

**REVIEW
ARTICLE**

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Autopsy**

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A Review

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WHEN THE CHILD DIED, the attending physician was puzzled, and after expressing his sympathy to the parent he sought permission for an autopsy: "To lose one's offspring is hard, harder to lose a son, and hardest [to lose him] by a disease not yet fully understood by doctors. But for the sake of the other children, I think that to have seen his organs will be of the greatest utility." These words, apart from their rather archaic flavor, might have been uttered today; actually, they were written almost 500 years ago, at the end of the fifteenth century.¹

Why does a patient die? Was foul play involved or was death due to natural disease? If the latter, what disease? How can we find out about it? These questions, essential parts of our current medical thought, were equally important 500 or 600 years ago when medical practice and medical theory bore little relation to their present state. Yet even long ago, helpful answers for these questions might come from an autopsy.

The word means, literally, seeing for one's self, making a personal inspection. Usage, however, has restricted the term to its pathologic sense—*ie*, the dissection of the dead body to determine, through observation, the cause of death or the nature of disease.

Ever since man first became reflective he has asked the same question, Why did the person die? The answers, however, have not remained the same, for they depend on whatever view of the world the questioner might hold. Historically, we can distinguish two main opposing conceptual frameworks, the animistic and the naturalistic.

Animism

According to the animistic view, what happens in the world around us is somehow controlled by personal beings or gods, or some sort of spiritual forces, that stand above the merely "natural" order of things—*ie*, they are "supernatural." They respond to man's desires,

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suitably channeled. Animism has many forms, but all have in common the belief in unseen powers at work, superior to the ordinary or usual sequences of nature, and subject to human influence.

We see a fine example of such animistic thinking in the *Iliad*. The very beginning of the poem describes a plague that overtook the Greeks besieging Troy. Why and how did the plague arise? Homer provided the answer: Agamemnon had captured the beautiful daughter of a priest of Apollo and treated harshly the grieving father who tried to secure his daughter's freedom. The old priest, deeply offended, prayed to Apollo for vengeance. The god, in answer, sent a severe pestilence that carried off the Greeks in multitudes. After much consultation the Greeks realized that the *cause* of the disease was the anger of Apollo, and they took suitable steps to appease him. They returned the captive to her father, made suitable sacrifices to the god, and thereupon the epidemic ceased.²

Clearly, an animistic philosophy of this type has its own notion of causality, quite different from that to which we are accustomed. If the will of Apollo brought about the pestilence, then any autopsy of the victims would be quite irrelevant and not at all helpful. Animistic philosophy does not promote the study of disease through post-mortem examination.

The *Iliad*, written probably in the eighth century BC, described events that occurred some four centuries earlier. Animistic thinking, however, goes much further back and takes different forms, some of them directly relevant to the history of the autopsy.

One such form is the so-called haruspicy, the foretelling of the future through examining the entrails of animals. This practice, which scholars have traced back at least 3500 years to ancient Babylon, represents a particular example of *divination*, that is, the attempts to foretell the future through communication with divine powers. The communication could take specific forms such as omens or portents which the specially trained auger could interpret. One form of communication lay through examining the entrails (especially the liver) of certain animals. As with other omens the entrails supposedly contained a cryptic message of a god. The interpreter—in Roman times called the haruspex—was able to read the message and transmit it to the social group.

Hepatoscopy or haruspicy, the process of divination by examining the liver or other organs of sacrificial animals, was widespread in the ancient world, and can be traced to the time of Sargon I of Babylon (perhaps 3500 BC). Models of the liver with diagrammatic markings

for the instruction of the diviners have been found in many places. The theory seemed to be that the god who accepted the sacrifice identified himself with the spirit of the animal. The god's intentions were reflected especially in the liver, considered the seat of the soul. The diviner, by studying hepatic morphology, could perceive and interpret the intentions, and therefore could predict the future. Interpretations might proceed along the lines such as these: An inversion of the usual lobular proportion meant an inversion of the "natural order" as, that a servant could control the master or the son be exalted above the father; if the hepatic vein were defective on the left, this would mean that the downfall of the enemy's army is likely.³

Through rites such as haruspicy, the ancients learned a great deal about normal and abnormal anatomy. We must realize, however, that this information had a specific religious orientation and was not in any way directed toward the understanding of disease. Yet the information gradually accumulated and eventually did become relevant to autopsy performance.

Animistic philosophy thus contributed in an oblique way to our knowledge of pathology. Additional information came from empirical activities having to do with gathering and preparation of food. Sigerist has commented, "In all archaic civilizations the chief sources of anatomical knowledge were the kitchen and the cult."⁴ Certainly, the early hunters, butchers and cooks learned a great deal about animal anatomy. Although this knowledge gained in a purely empirical fashion was not oriented to the understanding of disease, the information thus gathered, like that from haruspicy, did eventually accumulate to play a role in the autopsy, when the time finally became ripe.

During the Talmudic period the Jews developed considerable knowledge of anatomy and pathology from the examination of slaughtered animals. The Bible states, "Thou shalt not eat of anything that dyeth of itself." However, as time passed, the simple rule of not eating that which died of itself was elaborated and the rabbis examined all slaughtered animals for signs of disease, paying especial attention to the condition of the lungs, meninges and pericardium. Procedures originally having a religious background thus contributed to the background knowledge of normal and abnormal anatomy.

Naturalism and Scientific Beginnings

In contrast to animism in its numerous manifestations, a naturalistic philosophy represents true protoscience. Hippocrates (468–377 BC) emphasized that disease resulted from "natural" causes and was not

due to divine or supernatural origin. Naturalistic thinking dealt with the realm of nature, the domain connected with "laws" and dependable sequences, with cause and effect that are intelligible to reason and in which caprice and willfulness play no part. Hippocrates was the first great naturalistic physician and his concepts determined the course of scientific medicine ever after.

But medicine, even when pursuing naturalistic philosophy, did not immediately find a place for the autopsy. Indeed, after Hippocrates almost eighteen hundred years elapsed before the autopsy became a force in pathology. To explain this phenomenon fully would require a whole text of medical history, but we can perhaps furnish a key with the Greek concept of "physiology," which had a meaning quite different from its present connotation. The Greeks, who contributed so much to medical science, built their doctrine on the study of nature—the *physis*. "Physiology" for them was the science of nature, the description and explanation of natural occurrences, of what happens. It embraced what we today would call "natural science," such as physics, anatomy or physiology (in its modern narrow sense). All these came under the study of nature—*ie*, "physiology" in the Greek sense.

The structure of living creatures—*anatomy*—formed an important part of natural science and received considerable attention from Greek philosophers. But anatomical studies, particularly in animals and to a much lesser degree in man, were largely what we could call an academic discipline or "pure science," not primarily directed to the understanding of disease.

