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# William Cowper

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*William Cowper, now virtually forgotten, was the first of the surgeon-scientists of Great Britain. He was the first to bring the power of the experimental method to bear on practical surgical problems and to urge that the principles of surgery be drawn from an understanding of the "animal oeconomy." In these areas he anticipated the celebrated Hunterian school of surgery by more than half a century and by his example he actually set the foundation on which that school was built. Cowper was a scientist of a high order. He was the first to prove the existence of capillaries in higher mammals, to describe naturally occurring arteriovenous shunts in the lungs and spleen, to define the essential physiology of aortic valvular disease, and to recognize the nature and consequences of arteriosclerotic vascular disease. He was the author of two important anatomy books and the first English language treatise on general physiology available to surgeons. He was one of the first two surgeons ever honored by election to the prestigious Royal Society of London. An analysis of the works and doctrines of William Cowper appears to cast serious doubt on the common teaching that the idea of "scientific surgery" was the sole creation of John Hunter.*

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DURING THE EIGHTEENTH century, surgery discovered itself to be an activity of the brain as well as the hand. During that period and by that discovery, it was redeemed from the stagnation and triviality that had characterized it in earlier ages. This was the period of the "Enlightenment" of surgery and the beginning of the "modern" era. During this time surgeons awakened to matters of physiology and pathology and began to appreciate the possibilities of the experimental method.

It is a well-established doctrine that this modern era of surgery began with the school of John Hunter (1728 to 1793). Hunter has been immortalized as the "founder" or "father" of what is termed "scientific" surgery. A long line of adoring historiographers have repeatedly stated that until the advent of John Hunter there had been only darkness and empiricism in surgery and after him all had become science and light.

This view, originally advanced by Hunter's brother-in-law, Everard Home in 1814<sup>1</sup> and repeated by Hunter's student, Joseph Adams, in 1817,<sup>2</sup> has been

echoed by most later historians. It is evident, for example, in the epitaph of Hunter given by the eloquent Berkeley Moynihan:

Before Hunter's time, surgery was a thing apart, independent of all other sciences . . . governed only by the experiences and aptitudes gained in the day to day practice of the art. All advance was therefore slow even when recognizable, and was largely empirical. No physiological knowledge nor any experimental discovery broadened the old path or opened up new ones. Hunter changed all this.<sup>3</sup>

The rise of surgical science was more complicated and perhaps less sudden than it appeared to Home, Adams, and Moynihan. It is simply not true that John Hunter suddenly appeared and singlehandedly wrenched surgery from the clutches of philistinism. Such constructions are romance and not history. Their charm and simplicity have helped them become dogma but have not helped them become true.

It is not, however, the purpose of the present article to burn down the quaint churches of the Hunterian mythology or to detract from the real importance of John Hunter to the history of surgery. Rather, it is the intention of this article simply to observe that the idea of basing surgery on scientific principles did not originate with John Hunter. This idea had in fact been around in

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quite well-developed form for some time before Hunter was born. This article illustrates this assertion by describing some of the works and doctrines of the worthy but forgotten William Cowper (Fig. 1).

William Cowper was born in 1666, the youngest son of an undistinguished family of the village of Petersfield in the south of England. Nothing is known of his early life except that he received an unusually fine primary education in Latin. At 16 years of age he was sent by his family to London and became an apprentice to a surgeon named William Bignall. He completed his apprenticeship under John Fletcher and for reasons that are unknown spent 9 rather than the required 7 years in servitude. His teachers were men of no particular distinction.

