SOME REMARKS ON THE RECENT DISCOVERY, THAT THE CHIEF MOTIVE POWER OF THE BLOOD IS IN THE LUNGS AND NOT IN THE HEART, AND ITS APPLICATION TO USEFUL PURPOSES.

BY SAMUEL A. CARTWRIGHT, M.D., OF NEW ORLEANS, LATE OF NATCHEZ.

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I HAVE elsewhere detailed the experiments proving, by ocular demonstration, in the vivisection of alligators, made in this city, that the chief motive power of the blood is in the lungs, and not in the heart. Animation was restored by artificial respiration, after the animal experimented on had been perfectly dead to all appearances for about an hour. Organic as well as animal life had been destroyed by tying the trachea. It is a remarkable fact that tying the trachea is the only means by which that animal can be expeditiously killed. They will live for days after decapitation, or immersed in water, but speedily die when the trachea is tied. After life had been, to all appearances, completely extinguished, the heart, lungs and abdominal viscera were exposed to view by a careful dissection. The inflating process was then commenced. The blood, at length, was seen to move from the vessels of the lungs to the quiescent heart—thus proving that the primum mobile and chief motive power of the blood are in the lungs and not in the heart. Dr. Dowler, who performed the vivisection, supposed that atmospheric air imparted to the globules of the blood a self-locomotory. According, however, to the theory of Mrs. Willard, of Troy, to test which some of the experiments were made, it is the caloric evolved in the transformation of venous into arterial blood that gives the motion. Be this as it may, the important discovery, that the primum mobile of the blood and its chief motive power are in the lungs, rests not on theory, but on ocular demonstration, repeated again and again. Mr. Crawford, long ago, attempted to explain the phenomena of animal heat by supposing that the caloric, generated in the lungs by respiration, was conveyed through the arterial system in a latent state to all parts of the body, and was there given out in the form of sensible heat. The foundation of this theory was the greater capacity of arterial than venous blood, for caloric. His premises were denied by Davy and the most of his co-temporaries—but subsequent observations have proved them to be correct in the main. Mrs. Willard's theory of the motive powers of

the blood rests upon the same basis as that of Mr. Crawford's doctrine of calorification—the different capacity of arterial and venous blood for caloric. The theory itself is not the subject under consideration, but only its main proposition, that the chief motive power of the blood is in the lungs, and not in the heart. Whatever be thought of the theory itself, it has the high merit of having announced a most important truth, which is proved by ocular demonstration, and will stand as an important discovery, whether the reasoning that led to it be correct or not.

I propose to make some remarks on the application of this important American discovery to useful and practical purposes. Lord Bacon truly says: "For of all the signs of philosophies none are more certain and noble than those taken from their fruits. For fruits and the discoveries of works are as the vouchers and securities of the truth of philosophies." "As it is in religion that faith be manifested by works, philosophy should be judged by its fruits, and held as vain if it prove barren."—(*Nov. Org., Sect. iv. 73.*) The discovery that the chief motive power of the blood is in the lungs, and not in the heart as Harvey supposed, I propose to show will not prove barren, but rich in useful fruits—"the vouchers and securities for its truth." Lest, however, some errors which have crept into physiology, may prevent any portion of those physicians, who are not too old or full of prejudice to receive a new idea conflicting with their former opinions, from seeing and believing in the discovery, it may not be amiss to surround it with some of the highest authorities in medicine, each holding a light so closely to it, as to convince the sceptical that it rests on the rock of the latest revealed truths in science, and not, as they might gratuitously suppose, on idle speculations behind the times.

Among the authorities, Sir Benjamin Brodie stands foremost and closest, he having, many years ago, come very near stumbling on the discovery. He killed a cat, i. e. paralyzed the action of the heart and lungs, with the poison called *woorara*, and then by dint of artificial respiration, kept up for two hours and a half, brought the animal to life. He saw so far into the mystery of the motive power of the blood, as to ascertain that the heart's action depended upon the action of the lungs; and hence the experiment with the cat was to see whether life might not be preserved by artificial respiration until the effect of the poison on the nervous system had time to wear away. Sir Benjamin's idea was good, and true as far as it went, but it did not reach the main truth of the discovery first announced in Troy, and subsequently demonstrated in New Orleans. Although he brought the cat to life, he had no suspicion that the chief motive power of the blood was in the lungs, and that the heart performed a subordinate part in giving it momentum. His experiment, however, went far enough to prove, that Bichat and some other physiologists, in supposing that the blood continued, for a time, to circulate through the lungs by the action of the heart after respiration ceased, only becoming unaërated after the lungs ceased to act, fell into a great error, which for many years misled investigation from the true path of inquiry.

Dr. Kay, however, deserves much credit for correcting the error,

which he has done by proving, that as soon as respiration stops, the blood begins to stagnate in the pulmonary capillaries, because it ceases to be transformed from venous to arterial. In the language of the new philosophy, because its motive power is taken away by the cessation of the process of arterialization, therefore it stagnates. Dr. Kay ascertained the fact, but he could not divine the cause. His researches do not go far enough to detract from the merits of the discovery, but they furnish sufficient light to show that it rests upon scientific truth.

