scarcity of phenomena, the lack of muscular relaxation, and the great tendency to the production of asphyxial states. The narcosis of ether is characterized by phenomena of irritation and stimulation, by a moderate tendency to the production of asphyxial states, and by the marked absence of phenomena of depression as compared with chloroform. The narcosis of chloroform, as compared with that of ether, is characterized by the absence of irritation and stimulation, by a tendency to the production of mechanical asphyxia, and by the occurrence of phenomena of depression.

(For details of the administration of the general anæsthetics for surgical purposes, the reader is referred to the author's article on *Chloroform, Ether, and Other Anæsthetic Agents, Administration of.*)

Thomas L. Bennett.

ANÆSTHOL.—This is an anæsthetic recently introduced by Willy Meyer, of New York, to replace the A.C.E. mixture. He mixes chloroform and ether in molecular proportions, *i.e.*, 43.25 per cent. of chloroform and 56.75 per cent. of ether by volume, and calls the mixture "M. S." Of this he takes 83 volumes, and adds to it 17 volumes of ethyl chloride. The mixture has a boiling point of 40° C. (104° F.), and would seem to be open to the objection urged against the A. C. E. mixture, that constituents of different volatilities do not volatilize equally. We might expect the ethyl chloride to vaporize more rapidly than the ether, and this more rapidly than the chloroform. *W. A. Bastedo.*

ANAKHRE. See *Goundou.*

ANAPHRODISIACS.—This is a term applied to agents which are used to lessen an immoderate or morbid sexual desire, but the treatment must be of wide scope and include the moral, dietetic, and hygienic management of the case, while not infrequently surgery must be called upon. The causes of aphrodisia are many, and not the least important is reflex irritation of the genitalia, caused by physical peculiarities or deformities, phimoses, strictures of the urethra, diseases of the prostate, chronic constipation, fissures or hemorrhoids of the anus, eczema, highly concentrated urine, etc. In other cases the reflex irritation may be caused by the presence of worms in the rectum or in the vagina, in the case of female children, and by excessive exercise causing friction of the thighs in young children (horseback riding, bicycle riding). These conditions will each call for its own special treatment in addition to the general measures which should be adopted; for the detection and relief of the exciting cause are difficult problems and far more important than the exhibition of drugs. For another class of patients, those suffering from diseases of the nervous system or those with psychical perversion, the essential of treatment is confidence in the physician, on the part of the patient, and suggestion, hypnotic or otherwise. Many authenticated cases have been recorded of permanent cures based upon the treatment by suggestion, and it is invaluable in cases of neurasthenia.

In general, for the treatment of aphrodisia nothing will be found better than physical and particularly mental work to the point of fatigue. The latter accomplishes its results in two ways: first, by exhausting the brain where the sexual impulse (if not reflex) has its origin; and secondly, by so absorbing the patient's interest as to preclude the occupation of his mind by lascivious thoughts, pictures, and mental impressions. The anaphrodisiac effect of mental activity is easily explained when we consider the large amount of nervous energy which accompanies each conjugal act.

In the general management of a case the physician should advise a non-sedentary life, as much as possible in the open air, light diet, with an absence of meats, coffee, highly seasoned foods, and alcoholic stimulants; the kidneys should be kept well flushed, the bowels well open, and the patient should sleep on a hair mattress, with light covering, in a cool, well-ventilated room. As a full bladder is frequently a cause of irritation, it should be emptied upon going to bed and the first thing in the morning. The patient should arise early and take a cold douche or sponge bath. The only mechanical contrivance which seems to be of much benefit is one that will prevent the patient from sleeping on his back, and for this purpose a towel knotted at the back may be used. The insertion of rings in the prepuce or labia and the local application of caustics are to be condemned. Drugs which may be used are the bromides, gr. x. to xx. three times a day, and antimony, chloral, salicin, conium, and other depressants; nauseants may be used with care, and are effective sometimes. *Charles Adams Holder.*

ANAPLASIA.—This word is used by some writers synonymously with anaplasty, having the meaning of a repair of injured parts by means of plastic operation. In 1893 its use in an entirely different sense was introduced by Hansemann, who wished to designate by some specific term the morphological and physiological differences which exist between the cells of malignant tumors and those of the normal parent tissue.

