sensation of abdominal depression, coupled with flatulent rumblings, and indigestion in various forms. In rheumatic patients, an intense increase of muscular pain took place, and in irritable women a feeling of contraction of the limbs was generally complained of. All these anomalous affections were of long duration. Relief having been obtained, relapses were frequent. They varied, in fact, with the changing phases of the epidemic, and almost completely bade defiance to the efforts of medical skill. It is utterly impracticable to follow M. Gendrin any further in his minute and admirable disquisition on this department of his subject. Faithful translation can alone do justice to the merits of the entire chapter.

We must here intermit our analysis for the present. In a fitting state of our columns it shall be resumed, and continued until the interesting works of MM. Bouillaud and Gendrin are fully and satisfactorily examined.

A Critical and Experimental Essay on the Circulation of the Blood ; especially as observed in the Minute and Capillary Vessels of the Batrachia and of Fishes. By Marshall Hall, M.D., F.R.S.E., M.R.I., M.Z.S,, &c. &c. London, Seeley and Burnside, 1832. 8vo. pp. 188. Plates.

This volume abounds in original views and observations. The experiments detailed seem to have been conducted with care and judgment ; and the conclusions at which the author has arrived, lead us to hope that further investigation will clear away many of the obscurities which at present surround the doctrine of capillary circulation.

After a few preliminary observations on the principles of investigation in physiology, Dr. Hall proceeds at once to examine the anatomy of the minute and capillary vessels. All the descriptions of minute capillary circulation, Dr. Hall observes, are distinguished by numerous inaccuracies. To obviate the cause of these, the author employed the achromatic microscope of Mr. Dolland, and verified every fact by repeated experiment in the presence of competent judges.

In describing the capillary circulation, it is essentially necessary to distinguish the true capillaries from the minute arteries or veins ; they are obviously distinct from both ; they do not become smaller by subdivision nor larger by conjunction ; but they are characterized by continual and successive union and division, whilst they retain a nearly uniform diameter.

To determine whether there was any characteristic difference between the capillary vessels and circulation of the system and of the lung, Dr. Hall examined with the microscope the lung and mesentery of certain batrachian reptiles, and the tail and fin of the stickleback. By plunging the batrachia in water, heated to 120°, he was enabled to suspend all animal sensation and motion, while the circulation went on uninterrupted for several hours, by this ingenious application of a principle first noticed by M. Edwards, all unnecessary suffering was spared, and the observer was enabled to contemplate at leisure " the splendid and interesting scene" of the capillary circulation.

The fin and tail of the stickleback are merely nutatory organs composed of a reflex membrane enclosing numerous vessels. The arteries run along each border of each ray to its extremity, where they are reflected, become venous, and pursue a similar but retrograde course. During its whole course the artery gives origin to capillary vessels few in number, inclosing large spaces and joining the veins. The structure of the frog's foot is more complicated than that of the fin or tail of the fish. The minute arteries are characterized and distinguished from the veins by pursuing a straighter course across the web by their small size, light colour, and rapid circulation ; hence they are apt to elude a cursory observer, but by a high magnifying power they are seen to occur in nearly equal numbers with the veins. On inspecting the circulation in the web of the frog, under the microscope, the minute veins first strike the eye ; they are large, red, and tortuous, presenting a most distinct view of the flow of blood. In the arteries, a pulsatory movement of the blood is seen quite distinctly, but it does not extend to the blood in the capillaries or veins ; this communication of impulse is prevented by a peculiar vascular arrangement to be presently described. Although the author was

unable to detect any anastomosis between the minute arteries, the roots of the veins were seen to communicate and produce the remarkable phenomenon of a double and contrary course in the flow of the blood. The final object of the difference seems to arise from the circumstance, that the circulation in the arteries being rapid and not easily interrupted, does not require the aid of anastomosis; in the veins the circulation is feeble and easily suppressed, an event which is prevented by the institution of cross currents from the venous anastomosing roots. Dr. Hall denies the termination of an artery directly in a vein, and believes that generally, if not invariably, capillary vessels are interposed. This, we may remark, is contrary to the opinion of Haller, and opposed by the microscopical observations of Leeuwenhoeck, Cowper, Baker, and Spallanzani in his beautiful experiments on the circulation of the blood. The transition of the arterial into the capillary vessels has been examined carefully, with every power of the microscope, by Dr. Hall.

"The larger arteries first divide into branches. These subdivide into still smaller branches, which are also successively smaller than the trunk from which they proceed. At length the singular fact is observed, of each of the two branches being as large, or even larger, than the vessel from which they originate. At this point there is an obvious and remarkable change in the appearance of the circulation: the course of the blood becomes of only half its former velocity, and the globules, consequently, instead of moving too rapidly to be seen, become distinctly visible. If the vessel be traced, it is next observed, not to subside, but to unite with other branches, and to pass into that distinct system and net-work of vessels to which I would restrict and appropriate the term capillary. The object of this peculiar distinction and character of the capillary vessels is very obvious: a more diffused and slower circulation is required for administering to the nutrient vessels or functions, than that of the arteries; this peculiar character of the circulation is conferred at once, by the subdivision of the minute artery into branches of equal size with itself."

The arrangement of the pulmonary capillaries is somewhat different from that of the systematic vessels; they have been examined by the author in the salamander, frog, and toad.

