

XXX. *On the influence of the Nerves upon the Action of the Arteries.* By Sir Everard Home, Bart. F. R. S.

Read June 30, 1814.

THAT the pulsations of the arteries correspond in their frequency with the contractions of the left ventricle of the heart, is universally admitted; and those pulsations continuing in the arteries after the limb to which they belong is rendered paralytic, has led to the belief, that all arterial action is independent of nervous influence.

The object of the present Paper is to shew that the nerves which accompany the arteries regulate their actions, and it is through their agency that the blood is distributed in different proportions to the different parts of the body.

The facts which have led me to conclude that this office is performed by the nerves, I shall lay before the Society in the order in which they occurred.

An officer, who had been wounded by a musket ball in the leg immediately below the knee, came under my care. With a view to find the ball, a seton was passed in the course it had taken, and brought through the skin just beyond the part in which it was lodged; a caustic was then applied to the skin just below the tuberosity of the tibia, to which the ligament of the patella is attached: it produced great pain all round the joint and through the leg, and what was very remarkable, the matter in the canal surrounding the seton rose and fell with

great violence; this circumstance induced me to feel the pulse at the wrist, and to keep my finger upon it during the time this effect upon the pus continued, which was several minutes, corresponding with the pulse at the wrist, which, however, had been in no degree disturbed.

The increased action of the arteries, rendered evident by the effect upon the pus, following so closely upon an irritation on the neighbouring nerves, made it clear that it arose from that cause, and brought to my recollection an instance, in which the aorta had been seen pulsating with great violence, in consequence of an irritation upon the nerves of the urinary bladder.

To ascertain whether such a connection between the actions of nerves and arteries could be demonstrated in a state of health, as well as disease, I instituted the following experiments, which were made in the presence of Mr. BRODIE and other gentlemen competent to form a judgment respecting them.

The carotid artery of a dog was laid bare, the intercostal nerve and par vagum, which form one bundle, were separated from it by a flattened probe for one-tenth of an inch in length, the head and neck were then placed in an easy position, and the pulsations attended to by all present, for two minutes, that the eye might be accustomed to them in their natural state: the nerve passing over the probe was then slightly touched with the kali purum. In a minute and a half the pulsations of the exposed artery became more distinct; in two minutes the beats were stronger, and in three more violent; in four minutes the violence was lessened, and in five minutes the action was restored to its natural state.

This experiment was repeated with the same results upon

a rabbit, and in that animal the par vagum was separated from the intercostal nerve, which cannot be readily done in the dog; and it was found when the par vagum alone was irritated, no change took place in the action of the artery. The carotid artery was chosen as the only one in the body of sufficient size that can be readily exposed, to which the nervous branches supplying it can readily be traced from their trunk.

This experiment was repeated three different times, so as to leave no doubt respecting the result.

Having ascertained by these experiments that the increase and diminution of the action of an artery does not depend upon irritability, but nervous influence, I made the following experiments, to determine whether heat or cold had the greatest effect in stimulating the nerves to action.

The wrist of one arm was surrounded by bladders filled with ice, and after having remained in that state five minutes, the pulse was felt at the same time in that and in the opposite wrist, and the beats were found evidently strongest in the cooled wrist. This experiment was then made with water heated to 120° or 130° , beyond which the heat could not be submitted to, and the pulse was found to be softer and weaker than that in the other arm.

When one wrist was cooled and the other heated, the stroke of the pulse in the cooled arm had great force beyond that in the heated one.

These experiments were repeated upon several young men at different ages, and on several women, with an uniform result, and explain the glow produced by the cold bath, and the other beneficial effects of cold bathing, in a more satisfactory manner than has been hitherto done.

This influence of the nerves upon the arteries, throws considerable light upon some of the most important actions in the animal economy. By its means the same arteries, at different times, allow very different proportions of blood to pass through them, and those employed in furnishing blood for the secretions have the supplies regulated, which explains the use of the system of nerves with which the blood vessels of the viscera are so abundantly furnished.

The erection of the penis, produced by a particular state of mind, is one of the effects of this influence of the nerves upon the arteries, and the stoppage of the secretions from the same cause is another of an opposite kind.

The ready supply of blood to a limb by the small anastomosing branches, when the principal arterial trunk is obliterated, depends upon the same cause; and the coagulation of the blood in the arterial trunk leading to a mortified part, arises from the nerves having previously lost their influence over it. On this dominion of the nerves over the actions of arteries depends the growth of the body, the regeneration of parts in those animals in which it occurs, as lizards and others, and the formation of tumours of all the different kinds. The circulation of the blood is therefore no longer to be considered as wholly dependent upon the heart and the elasticity of the arteries, for although by these alone it can be kept up, the action of the nerves is necessary to regulate the distribution of the blood to the different parts of the body, accordingly as supplies are wanted to carry on the necessary operations of the animal economy.