The type and character of the parent cells are usually preserved to some extent in the tumor cells which arise from them; as, for example, the cells of a squamous-cell carcinoma of the skin may undergo a horny change; those of an adeno-carcinoma arising from cylindrical cells are more or less cylindrical in shape; the cells of an adeno-carcinoma of the thyroid may produce a colloid-like substance; metastases of an adeno-carcinoma of the liver may secrete a bile-like fluid; and the sarcomata arising from the chromatophores of the skin produce melanin. These resemblances of tumor cells to their parent cells are not so marked as the differences which exist between them, both in morphological and physiological characteristics. The latter are shown by striking variations in size and form; by changes in the finer structure of the nucleus and cell body as shown by staining reactions (hyperchromatosis, hypochromatosis, etc.); by abnormal cell-division forms; by the changed chemical character or total absence of cell function; and by the tendency to undergo degeneration. To all of these alterations in cell character which constitute malignancy Hansemann would apply the term anaplasia, as opposed to heteroplasia and metaplasia. According to his view, the significance of these changes must be that the cells of malignant tumors have lost in differentiation and so have acquired the power of individual existence. The manner in which the cells have undergone this change or the etiology of malignant tumors is not included in the meaning of the term. There can be no doubt that the use of the term anaplasia in this application is of great service; and though Hansemann's views have met with much opposition, it has gained a wide acceptance in modern pathology. *Aldred Scott Warthin.*

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ANASARCA. See *Circulation, Disorders of.*

ANATOMY, HISTORY OF.—Considering the necessity of the anatomical sciences as a basis for the proper study of the healing art, and the high position assigned them in modern times, it may seem strange that their early development was slow, and the knowledge of the ancients concerning the structure of the human body crude and superficial. The principal cause of this was the prevalence of animistic ideas, it being thought that spirits inhabited or controlled the body in some mysterious way. Involuntary movements, such as the pulsation of the heart and arteries, the twitching of muscles, the phenomena of respiration and bodily heat, were all considered indubitable signs of the presence of such spirits, to which were ascribed most cases of disease and disordered action.

After leaving the body the spirit was thought to maintain some occult relation to it. Hence the corporeal remains were either preserved with pious care, or burned or entombed to prevent their suffering insult or injury that might affect the career of the spirit in the other world. Mingled with these superstitious ideas were others derived from horror of death and repulsion from corrupting flesh. Contact with a dead body was usually held to be a defilement requiring long purification, and to attempt to inspect its internal structure was a sacrilege meriting the severest punishment. Dissection was, under such circumstances, practically impossible. It is certain that but few writers of antiquity were able to avail themselves of this method of research.

The sources of information were therefore indirect. Animals killed either for food or sacrifice, the occasional examination of persons severely wounded or suffering from eroding diseases, the noting of the effects of putrefaction which displayed the deeper structures, especially the bones, were the usual means employed for the investigation of the human body. In Egypt, it is true, bodies were eviscerated for the purpose of preserving them as mummies; but this appears to have been done by a low class of servants under the direction of priests who regarded the interests of the spirit in the other world as the only essential, and who therefore gave no thought to exact anatomical knowledge.

Yet among the ancient Egyptians are found some of the earliest attempts at recording anatomical data. The Ebers papyrus, of about 1550 B.C., and said to be the oldest complete book extant, relates to the healing art and contains incidental allusion to the structure of the body. Vessels and nerves are together designated as "metu"; of which four are distributed to the nostrils, four to the temples, four to the head, two in each hand and foot, etc. The heart is regarded as the centre of the vascular system, and vessels containing blood, air, water and other fluids pass from it to all parts of the body. Vital spirits are said to enter one nostril and penetrate to the heart; an idea which was to have a great effect upon anatomy and physiology as far down as the seventeenth century. Similar determinations, of no greater value, are found in papyri of a somewhat later date.

Contemporary with the Egyptian culture, or possibly anterior to it, was that of Chaldæa and Assyria from which the Phœnicians and Hebrews derived much. One of the contributors to the Ebers papyrus is stated to be from Byblus, a town of Phœnicia. Certain cuneiform inscriptions indicate that the situation of the vessels of the neck was known, as they describe the compression of these structures to relieve the pains of circumcision.

