power to the Secretary of State for the Home Department and the Chief Secretary for Ireland to grant licences to practise anatomy to qualified medical practitioners, teachers of anatomy, medicine, or surgery, and students attending schools of anatomy, upon application countersigned by two Justices of the Peace. Clauses II and III give the Secretary of State power to appoint "not fewer than Three Persons to be Inspectors of Places where Anatomy is carried on," and to appoint them to districts and lay down their duties. Quarterly returns of bodies removed for anatomical purposes must be made by the Inspectors.

The most important clause is the VIIth, which gives power to persons having the lawful custody of a body to allow it to be dissected in certain circumstances and under certain conditions; from this clause 97% of our present supply is derived—i.e., from unclaimed bodies in the custody of local authorities. This power to permit the anatomical dissection of a body is overridden (1) if the person when living expressed in writing or in the presence of two witnesses his wish not to be dissected, or (2) if the husband, wife, or any known relative of the deceased objects. Clause VIII deals with so-called "bequests"—as there is no legal property in a body, the term is not accurate: it authorizes those having custody of the body of a person who during life directed that an anatomical examination should be made of his body after death, to have this done, again unless the husband, wife, "nearest known relative or any One or more of such person's nearest known Relatives, being of Kin in the same Degree," objects.

Bodies must not be removed for anatomical examination until 48 hours after death and 24 hours after notice has been given to the Inspector, and must be accompanied by a medical certificate of the cause of death. Persons licensed as above to receive bodies for dissection must transmit the particulars and the medical certificate to the Inspector and keep a register (Clauses X and XI). One week's notice must be given to the Secretary of State of places where anatomy is taught or bodies are received for dissection (Clause XII). Bodies must be removed in a "decent coffin or shell," interred with the appropriate religious rites, and a certificate of interment sent to the Inspector within six weeks (XIII). Nothing in the Act is to interfere with necropsies directed by a competent legal authority (XV). The Act directing the bodies of murderers to be dissected is repealed (XVI). Punishments for offences against the Act are laid down as a maximum of three months' imprisonment or a fine not exceeding £50.

The Act was immediately and completely successful in bringing body-snatching to an end. Dr. James Somerville, the first Inspector appointed for England and Wales under the Act, gave evidence before the Parliamentary Select Committee on Medical Education in April, 1834—20 months after the Act's coming into force. He stated that exhumation had entirely ceased; prices of subjects were greatly reduced, and they were obtained in a much fresher condition. In the first year after the passing of the Act 600 subjects were supplied to the London schools, as compared with his estimate of about 300 previously. There were temporary declines in supply, Dr. Somerville stated, through "the extraordinary mildness of the season" causing

a lower death rate following the extraordinary previous mortality from cholera and "the late influenza"; also because of the "exceptional diffusion of comfort" among the working classes. Both these causes are liable to cause shortages to-day. In Scotland the success of the Act had not been so instantaneous, but difficulties had been smoothed by the Inspector for Scotland, Dr. Craigie. The Return of Licences under the Act at the time showed 8 hospital medical schools and 8 private schools in London and 16 hospitals and private schools in the Provinces; in addition 19 persons in the Provinces were licensed to practise anatomy for their own information or that of their private pupils.

Legal and Administrative Changes since 1832

Before discussing the supply position from 1832 to the present time, certain legal and administrative changes since the passing of the Act must be mentioned. The Amending Act of 1871 (34 Vict., Cap. 16) merely gave power to the Secretary of State to vary, by Order, the period within which the certificate of interment must be sent to the Inspector of Anatomy—i.e., to vary the time within which the dissected subject must be buried. A change was desirable as the result of improved methods of preserving bodies, together with a gradual fall in the supply in relation to the number of students. The first Order in 1871 extended the period from six weeks to six months. At various dates the period was further extended, and in 1940 a similar Order to that of the last war was made for England and Wales—i.e., at the present time the period during which a body may be retained for dissection is two years.

The functions of the Home Office under the Anatomy Acts were transferred in 1919 to the Ministry of Health. When the Local Government Act of 1929 came into force a circular was issued transferring the functions of the Boards of Guardians under the Anatomy Acts to the Councils of the appropriate local authorities—i.e., to the Councils of Counties and County Boroughs.