Anatomy played but a small part in early Greek medical theory. The Greeks explained disease largely by the humors: disease resulted from disturbed proportions in the observed—and hypothetical—fluid components of the body. The solid components, the very aspect to which dissection attended, had only a small role. Of course, in some aspects of disease, especially in some surgical conditions, anatomical disturbances might be so striking that they could not be ignored. But in general, ancient study of disease did not stress the solid organs, the anatomical structure, nor the changes therein. Until theories of disease took deliberate account of structural change, the autopsy had little place in medicine.

Anatomical knowledge, however, continued to increase slowly in the ancient world, but had little impact on medical theory until the late Middle Ages. In Egypt embalming had been practiced from an early time. The embalmers, who were probably of a low social class, re-

moved the internal organs and must have made observations of the normal and the deviations therefrom. But apparently they did not communicate their observations to the priests or other upper class individuals who might practice medicine or write about scientific findings.

Available Egyptian records, such as the Edwin Smith papyrus and the Ebers papyrus, demonstrate knowledge of anatomy, but scholars believe most of these terms are derived from animal rather than human anatomy.⁵ There is also considerable interest in bodily structures in reference to wounds and fractures. But in reference to "medical" diseases—believed due to magic and best treated by further magic—bodily structure seems not to have played a part.

In all events, the Egyptians did not forbid the cutting of the human body, and this may have established the situation whereby in the third century BC dissection was practiced in Alexandria. Scholars have debated at length whether the early Greeks performed human dissections. Edelstein⁶ has carefully reviewed the entire problem and concluded that no human dissections were performed in the Greek world prior to the third century BC. At that time, in Alexandria, it is generally accepted that human dissections were performed with official approval, both to determine the normal structure and the changes made by disease. Herophilus (335–280 BC) was a famous teacher in Alexandria who wrote a treatise on human anatomy, describing among other things the structure which still carries his name, the torcular Herophili. However, in regard to pathology he accepted the dominant humoral theories and did not place much emphasis on morphologic disturbances.

About a generation later Erasistratus (ca 310–250 BC) carried out dissections and made observations about the effects of disease. He noted, for example, that the liver of a man who died from dropsy was hard as stone but in a man who died of snake bite the liver was soft. He largely abandoned the prevalent humoral theory in favor of a solidist theory and realized that diseases were associated with changes in the solid organs. The study of these was therefore worthwhile—a point of view that eventually gave significance to the autopsy.

In his long scholarly study, Edelstein concluded that human dissection and possibly vivisection were practiced at least in Alexandria, up to the time of Galen (130–200 AD). More recently, however, Kudlein⁷ disagrees and maintains that the only dissections were done in the third century BC. Galen deplored the lack of opportunities for dissection and emphasized the importance of learning about the

human body from any possible source. He observed wounded men, practiced dissection of animals, especially those like apes which resembled men, and told of examining two skeletons observed by chance, one washed out of a grave by a flooding river, one of an unburied robber picked clean by birds.

A catacomb dating from the fourth century AD, discovered in Rome in 1956, contained many frescoes. One picture shows a large dark figure, surrounded by smaller figures, one of whom points at a body on the ground. The body appears to have a large abdominal opening. Some observers consider this to be a picture of a surgeon performing an operation, but others thought it portrayed an autopsy or anatomical dissection. The problem was extensively discussed⁸ and many interpretations made, but no definite conclusions were reached. So we are left with the unanswered question of whether autopsies were performed in Rome in the fourth century.

Medieval Period

Little information about autopsies is available for the early Middle Ages, but for the later medieval period scattered references show some degree of interest in autopsies. In the year 1111, in an English chronicle, there is a report of a Norwegian king who returned from Jerusalem. While stopping in Byzantium, many of his followers died and he thought this was due to their drinking wine that was too strong. A pig's liver placed in this wine was damaged. Then one of the dead followers was eviscerated, and similar changes were noted in his liver. Wolf-Heidegger⁹ comments that since this case was reported without apparent surprise, it suggests that autopsies were not unknown.

Roger Bacon (1214?-1294) and Arnold of Villanova (1235-1312) recommended the study of the dead body but did not mention any personal experience. Further evidence of autopsies performed in England in the thirteenth century is provided by a picture found in a manuscript dating about 1290. This contains two inserted leaves, with eight miniatures, one of which is apparently a picture of an autopsy. Sudhoff¹⁰ first described this in 1914, and it has since been studied by various scholars.¹¹ There seems general agreement that the picture may have been painted as early as 1270 and does represent an autopsy or dissection, although the interpretation of the actual features remains in dispute.

Various other pictures apparently depicting autopsies have been found in early manuscripts. These are well described by Wolf-Heidegger

and Cetto.¹² Singer¹³ has concluded that dissections were being done in Italy between 1266 and 1275, and that the earliest dissections were medicolegal. He pointed out that the University of Bologna was largely controlled by the law faculty, who would probably seek autopsies to help solve legal problems rather than to promote medical knowledge.

A clear report of an autopsy in the medieval period is included in Fra Salimbene's chronicle.¹⁴ Fra Salimbene was a Franciscan friar who travelled extensively in Italy and France and kept a detailed chronicle in Latin which provides much information about the thirteenth century. In 1286 he described a period of severe cold, snow and fog in Cremona, during which there were many abscesses and deaths among both hens and men. A physician opened a hen and found an abscess, or "vesicular aposteme at the tip of each hen's heart." He then opened the corpse of a man who had died of apparently the same ailment and found a similar lesion. Fra Salimbene made no comments on this and expressed no surprise or disapproval. Nowhere else in this chronicle did he describe any medical problems.

Another clear report is that of a nobleman, Azzolino, who died at Bologna under suspicious circumstances in February 1302. The court ordered a postmortem examination which was done by two physicians and three surgeons under the leadership of Bartolomeo de Varignana, the professor of medicine in Bologna. Their report, which is still extant, concludes with a statement, "We have assured ourselves of the condition by the evidence of our own senses and by the anatomization of the parts."¹⁵

As we approach the Renaissance we find a complex situation. Some scholars sought to recover the ancient learning, while at the same time others searched for new knowledge. In medicine this involved the empirical study of anatomy, as the single medical discipline capable of precise investigation. The rise of anatomy in the fourteenth and fifteenth centuries lies beyond the scope of this study, but other publications give a good review.¹⁶

In pathology the time-honored system of Galen was still dominant, although soon to come under severe attack. As anatomical studies progressed, the autopsy became more significant.

