was a small boy of 10 in 1936 when the tranquil, bucolic life I had up to then spent in my grandparents' home in Central Italy was shattered. Late one night my grandfather—he who was everything in my life, from whom all other relationships derived their meaning—had been felled by a toccata, the dreaded stroke. Roused from sleep, I heard my grandmother tell me that the angel of death was wrestling with my beloved grandfather and that I should hurry to fetch Annina, the elderly widow famous in our parts for her uncanny knowledge of medicine. Intense, intelligent, with extraordinarily bright eyes sunk deep in her wrinkled face, Annina was accorded the status of folk-physician not only by the people of the countryside but even by the country doctor himself, who had seen the cures wrought by Annina's application of her "friends," the leeches.

As I raced through the dark streets toward Annina's house in the valley, strange fantasies added to my terror. The specter of death was everywhere: lurking behind the bushes, whispering in the wind. It was as if the whole air had come alive with the sibilant sounds. Leaving the cobbled road, I took a shortcut through the fields, reminding myself that I was there to help my grandfather, if possible, to thwart the angel of death, who might even now be beating his wings over grandfather's bed.

At last, against the backdrop of the star-filled sky, I spotted the tall poplars around Annina's house. Starstruck by my loud knocking and pale face, Annina asked a few questions, then seized her bag and clasped my hand. Like athletes forced to sit on the sidelines too long, together the old medicine woman and I hurried back the way I had come to our medieval house rising out of the Umbrian plains like a gray stone mirage.

After exchanging a few words with my grandmother, Annina gazed down at my grandfather, sat beside his bed and fussed with two small bottles of water full of gray-green worms. She straightened them out on a dish, and having palpated a few spots on my grandfather's ears, neck and temples, she gently but firmly pressed the worms on to his skin, holding them awhile until they fastened themselves to it (Figure 1). The sight of those disgusting creatures wriggling like tiny snakes around grandfather's face and neck reminded me of pictures I had seen of Medusa's head and filled me with horror. Petrified, I watched Annina's reenacting on my grandfather the ancient medical ritual of leeching. A deep sadness swept over me, and for a while I felt that this was an irremediably bad world when such a wonderfully dear and good man as my grandfather should have to be subjected to this gross procedure.

Later, the country doctor, a barrel-shaped young man, arrived. Although grandfather was motionless and breathing irregularly, the doctor smiled and spoke a few pleasantries with what seemed to me a useless attempt at cordiality. Disregarding Annina's leeches, he attempted to shake my grandfather's hand, but the pressure was not returned. He then raised my grandfather's leg, which fell heavy and inert over the edge of the bed. For what seemed like an eternity, the doctor stood silent at the foot of the bed, his hands joined under his chin like a man absorbed in meditation. Then he opened his bag and picked up a hypodermic syringe. As though skimming through a history book in which centuries pass before one's eyes in rapid succession, the doctor brought medical practice back to modern times. Very slowly, with the hesitant gesture of someone stroking a shy, possibly dangerous, creature, he injected a yellow fluid into my grandfather's back. "Camphor helps the heart," he murmured to my grandmother. Then he turned to Annina and conferred with her in the arcane language of medicine. The upshot was their decision to repeat the leeching treatment.

By this time, the worms were swollen and saturated with blood. When Annina sprinkled a few drops of vinegar on them, they quickly detached themselves from my grandfather's person and tumbled on to the pillow and sheet. Since there was no time to buy more at the town pharmacy miles away, Annina decided to use the same leeches. Plucking the bulging creatures from the bed, she rushed downstairs to the kitchen, placed some wood ashes from the fireplace in a large dish and plunged the leeches into the ashes. At first,
they went into a kind of convulsion and then began to regurgitate the blood. Their bodies contracted rhythmically, sometimes spasmodically, and each time small geysers of blood gushed out. Leaving the leeches to their regurgitation, Annina ran back to my grandfather's room. Rivulets of blood trickling from the tiny wounds left by the leeches had wreathed grandfather's head, pillow and bedsheet. Instructing my grandmother to press towels against the blood vessels, Annina returned to the leeches and again rolled them on the ashes to ensure complete regurgitation. My grandfather bled for almost an hour, enough time for Annina to wash the leeches and attach them once more.