Certain changes in the appointments and duties of the Inspectors of Anatomy must also be noted. Dr. James Somerville was Inspector for England and Wales from 1832 until 1842, when separate Inspectors were appointed for London and for the Provinces. In 1921 a single Inspector, Dr. Alexander Macphail, was appointed for the whole of England and Wales, and in 1939 Prof. Henderson, his successor and the present Inspector of Anatomy—now serving with the Royal Navy—was appointed Inspector for Scotland also. Originally the Inspectors of Anatomy were concerned with the administration of the Anatomy Acts and not with questions of supply. In 1921, however, when the supply position was extremely serious, the Minister of Health, Lord Addison—himself an anatomist—agreed that Dr. Macphail should be appointed as Inspector of Anatomy and also as a whole-time medical officer on the staff of the Ministry of Health, and should concern himself with questions of supply. Since then the Inspector has held what might be described as a watching brief over the supply of bodies for dissection. In agreement with the professors of anatomy concerned, he opens up new sources by approaching local authorities to give their sanction to co-operation in the work of the Anatomy Acts; stimulates existing sources by correspondence and visits; corresponds with other Government Departments on matters which have given rise to difficulties or disputes; and so on. For London, the Inspector has agreed to take the more direct responsibility of allocating supplies to the different schools, in co-operation with the London Committee of Licensed Teachers of Anatomy, whose meetings he attends by invitation. In Scotland, the Inspector attends the statutory Annual Meeting of the Edinburgh Anatomical Committee, the Glasgow Institute of Anatomy, and the Aberdeen Funerary Committee. His statutory duties under the Anatomy Acts include occasional visits of inspection to the medical schools and the supervision of the work performed by the Clerks to the Anatomy Offices in London and Edinburgh.

Turning to supply, reasonably correct and comprehensive figures are fortunately available to show the variations in supply in relation to the number of medical students from 1832 to the present time.

The Supply since 1832

Fig. 1, based on a graph supplied through the courtesy of Prof. Brash of Edinburgh, shows the number of subjects in

FIG. 1.—Graph showing number of students per part in Edinburgh in 1843-1938.

relation to the number of students in Edinburgh from 1843 to 1938. Fig. 2 shows the same for England and Wales from

FIG. 2.—Graph showing average number of (a) subjects (—), (b) students (---) in 5-year periods 1847 to 1942 in England and Wales.

1847 to 1942. The trend of the graphs is similar, and shows that in England and Wales until 1860-70 the number of subjects was approximately equal to the number of students. Afterwards the supply gradually fell in relation to the number of students, and about 1900 it began to fall absolutely. By 1903 the position was serious enough for representations to be made to the Home Office and the Local Government Board. In December, 1910, an Anatomical Supply Committee of Great Britain and Ireland was constituted, and issued a report in 1912, which resulted in a deputation to the Home Secretary and a Conference at the Home Office in March, 1913. The outbreak of war in 1914 occurred before any definite action had been taken, and from 1914 to 1918 the supply decreased gradually with the decrease in the number of students during the war. The sudden large increase in the number of students in 1919 made the position temporarily very serious. The Minister of Health received in 1919 another deputation from the Anatomical Supply Committee, and was asked to consider amending the Anatomy Acts or introducing fresh legislation "whereby it shall be compulsory for the legal custodians of any unclaimed body to notify the possession of the same to an accredited Government official, and to act on his instructions regarding its disposal." No legislative action was taken, but hortatory circulars were issued to Boards of Guardians and, as already mentioned, on the appointment of a new Inspector as a Medical Officer of the Ministry in 1921, he was charged with making systematic approaches to Boards of Guardians and institutions and generally to concern himself with the questions of supply. This action—together with the restoration of the number of students to normal levels—gradually improved the situation, and the supply on the whole increased, with annual fluctuations, until about 1936, when it again declined. The average number of subjects supplied in the whole of Great Britain for the three academic years 1936-7 to 1938-9 was 759 per annum. Omitting the academic year 1939-40, the average for the three war years 1940-1 to 1942-3 was 673—a fall of 11%.

