



ARTIFICIAL LIMBS.

THE TENDENCY OF CIVILIZATION. — MAN'S PHYSICAL AND MORAL POSITION IN NATURE. — THE CURE OF WOUNDS AMONG SAVAGES. — SURGERY AMONG THE EGYPTIANS. — THE TESTIMONY OF HERODOTUS. — SURGERY AMONG THE GREEKS. — AMONG THE ROMANS. — THE USE OF DISSECTION IN THE STUDY OF ANATOMY. — SURGERY AMONG THE EARLY CHRISTIANS. — THE REVIVAL OF SURGERY. — SURGERY IN AMERICA. — THE CORK LEG. — THE ARTIFICIAL LIMBS OF MODERN TIMES. — THE KNOWLEDGE GAINED BY EXPERIMENT. — THE UNION ARTIFICIAL LIMB COMPANY OF PROVIDENCE, R. I.

In the increasing progress of civilization, the tendency of which is to secure for mankind better conditions for comfort, health, and the development of all the complex human faculties, there is no special department the advance in which presents a more satisfactory record than surgery and the modern inventions which are allied to it, and designed to remedy, as far as possible, the injuries which, of necessity, surgery produces.

Physically, as morally, man stands at the head of creation, and in his physical organization, the specialization of the functions of his organs, and their mutual interdependence, together with the importance of each of them to the well-being of the whole, are carried to the farthest point. In the lowest form of animal life, the zoöphytes, which consist merely of a sack for receiving food, if an individual is turned inside out he continues to live, and his new stomach performs its operations with apparently equal ease. The hydra has been divided into numerous parts, with the only effect of making as many separate animals as parts into which the single individual has been divided. Many varieties of worms may be divided in the same way, each of the parts becoming soon as perfect an animal as the original specimen. Crabs and other kinds of shell-fish, with many insects, reproduce the legs they lose; but, though this power of healing injuries is possessed in

kind by the higher animals, yet they possess it in a diminished degree, according to the increasing perfection of their organization, the greater specialization of their organs, and the greater interdependence of their parts.

In many of the savage tribes, who lead hardy lives, living upon simple food and taking constantly vigorous exercise, very severe wounds are cured by simple natural processes, so as hardly to leave a scar. Nor are similar instances unknown in civilization, where the individual, by the same course of life, has possessed the same degree of health.

But, unlike the crab, the human body cannot replace, by a natural process of growth, a leg which has been lost by accident. It is upon the superior character of the human brain, and the consequent ingenuity and invention of the race, that man has to depend for the means of supplying the loss of any such important organ in his animal economy; and for the success already attained in this branch of industry the present generation may well congratulate themselves.

The practice of surgery was early established among the Egyptians, and among them was a privilege of the priests. The custom of embalming the bodies of the dead, in which process they were opened, gave opportunity of becoming acquainted with its constitution. On the ruins of Thebes, according to the authority of Kenrick, in his *Ancient Egyptians under the Pharaohs*, "basso-relievos have been found displaying surgical operations and instruments not far different from some in use in modern times."

Herodotus, who visited Egypt during the fourth century before the Christian era, has left us, in his account of that country, a description of many of their manners and customs. In this work he speaks of many of their surgical operations, and makes mention of their appliances. From this some writers have supposed that he describes their use of artificial limbs. Though it is most probable that the Egyptians made no use of such artificial limbs as have been introduced during the last thirty or forty years, yet it is quite probable that they invented and used some appliances which would enable a person who had lost a leg, for example, to walk about with more or less facility. For a people who had arrived at sufficient surgical knowledge to cut off a leg, the conception would not be difficult of supplying it with something like

a wooden stump, or else with crutches, by which locomotion would be possible.

But, in common with all the nations of antiquity, the Egyptians, as far as our information of them goes, knew nothing scientifically concerning the construction of the human body. They were debarred this knowledge by the fact that religious scruples forbade the dissection of the body; and thus, though they had a general conception of the various parts of the body, and of its internal arrangement, yet they knew nothing of the relative importance of its parts, or of their functions; and their surgical, like their medical practice, must have been purely empirical and experimental.