In 1691, Cowper was awarded the diploma of the Barber-Surgeons' Company. This, together with a license from the local Anglican bishop,<sup>4</sup> entitled him to enter into the practice of surgery. The field was even more crowded with pretenders then than it now is. A contemporary of Cowper's described the situation in London:

If you take a prospect of all the outparts of the town, you would imagine there were a plenary indulgence granted to all empiricks, quacks, barbers, old women and others whom it shall please to take upon them the profession of chyrurgery. You will either think this art the most easily attainable of all the others since mere pretence to the same will carry a man very far into the good opinion of the people or, last of all, you will find just reason to imagine this formerly sublime profession is now become a sanctuary or refuge for decayed tradesmen, who know not how to live longer upon their own employment.<sup>5</sup>

What Cowper had actually won by his long apprenticeship was not entry into a learned profession or high art, but admission to a low, trivial craft, humiliated by its association with barbering and degraded by the competition of empiricks and quacks. Its province consisted of little uncouth tasks, traditionally considered to be beneath the dignity of the physicians. Its ordinary operations were the dressing of wounds, the reduction of fractures and dislocations, the draining of pus from ripe boils, and especially of "venting the storehouse of vital spirits" by letting blood. This was the most characteristic and by far the most often practiced of the surgeon's operations. It was performed in all cases involving inflammation of a part of the body and for fevers, epilepsies, manias, lethargies, and any of a hundred other indications that might occur to the surgeon, physician, or the patient himself. Major

operations were quite rare; major thoughts were rarer still, and in any case not the province of the lowly surgeon but of the better educated physician before whom the surgeon was servile in all theoretic matters.

What little intellectual content there was in surgery consisted of two things: a smattering of gross anatomy presented at occasional dissections in the Barber-Surgeons' Hall<sup>6</sup> and some vague and variable traditions concerning the cause of diseases bestowed on surgical apprentices at puberty by their masters.

The books most consulted by the few British surgeons who thought well of reading were James Cooke's shameless recapitulation of ancient doctrines,<sup>7</sup> Scultetus' picture book of tools and major operative tortures,<sup>8</sup> and Richard Wiseman's compendium of cases drawn from his personal practice.<sup>9</sup> Also available were some English translations of the works of the venerable but long dead Ambroise Pare.<sup>10</sup> These were the only books accessible to the average British surgeon who usually was not competent to read the great body of literature written in Latin. It must be emphasized, however, that the scarcity of books was not of itself a terrible disadvantage, since the ordinary surgeon had a small appetite for literature and relied on his own experience for instruction.<sup>11</sup>

Such self-reliance had long been traditional in surgery and was a major cause of its pathetic insufficiency in matters of theory. This weakness was known to surgical writers such as Wiseman, who considered that it might best be corrected by the collection and publication of surgical case histories. Thus this became the format of Wiseman's 1676 text. It must be observed, however, that there is essentially nothing in Wiseman's understanding of surgical diseases that can be regarded as much advanced over Hippocratism. For example, Wiseman sets out his ideas of the immediate causes of disease in the language of "humours." Not only does he fail to draw ideas from the great physiologic works produced during his century by experimenters such as Lower, Harvey, Borelli, and Leeuwenhoek, but he discounts the notion that the "philosophical curiosities" discovered by these men had anything whatsoever to teach surgery. The theoretic basis that Wiseman thought most appropriate for surgery was collected experience in practical matters. This was the philosophy of the foremost surgical writer that Great Britain had produced as the end of the seventeenth century approached. The idea had not yet occurred that surgery might improve through an understanding of the mechanism of the body in health and disease.

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Fig. 1. Portrait of the proud William Cowper from his *Anatomy of Humane Bodies*, 1698.

Thus the surgery that Cowper's time had inherited was still the old surgery. In truth, it was still the ancient surgery very little improved. It was a confusion of vague traditions, a little anatomy, and many strange experiences. It was devoid of certainties and had not yet discovered the method by which it could form reliable principles. This then was the condition of the art as Cowper found it, and although he had become a surgeon as the result of 9 year's labor, he was not content to be merely a surgeon in the image of the ignorant empiricks who were most of his colleagues. Unlike them he could and did read the works of the ancient surgeons, as well as the transcriptions issued by the "moderns." He was not satisfied with either. He turned over the works of the physiologist Willis and reviewed those of Mayow and Croon. He read *De Homine* by Descartes and *De Motu Animalium* by Borelli. He became a convert to the radical school of physiologic thought that considered the animal body to

be a machine, acting according to fixed laws. Most significantly, he was a convert to the experimental philosophy of Francis Bacon, which had captivated a great many of the active minds of the seventeenth century. He began to study anatomy from bodies as well as from books, and he began to perform experiments on living animals.

