

when forcibly compressed between two plates of glass, it also exhibited beautiful colours, that were complementary to each other in the two images of a candle seen through it, by means of a prism of Iceland spar; and when the pressure was removed, these complementary tints disappeared.

Inasmuch as these colours might be supposed owing to the thinness to which the plate of jelly was reduced by pressure, Dr. Brewster cut the cake to the same thinness which it had possessed while under compression, but without any production of colours till pressure was again applied.

In the author's concluding experiment, he formed one twentieth of an inch thick of the same jelly, by melting it between two plates of glass. When merely consolidated by cooling, this had no power of depolarization; but by pressure it instantly restored the evanescent image, and exhibited, as in the former cases, the complementary colours, showing, says the author, that pressure communicates a modification of structure correspondent to that of crystallized minerals.

*Experiments made with a View to ascertain the Principle on which the Action of the Heart depends, and the Relation which subsists between that Organ and the nervous System. By A. P. Wilson Philip, Physician in Worcester. Communicated by Andrew Knight, Esq. F.R.S. Read February 9, 1815. [Phil. Trans. 1815, p. 65.]*

The author's ultimate object is to ascertain the manner in which certain poisons act in destroying life; but for this purpose he found it necessary previously to determine how far the powers of the nervous and sanguiferous systems depend on each other; and though it be generally allowed that the powers of the nervous system cannot continue long after the cessation of the circulation of the blood, the converse is not so generally admitted; since there are persons who maintain that the nervous power may be wholly destroyed without impairing the vigour of the heart.

The present inquiry relates solely to this part of the subject, how far the power of the heart is influenced by the state of the nervous system; and the author designs, at some future time, to investigate experimentally, by what steps certain poisons destroy the powers of both.

M. Le Gallois maintains, that though the destruction of the brain does not impair the action of the heart, it is immediately and extremely debilitated by destruction of the cervical part of the spinal marrow. Dr. Philip, however, did not find this to be the case in his experiments, of which the first ten, performed on rabbits, relate almost exclusively to the effect of destroying the spinal marrow.

The animals were in general first rendered insensible by a blow on the occiput, after which the circulation was found to depend wholly on the continuance of respiration by artificial means, and not to be in any degree altered by subsequent removal or destruction of the spinal marrow, which was effectually done by means of a hot wire.

The next experiments related to the effects upon the heart of certain stimuli applied to the brain or spinal marrow. Spirit of wine, applied to the brain or to the upper portions of the spinal marrow, excited considerable increase of the heart's action, but not when applied to the lumbar portion. A watery solution of opium or infusion of tobacco also, occasioned a slight increase; but this was soon succeeded by more languid action of the heart, which, however, recovered its power as soon as these applications were washed off from the brain or spinal marrow.

When tincture of opium is applied to the hind legs of a frog, the animal is deprived of sensibility in less than a minute; but this effect was found not to arise from the opium, but solely from the spirit of wine in which it is dissolved, which alone has the same effect, while a watery solution of opium has no such power. But though a frog be rendered insensible by application of spirit of wine to its feet, the heart nevertheless continues to act, and its force is even increased by subsequent application of spirit of wine to the brain or spinal marrow.

The effects of opium or tobacco were also found to be the same upon frogs as they had been observed in former trials upon rabbits.

In the course of these experiments it was observed, that considerable pressure either on the brain or spinal marrow, had little or no effect on the motions of the heart; and it was further remarked, that the peristaltic motion of the intestines was not affected thereby, and indeed that it in general obeyed the same laws as those of the heart in regard to being influenced by stimuli applied to the brain or spinal marrow, but at the same time that it is not dependent on those parts for their continuance.

Since the apparent inconsistency between two facts, both well ascertained, evidently arises from some imperfection of our knowledge of the principles by which they are to be explained, the author endeavours to elucidate this subject by further experiments.

By applying strong stimuli, and repeating them, to the spinal marrow of a frog, the muscles were made to contract till their irritability was exhausted. In a second frog the nerves supplying the muscles of one leg were divided, and the irritability of its muscles was exhausted by the application of salt to the muscles themselves; and afterwards that of the other leg was exhausted by the same means, without dividing the nerves. Under these different circumstances the irritability was sooner exhausted in that limb to which the nerves remained entire. It appeared therefore, that the property of the heart, of being excitable independent of nervous influence, is common to it with other muscles; and also its property of being excited through the medium of its nerves, although it possesses the latter in a much less degree, being sparingly supplied with nerves, because its usual stimulus is immediately applied to itself, while that of the voluntary muscles is conveyed to them from the sensorium.

And it further appears to the author, that, in the same manner, the spinal marrow is capable of performing its functions independently

of the brain, yet may be influenced through the brain, the office of which is considered as purely sensorial. The separate existence of these powers is illustrated by a review of the various classes of animals, in the lowest of which we find only the muscular system; in the next above the muscular and nervous without sensorium; and in the most perfect animals we find the three vital powers combined, each having existence not immediately depending on the others, but so connected that no one can subsist long without the others, since all are supported by the same circulation, that is dependent for its continuance upon muscular action, which cannot exist without respiration, while this again depends on the nervous system for its continuance.

Although the heart of a frog retains its power long after the brain and spinal marrow are removed, nevertheless Dr. Philip found that its force may be for a time extremely impaired, by suddenly crushing the brain or spinal marrow, but it will again recover its power after the entire destruction of those parts; and corresponding effects were observed, though not so distinctly, in rabbits.

It is to this cause that the author ascribes the difference between his results and some of those of M. Le Gallois, who, instead of employing a small wire to destroy the spinal marrow, used an instrument which fitted the cavity of the spine, and consequently crushed the marrow more suddenly.

From the whole of his experiments the author concludes, that the involuntary muscles obey the same laws as those of voluntary motion; that the difference arises from their being under different stimuli; that both are liable to be stimulated through the nervous system; that they each have power independent of that system. That what has been called nervous system consists of two parts, one purely sensorial, the other conveying impressions.

That the three powers are combined in the most perfect animals. That the muscular may be destroyed through the nervous system, and the nervous through the sensorial; and though each is not strictly dependent on the others, they are so connected that no one can exist long without the others.

*Experiments to ascertain the Influence of the Spinal Marrow on the Action of the Heart in Fishes. By Mr. William Clift. Communicated by Sir Everard Home, Bart. V.P.R.S. Read February 16, 1815. [Phil. Trans. 1815, p. 91.]*

These experiments were undertaken by the author, in order to ascertain the truth or fallacy of M. Le Gallois' conclusion respecting the action of the heart being dependent on the spinal marrow. For since the death of quadrupeds (on which M. Le Gallois operated) is so readily produced by injury to the vital organs, it appeared to Mr. Clift that fishes would be far preferable, from their being more tenacious of life.

After two or three preliminary experiments on the duration of the