The Hebrews, during their captivity in Egypt, probably obtained some ideas concerning surgery; but, even at a late period in their history, they had greater confidence in the skill of the priests of Phœnicia, who were also surgeons, than in their own, for the treatment of wounds and fractures. In 2 Kings 1, 2, Ahaziah, wounded by a fall, sent to consult the priests of Baal-zebub whether he should recover. Other instances can be found in the same book, which show that the surgical knowledge of the Hebrews was very slight.

The Greeks early obtained a knowledge of surgery from the Egyptians, and, with their inquiring disposition of mind, added to it by inventions of their own. *Æsculapius* acquired, in the mythical period of Grecian history, such a reputation for his skill in surgery, that he was raised to the dignity of a demigod; had temples built in his honor, and was fabled to be the son of *Apollo*. *Homer*, in his poems, speaks of his two sons, *Podalirius* and *Machaon*, as companions of *Agamemnon* during the Trojan war, who rendered great service to the Greeks in dressing their wounds. The first of these he praises for his skill in blood-letting, and the second for his skill in dressing wounds. Despite, however, the presence of these divinely descended surgeons, it would appear from *Homer* that fractured limbs were considered beyond their art, and in such cases the poet invokes only the aid of *Apollo* himself, making no mention of the possibility of human aid therein.

For centuries, however, among the Greeks the practice of surgery was retained as a monopoly in the family of the descendants of *Æsculapius*, who were known as the *Asclepiades*, and who had schools of medicine established at *Rhodes*, *Cnidus*, and *Cos*.

About the sixth century before the Christian era, Pythagoras established at Crotona another school of medicine. One of his pupils, Damocedes, saved his life, when taken prisoner by the Persians, by setting a dislocated ankle for Darius after the Egyptian surgeons had failed to do so. The next distinguished name in the annals of Grecian surgery is Hippocrates. To perfect his knowledge of the anatomy of the human body, the dissection of which was forbidden, he dissected those of apes, as being the animals most nearly approaching the human form.

In the third century before the Christian era, dissection was first introduced in the school at Alexandria which was founded by Ptolemy Soter. The surgeons who introduced this necessary appliance for the study of anatomy were named Herophilus and Erasistratus, and the world owes much to the knowledge they thus gained.

In ancient Rome the first great name we meet in the annals of surgery is that of Celsus. Among the subjects spoken of in his writings we find the process of tying the arteries, when they were wounded, with remarks upon dislocations, fractures, and amputations of the limbs. Before the Christian era other distinguished surgeons appeared in Rome, but their labors were not devoted to the special branch which occupies us.

With the advent of Christianity surgery degenerated. Again, the prejudice in the popular mind against the use of dissection, operated as an impassable barrier against the accurate and positive study of anatomy; while a new and perhaps a greater obstacle in the way of surgical progress was raised by the superstitious reverence for the relics of saints, with which the spread of the new religion became connected. It was impossible that surgery, or any branch of positive science, should be pursued, when adoration at the shrine of the supposititious bones of some hypothetical saint was universally believed to be the most efficacious means to be found for curing disease, or relieving an unfortunate from the sad results of some accident.

The first writer upon surgery who appeared in the first five hundred years of Christianity, who is worthy of mention, is Aetius, who lived between 500 and 550. His writings are both numerous and valuable, and yet he urges the importance and the efficacy of charms and amulets in averting or curing disease or accidents.

About the middle of the seventh century the Arabian surgeons

in Spain began to attract the attention of Europe by their skill and learning. The revival of Grecian learning began among them before it was known in Middle Europe. Rhazes, Avicenna, Albucasis, who invented the probang, Avenzoar, who flourished between 852 and 1100, are the chief names of those who acquired the most distinction while the dark ages still buried Europe in ignorance.

During this time the practice of surgery in Europe had, by degrees, fallen more and more into the hands of the priests, who were the only persons in the dense night of superstition who had some little knowledge; but, by the edict of Tours, in 1163, the practice of surgery was forbidden them, since it was supposed to call their attention away from the more important subject of spiritual healing.

For the next two centuries or so the practice of surgery degenerated, therefore, chiefly into the hands of the barber surgeons of Europe. At the hands of Andreas Vesalius, who was born in Brussels in 1514, the study and practice of surgery received the new life, and commenced the course of vigorous growth, which has characterized this study up to the present time. From his early youth his attention was strongly directed to anatomical studies, and he revived the practice of dissection, though he commenced it against all the prejudices of the time, and in face of the dangers of the Inquisition.