Despite a terrible reluctance to watch the sickening process again, I felt drawn to my grandfather's bedside. Feeling my hand in his, he opened his soft, limpid eyes, full of hope. His hand was quivering; the fingers contracted slightly. I stared at the strange creatures laboring in their own way to save my grandfather's life and sensed in my childish imagination that nature was close at hand, around us, inside us, even fastened to us.

Many years have passed since that frightening night at my grandfather's bedside. The dramatic events of the second World War in Europe in which I was involved, family deaths and partings, and the challenge of my immigration to America all left me older than my contemporaries, burdened with debts, and enrolled as a graduate student at an American university. I was worlds apart from the world of Annina and her leeches. Or so I thought. But like one of those geologic seams that go underground somewhere along the European coast only to emerge on the other side of the Atlantic, Annina's little creatures reappeared one day, busy and vibrant as ever, in my zoology class laboratory. They were there in a jar, right in front of me. As if seeking to escape, they circled around the brim of the jar like weightless miniature dolphins, then submerged to the bottom, only to emerge once again on the surface. In the strange and mysterious way our memory works, that scene conjured up the faces and events of that unforgettable night long ago: my grandparents, Annina, the country doctor—and the leeches. I experienced one of those rare feelings that resemble no other that I know of when science discloses some wonder that puzzled us in our childhood.

"Class Hirudinea," the laboratory instructor was saying, and his voice brought me back abruptly from the past. In the laboratory, all was harmonious bustle and facetious remarks as the leeches were transferred to Petri dishes and placed under dissecting microscopes. No longer anonymous, they were named, identified and classified, and pencils were busily recording their gross anatomy. Microscopically, the skin appeared gelatinous and translucent, with reflexes of iridescent green. Dark pale granules were scattered in wild profusion throughout the cylindrical bodies or...
clustered in masses of concentrated hues. The bodies were spaced in rings, "and therefore" the instructor sententiously remarked, "they belong to the phylum Annelida." The alimentary canal, a long tunnel which began with a sucker with three horny teeth, branched into large pouches and opened at the other end with another sucker. Later we learned that these suckers fasten onto and pierce the skin and that the blood is sucked out by the action of a muscular pharynx. A substance produced in the pharyngeal glands, discovered by Dr. John B. Haycraft in 1884, prevents coagulation of the blood and hence the wound made by a leech continues to bleed for a long time after the leech has detached itself.2,3

Late in the 1950s, Dr. F. Markwardt succeeded in isolating an anticoagulant enzyme, hirudin, an activator of thrombin which prevents conversion of fibrinogen to fibrin.4 The leeches ingest approximately 40 cm² of blood, almost 10 times their own weight, and their satiation often lasts for a year. Since they feed outside an aquatic environment, the skin secretes a thick, enveloping sheet of mucus to reduce dessication of the body.

If, for comparison, we put at the top of the Scala Naturae the "evil, flesh-eating beast," as Jean-Paul Sartre called man, leeches are indeed very low class, phylogenetically speaking. Yet one of this plebeian class emerged into fame, attained an illustrious lineage, and even merited the appellation never given to any other animal: medicinalis. The lowly leech, Hirudo medicinalis, stood for centuries with the doctor and priest by the bedside of our ancestors!

For almost 3 thousand years, few treatments have been accorded the admiration, verging on awe, that surrounded Hirudo medicinalis. Some time ago, I spent many hours at the National Library of Medicine, where I obtained an unobstructed view of a spectacular saga in medical history. The modern electronic visual devices available there made almost instantly accessible those old books that in my youth rested peacefully on the highest shelves of European libraries and led me to discover a prodigious literature on leeches. Perusing those books was a voyage of discovery into a remarkable chapter of the history of medicine. Nobody knows exactly when leeches began to occupy an important corner in the little bag of every respected physician; nobody was able to say exactly why they were there. Every physician made use of them in whatever way he liked, and they became indispensable to the treatment of every ailment under the sun.