In 1694 Cowper produced a small book of experiments on the function of muscles in which he attempted to correct erroneous doctrines on the subject that had been introduced by speculators. In this work, which he titled *Myotomia Reformata*,<sup>12</sup> Cowper harranged bravely against the old traditions of plagiarism and fantasy and on behalf of the new, more certain, experimental science:

The greatest part of books now extant are mere copies or extracts and useless rhapsodies. Originals are few and rare; mankind finding it much easier to transcribe and steal than to

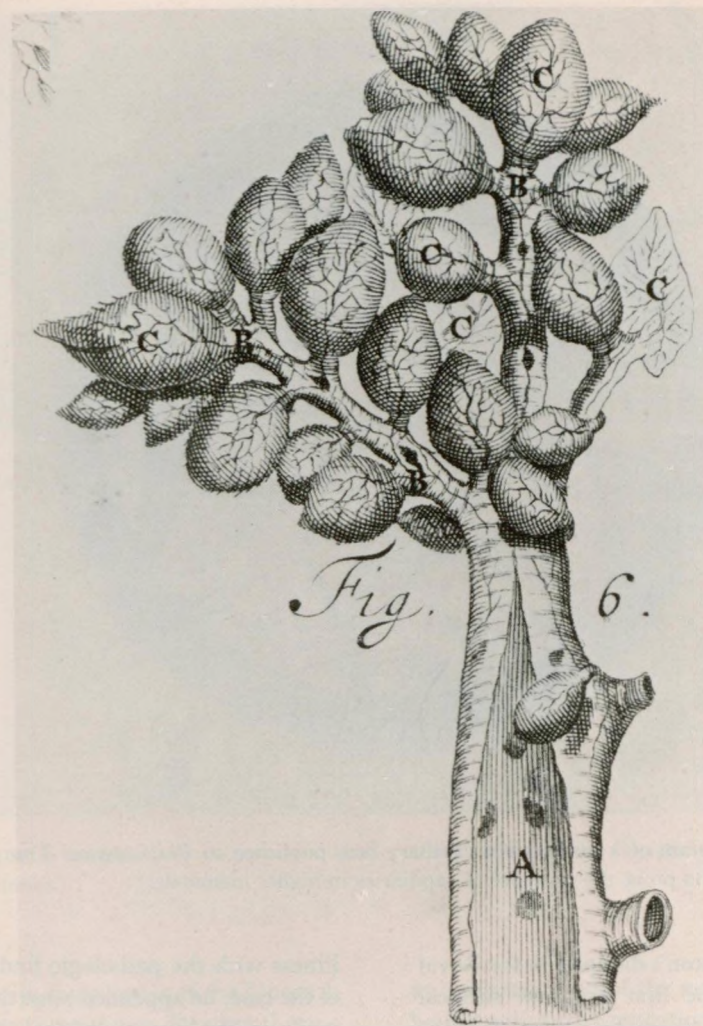


Fig. 2. Fine anatomy of alveoli from Cowper's *Anatomy of Humane Bodies*. This figure had been previously published by Bidloo.

invent and improve. . . One great mistake has much obstructed the advancement of true knowledge and that is a great opinion the senses are gross and ignoble and that abstracted contemplations are the perfections of human nature. And so it comes to pass that man is fed and pleased with chimeras and shadows instead of true substantial knowledge which is to be learnt by true physical examination of sense and experiment, by enquiry and observation.