So strongly, in his own nature, did the modern spirit of inquiry battle with the restraining superstition he had inherited from the times in which he lived, that, it is said, he never commenced the dissection of a subject without first kneeling in earnest prayer to be forgiven for such a crime.

In 1543, when only twenty-eight years old, he published his great work, in folio, entitled *De Corporis Humani Fabrica*—the Fabric of the Human Body. In this work, which opened the modern era of surgery, he took persistent and strong ground against the superstitious reverence for antiquity; and so admirable has been its effect, that it has been well called “the discovery of a new world,” and “an immortal work, by which all that had been written before was almost superseded.”

The world was ripe for the new era, and about the same time Fallopius and Eustachius, with, soon after, Paré, in France, appeared to take part in the great work of establishing surgery upon the positive and scientific basis of dissection. To the last

of these belongs the honor of having revived the process of tying the arteries after amputation. Up to this time, during the middle ages, the stoppage of the blood was produced by cauterization with a hot iron, and the application of tar, or boiling oil. In many cases the severing of the limb was performed with a red-hot knife, in order to cauterize the flesh as soon as the cut was made. This method is a fair sample of the cruelty of the methods then employed in all the operations of surgery. It would seem almost as though it was thought that the more the patient was made to suffer, the greater the credit which belonged to the operator.

During the seventeenth and eighteenth centuries many distinguished surgeons flourished in Europe. The simple mention of their names would occupy too much room here; but the tendency of the practice of surgery began to be turned towards the methods of alleviating suffering; and, towards the beginning of this century, conservative surgery, or the theory of preserving, as far as possible, the injured parts, began to replace "heroic surgery," or the too prompt use of the knife. To the American surgeons belongs the chief credit for the inauguration of this new method, and many of its processes are peculiarly our own.

In the United States, before the Revolutionary War, our surgery was only a reflex of that of the mother country. The exigencies of that struggle, however, developed the talent which had before been lying hidden for want of an opportunity; and since that time American surgery has had an independent growth, and been recognized throughout the civilized world for its contributions to the knowledge, and the appliances for lessening the dangers and the sufferings, of disease and accident.

Among the numerous improved methods and discoveries which the world owes to the invention of American surgeons, the use of chloroform and other anæsthetics, and of artificial limbs, are, perhaps, the most noteworthy. The present perfection of these last is due entirely to American genius. From the times of Herodotus to the beginning of this century, the unfortunate patient who had lost a leg would find in the whole world no appliance to replace it but a wooden stump and crutches.

The idea that it was possible to replace these clumsy and inadequate means of locomotion with an artificial leg, which would enable the owner to walk, dance, run, skate, or do anything with one or even with two artificial legs which he could do with his natural ones, even as late as fifty years ago, appeared to be the

absurdest visionary dream—an attempt to realize the poetic vision of the famous “cork leg,” which formed the basis of the song concerning the fate of Mynheer Van Flam, “the richest merchant in Rotterdam,” who, having lost his leg, had it replaced by an artist who

“had made cork legs his study and theme:
Each joint was as strong as an iron beam,
And the springs were a compound of clockwork and steam.”

Having tried on his leg, however, it ran away with the unfortunate merchant; and, though he tried in every way to stop, and even

“flung himself down to stop its pace,
But the leg got up and continued the race.”

So that to this day, as the song informs us, he is still dragged unwillingly in his journey over the world.

It would seem that the poets who have sung the artificial leg had lost the original prophetic character of their profession, since not only in this ballad, but in Hood's story of *Miss Kilmansegg and her Golden Leg*, the new limb proved the death of its possessor, Miss Kilmansegg having had her brains dashed out with her leg by a burglar who was attracted by the solid gold of which it was composed.