In the XVI book of the Iliad, Homer described a field hospital where physicians treated the battle wounds of Odysseus, Agamemnon and Eurytides with leeches.5 Homer’s use of the term, however, is somewhat enigmatic since the Greek word tsetrai can be translated as "leeches" in its archaic and obsolete sense of "physician" or "surgeon" (T.D. Burney, personal communication). Even admitting the possibility of a double entendre in the use of the term, it is noteworthy that from medieval times through the Age of Enlightenment, the term "leech" was used to designate English physicians; moreover, even Anglo-Saxon medical writings were often referred to as "leech books."6

Nikandros of Colophon (c. 275, B.C.) referred to the ancient use of leeches in "Alexipharmacia," a poem of 630 verses.7 In Roman times, the humoral concept of diseases propounded by Galen (c. 129 to 199, A.D.), physician to the emperor Marcus Aurelius, prompted the use of leeches since blood-letting would eliminate the obnoxious substances in the body and restore the balance of four humors—blood, phlegm, yellow and black bile—which is altered in disease. Galen must have had a keen interest in leech husbandry since he wrote that "...if the tails of leeches are trimmed, more blood will be extracted."8

The writings of Galen influenced the thinking of Antyllus (c. 150, A.D.), one of the greatest surgeons of antiquity, who described in some detail venesection, arteriotomy, cupping and the application of leeches for a variety of diseases.9 Interest in leeching continued throughout the Byzantine and Middle Ages, and the influence of Galen on the use of leeches is obvious in the writings of Paul of Aegina (600, A.D.)10 and Rhazes (850 to 923, A.D.).11 The Persian physician Avicenna (980 to 1037) went even further, contending that leeching made amantes ne sint amentes, that is, kept lovers from sinking into madness.12

Closer to our own times, Ambroise Paré (1510-1590) was the most celebrated surgeon of the Renaissance and author of the Ouvres. This magnum opus is outstanding not only for its discussion on the treatment of gunshot wounds and the ligation of arteries after amputation, but also for an entire chapter devoted to leeching.13

During the 17th and 18th centuries, blood-letting in general and leeching in particular were important features of the stock-in-trade of barber-surgeons. We are reminded of this fact by the pervasive barber pole with its red-and-white diagonal stripes: red strands for blood, white for bandages.14

Francois Joseph Victor Broussais (1772 to 1832), an ex-army surgeon in Napoleon’s army, gave a tremendous impetus to leech treatment. The recipient of a vicus militaire training in medicine, he affirmed that there are no diseases, only symptoms, and that a regimen of starvation and the application of up to 30 leeches would cure every ill. Doubtless under his influence, Napoleon imported about 6 million leeches from Hungary in 1 year just to treat his soldiers.15 Called the "most sanguinary physician in history,"16,17 Broussais caused a boom in the leech industry. As a result of his teachings, the supply of leeches in France became exhausted; from an adequate supply of 2 million to 3 million leeches in 1824, 42 million had to be imported in 1833. Twenty-one years later, that number had increased to 87 million.

Leeching was extensively used in military medicine not only in France, but also in England. In his Outlines of Military Surgery (1832), the British army surgeon, Sir George Bollingal, recommended repeated leechings for gunshot wounds, especially those of the joints, and advised that an ample supply of leeches should be available in military hospitals.18 During this same period, a young woman was reported to have...
attempted suicide by using leeches. Whether she was successful is not known, but it is probable that the 50 leeches she applied to her body actually killed her.\(^{19}\)

It would seem that leeching never attained wide usage in the United States; at least, by 1958, only a few thousand were being imported from Europe. In one recorded instance, American ingenuity prompted their application to a practical problem: a Chicago drug store once advertised the sale of leeches "to reduce accumulated blood in bruises around the eyes"—probably a euphemism for what may well have been a widespread ailment: black eyes.\(^{20}\)

After World War II, leeching generally lost favor and no longer occupied an honored place in the arsenal of medical cures. But there were exceptions. Perhaps the last famous patient to be treated with leeches was the 73-year-old Joseph Stalin. According to Time, on March 16, 1953, hours before his death of a cerebral hemorrhage, doctors reached back desperately for an old remedy: leeches to suck at the dying man’s veins.\(^ {21}\) But Stalin succumbed to the common fate of all men, and the leeches were relegated to their aquatic world.