Religious and Social Attitudes

At this time there were still strong religious and social objections to the autopsy. Although in the early years of Christianity there was

no formal church prohibition, certainly the general attitude of church leaders was unfavorable. Both Tertullian (160–230) and Augustine (354–430) wrote strongly against dissection, apparently more on humanitarian and aesthetic grounds than on any theological basis. Vindician, a physician and friend of Augustine, is quoted in a tenth century manuscript from Monte Cassino as saying, “It pleased the ancient anatomist to examine the viscera of the dead to learn in what way they died, but for us *humanitas* prohibits this.”¹⁷ There were no official church decrees on the subject but at the Council of Tours in 1163 it was affirmed that “the church abhors blood.” This was interpreted to mean that the clergy could not perform surgery on the living or the dead. Since most physicians did belong to the clergy this fairly effectively prevented autopsies, but did not absolutely forbid them.

In 1299 Boniface VIII forbade the cooking of bodies to separate the flesh from the bones. This had been done to bring home the bones of people who died on crusades. Although the ruling specifically referred to cooking the body, many people interpreted it to forbid any dissection.¹⁸ Nevertheless, it was about this time that a few physicians began to dissect and eventually the church attitude was modified. In 1410, Pope Alexander died suddenly and was autopsied by Pietro D’Argelata. Pope Sixtus IV (1471–1484) issued a bill permitting studies on human bodies by students at Bologna and Padua, and Clement VII (1523–1534) confirmed this. In 1556 Ignatius Loyola was autopsied. Stones were found in the kidneys, bladder, and gall bladder.¹⁹ It therefore appears that by this time autopsy was fully accepted by the Catholic Church.

In fact, one autopsy had been performed in 1533 specifically for a religious reason. According to the *New World History*, compiled by Oviedo y Valdes, in the sixteenth century, there was born in 1533 in Española (now the Dominican Republic) a double monster, female twins, joined from the region of the umbilicus to a point in the thorax just below the breast. Of course, the infants were to be baptized, but the priest was uncertain as to whether one soul or two souls required baptism. The father reported that one would cry while the other was quiet, one might sleep while the other was awake. Two baptisms were performed, but the priest was still uneasy. When the infants died at the age of 8 days an autopsy was done in the hope of settling the question. Since two complete sets of internal organs were found, it was decided that there probably were two souls. Chavarría and Shipley, who located and translated this fascinating story, com-

mented that this was perhaps the only postmortem examination ever conducted to study the soul of the deceased.²⁰

Respect for the body was an important part of the Jewish tradition, since the Bible taught that God created man in his image. Handling a dead body made a man unclean for several days, but there were rules for his purification. Nevertheless, it was emphasized that the body must be treated respectfully and buried promptly. Even for a criminal put to death, hanged on a tree, "his body shall not remain all night upon the tree, but thou shalt in any wise bury him that day." These laws were interpreted by the rabbis to forbid postmortem dissection which would be a disgrace to the body. However, it is recorded that about 100 AD the students of the Rabbi Ismael obtained the body of a young harlot who had been executed and boiled it in order to count the number of bones. They found 252.²¹

There is one passage in the Talmud stating that if an autopsy would save the life of an accused murderer, it would be permitted. Autopsies were otherwise not approved by Jewish authority until the eighteenth century when Rabbi Landau was asked if it were permissible to make an incision in the body of a patient who died of cancer, in order to learn the proper therapy in future cases. Rabbi Landau replied that autopsy is a desecration of the dead and is only permissible to save the life of another patient immediately at hand, not some problematic future patient.²² This ruling was apparently maintained by orthodox Jews until the twentieth century when the Knesset, the Israeli parliament, passed a law permitting autopsies under strictly limited conditions.²³

Some indications of the popular objections to autopsies may be noted. In 1538, Guillaume Rondelet (1507–1566), a scientist in Montpellier, autopsied his own infant son and later requested that autopsies be performed on his sister-in-law and his first wife. This is told in a biography dated 1578, by his pupil Joubert, who comments, "à cette époque le public avait l'anatomie en horreur."²⁴

Vesalius, the noted anatomist, who practiced medicine and performed many autopsies, died in 1564 during the return from a pilgrimage to Jerusalem. Many years later a biographer, Melchior Adam, published a letter allegedly written by Hubert Languet in 1565, stating that Vesalius had been forced to make this pilgrimage as expiation for the sins of murder and impiety. O'Malley is convinced that there is no foundation of fact for this story,²⁵ but points out that it may be based on the same rumor referred to by Ambroise Paré, who, writing in 1573, warned against opening a body too soon and noted

that "in this century it happened that a great anatomist . . . I say great and famous . . . then a resident in Spain was ordered to open the body of a woman believed to be dead of suffocation of the womb. At the second cut of the razor the woman began to move and show other signs that she still lived . . . the good master had to leave the country . . . and being exiled, soon after died of grief which was certainly a great loss for the Republic."²⁶

Jarcho has called attention to the problems of performing autopsies in Germany in 1670. In a medical periodical of that year, there is an autopsy report with a comment, "the other structures could not be examined because a female relative changed her mind. Our people have a great horror of autopsies and very rarely allow them unless special persuasion has been used." The editor of the journal added a discussion of the difficulties of obtaining permission and some possible answers to the objections of relatives.²⁷

Popular reluctance for autopsies at a slightly later period is also evident by the fact that, when in 1699 the Republic of Lucca established rules designed to limit the spread of consumption which included the recommendation of autopsies, the ruling had to be revoked because of the citizens' objections.²⁸ Even today these attitudes are still encountered, and further consideration would carry us too far afield.

Conduct of the Autopsy

The historian who tries to reconstruct old autopsy procedures has great difficulty, for detailed written accounts exist only for relatively recent times. We have not found records that enter into significant detail prior to the late fifteenth century. When we study past autopsy records we must appreciate certain limitations, since what the physicians saw and described was quite limited by what they knew, that is, by the prevailing theories. Today we frequently hear that descriptions should be "objective" and should be sharply separated from interpretation which is admittedly "subjective." Such a principle, however, is really an utter myth, for background theories, like spectacles, determine what the observer sees. Failure to note particular features may be due to imperfect instruments—the naked eye will fail to perceive what is quite obvious with the microscope; but even more fundamentally the failure is due to mental set, which, in turn, results from the prevailing medical concepts. The pathologist sees what he expects to see, and his expectations are determined by his conceptual background.

Autopsy reports in the past, as in the present, paid variable degrees

of attention to the clinical history. The "case report" might give the clinical findings in considerable detail; but quite often the autopsy findings will have but little reference to the clinical course. In comparable fashion the degree to which pathologic findings were expressly correlated with clinical data would vary greatly.

Quite often the examination was carried out only until the pathologist was satisfied that he had demonstrated the cause of death, and then the dissection and the examination would cease. Sometimes, however, the examiner noted the state of all major viscera in more systematic fashion. Of course, the concept of what constituted a "complete" autopsy changed in the course of centuries.

We can examine some autopsy records from the fifteenth through the nineteenth centuries. The study of selected cases can provide a synoptic view of autopsy procedure, a survey rather than a systematic history.