The result of the diminution of supplies has, of course, been to increase the number of students per part. The optimum number for anatomy students is generally considered to be 2 per part—i.e., 16 per body; allotting 2 for each limb, 4 for the head and neck, and 4 for the thorax and abdomen. This level was approximately maintained until about 1920, since when more than two students per part have had to dissect in many schools. For the academic year 1941-2 there were 12,582 students (including dental students but excluding operative surgery classes) according to the returns received in the Anatomy Office, and the number of subjects supplied (excluding those for operative surgery and examinations) was 608, making an average for the whole country of 20 students per subject, or 3.3 students per part instead of 2. Of course, the position varies for each school, being on the whole best in the Provinces and definitely worst in Scotland. The position is perhaps rather better than is shown from these figures, since dental students are included, and the amount of dissection performed by dental students varies within wide limits.

The causes of the diminution of supply may be divided into (1) long-term, (2) wartime, (3) temporary or seasonal.

(1) The long-term cause which has been operating with gradually increasing force over the past 100 years is, of course, the improvement in the social and financial position of the poorest classes. Improvements in real wages, social legislation, and philanthropic efforts have all played their part, and there is little reason to expect that this process will not continue—indeed, certain aspects of social legislation already adopted in principle by the Government may be expected to have most important effects on supplies.

(2) The present war has accelerated this tendency in that the disappearance of unemployment and the high wages of the working classes have led to the almost complete disappearance of the "casual" class and have reduced the number of persons whose bodies their relatives have not thought it worth while to claim, since even elderly and infirm persons dying in institutions may, under present conditions, have left some estate. There are also minor difficulties peculiar to the war, such as delay in tracing relatives, difficulties in transport, shortages of staff, etc.

(3) Temporary difficulties may be caused by a lowering of the expected mortality as a result of mild winters and the absence of epidemics. The efforts of the Ministry of Health and the medical profession to lower the death rate have the paradoxical result of increasing the difficulties of one part of the work of the Ministry and of undermining to some extent the foundations of medical education.

What are the sources from which the supplies of subjects for dissection are at present derived? In 1941-2 the supplies for the whole country came as to 97% from unclaimed bodies in institutions (of which 70% came from public assistance institutions, public hospitals, etc., and 27% from mental institutions); 3% were derived from "bequests."

"Bequest" Subjects

As regards "bequest" cases, the number is small but increasing. A majority of inquirers hope to obtain some financial reward for the "bequest," and when they find that this is impossible lose interest. Nevertheless, an increasing number of enlightened medical men and others of the educated classes express a wish to leave their bodies for anatomical dissection. Thus in 1943 some 30 applications were made for the necessary forms, and actual "bequests" were received to the number of 20 for London, 13 for the Provinces, and 5 for Scotland. It comes as a surprise to many people that they cannot dispose of their own body as they wish, but since it has been held that there is no property in a body, it is not possible to bequeath, in the legal sense, one's own body for anatomical dissection. When an individual desires that his body should be used for this purpose he should understand that the legal right to dispose of his body after death rests with the person—i.e., the next of kin or executor—in whose custody it will be at that time. Further, it can be sent to a medical school for anatomical examination only in the absence of an objection from any near relative. Accordingly, the person making such a "bequest" should arrange to leave with his papers a written statement of his desire to benefit medical education in this way. The executor or next of kin should then, immediately after the event of death, have the necessary forms completed and sent in.

The professor of anatomy who receives the body is responsible for its preservation until it is ready for burial. This is conducted by a clergyman of the faith which the deceased professed during life, and the burial certificate, with full information, is sent to the Inspector of Anatomy, who transmits the particulars to the person who originally authorized removal of the body for this purpose. It may be noted that a funeral service may be held before the removal of the body or, of course, a memorial service in the absence of the body.

All expenses connected with the removal and a simple funeral are borne by the medical schools. Bodies may be left to a particular medical school, but it is more desirable that testators should not express such a wish and should allow their bodies to be sent to the medical school which is most convenient at the time of death. The forms required are (1) a medical certificate of the cause of death; (2) in the London area, a notice to the Inspector of Anatomy to remove the body, to be signed by the next of kin or executor; in the Provinces and in Scotland, a similar form with, in addition, a form to be sent to the professor of the medical school concerned. Should the forms not have been obtained during life, or be inappropriate, or have been mislaid, they can, of course, be obtained by the next of kin or executor as set out below.

To sum up, persons intending to bequeath their bodies for anatomical dissection should (1) ascertain so far as is possible that no objection will be raised by the nearest relatives; (2) place with their papers a written statement of their intention; (3) apply for the necessary forms and instructions to H.M. Inspector of Anatomy at the Anatomy Office, Ministry of Health, Whitehall, S.W.1 (for England and Wales), or the Anatomy Office, St. Andrew's House, Edinburgh (for Scotland).