The anatomy of the Hebrews was probably derived mainly from Chaldean, Assyrian, and Egyptian sources. The principle of life was believed to reside in the blood (Gen. ix. 4; Lev. xvii. 11), which was accordingly forbidden as food and used as a propitiatory offering. The heart was supposed to be the seat of the understanding, courage, and love; to dilate with joy, contract with sadness, harden or soften with the passions. These expressions, which have become wholly figurative in modern times, were formerly believed to be literally true. The later Talmudists had some anatomical knowledge of the female genitalia, the œsophagus, the lungs, the kidneys, the spinal cord, and the cauda equina. One of the rabbis, at the close of the first century, is said to have boiled a body for the purpose of obtaining the skeleton. A fabulous bone, "luz," was thought to become the seed of the body from which it is to be renewed at the resurrection.

The early writings of India contain no anatomical knowledge except names of a few parts of the body. Somewhat later (900–200 B.C.) there are rude attempts at the enumeration of structures. To what extent these enumerations are based upon actual examination and misinterpretation of anatomical facts it is impossible to say. In them the primitive elements of the body are air, bile, and phlegm, air having its seat below the navel, the bile between the navel and the heart, the phlegm above the heart. Seven organic products were believed to be formed from these primitive elements: watery chyle which in the liver and spleen forms blood, from which arises flesh which forms cellular tissue, from whence comes bone which generates marrow, which gives origin to semen and menstrual blood. The ancient Hindoos are said to have practised dissection, it being held lawful to pursue such investigations for scientific purposes, though under many limitations and restrictions; but the sculptures of the rock-cut temples of Elephanta and Ellora show ignorance of the anatomy of muscles. Later authors appear to have had a vague idea of the circulation of the blood, as they state that the watery chyle circulates through the vessels and irrigates the system as water does a field.

The Chinese have not, even at the present day, any exact anatomical knowledge. The tracing of their crude notions back to the mists of the past is of purely archeologic interest, and it is difficult to say whether the allegations of great antiquity made for some of their medical writings are based upon authentic facts. They considered the elements of the body to be air, water, "metal," and "wood"; the liver to be the seat of the intelligence, the seat of life to be in the middle of the breast. Arteries and veins were not separately distinguished, but some notion of a circulation or translation of the blood appears to have been advanced, as it is stated that it completes a course throughout the body five times in twenty-four hours.

The Japanese in matters of anatomy copied from the Chinese. Their older writings are curious mixtures of fact and error. They teach that the heart contains blood, rules all the other viscera, and is connected with the liver, lungs, spleen, and kidneys; that blood is prepared in three "combustion organs" of rather mythical character, perhaps the thoracic duct, the pancreas, and the lacteals. They assert the structure of the lungs to be like that of a honeycomb, and state that they contain a nourishing gas which penetrates the whole body outside the vessels that carry the blood. The brain, the spinal cord, and the marrow are said to be of one nature, the brain having the highest rank. The seat of the soul is stated by most authors to be the heart, as it has been seen in some animals to beat after the severing of the head from the body. Others place it in the brain, the spleen, the lungs, the kidneys, or the liver. The nerves are often confounded with the tendons, often described as tubular canals. In the middle of the eighteenth century, a physician named Yamawaki obtained permission from his prince to dissect a body, an illegal act that could be done only under powerful protection. He published his observations and declared that the older teaching should no longer be thoughtlessly followed. Dissection was thereafter surreptitiously practised, and very accurate wooden models of the skeleton were made. After this anatomical works from the Dutch were translated into Japanese.

It is among the Greeks that we first meet with a knowledge of anatomy that can be called scientific. With keen and active intelligence they examined and speculated upon all things in the world around them. Prepossessed with the anthropocentric theory of the universe, they attained only a partial and distorted view of natural phenomena, but often showed astonishing powers of generalization in speculative theories. Among them arose the group of so-called "natural philosophers," at the head of whom we find Pythagoras (584–504 B.C.). He attempted to explain natural phenomena by means of harmonic numbers which he considered as actual entities having mysterious powers, the elements of the body being comprised in the number 10, each single number (1+2+3+4) having therein a counterpart. He was the first to deny the spontaneous generation of animals, holding that all life must spring from germs preexisting in the semen which, formed from the brain of the male, combines with moisture from the brain of the female, being the perfected foam of the blood. This idea is perhaps connected with that of the origin of the goddess of generation, Aphrodite (ἀφρός, foam), from the

foam of the sea. To the successors of Pythagoras are assigned by later writers some anatomical investigations and discoveries. Thus Empedocles (about 500 B.C.) discovered the labyrinth of the ear, Alcmæon, his contemporary, the Eustachian tube and the optic nerve, Diogenes of Apollonia (450 B.C.) described the great vessels, all after the dissection of animals. It is to him we owe the names of the amnion and the chorion, membranous envelopes of the fœtus. Empedocles is said to have advanced some crude ideas of the modern doctrine of the survival of fit and adapted animal forms. Democritus (about 450 B.C.) studied and compared the organs of man with those of lower animals and observed that they become adapted to certain purposes.

