III. "The Direct Influence of Gradual Variations of Temperature upon the Rate of Beat of the Dog's Heart." By H. NEWELL MARTIN, M.A., M.D., D.Sc., Professor in the Johns Hopkins University, Baltimore, U. S. A. Communicated by Dr. M. FOSTER, Sec. R.S. Received December 27, 1882.

(Abstract.)

In the investigations described, the method of experiment was such as to completely isolate physiologically the heart of the dog from all the rest of the body of the animal, lungs excepted.

This was accomplished by occluding the right and left carotid and subclavian arteries, the aorta just beyond the origin of the left subclavian, and ligaturing both venæ cavæ and the azygos vein. In consequence the only fraction of the systemic circulation left open was that through the coronary system of the heart; no organ but the heart itself has any blood sent it, except the lungs. Hence the cerebro-spinal nerve-centres and the sympathetic ganglia very soon die, while the heart remains alive, in good working condition, for two hours or more. The right auricle is supplied uniformly with defibrinated calf's blood, conveyed to the superior vena cava from Marriotte flasks. The blood, after traversing the pulmonary circuit, is finally pumped by the left ventricle into a cannula, which is tied into the aorta just beyond the origin of the left subclavian artery. From the distal end of the cannula a wide rubber tube carries the blood to an exit cannula seven or eight feet above the level of the heart. By raising or lowering this exit, and by raising or lowering the level of the Marriotte flasks feeding the heart, arterial and venous pressures could be changed at will, or maintained very nearly constant.

Venous and arterial pressures being kept constant, the temperature of the blood supplied to the heart was gradually changed by raising or lowering the temperature of the water contained in the vessels in which the feeding Marriotte flasks were immersed.

The pulse rate was recorded by a Fick's spring manometer, and arterial pressure by a Marey's mean-pressure mercury manometer, each being connected with the central stump of a carotid artery. Temperatures were read by means of a thermometer tied into the root of the left subclavian, so that its bulb projected into the aortic arch.

Uniform artificial respiration was maintained.

As the result of many experiments it was found (1) that the isolated dog's heart beats quicker when supplied with warm blood, and slower when cold blood is supplied to it; (2) that the rate of beat depends much more upon the temperature of the blood in the coronary arteries than on its temperature in the right auricle or ventricle; (3) that when defibrinated calf's blood is used to feed the heart that organ

cannot be kept alive as long as when defibrinated dog's blood is employed; (4) that no matter how long an experiment lasts the defibrinated blood, circulated again and again through heart and lungs, shows no tendency to clot; hence fibrinogen is not produced in those organs.

The question answered by the first of the above results was the one for whose solution the research was undertaken. The experiments show that, in spite of its highly developed extrinsic nervous apparatuses, the heart of the mammal does, so far as its rhythm is concerned, in its own nervo-muscular tissues, respond to temperature variations within wide limits (42°—27° C.), just as the frog's heart or that of the embryo chick does. To account for the quick pulse of fever we, therefore, need not look beyond the mammalian heart itself; we require no theoretical assumption of any paralysis of inhibitory, or any excitation of accelerator cardio-extrinsic nerve-centres.

January 18, 1883.

THE PRESIDENT in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

I. "Preliminary Paper on a Uniform Rotation Machine; and on the Theory of Electromagnetic Tuning Forks." By R. H. M. BOSANQUET, St. John's College, Oxford. Communicated by Professor H. J. S. SMITH, F.R.S. Received December 20, 1882.

(Abstract.)

The primary object of the machine is the construction of standard notes. It admits also of the accurate determination of tuning forks, &c., having pitch near that of any standard note of the machine, besides other applications.

The machine consists of a three-crank axle with a fly-wheel. The cranks are acted on by electro-pneumatic levers, the valves of which control the wind supply as the slide-valve of a steam engine does the steam. Two of these are acted on by a commutator on the axis; the third is connected with a clock which closes the circuit at every second. The effect of this is to govern the machine, so that it will