experiment, the size of the coryza virus particles can only be compared with particles of known dimensions which were treated in a duplicate series of filters at the same time and under the same conditions as the tracheal exudates from the chickens. This experiment indicates that the coryza virus particle is smaller than *S. marcescens*, 0.5 by 1.0 μ, Bergey,[9] and larger than the carbon monoxide hemoglobin molecule which has been determined by Northrop and Anson[10] and Svedberg[11] to be about 5 m μ in diameter. Svedberg also found the ovalbumin molecule to possess a diameter of 4.34 m μ. Using these values in connection with Poiseuille's law for determining the radius of the pores in permeable membranes, it has been found that the coryza virus particles pass through acetic-cellodion filters with pores of an estimated diameter of 120 m μ, and are retained by those possessing a calculated pore size of 80 m μ. Therefore, the diameter of the coryza virus particles must be between 80 and 120 m μ. In general this finding is in line with the observations of Bauer and Hughes[11] and Elford,[12] who state that a relatively large group of virus particles has an end-point within these limits.

CHARLES S. GIBBS

THE HEART RATE IN HEAVY WATER

HEAVY water should afford a new method of controlling the rate of physiological processes. We have found that the frequency of pulsation of the excised heart of the frog can be slowed down in 20 per cent. D_2O.

The heart of a winter frog was carefully excised, including the *sinus venosus,* and the base tied to a small glass rod. A fine wire hook was inserted in the apex and attached to a heart lever writing on a kymograph. The heart was immersed in a 2 cc of Ringer's fluid containing approximately 20 per cent. heavy water in a small shell vial. The room temperature was 18–20° C.

The first heart tested was slit in the ventricle to facilitate diffusion, but this treatment rendered the beat rather feeble. After 15 minutes in ordinary Ringer the time for ten beats was 11.3 secs. The vial of D_2O Ringer was then substituted for the control, and the time for ten beats became 16.9 secs. after 5 minutes. The second heart tested was not slit and beat more vigorously. After 6 minutes in H_2O Ringer the time for ten beats was 11.5 secs. It was then immersed in the D_2O Ringer and after 10 minutes the time for ten beats was 27.8 secs. It was then transferred to ordinary Ringer and the time for ten beats was reduced to 20 secs. The third heart tested was placed immediately in the Ringer containing heavy water and after 5 minutes it was beating vigorously once a minute. Seven minutes after immersion the beat was constant at a rate of once every 5 secs. After transfer to H_2O Ringer the heart gave a regular beat every 2 secs. After 10 minutes of this constant rate the heart was replaced in D_2O Ringer in which the pulsations occurred every 3 secs. for 1 minute and then stopped. However, the heart partially recovered when replaced in H_2O Ringer after 7 mins., the rate being once every 2.5 secs. in regular sequence, except for a regular pause every 6 to 8 beats.

Although the scarcity of the heavy water precludes extensive tests at the present time, the slowing down was twice reversed in the third heart, indicating the influence of the heavy hydrogen isotope.

A similar effect has been observed by Mr. H. Z. Gaw[1] in the rate of contraction of the vacuole in a race of *Paramecium caudatum* in 30 per cent. D_2O, in which the vacuole empties every 19 secs. compared to every 11.3 secs. in controls (Temp. 18.8° C.). The slowing of the vacuole is completely reversible after return to ordinary water and it is probable that complete recovery of the heart would occur under conditions of normal circulation. In each case the heavy water has an effect similar to that produced by lowering the temperature. The biological effects of heavy water are what one would expect from the lower energy content[2] of chemical systems involving deuterium.

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