As in many primitive nations, the physicians of the Greeks became segregated into a guild. This was known as the Asclepiadæ, after the god Asclepias or Æsculapius, from whom they claimed descent. With the advance of culture, the need of a more careful investigation of the human body became evident, and about 430 B.C. a group of physicians of this guild arose who pursued a more rational method. The principal of these was the celebrated Hippocrates, often called the "father of medicine." A large body of writings formerly ascribed to him has been shown by modern research to be the product of his school rather than his individual work. The anatomical data found therein are evidently obtained mainly from the dissection of animals, although the osteology is that of man. The statements concerning the bones and sutures of the skull are fairly accurate, as are also those concerning the larger bones and joints. The heart (apparently described from that of man) is recognized as forcing the blood and pneuma or vital spirits of the air through the vessels, and the brain is in some writings distinguished as the organ of thought and conscious sensation. Tolerably accurate though these facts may be, the conceptions of the elementary constitution of the body were erroneous in the extreme, being similar to the speculations of the natural philosophers. It was believed that the bodies of living things were composed of four elements—earth, water, air, and fire—proper mixtures of which produced the so-called elementary fluids blood, mucus, black and yellow bile; that yellow bile was formed in the liver, black bile in the spleen; that the different organs were produced by the action of "innate heat" upon the elemental fluids, the food stuffs, and the aqueous and earthy bases of the body. Muscles were not usually recognized as distinct from the general mass of the flesh. Arteries were not distinguished from veins, both being described under the common name of *φλεβές*. Under the term *νεῦρα*, nerves were likewise confounded with tendons or even sometimes with vessels. The brain is described in some passages as an organ for the absorption of superfluous mucus which it again gives out, and for the secretion of semen which is conveyed to the testes by the spinal cord. The lungs are said to take up cold air and pass it through tubes (*ἀρτηρίη*) to the heart for the purpose of cooling that organ. These characterizations show that the ideas then prevalent as to the structure of the body were largely imaginary, the necessity of controlling hypotheses by exact observation not yet being fully realized.

The conceptions of Plato as to the constitution of the body and its union with a mortal and an immortal essence were founded upon the Hippocratic anatomy. He imagined the seat of the immortal soul to be in the head, that of the higher passions in the upper thorax, and the heart to be "the centre or knot of the blood-vessels, the spring or fountain of the blood which is carried impetuously around"; and that it is cooled by the soft, spongy, and bloodless lungs. The lower passions he supposed to be placed in the thorax below the diaphragm, "in the same house" with the liver, which is "solid and smooth and bright and sweet, and also bitter, in order that the power of thought which originates in the mind may be reflected as in a mirror." The uterus he considered a wandering organ, that, like a wild beast, seeks satisfaction for its inordinate desires. Death he thought to be caused by the separation of the soul from the marrow, of which the brain is the most perfect part, and whose basis is "triangles"—a Pythagorean conception.

In these remarkable speculations we discern an attempt to ascertain by imagination alone, without any careful examination, the purpose or end for which structures are formed. This teleological error, the belief that the mind can discern the "final causes" of structure, tinctured all the anatomical investigations of the ancients.