The Renaissance

At the end of the fifteenth century an Italian physician, Bernard Tornius, performed an autopsy, the manuscript account of which has been translated and discussed by Lynn Thorndike.¹ Tornius, judging by his other writings, was a well-educated humanist, with broad intellectual interests including philosophy, theology and physics. He was also given to the scholastic type of disputation.

The autopsy was performed on a child, probably less than 12 years of age. Tornius gave no separate clinical history but in the course of his discussion indicated a few salient clinical data, including fever (interpreted to be a "double tertian"), difficulty in breathing and lassitude.

The introduction emphasized the usefulness of examining the internal organs "for the sake of the other children" in a disease "not yet fully understood by the doctors." Then, after noting the external appearance, Tornius opened the abdomen and peritoneum "according to rule." He noted the full bladder and then removed the colon, ileum and jejunum, cutting them off at the mesentery. He found two worms. The liver was affected by certain spots [*maculis*] like ulcers. There was an obstruction, of a "viscous humor" that filled the cavity of the portal vein [*?vena cava*] at the origin of the "emulgent veins." The kidneys were swollen, as was the heart. The vein carrying blood to the lungs [*ie*, pulmonary artery] was filled with a viscous humor. Having seen these things, Tornius did not search further for other findings, since in his judgment the cause of death was apparent. The

description of the actual dissection takes approximately one text page.

The "viscous humor" in the pulmonary artery was quite certainly postmortem clot. The type of clot in the vena cava, however, is not so clear, nor is the nature of the spots in the liver. Thorndike makes the plausible suggestion that the child suffered from "multifold metastatic abscesses of the liver, the result of septicemia or pyelophlebitis," but we can have no real assurance.

After the relatively brief description of findings, Tornius devoted over four text pages to discussion, inferences and recommendations. The worms were, he thought, quite unrelated to the principal illness. The blood clot was apparently deemed the important feature in the pathogenesis. "When transmission of blood through the chilio-venous vein and the pulmonary vein was prevented, ebullition [sic] and fever resulted. And because in that blood there was much phlegm, that fever was like a phlegmatic [quotidian] one . . ."

In the discussion, which reminds us of some of Moliere's satires, as in *Le médecin malgré lui*, Tornius refers extensively to authorities such as Galen and Avicenna, and with great subtlety argues various possibilities in pathogenesis.

In the late fifteenth century Antonio Benivieni (1443–1502) did much to promote the performance of autopsies and the knowledge of pathology. A native of Florence, he was a cultured humanist as well as a successful physician. In one of the classics of medical history, published posthumously in 1507, he recorded a number of his clinical experiences, many of which had autopsies. The publication bears the title, *De abditis nonnullis ac mirandis morborum et sanationum causis—On some remarkable hidden causes of diseases and of cures* (shortened by Singer and Long to *The Hidden Causes of Disease*).²⁹ The book is in the tradition of the so-called "century," that is, relatively brief recordings of unusual cases, generally published in batches of a hundred. The various centuries were primarily clinical reports that often had recourse to autopsies to settle clinical uncertainties and find the cause of death. They provide a major source of insight into the contemporary medical practices and medical theory. Books of this character were not infrequent in the sixteenth, seventeenth and eighteenth centuries. Benivieni's book is an excellent early example of this type of publication.

The 110 cases are all reported briefly. In about 15 instances autopsies were performed to find the cause of death. Sometimes Benivieni himself performed the dissection, sometimes he was only an on-

looker. But invariably the pathologic findings received only brief mention. Thus, he tells of a woman who had suffered for a long time from intestinal pain and infrequent and painful bowel movements. When she died and the body was opened, the intestine [locus not specified] was constricted by a thick callus. Only a narrow channel was left, so that the stool could scarcely pass. This brief statement represents the whole pathologic report. In another instance the patient vomited almost everything that he ate and he wasted away from lack of nourishment. The entire pathologic description reads:

It was found that the opening of his stomach had closed up and it had hardened down to the lowest part with the result that nothing could pass through to the organs beyond, and death inevitably followed.³⁰

From our present day standpoint these descriptions are certainly inadequate, but we should try to study the Renaissance autopsies in terms of the contemporary values. Benivieni was one of the leading physicians of the period; he described autopsies in brief and laconic terms. Therefore, laconic descriptions characterized the best clinical thinking of the era, and formed a perfectly valid mode of communication with fellow physicians. The historian should not try to impose later values on an earlier period. Apparently the brief references to anatomic changes quite adequately served the medicine of that era, even the best medicine.

Seventeenth Century

In the sixteenth and seventeenth centuries very many autopsies were performed and recorded. One of the great medical compilations of all time is the *Sepulchretum* of Theophilus Bonetus (1620–1689), first published in 1679. A second edition³¹ appeared in 1700, in three folio volumes, and it is this which we have used. The volumes collect over 3000 autopsies, reported in varying length from a few lines to half a folio page or sometimes even more. Some 450 authors are represented, ranging from Galen to the physicians of the late seventeenth century. All the outstanding physicians are included—Bartholin, Fallopius, Fernel, Harvey, van Helmont, Malpighi, Paracelsus, Paré, the Riolans, Sennert, Vesalius, Wepfer and Willis, to single out but a few. The annotations are inconstant and range from a few lines to several pages.

The work is a true treasure chest, but its wealth has never been adequately explored. We must rest content with but a single example,

reported under the heading of "Cachexia" within the broader category of "Cachexia, Anasarca and Leukophlegmasia."³²

The report concerns a 7-year-old girl who had shown signs of "obstruction" in the lower abdomen, evidenced by swelling and firmness of the abdomen and scanty urine. There was a "low" fever, headache, with swelling of the face, and pallor, followed by pulmonary "catarrh" on lying down, serous vomiting, swelling of the hands and blackish thick urine. Convulsions supervened and she died. The mother, who had had severe headaches in the past year, and whose young son seemed to be suffering from the same disease, wanted an autopsy. The autopsy report splendidly illustrates the procedures of the time, as well as the conceptual set and doctrinal background of the era.

The abdomen contained much serum, in which the intestines were floating. The stomach and intestines were swollen with gas. The liver was very large but entirely natural in color and configuration [*constitutione*]. The spleen was normal. The kidneys were three times the normal size [*naturalibus triplo majores*]; the interior showing no defect, the outside entirely destitute of fat, and of varied color. Since from these [findings] the cause of death was not known, the thorax was also incised.

The remaining findings may be summarized: The thorax contained much fluid; the lungs showed "hardening" [*scirrhus*] of the right upper and left lower parts; the heart was larger than normal, with abundant fluid in the pericardium; black clot lay in the right ventricle, like a worm. The head was not opened because time was pressing. The report embodied no discussion or notes. The case was classified as "leukophlegmasia produced by disease [*vitio*] of the lungs."