These were bold and radical notions to be advocated by a lowly surgeon—all this physiology and philosophy. However, Cowper was not content merely to show that experimental philosophy could correct the past errors of anatomists. He began to apply the same methodology to surgical questions. This is evident from a little paper that he presented to the Royal Society in

1694.<sup>13</sup> The paper was concerned with the effects of styptic powder invented by a surgeon named John Colpatch. The powder was advertised to have a miraculous efficacy as a hemostatic. Cowper made experimental trials of the substance in the wounds of animals and humans. He found that it not only lacked the fabulous properties claimed but that it was a violent caustic that produced eschars similar to those made by an actual cautery. Cowper reported his findings to the Royal Society simply and honestly with the suggestion that medications such as styptics should be subjected to fair experimental trials before they became available to the public. This was exactly the kind of practical approach to science that Francis Bacon had advocated in his *Novum Organum* and *Advancement of Learning*.

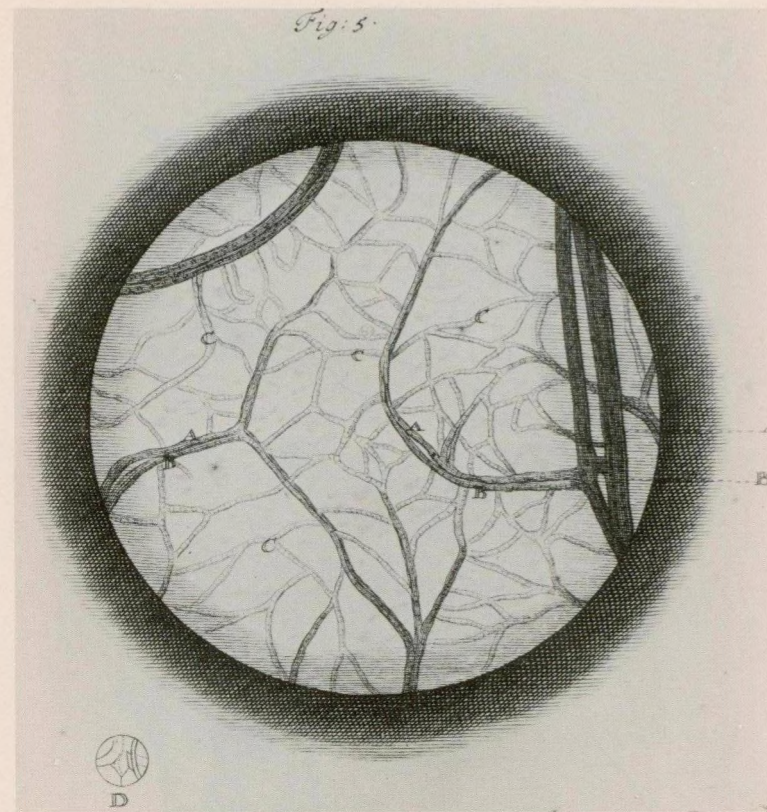


Fig. 3 Cowper's diagram of a mammalian capillary bed, published in *Philosophical Transactions* in 1702. Cowper was the first to prove the existence of capillaries in higher mammals.

It was much approved by Bacon's disciples in the Royal Society and represented the first practical surgical paper ever presented to that society by a member of the surgical craft.

Two years after his first little triumph, Cowper again appeared before the Fellows of the Royal Society. His subject on this occasion was a review of the entire known mechanism of digestion and the absorption of chyle into the bloodstream.<sup>14</sup> His treatment of this difficult and mysterious physiologic issue drew on the works of seventeenth century physiologists. It strengthened his reputation among the foremost scientists of his country. Indeed, rarely before had a surgeon enjoyed such respect among real intellectuals and rarely since.

In the same year, Cowper published the case history and autopsy findings of a young woman who had died of a tumor of the kidney.<sup>15</sup> In this paper, which demonstrates the thoroughness and ingenuity that typify his work, Cowper showed the reasons for the patient's symptoms and correlated the entire clinical

illness with the pathologic findings. To his discussion of the case, he appended some microscopic observations made in the fins of living fishes that supported the theory that obstruction of the capillaries was the general cause of tumefactions.