Aristotle (384–323 B.C.), a pupil of Plato, opposed the idealism of his master, insisting that the proper method of advancing science is to first collect all the facts or particulars and afterward deduce from them causes and principles. His extraordinary industry and activity and his penetrating intelligence had a great influence not only upon his own time, but upon the scientific thought of all subsequent ages. He may be said to have originated the sciences of comparative anatomy and morphology, and was the first to conceive the animal kingdom as a connected genetic chain. By the aid of Alexander the Great he was able to collect vast stores of material, which he utilized as far as the limited resources of that age would permit. He dissected numerous animals and gave a fairly accurate idea of their constitution. A great deal of his classificatory work holds good to the present day. He distinguished arteries from veins by their structure, but grouped them together as *φλεβές*, correctly describing many of their principal branches. He considered, however, that some of the arteries carried only "pneuma." Certain of the nerves he distinguished from tendons, supposing them to be hollow tubes (*πόροι*), a name which he also applied to the ureters. Vessels and nerves he believed to arise from the heart, which he therefore considered as the seat of movement and of the soul. Different from the usual four elements is his principle of life, a fifth element (*quinta essentia* of after writers) which produces heat and cold. He appears to have considered this, however, as a function of the organized body. He seems to have been aware of the lacteals and to have supposed them to empty into the inferior vena cava and the aorta. His division of the body into structures and products composed of parts similar to each other and the whole which they compose (homœomeria) and of others formed of dissimilar parts is an adumbration of the modern conception of tissues and organs. In the domain of purely human anatomy he depends upon other authors, and expressly says "the internal parts of the human body are unknown or are supposed to be the same as the similar or analogous parts of animals." He studied the development of the chick in the egg, and held that it was an advance from a simple to a more complicated form. Observations of putrefying matter and of many cases in which germinal development is obscured led him to the view that animals may be generated spontaneously—"*Corruptio unius est generatio alterius.*" These views were destined to have a powerful influence upon subsequent speculation.

A contemporary of Aristotle, Praxagoras (about 335 B.C.), appears to have been the first clearly to distinguish arteries from veins both by structure and function. He held that arteries normally contain air during life, but when wounded, blood is drawn into them from the surrounding parts. The brain he supposed to be an appendage to the spinal cord.

Under the patronage of the Ptolemies the natural sciences flourished greatly in Egypt during the third century before Christ. At Alexandria the "Museum" was founded, an institution very like a modern university, provided with a large body of teachers and having students from the entire civilized world. Here dissection was publicly practised for the first time: the Egyptian custom of embalming the dead probably aiding to break down the prejudice against it. A large number of anatomical specimens were made and a vast library collected. The advances were considerable. Herophilus (335–280 B.C.), called by Fallopius "the evangelist of anatomists," especially investigated the brain, which he believed to be the organ of thought and motion. He

named the calamus scriptorius, surmising it to be the seat of the soul, discovered the sinuses of the dura mater, the confluence of the sinuses, which still bears his name (*torcular Herophili*), the retina, the uvea, and ciliary processes of the eye, the hyoid bone, the lacteals and lymphatics. He gave the duodenum its present designation (*δωδεκαδάκτυλον* = duodenum), distinguished the arteries from the veins, and admitted that both contained blood. It is said that he even vivisected criminals to obtain a knowledge of the soul.

His contemporary and rival, Erasistratus, was no less famous. He also saw the lacteals, and distinguished nerves of sensation from those of motion. He held that the vital spirits received from the air were changed to animal spirits in the brain, described well the heart and its valves, assumed a virtual connection between the arteries and the veins, holding that they discharge opposite each other. The arteries he supposed to carry air, blood being drawn into them when wounded. The substance of glandular organs he named the parenchyma (*παρέγχυμα*, poured in beside), holding that it is formed from altered blood effused from the blood-vessels. The name still remains. He held that the development of the fœtus is by epigenesis or new formation, instead of by preformation. He remarked the induration of the liver in dropsy, and may thus be said to have been the first to make observations in pathological anatomy.

The school of Alexandria gradually declined and made no further progress in anatomy, it even being held by certain of its teachers that a knowledge of that science was unnecessary for the healing art. The influence of the anatomical teaching of Herophilus and Erasistratus was, however, of wide extent.

Asclepiades (128–56 B.C.) revived the atomic theory of Leucippus, Democritus, and Epicurus, applying it to the structure of the body, which he conceived as composed of innumerable minute particles, the "leptomeres," cognizable by the understanding though not by the senses, between whose interstices the fluids of the body move. This appears to be the first hint of the modern cell theory.

The rise of the Roman empire transferred the centre of civic activity from the Eastern cities to Rome. Among the earlier Roman writers on medical subjects we find Celsus, who lived under Tiberius and Claudius (about 50 B.C. to 7 A.D.). Such of his works as have survived are interesting as showing the value placed upon anatomical studies at this period. He speaks decidedly as to dissection: "The examination of dead subjects is imperatively necessary for students, as they ought to know the position and order of the parts." Of osteology and the larger viscera he shows some accurate knowledge marred by numerous errors.