A few points call for comment. The child seems to have had a clear-cut case of acute nephritis, but this disease was unknown to the seventeenth century physician. In the clinical history he noted the separate features that to us can spell out the diagnosis, but he did not place the findings into a clinical unity, nor did he pay attention to the kidneys, even though they were considerably larger than normal. The association of clinical data and anatomical findings simply made no special impression on him. The time was not ripe for such an association.

Instead, he expressly denied that the abdomen showed the cause of the disease and—presumably for that reason only—he investigated the thorax. There he found changes in the lung, probably broncho-

pneumonia, which he considered the hidden cause of the whole disease picture. He paid attention only to what seemed to him significant. We must not think of him as obtuse but must realize that he labored with a conceptual background quite different from our own today. Medical history has the function of showing how and why the background has changed.

Eighteenth Century

In the eighteenth century, medicine acquired more sophistication than in the seventeenth, and pathology made considerable advance. The autopsy continued to play a major role. Hermann Boerhaave (1668–1738) made a substantial contribution in two of his publications, published as separate *libelli*—today we would call them monographs.

The first appeared in 1724.³³ Boerhaave emphasized the importance of the history. “Everything pertaining to the case must be listed; nor that least thing neglected which a critical Reader might rightly seek to understand the malady.” Accordingly, he gave in great detail the history of a nobleman, a great trencherman subject to gout. Preceding the fatal illness he ate a most injudicious meal: “veal soup with fragrant herbs; . . . a little white cabbage boiled with sheep; spinach; and calf sweetbreads lightly roasted (or fried); a little duck, thigh and breast; two larks; a bit of apple compote and bread; and . . . dessert consisting of pears, grapes, and sweetmeats. With his meal he drank a little beer and a little wine from Moselle.” Shortly after he felt that something “irritated the opening to his stomach.” After unsuccessful attempts to obtain relief by vomiting, he felt a horrible pain and declared that “something near the upper part of his stomach was ruptured, torn, or dislocated.”

Suffering great agonies, he took a great deal of medication by mouth, including many emetics and much fluid, but all without relief. He passed very little urine despite the great amount of fluid ingested. The sufferings were horrible and he died in agony, while the physicians stood by, helpless and completely baffled.

The autopsy procedure, narrated at great length, fills almost six large closely printed pages of text—a far more detailed description than any in the *Sepulchretum*. The autopsy was carefully performed, stepwise, the incision beginning at the xiphoid, going down to the pubis, “and then to the lumbar areas; then making four incisions so as to injure nothing and to remove nothing from its position.”

The different organs and the regions of the abdomen are described

in variable detail, cursorily where there was little change, at length where the appearance was abnormal. No organs were removed. Since examination of the abdomen did not explain the clinical findings "the true cause of the disease was believed to lie in the thorax." Therefore, after the abdominal organs were all restored to their "natural position," the thorax was carefully opened.

This was the first reported case of a ruptured esophagus. The thorax contained over 10 liters of fluid material. The actual rupture of the esophagus and the adjacent pleura, and the collapse of the lungs are vividly described, as is the precise method of the examination. Except for a small incision made in the esophagus, the organs were neither incised nor removed.

A second case report,³⁵ of 1728, also casts interesting light on autopsy procedure. Clinically the case was a complete puzzle. Despite an "exact account of all the symptoms obvious to the senses and displayed during the course of the disease, yet nothing was known of the true cause until there has been an autopsy." The salient features of the highly detailed history: a youngish man (age not given) had, over a 10- to 11-month-period, a slow onset of symptoms, consisting of pain in the left thorax, with annoying cough. The pain spread, grew unbearable, accompanied by utmost difficulty in breathing and severe cough. He died in intense agony, virtually of suffocation.

In performing the autopsy, Boerhaave examined only the thorax. He described the careful incisions and the procedure by which he entered the thorax, trying to preserve everything in its proper location. A huge mass involved the mediastinum and thoracic cavities, compressing the lungs and also the heart and vessels. The homogeneous tumor was "white as purest tallow" and weighed about 7 pounds. We can perhaps hazard the diagnosis of liposarcoma. Apparently, only the tumor mass was removed from the body. After examining the thorax, Boerhaave terminated the autopsy. He had found reasons "sufficient to explain, without exception, all the symptoms," and he "saw no reason for further dissection."

In the eighteenth century, autopsies were being abundantly performed, and references to findings appeared in many medical texts and learned journals. But with G. B. Morgagni (1682-1772) the science of pathology reached new heights.³⁵ The rationalistic approach that dealt largely with a priori concepts, that could find an explanation for every phenomenon and could systematize every facet of disease, had reached its climax with Boerhaave and his pupil Gaub (1705-1780). Meanwhile an empirical approach, with its pa-

tient accumulation of data, was making slow but steady progress.

The *Sepulchretum* had offered vast quantities of autopsy observations but only minimum synthesis. Morgagni, however, crowning a life-time of patient empirical study, not only gathered together masses of pathologic data but connected them with clinical observation in a way that brought new illumination into pathology. The clinical data formed the framework and the anatomical findings furnished the explanation. Morgagni avoided a priori speculations and kept quite close to the observed data and to the inferences that followed quite directly from the concrete anatomical findings.

From the work we learn much about the contemporary autopsy procedures. For example, a woman of 75, very fat, while "sitting very intently at her domestic employments . . . felt something or other move up and down within her . . . the house seemed to her to totter," and after "a very short stertor, she died." Morgagni performed the autopsy the next day. The description of the autopsy and his comments and analysis fill four and half printed quarto pages.³⁶

In opening the body he noted the very thick adipose layer. He cut through the cartilage of the ribs, which offered relatively slight resistance, and removed the sternum. A large amount of fat lay in the mediastinum, and the diaphragm was very high. The lungs were "sound" but he noted plural adhesions on the left, posteriorly. The pericardium, distended with blood, "resembled a spheroid," almost "a span" [approximately 9 inches] in diameter. He made no mention of removing the heart, but apparently examined it *in situ*. He saw a rupture posteriorly, the size of a "lentil" and here the ventricle was thin. In considerably more detail he described "a bone of more than an inch in thickness, in the shape of half a circle, to which the mitral valves adhered." He described aortic calcification and "bony" changes in the arterial system. In the abdomen he noted the omentum and the mesentery, spleen, pancreas, gall bladder (containing 14 stones), and kidneys, describing them briefly, but he did not mention other organs. Then he examined the cranium and its contents. Frontal exostoses drew his particular attention.

The autopsy furnished material for additional studies. He removed the kidneys, the aorta, "the part of the heart that was nearest to this artery and the tubes of the uterus, which were of a white color, that I might, on the day following, examine into some things which do not relate to the disease." But what he did with these organs he did not say.

Autopsies, at least in "private" cases, required express permission.