All of this is modestly reported by Cowper and is related to the particular case under discussion. This report is remarkable for the general freedom from systematic theorizing and exaggerated conclusion that so commonly afflicted the medical writing of those times and that have not been entirely banished in our own time. What Cowper produced was genuine surgical science. His report of this case represented the most comprehensive clinicopathologic study published in the *Philosophical Transactions* of its time. It set the standard imitated by surgeon-scientists who came after him.

On the basis of these early works, William Cowper was elected a Fellow of the Royal Society in 1696, one of the first two surgeons ever so elected. (The other surgeon elected in the same year was Charles Bernard,

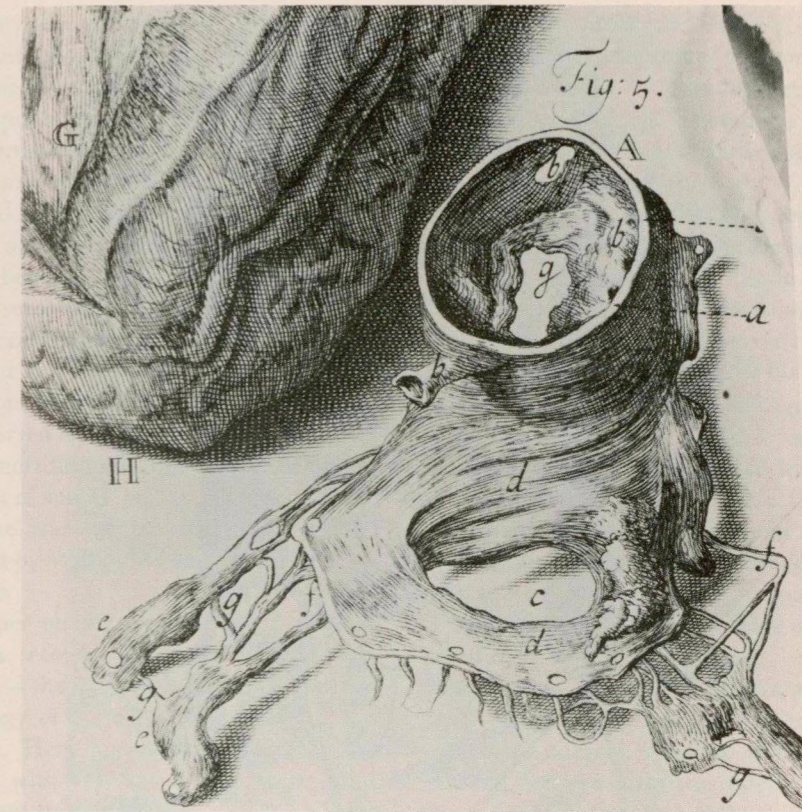


Fig. 4. Diagram of a stenotic and incompetent aortic valve, published in Cowper's 1705 paper on the ossifications of arteries.

an inconsequential scientist, but surgeon to the Queen.) He joined such exclusive company as Newton, Leeuwenhoek, Wren, and Halley. He became one of the Society's most prolific contributors.<sup>16</sup>

In 1698 impatient for a popular fame greater than that generally afforded to 32-year-old surgeons, Cowper simultaneously produced both the major work and blunder of his life. The work was a magnificent anatomy of the human body<sup>17</sup>; the blunder was to use as its illustrations all the plates that had been published 13 years earlier by Gottfried Bidloo<sup>18</sup> of Holland (Fig. 2). Bidloo<sup>19</sup> took this act in very bad humor and blasted Cowper in a fierce letter to the Royal Society. Cowper, who had once bitterly condemned the plagiarisms of former ages, now found himself accused of the same crime.

However, more important than the controversy surrounding the illustrations<sup>20</sup> is the fact that Cowper introduced his book with a long discourse on the "animal oeconomy." Cowper made a strong plea that

an understanding of the mechanism of the body could be the only sure foundation for medicine and surgery. He was most radical and most definite on this point:

Without a due knowledge of the animal mechanism, I doubt not all our attempts to explain the multiform appearance of animal bodies will be vain and ineffectual, and our ideas of the causes of diseases and their symptoms as extravagant and absurd as those of the Chinese and Indians. Nay, I am afraid the whole art of physick will be little better than empirical.