Baron Cuvier, the highest authority in natural philosophy, brings the light of that science in support of the new doctrine, that the chief motive power of the blood is in the respiratory organs. His great work, called "*Animal Kingdom*," revised by Latreille, article *Reptilia*, says—"The blood derives its heat and the fibre its susceptibility of nervous irritation from respiration." Not only that, but his other great work—"Lecons d'Anatomie comparée," abounds with proof of the intimate relation of muscular motion and nervous influences, with respiration as their source and spring. Speaking of animals, he says, "*Chacune de ses classes jouit de la faculté de se mouvoir précisément dans le degré qui correspond à la quantité de la respiration.*"—(*Vol. I. p. 52.*) The blood could not derive heat from respiration without deriving more or less power of motion; because caloric is not inoperative. Those who object to the truths of natural philosophy as authority in medicine, forget that the former is the root of the latter. Hence objections, drawn from medical theories, should have no weight when brought against the truths of the mother science.

Harvey discovered the course of the circulation of the blood, but he did not discover the chief power that moved it. His discovery was incomplete, as it erroneously placed it in the heart instead of the lungs. In consequence of this radical error, the science of medicine has not been as much enriched by the discovery of the circulation as was anticipated, as it only served to lead the blind into a dazzling and uncertain light—whereas the discovery that the chief motive power of the blood is located in the lungs, and not in the heart as was erroneously supposed, has opened a rich field for improvement in physiology, pathology, and in the more successful methods of treatment in disease. Before Dr. Bassi, charged, by the scientific congress lately held at Genoa, to explain the reason why silk worms fed on indigo leaves have a blue color imparted to the membranes between the parietes of the air-tubes, can give a satisfactory explanation of that phenomenon; and before Prof. Bryan, of Philadelphia, can interpret the experiments he is now making on papilios, they will have to look into the anatomy and physiology of those insects, brought into the light furnished by the discovery locating the motive power of the blood in the lungs. The dorsal vessel, called the heart, according to Cuvier, has no muscularity, although these insects have upwards of four thousand muscles. M. Lyonet counted in the caterpillar, called the *cassus lignéperda*, 4041 distinct muscles. The heart has but one artery, and that artery no branches. The muscles have no bloodvessels distributed to them, nor is there any cellular membrane between the layers of their fasciculi, being parallel and without

attachment except at their origin and insertion—resembling hairs tied at their two ends. There are no veins, but more nerves than in the human body, viz., 47 pair in the papilios. Every part of the insect is pervaded by tracheal branches penetrating to the extremities of every appendage of the body; yet in the interstices between the tracheal vessels the nutritive juices, which the experimenters found colored in those worms fed on indigo leaves, are carried by some unknown agency to all parts of the body—no doubt by the same spring or locomotive power which in man is the *primum mobile* of the blood.

But it is not so much in explaining mysteries in entomology that the discovery is valuable, but in leading the way to important improvements in therapeutics and other practical and useful sciences. Thus before roses can be planted on the pallid cheek, it is important to know in what way healthy red blood can be soonest made, warmed, depurated and kept in motion. Before the “young idea can be taught to shoot” *with vigor*, it is all-important that a current of red healthy blood be distributed to the brain—the organ of thought. The same important agent, red healthy blood, is absolutely necessary to give tone, vigor and symmetry to the body, and to prevent it from falling an untimely prey to consumption and other ills. But it is not so generally known, that red healthy blood is just as necessary for the full development and integrity of the moral faculties as the intellectual; and under this aspect, the discovery of its motive powers has strong claims to the attention of theologians. Church history bears witness, that “*the stony ground*” where the seed of christian truth takes no deep root, is the very ground trod by a people whose blood is vitiated by idleness, filth, impure air and unwholesome diet. Instance, the indolent Hindoos and other inhabitants of populous Asia, breathing the impure air of crowded hovels without sufficient food or clothing. Instance, the idle eaters of ant eggs and caterpillars, overspreading Africa, and the denizens of the cellars of London. Education, therefore, in its broadest sense, physical, moral, religious and intellectual, is essentially and indissolubly connected with red healthy blood. Hence, when Mrs. Willard indicated one of the chief ways, by which red healthy blood could be made at will, and that every child could be taught to make it for itself, she was not, as it was supposed, out of her province, as the head of a renowned institution of learning, but standing on the broad platform of her profession, and directing the building of a permanent basis for it to rest upon throughout all time. In forming that basis, she naturally looked into the science of physiology for certain materials in regard to the motive powers of the blood; and not finding them there, after going as far as Harvey went, she brought that science back to natural philosophy, the parent from which it sprung, which receiving new strength and increase therefrom, readily conducted her to the hiding place of the materials she was seeking—a golden fleece, more valuable than that of fable. If some medical men gainsayed her for overturning things on the altar of Harvey, it was because they had not reflected that the empire of science, so long encroached on by empiricism, calls for enlargement, and that America, like Rome, needs a Minerva. Surely the almshouse, the hospital and the sick room, is too