The granting of autopsy permission was often specifically emphasized. On the other hand, persons dying in the hospital might, apparently, be dissected without permission, but primarily for the benefit of anatomy students. For example³⁷ a woman suffered an attack of apoplexy. After 3 days at home she was brought to the hospital but died within a day. Morgagni was "at this time teaching anatomy in the college . . . and this body was brought to the college, where the greater number of its parts were dissected, but particularly the brain; and this about the eighth day after death." There are many similar instances.

Persons dying of violence were also brought to the college for anatomy demonstrations. In all of these, where the dissection was primarily for the sake of the anatomy, Morgagni noted any pathologic findings. These he could add to other data, when specific pathologic conditions were discussed. Incidental pathologic findings recorded, perhaps, as curiosities, would have no great value until the isolated details were integrated into some broader whole.

Nineteenth Century

Morgagni was indeed the high point of a tradition that had progressed steadily since the sixteenth century. But in the latter eighteenth century new developments, closely linked to the French Revolution, introduced new changes into pathology and the conduct of autopsies. We can regard Xavier Bichat (1771–1802) as a turning point in medical history. In his short life he exemplified what we may call the "complete physician," that is, in his own person he centered all medical activities, both "preclinical" and clinical—anatomy, physiology and pathology, on the one hand, and bedside care on the other. He pursued them all and achieved distinction in all.

Bichat is best known as the so-called Father of Histology who directed attention away from organs toward the components of organs—the tissues.³⁸ The bodily organs, of course, were obviously composites, and the distinction between the parenchyma of an organ and the framework goes back to classical times. But Bichat, highly analytical, distinguished twenty-one different kinds of tissues in the body, established fundamental differences between them and determined many of their properties. He did this without any recourse to the microscope, but solely by dissection and the use of simple physical procedures and simple chemical reactions.

The study of tissues forms part of the science of anatomy. Bichat was also a physiologist, concerned with function and the differences

between the living and the nonliving. And then he was a clinician who worked assiduously in the wards and even more assiduously in the postmortem room. In the year that he died he allegedly performed some six hundred autopsies. But his interest in the autopsies went hand in hand with his interest in living patients. All was linked into the unity of clinical medicine.

In his final work, published posthumously, Bichat commented briefly on the interrelation of medical disciplines. We should "dissect in anatomy, experiment in physiology, follow the disease and make the necropsy in medicine; this is the three fold path, without which there can be no anatomist, no physiologist, no physician."³⁹ The significant feature here is the intimate connection between the clinical study of patients and the autopsy. This point of view received impetus from two major developments. First was the great growth of hospitals in the eighteenth century: vast numbers of patients crowded the wards and furnished a tremendous reservoir of clinical material. Then, a new spirit of scientific curiosity, of scientific interest permeated medicine.

The French Revolution and the Napoleonic Wars had a great deal to do with this, for battlefields create practical demands that must find some sort of answer. But perhaps even more important was the radical change in intellectual climate that swept away the stuffy cobwebs of the old regime and permitted young eager men to rise rapidly, to experiment, to perceive new problems and find new answers. It is no accident that in the first third of the nineteenth century France was the medical center of the world.

"Hospital medicine" was the road to progress, achieved through large numbers of patients, carefully observed while alive, and carefully autopsied when dead. The same clinician who observed them during life performed the autopsy. The correlation of clinical data and autopsy findings, carried out on a vast scale, yielded magnificent progress.

Paris abounded in truly great physicians who practiced hospital medicine—Pinel, Bichat, Bayle, Corvisart, Laennec, Broussais and Louis, to name but a few.⁴⁰ Leading physicians, in their voluminous writings, drew heavily on their autopsy experiences. They would, in their discussions, provide some specific clinical history, then describe the external appearances, then detail the examination of thorax, abdomen and head, but in no set order. Organs were described at variable length, depending on the amount of pathology and the character of the case. The authors of monographs and books tended to

deal with specific topics, thus bringing to bear a large amount of experience on particular diseases such as tuberculosis, typhoid, pneumonia and "gastroenteritis." The spotlight rested on the diseases, and the autopsies were among the tools for that study.

Frequently the descriptions would illuminate the actual autopsy process as well as the attitudes. For example, Prost,⁴¹ a relatively minor French physician of the early nineteenth century, gave equal weight to the clinical observation and the autopsy, and both served to clarify medicine. In his dedication, referring to medicine, he spoke of "a science which must be based on facts, and which too often was the object of vain conjecture." He criticized those who, in approaching pathology, decided ahead of time where the seat of the disease lay, and then examined particularly that organ. Any anatomical changes found there were then interpreted as the cause of the disease and further examination was deemed unnecessary. We have seen that even Boerhaave might follow this method. Prost, on the other hand, declared, "Instead of seeking the cause of disease in the organs presumed to be their seat, I have tried to find out all the disorders of the organs in the diseases, and the differences that can be observed in the fluids and solids during their course."⁴² This we would interpret as a plea for the "complete autopsy." In the preparation for his book, he performed more than four hundred autopsies. None of these took him less than "several hours" to perform, and some of them engaged him for an entire day.

Yet Prost, despite his brave words, was by no means impartial in his observations. He paid special attention to the mucosa of the entire digestive tract. This, he admitted, was a "horribly disgusting" job, but one that would some day provide an unshakeable foundation for medicine.⁴³ Prost thus was an early devotee of the school that assigned a special causal role to gastroenteritis, a doctrine that has become especially associated with the name of Broussais, at a somewhat later date. Prost's autopsy protocols usually described the gastrointestinal tract in a detail considerably greater than for other organs. Prost exemplifies the dictum that pathologists observe what they want to observe, and that their perceptions depend on their theories. The "complete" autopsy is indeed a figment of the imagination.

Medicine of the early nineteenth century forms an extremely complex picture, one that is not as yet been adequately analyzed. Of the many intertwined components we would comment briefly on a few prominent strands.

The correlation of the clinic and the autopsy was the great contribution of the eighteenth century, one that reached still greater heights in the first half of the nineteenth. By correlating the clinical and anatomical findings, physicians defined disease entities more sharply, discovered new diseases, achieved greater precision in diagnosis, and began to appreciate disease-as-process—*ie*, that diseases underwent development, in which the time factor was important. Correlatively, this approach sharpened the critical judgment of physicians and promoted what is popularly known as the scientific spirit.

But certain things the hospital medicine did not do. It had no real effect on the actual treatment of patients or, if you will, on the concrete practice of medicine. And it had relatively little effect on the basic conceptual foundations of medicine that had arisen during the eighteenth century.

Microscopy

In the first half of the nineteenth century, however, other new developments greatly enlarged the framework of medicine. What we can call the basic or preclinical sciences underwent a sharp spurt. Physiology and chemistry made great progress but even more important was the development of the microscope which quite revolutionized anatomy and pathology. Cell theory, the direct outcome of microscopy, introduced a whole new dimension into the study of disease.