It is crucial to recognize that in this passage written at the end of the seventeenth century, Cowper has unmistakably set out the essential doctrine of the "Hunterian" school: That the principles of surgery should be drawn from an understanding of the animal mechanism. Moreover, Cowper has done so not in some obscure tract but in the finest English anatomy produced to that time.

Cowper's treatise on the "animal oeconomy" was the first primer of physiology available to the average

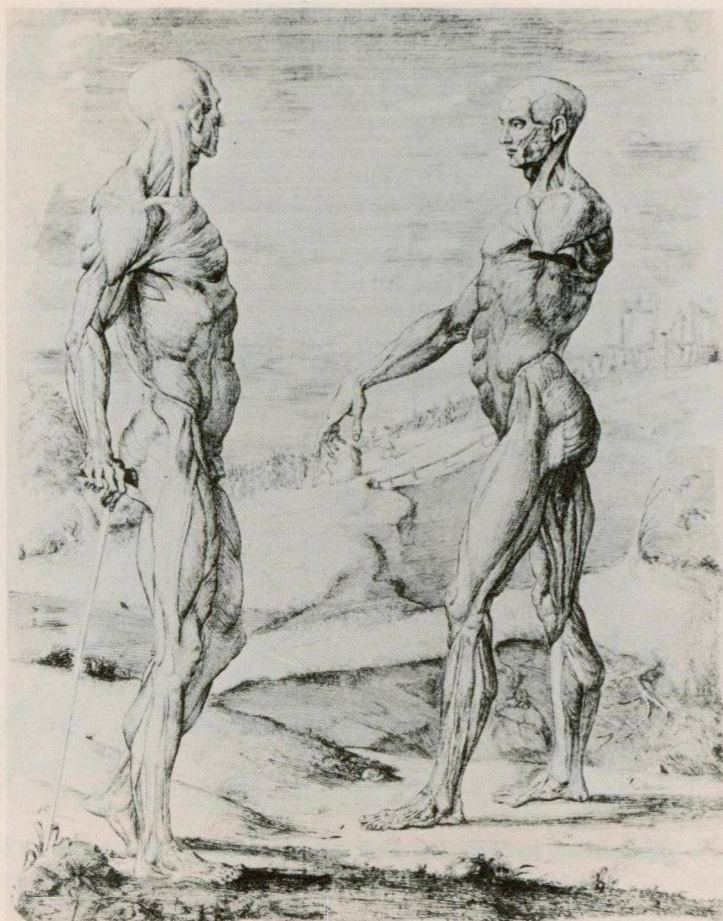


Fig. 5. An illustration from the second edition of the *Myotomia Reformata*, published 15 years after Cowper's death by his friends.

British surgeon. It was also a principal source for later writers of physiology, such as Boerhaave. Its importance has been forgotten by historians of surgery, who seem to have been distracted from a just appreciation of its value by the controversy over its illustrations.

With the publication of his *Anatomy*, Cowper achieved some of the fame for which he had hoped. It is doubtful whether he found much pleasure in it, tainted as it was with scandalous controversy. It is certain that such fame as he had did not make him content. It is equally certain that Bidloo's attack did not demoralize him. He proceeded with his work, finding in simple labor that serenity that the well-wishes of the multitude cannot provide and the hostility of all mankind cannot prohibit.

In 1702 he described the glands of the urethra that have since borne his name.<sup>21</sup> In the same year, using elegant preparations of mesentery, he first proved the existence of capillaries in dogs and cats (Fig. 3).<sup>22</sup> These vessels, which had been demonstrated in fish and

amphibia by Leeuwenhoek, Malpighi, and Swammerdam, had not been seen in mammalian quadrupeds until Cowper did so. His work was thus received as a major contribution by his contemporaries, and it helped him regain the name of an honest scientist among his countrymen.