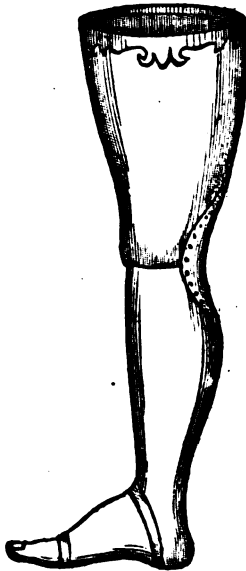
The history of the improvements in artificial limbs belongs entirely to this century. The first were made of cork. Though the first contained many improvements upon the old “peg leg,” or wooden stump, yet they were far from perfect.

The number of men wounded in the late civil war, and the generous policy of the government towards them, so increased the demand for artificial limbs that numerous inventions were patented in this direction. The materials used in these various inventions have been wood, leather, sheet iron, tin, zinc, raw hide, rubber, and a combination of these, with other materials, the compositions of which are the inventors' secret. The combinations of these various legs have been intended to secure ease and security in the motions, and to imitate those of nature as closely as possible; but, as is usual in all inventions, the first methods used for this purpose have been clumsy, and, on trial, have been found imperfect.

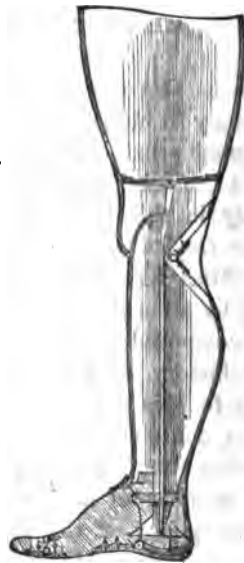
It is only thus by experiment and observation that the knowledge can be gained of what are the requirements in such cases,

and what means shall be taken to make an article which shall be perfect in all respects — strong enough without being too heavy ; so articulated as to work easily, and, in its natural movements, imitate the action of walking ; while, at the same time, its motions are secured by a mechanism which will not wear out easily, but will be permanent.

In the artificial legs made by the Union Artificial Limb Company of Providence, R. I., these qualities are so admirably attained by simplicity of arrangement, that it is not too much to say that they are perfect. The annexed engravings will illustrate the peculiar advantages claimed by the artificial limbs of this company, and the simple but effective methods they use to attain them.



No. 1.



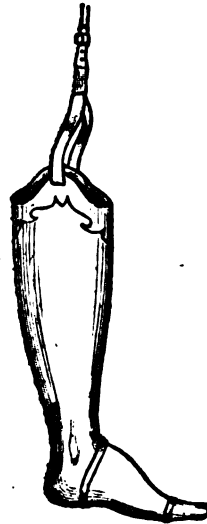
No. 2.

In the first place, by the use of Manilla paper as the material used in their manufacture, great strength is obtained with great lightness. (No. 1.) This company has often replaced legs of other material, weighing eight pounds; by one of their own weighing but little over two pounds. The importance of lightness in an artificial limb has been so uniformly proved by experience as to be now unquestionable. At first it was naturally supposed that the limb might approximate in weight the natural member which it replaced ; but this has been found to be a great mistake.

Then, too, the construction of these legs is such that the weight of the body is brought directly to the ground through the heel, without the intervention of an ankle joint; imitating nature in this respect, and securing the advantage which the old wooden leg had over all the methods prior to this invention. Its mechanism for the knee and ankle joints (No. 2.) is also the simplest, using no metallic bars, bolts, or springs, so liable to become worn or broken by use. The knee joint works automatically, by a rubber spring working over a pulley, and, as will be seen from the sectional view, bringing the leg and foot into a natural position in walking, without any muscular strain upon the



No. 3.



No. 4.

rest of the leg. The ankle joint works upon a new principle, giving the foot a rolling motion (No. 3.), like that of nature, so as to avoid the clapping sound, generally made in other legs, when the foot touches the ground.

The material of the leg is so manufactured as to be tough as horn, and entirely impervious to moisture, and insensible to the differences of temperature. As the leg is moulded upon a cast taken from the stump, it fits with perfect accuracy, and avoids the irritation which is frequently so objectionable from legs which do not fit perfectly. (No. 4.) The uniform testimony from those who have used the legs made by the Union Artificial Limb

Company, replacing with them, in numerous cases, the limbs of other manufacture, proves conclusively that, for use, these legs are as near as possible a perfect substitution for nature's handiwork; and it is a matter of congratulation that invention, guided by science, should have done so much to alleviate the loss by accident of so important a part of the body.