Marinus (under Nero) is known to us only through the writings of Galen, who praises his anatomical knowledge. He is said to have given excellent descriptions of the muscles and glands. He distinguished seven pairs of cranial nerves, apparently those mentioned by Galen, as follows: I. Optic; II. oculomotor and patheticus; III. ophthalmic branch of the trigeminus; IV. superior and inferior maxillary branches of the trigeminus; V. facial and auditory; VI. glosso-pharyngeal, vagus, spinal accessory and sympathetic; VII hypoglossal (?).

Rufus of Ephesus (under Trajan) had considerable reputation as an anatomist. He discovered the Fallopian tube (in the sheep), the optic chiasm, and the capsule of the crystalline lens. He wrote a work intended for students' use, giving the names of parts of the body, but only fragments of this remain.

Soranus of Ephesus (under Trajan and Hadrian, some twenty years before Galen) described with considerable accuracy the internal genital organs of the female, and it seems clear that he must have dissected sufficiently to inspect them. He distinguished the vagina from the uterus, stated that the latter has the form of a cupping glass, and is connected with contiguous parts by means of membranes, so that it is impossible that it should be endowed with independent movement. His statements concerning the ovaries and oviducts are, however, obscure.

Far surpassing these, and indeed excelling all other writers of antiquity in anatomical exactitude, was Claudius Galen of Pergamus, a physician at Rome under the Antonines (A.D. 131–201). He studied at Alexandria, and esteemed himself especially fortunate in having there seen a complete human skeleton. He was an arduous investigator, dissecting many animals and even vivisecting some in order to ascertain the functions of nerves. He may indeed be said to have been the first physiological anatomist. Numerous errors of description make it certain that he never dissected the human body, but it is evident that he investigated that of the monkey, probably *Macacus ecaudatus* (Geoffr.) of the north coast of Africa. Many of his descriptions hold good to-day, and all are of such value that his authority in anatomy was dominant for more than thirteen hundred years. He was strongly prepossessed with teleological ideas, and assumed false physiological notions (usually derived from his predecessors) as a basis for the interpretation of structure. He was greatly impressed with the dignity and importance of his work, calling it "a religious hymn in honor of the Creator."

He held that the food undergoes "coction" in the stomach, from whence it passes to the liver, where, by the influence of "natural spirits," it is converted into blood which enters the vena cava, part of it proceeding peripherally to give alimentation to the limbs, part to the left side of the heart where the "innate heat" removes from it the part unsuitable for the nutrition of the more delicate organs of the body (smoke, fuliginous matter) which is expelled by the lungs. He supposed the greater part of the blood to be distributed by a to-and-fro oscillation in the veins throughout the body, while a portion passes through minute holes in the interventricular septum into the left ventricle, where it mingles with pneuma received from the lungs with the blood in the pulmonary veins forming "vital spirits" (Hippocrates); the mingled blood and vital spirits then pass into the aorta and the arteries, in which they oscillate to and fro, giving life to the body. He adopted the view of Erasistratus, that pore-like openings at the termination of the arteries communicate with the veins. He taught that there are, therefore, two kinds of blood: one, contained within the veins, suitable for nutrition and growth: the other, in the arteries, suitable for the maintenance of life. The blood that goes to the brain there undergoes a further change: by the choroid plexuses of the ventricles its vital spirits are further refined to "animal spirits" suitable for producing motion and activity (Erasistratus); the unused residue is expelled through the cribriform plate of the ethmoid bone; the animal spirits being distributed to various parts of the body by means of the tubular nerves (Aristotle). The brain he deemed an organ for the secretion of mucus and at the same time the seat of the soul, of which the natural spirits, the vital spirits, and the animal spirits are all modalities.

Notwithstanding these faulty assumptions, which greatly retarded the development of correct ideas concerning the actual functions of the body, the services that Galen rendered to anatomy were real and important. His descriptions are clear, exact, and, barring some errors derived from his preconceptions or the material he used, fairly accurate.

In osteology and arthrology he is at his best, and many of his designations of bones and joints are still in use. In the muscular system he described for the first time the muscles of the face, larynx, and tongue. The muscles of the limbs he separated nearly as is now done. He omitted the opponens pollicis (not found in apes), while in his description of the muscles of the foot he included some ape-like characters. His descriptions of the vascular system are marred by his preconceptions. He made the veins arise from the liver, the arteries from the heart, which he did not consider to be muscular although composed of fibres. He considered the spinal cord to be an appendage to the brain and developed from it, that nerves of sensation arise from the brain, those of motion from the spinal cord, and mixed nerves from the medulla ob-