In 1703 he reported to the Royal Society on the history of a young woman with a massive pulmonary abscess.<sup>23</sup> He had successfully treated the abscess by surgical drainage, a remarkable and reportable achievement by itself, but typically he was not content merely to present an account of his success in a difficult case. Instead, he used the case to introduce a discussion of the pulmonary circulation in cases of inflammations of the lungs. Here he introduced the idea that pulmonary arteriovenous shunts were capable of dilating when the capillary circulation was obstructed, as in the case of a large abscess. This was an induction of astonishing sophistication for its time. It was not based on speculation, but on a long and diligent study of the

microscopic anatomy of capillaries in experimental animals. It represents a good example of the type of work that is now termed "surgical" science.

Soon after the publication of his work on lung abscess, Cowper produced a paper that should be considered a landmark in the history of surgery.<sup>24</sup> He reported that the calcific narrowing of arteries universally found during autopsies on the aged was not, as had been generally believed, a normal process. Rather, it was a specific disease (Fig. 4). Moreover, Cowper demonstrated by careful clinical-pathologic correlations that this disease was the principal reason that the feet of elderly persons were susceptible to the mortifications so often observed by surgeons. Until then it had been taught that mortifications and gangrenes were caused by the "want of spirits" or the "degeneration of humours." Thus he was the true originator of the doctrine later taught by William Hunter<sup>25</sup> that arteriosclerosis is a disease.

In this same paper on the ossification of arteries, Cowper reported a second, equally novel and very important discovery—the clinical symptoms and the basic pathophysiology of aortic valvular stenosis and aortic regurgitation. Here he also reported that the ventricles of hearts with valvular disease were often dilated and sometimes thickened.

This paper, containing two discoveries of the first rank, was the last of Cowper's contributions to the Royal Society. He was dying of the effects of asthma. He turned all of his remaining energies to the completion of a second edition of the *Myotomia Reformata*, which he had long planned and which he intended to make a larger and more magnificent work than the first edition. However, his hopes out ran his powers as is common with the greatest of men, and despite desperate exertions, he was unable to complete this project.

By 1708 he was no longer capable of working. He surrendered his notes and illustrations for the *Myotomia* to friends, begging them to finish his book (Fig. 5). He fled from the city and the follies of great haste and great ambition to a small country town in the south of England not far from where he had been born. There he died on March 8, 1709, at a place called Bishop Sutton. There he now lies buried beneath the chancel of a church, forgotten. His only memorial is the small marker placed over his grave by his wife. It testifies that he had given the whole passion of his life to the advancement of anatomy and surgery. It tells that he had ruined his health by his severe labors and that he had died in the forty-third year of life.

Cowper's influence lived after him. It is plainly evident in the works of William Cheselden, who had

been his student, and is likewise seen in the works of other eighteenth century surgeons including James and John Douglas, William Beckett, Daniel Turner, and Claudius Amyand. These men carried forward Cowper's idea of basing surgery on an understanding of the true mechanism of the body.

It cannot be said that Cowper alone won the soul of surgery to science. Nonetheless, it appears that a process of enlightenment began with him. After Cowper's example, the literate among the surgeons of Britain began to take their art more seriously as an intellectual discipline. Using his example they began to show greater curiosity concerning the immediate causes of diseases and to be less content with the vague humoral pathology of the ancient surgeons and Wiseman. They began to imitate Cowper's methods and contribute original observations and experiments to the literature. Indeed, the *Philosophical Transactions* of the Royal Society and the pamphlets of the early eighteenth century fairly bulge with the reports of their efforts.

The gap between physician and surgeon in matters of theory began to narrow. That between the barber and the surgeon began to widen so that by 1745, the bond between them was utterly broken. The practical work of surgery was little changed, but the way the surgery conceived of itself was altered forever. In this changed culture and very much enriched surgical environment, the Hunterian school formed around the middle of the eighteenth century.

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