The large and minute branches and roots of the arteries and veins are placed in parallel lines close to each other; the division of the minute arteries into capillaries takes place without any of those subdivisions observed in the vessels of the systematic circulation. The final arteries give out and the venous roots receive capillaries not only from their point, but along their sides; and between the terminal points of the arteries and veins, there is a considerable space occupied by innumerable capillaries, which diffuse the globules of blood in straight lines over the pulmonary membrane. There is plainly no disposition to anastomosis between the arteries, or to direct communication between the arteries and veins; but there is an intermediate space occupied by the capillaries, which subdivide, anastomose, and form a net-work of small vessels, by which the globules of blood are exposed over the greatest possible extent of surface to the influence of the air.

The preceding description is applicable only to the lung of the salamander; in the frog and toad the arrangement is merely modified by the combination of cellular with vesicular lung; the capillary circulation is similar in all, and it seems highly probable that the arrangement of minute and capillary vessels so clearly pointed out by the author, is not confined to the batrachia, but may be found applicable to the higher classes of animals.

The second part of this volume is occupied with a consideration of those powers which circulate the blood. We cannot afford space for a critical examination or comparison of the opinions entertained on the one hand by Harvey, Haller, Spallanzani, &c., and refuted with considerable energy by Hunter and Scarpa on the other, or for a review of the more modern doctrines promulgated by Carson, Barry, or Reuss. Dr. Hall supports the opinion, that the influence of the heart extends beyond the arteries, while he conceives that the latter vessels promote the motion of the blood, independent of the heart. We omit the usual arguments on the first of these topics, which are doubtless familiar to every one, rather selecting some illustrations drawn by Dr. Hall from his microscopic observations.

The circulation in the web of the frog is, under natural circumstances, rapid and pulsatory in the arteries, and slow but equable in the capillary and venous systems; but if the circulation be impeded in the slightest degree, the pulsatory movement at each contraction of the heart is seen in all the three systems of vessels. The experiment is rarely made by gently applying a ligature round the limb of a frog, when the pulsatory movement in the vessels of the web is immediately produced, and the mind at once convinced that the heart is capable of moving the blood through the arteries, capillaries, and veins, in the most remote part of the system.

The second topic, or influence of the vessels upon the circulation, has also occupied the author's attention, but we conceive he has been unfortunate in his adoption of the term "muscular action," contractile would have been equally intelligible, and reconciled many contending opinions.

In evidence of the muscular action of arteries, the author adduces the facts of a perfect circulation in acardiac fœtuses and acardiac animals; the manner in which the circulation is carried on in the crustacea and fishes, in the former of which a single heart distributes the blood through the systematic and pulmonary systems, while in the latter the heart influences only the bronchial circulation, and the blood is carried to the body by vessels uniting from the capillaries of the lungs; the effects of a ligature upon the aorta; the anatomical structure of the arteries; and, finally, the effects produced on them by an elevated temperature being similar to the results obtained on the muscular fibre. Dr. Hall, however, acknowledges that all these arguments are indecisive, and rests his belief on the discovery of an artery in the frog and toad, which pulsates independently of the heart—a most curious fact if authenticated by further research.

"The artery to which I allude (says the author), is a branch from each of the arteries which in the frog and toad, after separating at a short distance from the heart, rejoin and form the aorta. Pursuing its course backwards and downwards, it passes under the transverse process of the third vertebra. It is here bound down. It is also very tortuous. When the viscera are removed, two pulsating points are distinctly seen at this part. On a minute examination, these pulsating points are found to be portions of cellular and muscular textures, above and below the transverse process just mentioned, moved by the contraction of a subjacent artery.

"On removing these textures carefully, and on removing the skin from the back of the animal, the part along which the artery passes on emerging from beneath the transverse process, is sufficiently thin and transparent to admit of its being placed under the microscope. The artery is then plainly seen to pulsate, becoming straighter and paler at each contraction. The adjacent textures are moved at the same time, and the blood is frequently seen to oscillate in a branch of the same artery very near it.

"In this fact we have the most, and, I may add, the only, indubitable proof of a contractile action in an artery.

"It is interesting to contrast the appearance of automatic contraction in this artery with that of dilatation, the effect of the impulse of blood sent from the heart, as seen in the principal pulmonary artery in the batrachia. Whilst the former becomes straighter and paler, the latter is rendered still more tortuous, and is still more distended with blood."

The concluding portion of the volume contains remarks on the irritability of the capillaries, and the influence of the central portion of the nervous system upon the circulation, a question which has given rise, we understand, to a war of opinions between the author and Dr. W. Philip. To this part we shall not further allude, being unwilling to have anything to do with a discussion which was more calculated, we are told, from the manner in which it was conducted, on one side at least, to afford amusement than information, to the score or two of elderly Dubs who had an opportunity of seeing it.

We conclude our notice with a description of an organ which is called by Dr. Hall the caudal heart, and discovered by him in the tail of the eel. This is a membranous, transparent bag, placed at the extremity of the eel, aed giving off vessels which appear to have a peculiar distribution to the spinal marrow; one in particular ascends along the inferior spinal canal towards the heart. The action of this caudal appendage is quite independent of the pulmonary heart; it beats 160 in the minute, while the latter beats only 60, and soon loses its power of motion after the division of the fish. An organ very similar to this was described several years ago by Professor Jacobson, of Copenhagen.