quately controlled by the inclusion of 5 control monkeys, all of which developed complete paralysis within from 6-10 days.

Although the number of experimental animals in the several categories is small—due to technical difficulties peculiar to this type of work—the results are nevertheless so consistent that it seems safe to draw certain conclusions. While bilateral adrenalectomy is regularly followed by a disappearance from the serum of the natural poliocidal substance, it would appear that the same operation does not ordinarily change this property of the serum in animals which have acquired it as the result of convalescence from the disease or by active immunization. It is impossible to say, however, whether this difference indicates a qualitative dissimilarity in the nature of the 2 virucidal principles involved or is caused by variations in the quantities present. At any rate, our results agree well with similar observations of Marmorston-Gottesman and Perla[3] on the effect of suprarenalecomy on the natural and acquired resistance of rats to typhoid vaccine.

## 8168 C

## A Value for the Tension at the Surface of a Myxomycete.

DARWIN VEXLER. (Introduced by E. Newton Harvey.)

*From the Laboratory of Physiology, Princeton University.*

It has appeared of interest to obtain a value for the tension at the surface of a myxomycete* in view of the fact that these organisms exhibit relatively rapid protoplasmic streaming. The method used was the oil drop one of Harvey and Marsland.[1] An oil droplet is injected into the organism and is then pulled out by centrifugal force while under observation in the microscope-centrifuge. The buoyant force of the oil is equated to the tension around the circumference of a neck of protoplasm of the same diameter as the oil drop.

$$\pi DT = V_0(\Delta\rho)CG$$

[3] Marmorston-Gottesman, J., and Perla, D., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 648.

* The myxomycete used (Physarum polycephalum) was obtained from the University of Pennsylvania through the courtesy of Dr. W. Seifriz.

[1] Harvey, E. N., and Marsland, D. A., *J. Cell. and Comp. Physiol.*, 1932, **2**, 75.

Where D = diameter of oil globule, T = tension in dynes, $V_o$ = volume of oil droplet, $\Delta\rho$ = difference in density between oil and medium, C = centrifugal force in times gravity, G = force of gravity, 980.

The criterion of recovery was protoplasmic streaming after the experiment. It was noted that centrifuging apparently stimulates streaming. In almost all of the experiments, as the oil pulled out, a very thin pellicle was visible at the surface of the myxomycete through which the oil passed. The film coalesced again, leaving no frayed edges after the oil had separated. Once the oil starts to pull off the neck of protoplasm narrows very quickly.

The medium was frog Ringer's solution diluted 250 times. Four different oils were used, as shown in the tables. While the differences in values observed are not very great, that obtained using Menhaden oil seems significantly smaller. This may be correlated with the appearance of the oil on injection. In all cases but that of the Menhaden oil, discrete globules of oil were formed of the complete mass of oil injected. The Menhaden oil, however, formed a diffuse injection, and when centrifuged small parts of this in the form of small globules separated out and then pulled off. In control experiments, the Menhaden oil was seen to diffuse uniformly throughout the animal in 20 to 30 minutes, and was then not visible. Subsequent centrifuging resulted only in the separation of a layer of oil on the centripetal edge of the organism, not in the formation of globules which could be pulled out. It appears that both olive and paraffin oils may cause some denaturation of pro-

TABLE I.
OLIVE OIL. T = 56.05 Cr2. Density of oil, 0.914.