Microscopy for a long time was largely an academic and research subject. At first the microscope constituted a research tool with which a relatively small group of investigators made great advances, so that new search for new knowledge became closely associated with microscopic studies. The gross autopsy was the starting point, but actual advances came with the use of the new technics. Microscopy promoted not only superior analysis but experimental study as well. As a result, basic pathologic concepts like inflammation, degeneration, thrombosis and cancer began to take on more precise meanings.

As early as 1844 an enlightened pathologist, J. H. Bennett, recognized the limitation of gross pathology which, he thought, no longer was furnishing "fact sufficiently novel and important enough to advance the study of pathology." But the microscope, and the burgeoning chemical procedures could restore the postmortem examination to its place of importance.⁴⁴

Some indication of this we see in the well-publicized conflicts between Rokitansky (1804–1878) and Virchow (1821–1902). Rokitansky, alleged to have performed 30,000 autopsies, and probably the

most capable gross pathologist in all medical history, was a late-comer to microscopy. Although he did publish some microscopic investigations, he never achieved that real competence which comes only from a lifelong association with a discipline. Virchow, on the other hand, 17 years younger, entered medicine at a more favorable time. He grew up with microscopy and contributed greatly to its development in a way that other pathologists could not match. Rokitansky, skillful as he was in gross pathology, nevertheless failed badly in his theoretical interpretations. Virchow, on the other hand, was an outstanding contributor to the basic theories of pathology.

The traditional gross autopsy, with careful attention to clinical aspects, still performed significant service function, but its research capabilities became recognized as severely limited. Gross examination of organs remained the mainstay of routine pathology and cemented what had already been learned, but in regard to research it served principally to show the path that further investigation should take. The gross autopsy was a preliminary stage in promoting knowledge, rather than the principal methodology, but it nevertheless continued to fulfill its service functions, even though its role in research was diminished.

Technic

Increased attention was being paid to the actual conduct of the autopsy and the standardization of procedures. An important document on autopsy technic is a little book by Virchow, originally published in 1876, with an English edition the same year.⁴⁵ The autopsy had in large part been only a capricious dissection that came to an end when some antecedent questions seemed answered. Progress required some sort of systematization. Virchow, in giving details for autopsy performance, described his own experiences going back to 1844. At that time, autopsies, performed principally by young and untrained surgical assistants, were done with no regular method, so that "it was a matter of difficulty to make any discoveries."⁴⁶ When Virchow became prosecutor in 1846, he insisted on regularity and method and definite technic. The subject assumed particular importance in medicolegal autopsies, which required completeness.

As late as 1859, he declared,⁴⁷ pathologic anatomy was only "a supplement of the clinic. As a rule, the clinical teacher determined while the patient was alive which organ was to be the object of investigation; and the autopsy likewise was usually confined to that organ, or at least dealt with all the others only in a secondary manner." Virchow,

who wanted pathology to be a science in its own right, insisted that all the organs of the body should be minutely examined. While he ignored the comments of Prost, who over half a century earlier had maintained the same point of view, his own examinations were far more detailed than the Frenchman's. However, just as with earlier pathologists, his background knowledge dictated his procedures. Thus, he declared of the pancreas, "The slight importance of this organ, in a pathologico-anatomical point of view, causes its examination to be of little consequence."⁴⁸

Virchow's actual directions need not detain us. One typical protocol, for example, takes up fourteen duodecimo pages. He measured many of the organs but by no means all. No weights were given. The whole procedure took 3 hours. Again, we can think of Prost, who, in 1802, declared that 3 hours was the minimum time for postmortem examination.

An earlier book on autopsy technics deserves mention. Francis Delafield, the American pathologist, published in 1872 a volume entitled *A Handbook of Postmortem Examination and Morbid Anatomy*.⁴⁹ It combined directions for conducting an orderly postmortem examination with brief discussion of principal pathologic findings.

There have been many progressions in autopsy technics and many manuals devoted to their exposition. Procedures changed; for example, the degree to which microscopic study became a more "routine" part of the autopsy, and the relations of gross and microscopic pathology, would form a fascinating chapter in the history of medicine, but one that still remains to be written. As accessory disciplines became relevant to pathology, new methods of examination involved special technics. The history of their development lies outside the scope of this paper. The recent volume, *Current Methods of Autopsy Practice*,⁵⁰ devoted mostly to describing current procedures, also provides a brief historical resumé, and gives a detailed bibliography of works that discuss autopsy technic in which the books by Hektoen, Mallory and Farber can be especially noted.

Twentieth Century

The present complexity of autopsy procedures is a far cry indeed from the autopsies of the seventeenth and eighteenth centuries, yet the modern autopsy still serves a dual function. It must answer a specific question—what is the cause of death of this particular patient? This aspect we call the service function of the autopsy. Then, the postmortem examination may serve to advance general knowledge

and contribute to the science of disease. In earlier times the anatomical dissection was virtually the sole method of advancing the scientific study of disease. Now, however, the dissection is merely a starting point.

Early in the twentieth century, medical progress depended largely on the bedside and the autopsy room. The good clinician paid careful attention to the history, the physical signs and the course of the disease. Then, if the patient died, the autopsy might confirm the diagnosis or, if not, show the true state of affairs so that the clinician could find out where and how he went wrong. From autopsy observations he could increase his understanding of the known and, if research minded, find new paths into the unknown. The outstanding clinicians generally spent considerable time in the autopsy room and frequently were themselves no mean pathologists. The revered Sir William Osler epitomized the best of this era.

The autopsy also served as an unrivalled instrument for education at all levels, from the beginning student to the august professor. At the same time autopsies created a direct link to research in laboratory sciences, such as experimental pathology and bacteriology. "Clinical pathology," especially chemistry and hematology, were also taking on greater importance, but the available tests were relatively few and they fitted in readily to the framework of knowledge dependent on the autopsy.

Despite the rapid advances in medical science, all too much of medical education remained at a low level. The famous Flexner Report of 1910⁵¹ helped to set higher standards—among which pathology and the autopsy enjoyed a strong position. Largely as a result of Flexner's studies the levels of medical education and hospital practice rose sharply over the next thirty years.

Then the Second World War intervened, and 10 years after the close of the war the autopsy came under severe attack. This extraordinary phenomenon deserves a closer examination.

Decline of the Autopsy [?]

Following the Flexner Report a tide of improvements had set in. While the detailed story lies outside the scope of this essay, a few relevant features may be noted. The autopsy began to take an important part in deciding hospital accreditation. The reasoning went something like this: good hospitals have a high autopsy rate; poor hospitals, a low rate. Raise the autopsy rate and the poor hospitals will automatically improve, for more frequent autopsies would stimulate

more careful diagnosis and, in addition, have important instructional force. That a doctor "buries his mistakes" is a hoary jest whose origins are lost, probably back in antiquity. But a high autopsy rate would blunt the force of this comment.