Although it is clear that the number of subjects derived from "bequests" cannot replace entirely the number derived from unclaimed persons dying in institutions, yet I am convinced that, if more was known in our profession and by the public of the need for, and the conditions of, this method of disposal, the proportion of "bequest" subjects might be considerably increased. In this connexion, I venture to suggest that students should not become qualified without having some idea of the derivation of the bodies which they have dissected during their course on anatomy and operative surgery, and that it is desirable that teachers of anatomy should spend a few minutes giving to each of their classes a short talk on this subject. After all, the most effective answer to criticisms is that doctors themselves are willing to give their own bodies for this purpose.

ESTIMATION OF HEAT RADIATION IN CLINICAL PRACTICE

BY

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Whereas a great deal of work has been done on developing the quantitative administration of x rays and radium rays, the administration of infra-red radiation for clinical purposes still relies to a great extent on guesswork. The reason for this discrepancy is twofold. In the first place, as we shall see presently, the problem of exercising quantitative control over the administration of infra-red radiation is far more complex than in the case of x rays. Secondly, heat radiation is considered harmless, since overdosage is registered almost instantaneously by pain, whereas overdosage of x or radium rays is insidious, their effects not becoming apparent until some time after administration. It must be remembered, however, that weak sources of infra-red radiation are probably of little clinical value, and that powerful radiators producing definite clinical effects are by no means harmless. For example, cases have been recorded in which burns have been inflicted on unconscious patients, and even when the patient is conscious there may

be a general overheating of the body and disturbance of the circulation. It is the aim of this paper to define clearly the physical problems underlying the quantitative clinical administration of heat rays and to offer suggestions for the solution of these problems. We do not wish to discuss at this stage the physiological effects of the various kinds of infra-red radiation; our aim is rather to put into the hands of the medical practitioner the means of controlling this radiation in a quantitative and reproducible way.

Setting out the Problem

The heat rays used in clinical practice are electromagnetic vibrations like x rays, ultra-violet, and visible light, and are only to be distinguished from these radiations by their greater wave-length. The various radiators used in clinical practice all emit rays with a wave-length ranging from that of visible light (roughly 0.5μ) to the far infra-red with a wave-length of 8μ or more. The particular distribution of the radiated energy over the various wave-lengths—i.e., the *quality* of the radiation—depends in each case on the nature of the source, and in particular on its temperature and the character of its surface. Any hot body acts as a radiator. Its radiation is spread over all wave-lengths, but the wave-length in the neighbourhood of which the greater part of the energy is emitted depends on the temperature of the body. The hotter the body the shorter is this wave-length. Fig. 1 shows the energy emitted from 1 sq. cm. of a blackened surface at two different temperatures.

FIG. 1.—The radiation from hot bodies distributed according to wave-length. The shaded area shows the visible region.

The quality of radiation thus differs from source to source, and while its specification is undoubtedly of considerable importance in clinical applications, our main attention in this paper will be fixed on the primary task of determining the *total* quantity of radiant energy of all wave-lengths received on the skin of the patient. The complexity of the problem, and the way in which it may be subdivided, can be illustrated by the example of the radiant-heat cradle.

The first complication is that, in contrast to x-ray work, there is no definite beam of radiation. A surface element of the skin of a patient under the cradle receives radiation not from one direction alone but from practically all directions. The usual practice of radiology, which defines the quantity of radiation by the flow of energy across a surface placed perpendicular to the beam, thus becomes meaningless. It must be replaced by the specification of *radiation flux*, which is the flow of energy coming from all directions which passes in unit time across a unit area of the patient's skin. This is the only physical quantity which is of importance to the clinician, since it tells him how much radiant energy the skin actually receives; and our efforts must be directed towards its determination by methods suited to clinical practice. The most suitable unit for the measurement of radiation flux seems to be the gramme calorie per square centimetre per minute. This is the same unit as Mayneord and Tulley (1943) proposed for the measurement of "intensity of radiation." The actual magnitude of the radiation flux at a particular point on the patient's skin will depend not only on the distance of that point from each radiating element of the source but also on the orientation of the skin to those various elements.

* Working with a personal grant from the Medical Research Council.