But only for a time. Like the sphinx, the slimy creatures resurfaced recently in the world of medicine. An aggiornamento brought up to date by Dr. R. Lent\(^ {22}\) indicates that important biologic data are accumulating on the medical use of leeches. Large quantities of hirudin have been extracted annually from an estimated 50,000 leeches to study the mechanism of blood clotting.\(^ {4}\) What is the advantage of hirudin over heparin, the time-honored anticoagulant since 1938? Unlike heparin, hirudin is not inactivated by the "heparin-neutralizing" platelet factor 4 released during the coagulation process, and its effect does not require the presence of antithrombin III, which is consumed during the diffuse activation of the coagulation system. Hirudin is superior to other anticoagulants also because it does not interfere with the biosynthesis of clotting factors and does not affect other enzyme systems of the blood such as lipoproteinases.\(^ {4}\)

Surgical procedures likewise have been found to benefit from the use of leeches. Mr. Roy Sawyer, who operates Blopharm, a leech farm in England, last year sold £100 thousand worth of Hirudo medicinalis to hospitals and research centers around the world.\(^ {23}\) The "bloodthirsty" creatures are primarily used after microsurgery to reattach small body parts like fingers, phalanges and toes. After transplantation or reattachment of tissues, venous return sometimes fails to occur with a consequent reduction in arterial supply which nearly always results in tissue necrosis. Mechanical and chemical attempts to prevent necrosis after venous failure have been unsuccessful. But by secreting hirudin around the wound margin, leeches have been found to unplug small vessels and to improve blood flow through the reimplemented extremities.\(^ {23}\)

An array of active agents found in several leech species was discussed in a recent meeting held in England to evaluate the medical and scientific uses of the leech. Drs. J. Edwards and R. Monroe found that leech saliva contains a hyaluronidase, a collagenase and a fibrinolysin.\(^ {22}\) The hyaluronidase, also called orgelase, is believed to increase blood flow in the area of tissue on which the leech is feeding. Could, therefore, hirudin and orgelase be useful in unblocking cardiac blood vessels? This question deserves and is receiving inquiry. Dr. I. Baskova, for example, detected a new enzyme, destabilase, which destroys lysine bonds in crossed-link fibrin. He also observed an antiatherosclerotic effect of leech saliva whereby the "lipid swelling in the intima of atherosclerotic rats was diminished or disappeared" (I. Baskova, personal communication).

These findings are the last noteworthy addition to the long catalog of contributions made by leeches that began with Homer at the time of the Exodus, 3,500 years ago. Through the rough-and-tumble, sometimes muddled and unscientific history of medical successes and failures since ancient times, physicians somehow, sometimes, recognized the therapeutic, beneficial effect of leeching under certain circumstances. We may or may not agree with Roy Sawyer’s statement that "the secretion from bloodsucking animals is to cardiovascular diseases what penicillin was to infections."\(^ {23}\) But one thing is certain: the gray-green, unprepossessing, bloodthirsty creatures are reappearing in the physician’s vade-mecum.

My solo journey through that dark and scary night long ago remained something of a legend in the annals of my family. It assuredly was a highlight, a long-remembered highlight, in my young life. As I sat beside the bed of my beloved grandfather after the bloodletting I had witnessed, I could not foresee that just a few years later, as I was leaving for a short vacation, my grandfather, now partially recovered from the stroke, would clasp my hands in his worn ones and say in low tones: “This is good-bye; I will never see you again.” He died before my return.

References


9. Major, RH. In Ref 8,329.

10. Mettler CC. In Ref 8,330.

11. Mettler CC. In Ref 8,330.


13. Mettler CC. In Ref 8,429.