American Board Certification brought about stricter standards for the training of pathologists, so that the average level of competence unquestionably rose. Training centered largely on the autopsy, although surgical pathology became more and more important.

After World War II and the period of readjustment that followed, changes occurred with explosive violence. We will note three significant features.

For a variety of reasons, including stricter standards of accreditation and enhanced public awareness, autopsy rates in hospitals rose quite sharply. As a result the number of autopsies performed as part of the "routine" hospital pathology service went up enormously. This increased the burden on pathologists.

Furthermore, "tests" became increasingly important in medical practice. They usually had genuine value, but in addition they became more and more popular as a sign that practitioners were "scientific." And when hospital insurance footed the bills, the clinical laboratory became the financial center of the hospital, along with the x-ray department. Since the conduct of the clinical laboratory devolved on the pathologist, he had less time for autopsy studies. And since pathology residents had to learn clinical pathology, the time available for learning autopsy pathology diminished.

Coincidentally, first in a trickle and then in a flood, government funds became available for research—experimental research. Research demanded publications. Publications in turn brought about professional reputation, academic advancement, salary increases and, of course, more research grants. As a result of these factors, pathology, in academic circles as well as in community hospitals, was undergoing a metamorphosis.

Shortly after mid-century, critical voices began to be raised, and the autopsy became the focus of attack. In 1956 Isaac Starr published in JAMA an editorial⁵² entitled "Potential Values of the Autopsy Today." In contrast to an earlier period, he said, the present era is "characterized by an increased reliance on experiment as a means of acquiring medical knowledge." Correspondingly, interest in the autopsy has declined, starting with the professor whose chief interest lay in experimentation and extending to the clinical staff. Since the percentage of deaths coming to autopsy was increasing, "The morgue is

swamped with routine work. What used to be a rare privilege has become a burden." Starr denied that "research of importance is coming from studies being made at routine autopsies at present." And as a corollary of the above statements, he queried why anyone would advise a promising young pathologist "to spend much time doing autopsies today." He pointed to the huge stack of accumulated records, from which no valuable information emerged, and thought it "ridiculous to continue gathering routine information of this kind." As remedy he made rather vague suggestions regarding changing the character of the autopsy.

This attack, delivered by an internist (even though a prominent one), aroused spirited rejoinders from pathologists.⁵³ Without treating the many replies individually, we can point out certain general features of the rebuttal.

One line of defense lay in specifying the great medical advances of the previous 20 years that had arisen or developed through autopsy studies—and the list of such advances is impressive indeed. The autopsy, defenders pointed out, could still provide an enormous amount of information. Moreover, the newer technics, such as histochemistry, electron microscopy and hormone assays, could extend the information to be gained by the autopsy. Indeed, to such an extent is this true that "the autopsy, with increasing frequency, is assuming research proportions, thereby demanding in its performance greater skills and increasing expenditures of time and money."⁵⁴

The devotion of department heads to research and the neglect of teaching and service drew many critical comments. There were complaints that new heads of departments often had little interest in the autopsy and were too busy with research and administrative work to teach. "The failure of the autopsy service to yield quick, easy, and immediate rewards in the form of grants, publications, and promotions," when contrasted with experimental work, seemed one of the difficulties.⁵⁵

What is the primary *purpose* of the postmortem examination? One writer insisted that it was "primarily" to check the diagnostic accuracy of the clinical staff.⁵⁶ The questions would then arise, how much time and effort should be devoted to this particular purpose? Undoubtedly Starr had a worthwhile point when he criticized the mass of useless detail that accumulated in autopsy protocols. McManus⁵⁴ considered it unwise to treat all autopsies alike. He, too, stressed the wastage that occurred when every case receives a detailed autopsy. Instead, he pleaded for a selection and recognition of two different categories

of autopsies—each with a characteristic procedure—one of “research” caliber and the other “routine” (degree of detail not specified).

The discussion in 1956 did not settle anything, but from then to the very present, scattered editorials, articles, letters and symposia have dealt with one or another aspect of the autopsy.⁵⁷ In 1965 the topic again provoked attention through editorials and a symposium in JAMA. Hazard,⁵⁸ for example, emphasized the great values of the autopsy, but nevertheless held that their “mass performance” is “not the proper end,” and that there is little point in “merely increasing the number of autopsies.” Instead, like McManus, he pleaded for selection, and would distinguish the “research autopsy” and the “teaching autopsy,” and insisted on close collaboration between clinician and pathologist.

The need for autopsies to check up on the actual clinical diagnosis has been repeatedly stressed. Gall (writing in 1968) mentioned⁵⁹ that in 1912, in 1937, and again in 1960, when autopsy records were examined to determine the range of clinical error, there was “approximately an identical percentage of diagnostic error.” The reasons for this surprise finding are manifold, but the fact remains that clinical diagnosis needs postmortem surveillance. More recently, Bauer and Robbins⁶⁰ again pointed to the discrepancy between the clinical and the anatomical diagnoses.

There is substantial consensus that the autopsy has been an indispensable research tool, an unrivalled teaching exercise, and an important check on clinical diagnosis. There seems a consensus, too, that *mere* multiplication of autopsies will have little value. But if the autopsy is important and if skilled pathologists are so beset with other duties that the number of “routine” autopsies threatens to overwhelm them, what to do about it?

One reasonable possibility: in the “routine” cases do only quick gross examinations, or skimpy microscopic confirmation. A British pathologist⁶¹ had a concrete and helpful suggestion. He admitted the great decline in the appeal that the autopsy was exerting in both academic and hospital medicine. His solution was the introduction of “necropsy technologists” trained especially for their task. The “necropsy technologist” is quite consistent with the American concept of the physician’s assistant, at present a controversial institution. Whether this will help resolve the difficulties, only the future can tell.

But important problems are never solved: at best they may hibernate, only to reappear in the future in a somewhat different guise.

In regard to the autopsy, perhaps a lesson of history can be summarized in a quotation from a JAMA editorial.⁶²

It is a pernicious misconception that the mere performance of postmortem dissection leads to progress in medical science . . . progress depends not on the autopsy but on the person who is examining the material. Those who believe that the more autopsies we perform, the more medical science will progress, are pleading not for more autopsies but for more persons who can profitably utilize the data of autopsies, persons who have imagination, originality, persistence, mental acuity, sound education and background, the indispensable "prepared mind" without which observations are quite sterile. It is a grave disservice to confuse the performance of autopsies with the spark of insight which the autopsy may trigger. We want the insight; and autopsies alone, no matter how numerous, are not the equivalent.

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