| Exp. | | | r ($\mu$) | C (xg) | T (Dynes/cm.) | Recovery |
|---|---|---|---|---|---|---|
| April | 19 | 1 | 12 | 4330 | .35 | ? |
| ” | 28 | 1 | 6 | 5870 | .1187 | + |
| ” | 28 | 2 | 11.2 | 3950 | .278 | + |
| May | 5 | 1 | 10 | 3830 | .2145 | + |
| ” | 5 | 2 | 16 | 3475 | .498 | + |
| ” | 5 | 3 | 18 | 3710 | .674 | + |
| ” | 5 | 4 | 20 | 3245 | .727 | + |
| ” | 5 | 5 | 8 | 8350 | .299 | ? |
| ” | 6 | 1 | 14 | 4860 | .534 | + |
| ” | 6 | 2 | 20 | 2040 | .458 | + |
| ” | 6 | 3 | 8 | 6170 | .221 | + |
| ” | 8 | 1 | 44 | 386 | .418 | + |
| ” | 8 | 2 | 35.0 | 1185 | .813 | + |
| ” | 8 | 3 | 20 | 3589 | .804 | — |
| ” | 10 | 1 | 20 | 3020 | .677 | + |
| ” | 11 | 1 | 20 | 1185 | .265 | + |
| Aver. tension | | | | | .458 | |

MENHADEN OIL. T = 47.57 Cr². Density of oil, 0.927.

| Exp. | | | r (μ) | C (xg) | T (Dynes/cm.) | Recovery |
|---|---|---|---|---|---|---|
| May | 13 | 1 | 12 | 1710 | .117 | + |
| ” | ” | 2 | 6 | 3245 | .0557 | + |
| ” | ” | 3 | 8 | 3475 | .106 | + |
| ” | ” | 4 | 12 | 1780 | .122 | + |
| ” | ” | 5 | 14 | 2040 | .190 | + |
| ” | ” | 6 | 12 | 2820 | .193 | + |
| ” | 14 | 1 | 20 | 2040 | .389 | + |
| ” | ” | 2 | 12 | 2220 | .152 | + |
| ” | ” | 3 | 10 | 3240 | .154 | + |
| ” | 15 | 1 | 4 | 6020 | .0458 | + |
| ” | ” | 2 | 6 | 6480 | .111 | + |
| ” | ” | 3 | 4 | 7820 | .0595 | + |
| Aver. tension | | | | | .141 | |

PARAFFINE OIL. T = 72.99 Cr². Density of oil, 0.892.

| Exp. | | | r (μ) | C (xg) | T (Dynes/cm.) | Recovery |
|---|---|---|---|---|---|---|
| May | 16 | 1 | 12 | 5720 | .602 | + |
| ” | ” | 2 | 6 | 8350 | .2195 | ? |
| ” | 17 | 1 | 12 | 8270 | .869 | + |
| ” | ” | 2 | 20 | 4580 | 1.34 | + |
| ” | 18 | 1 | 8 | 8350 | .391 | + |
| ” | ” | 2 | 7 | 8350 | .299 | + |
| ” | ” | 3 | 8 | >8350 | >.391 | + |
| ” | ” | 4 | 14 | 6000 | .515 | + |
| ” | ” | 5 | 16 | 5360 | 1.005 | + |
| Aver. tension | | | | | 0.626 | |

50% OLIVE OIL, 50% MENHADEN OIL MIXTURE.
T = 51.81 Cr². Density of oil, 0.921.

| Exp. | | | r (μ) | C (xg) | T (Dynes/cm.) | Recovery |
|---|---|---|---|---|---|---|
| May | 19 | 1 | 32 | 466 | .247 | + |
| ” | ” | 2 | 24 | 2222 | .664 | + |
| ” | ” | 3 | 22 | 3475 | .870 | + |
| ” | ” | 4 | 12 | 7140 | .533 | + |
| ” | ” | 5 | 10 | 7300 | .378 | + |
| ” | ” | 6 | 12 | 6970 | .520 | + |
| Aver. tension | | | | | .534 | |

tein at their surfaces. No data is available for Menhaden oil. (J. F. Danielli, private communication.)

In general the tensions found for the myxomycete are somewhat lower than those determined by Harvey and Marsland[1] for *Amoeba dubia.* The results obtained are presented in the accompanying tables.

I should like to express my deep appreciation for the interest and direction of Dr. E. N. Harvey, and also that of Dr. J. F. Danielli.