small an empire for the numerous votaries of the comprehensive science of medicine—a science, like the Crystal Palace, embracing almost everything worthy to behold in its study, but narrowed down in its practical exercise to a few common-place duties, associating it in the public mind with nothing but nauseous drugs, making it the terror of the people, and in too many instances driving them from its advantages until the fear of death is upon them. So much knowledge, with a field too small to call a title of it into requisition, requires the extension of the practical sphere of its operations, and that sphere will need enlargement until it embraces in its practical boundaries, not only therapeutics, hygiene, &c., but the art, long sought after by the ancients, of making the old younger, children healthy, men vigorous, and women pretty. This art has always been imperfect; its basis or starting point—a knowledge of the motive powers of the blood and the ways and means of making red healthy blood at will—having been unknown. While the erroneous hypothesis of Harvey prevailed, that the heart, whose action is not under the will, was the *primum mobile* and chief motive power of the circulating fluids, instead of the lungs, which are under the will, there was no known way, except through the slow and uncertain process of diet, change of climate, exercise, or a course of medicine, by which the vitiated, cold, impoverished circulating fluids could be reached, depurated, or rendered red, warm and healthy. Body, mind and morals had to suffer all the effects of deteriorated humors as a necessary evil—the direct road to purify the blood through the respiratory organs being unknown, from incorrect theories of the power that moved it and the location of that power.

The true doctrine on this subject was no sooner promulgated, than I reduced it to practice, and have made it tell well as a valuable adjuvant in the treatment of many diseases, particularly those of a chronic kind, and the cold, phlegmatic ailments so common among females in hot climates. Some complaints, especially acute inflammations, require repose of the respiratory organs, absolute rest and a spare diet; while the great mass of chronic and congestive disorders are greatly benefited by their activity. Thus in pleurisy, the curative process of nature prevents full respiration by piercing the side with pain whenever the ribs are expanded; because the motive power of the blood being in the lungs, full breathing would aggravate a complaint consisting in too much heat and momentum. On the other hand, the cold, congestive and torpid affections require increased activity of the lungs to heat, redden, and vivify the circulating fluids. Full breathing in the open air and sun light is beneficial to children of infirm constitutions, and applicable to most of the diseases and infirmities peculiar to females, greatly assisting other necessary remedies, as malaxation, friction, inunction, bathing, &c., to improve the complexion, to prevent the hair from falling out, and the teeth from decay.

There has been a fearful increase of consumption and female complaints, and a large field opened for dentists, since the old-fashioned spinning wheel, called the big wheel, has been laid aside. In ancient times the women ground at the mill—that is, turned a horizontal stone with

an upright staff for a handle, requiring them to stand up and to use both hands. Two women grinding at the mill, standing opposite to each other, was one of the best species of exercise to expand the lungs and to depurate the blood, without giving coarseness to the muscular system, and no doubt greatly contributed to the health, grace and classic beauty for which the ancient women were so renowned. The discovery of the motive power of the blood, and the location of that power, will be a good antidote against the follies of Bloomerism, enticing women to assume indiscriminately the avocations of men. Most of these avocations would make them coarse, rough and masculine in appearance, like the weather-beaten female peasantry of Europe. The discovery is valuable as a key to find those species of exercise, which do not give coarseness, deformity and masculineness to the general muscular system and its tegumentary covering, but softness, symmetry, agility and grace, united with health, as the wheel and the mill-stone formerly gave. A substitute for the last-mentioned exercises is yet a desideratum. Mrs. Willard's substitute of early rising and running backward and forward before an open window, moving the arms and expanding the chest, is a very good one, but is defective in not being associated with some visible object of utility, and consequently somewhat difficult in being generally practised to a sufficient extent. The inventor of some species of play or kind of work, requiring similar movements, would be entitled to the thanks of the community. It could be improved by being performed in the morning sunshine, as sunlight is particularly beneficial to youth in strengthening their constitutions.

It was a rule in Egypt to bestow divinity and consecration upon the inventor of any useful remedy or thing; and as instinct oftener than reason led to discoveries, the Egyptian deities were mostly in the form of reptiles and other animals of the brute creation. But if America, like Egypt, Greece and Rome, is to have mythological divinities, I am sure that none will object to their coming in the form and likeness of woman. Hence I have no apology to make to the profession, of which I am a humble member, for giving in my adhesion to an important practical truth in science, first announced by an American lady, long famous for her erudition and intelligence, and for the number of our country's fair daughters who have been refined and polished by her hands.

New Orleans, Dec. 23d, 1851.

DENTAL AMALGAMS.

To the Editor of the Boston Medical and Surgical Journal.

SIR,—In your Journal of the 31st ultimo you state, page 458, in a paragraph with the above caption, that “there is an admirable paper on the character of amalgams for filling teeth, which at some periods have been exceedingly popular.” You continue—“It is clearly shown that nothing can be relied on for this purpose but gold,” and you wind up your paragraph in this *thoughtless* statement—“But quackery of every species thrives, and it would seem as though pseudo-dentists were some-