poliomyelitis serums were tested. Of these, 56 showed no neutralization whatsoever. Only 2 gave slight but definite protection. With 50 LD_{50} of virus, the 50% end-point with these serums did not exceed 10^{-1}. In several experiments complete protection was never obtained with 50 LD_{50} of virus, but in two experiments complete protection against 25 LD_{50} was provided by a 1:5 dilution of the serums. Of interest is the fact that the serum of one patient was obtained 13 years after the clinical disease, whereas the other was drawn 3 weeks after the onset of paralysis.

Similar tests were carried out using potent hyperimmune monkey serums* against the Lansing, Kotter (Brunhilde group) and Brockman strains of human poliomyelitis virus. None of these serums protected against the Schultz variant. Experiments in which 10, 25, and 50 LD_{50} of virus were used, together with a 1:5 serum dilution, showed no significant difference between the hyperimmune and pooled normal monkey serums. On the other hand, the "variant" immune guinea pig serum completely protected against 50 LD_{50} of MM virus.†

Summary. The egg-adapted variant originally obtained by Enright and Schultz has not proved to be of value as a means of measuring antibody response in serums from hyperimmune monkeys and convalescent human poliomyelitis cases. The results support the conclusions of Schultz, and of Powell and Jamieson that the egg-adapted variant is serologically related to the MM-SK group of murine encephalomyelitis viruses, rather than to human and monkey-adapted strains.

* These antiserums were obtained through the courtesy of Dr. I. M. Morgan and Dr. J. F. Kessel.

† Obtained from Dr. C. A. Evans.

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17086. Electron Microscopy of Tissue Cultures Infected with the Virus of Eastern Equine Encephalomyelitis.*

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During the past 2 years we have been studying the growth of several viruses in tissue culture with particular emphasis on the use of the electron microscope. The cellular destruction and overwhelming growth of the virus of eastern equine encephalomyelitis are here reported.

Successful electron microscopy of virus infected cells has been limited to studies on "virus induced" tumors[1,2] and has not been applied to small rapidly multiplying viruses. Our technic is essentially that of Porter[3] except that cells are usually fixed for only ten minutes with osmic acid vapor.[4]

Chick embryo tissue was cultured for 6

TABLE I.
Equine Encephalomyelitis in Tissue Culture. Titration on 10-day Embryos of Fluid Removed from Tissue Cultures.

Exp. No.	Original inoculum	Titer of virus in tissue culture fluid
1	10^{-2}	$10^{-5.5}$
2	10^{-3}	$10^{-6.5+}$
	10^{-3}	$10^{-6.5+}$
3	10^{-4}	10^{-7}

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2 Porter, K. R., and Thompson, H. P., *J. Exp. Med.*, 1948, **88**, 15.

3 Porter, K. R., Claude, A., and Fullam, E. F., *J. Exp. Med.*, 1945, **81**, 233.

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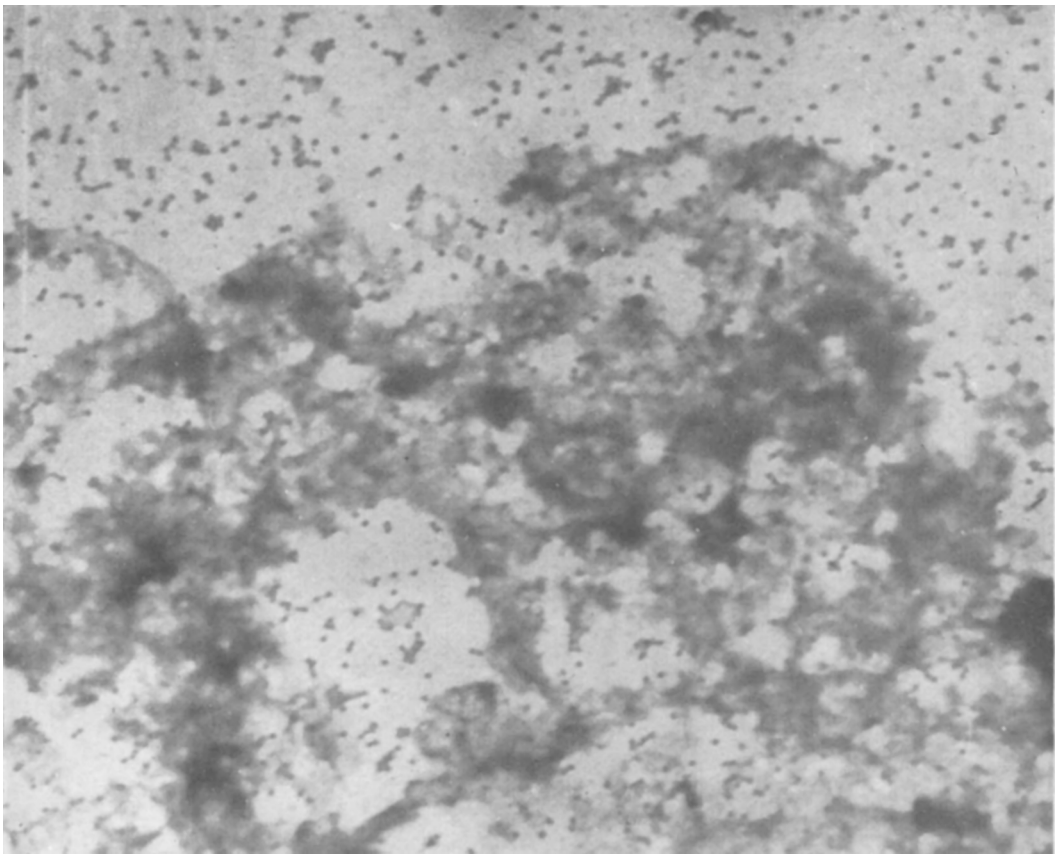

FIG. 1. Preparation of cell destroyed by Eastern equine encephalomyelitis virus. × 15,734. Fixed at 37°C with 2% osmic acid vapor for 10 minutes.

days with one transfer in roller tubes[5] in a completely homologous medium composed of chicken plasma and serum and chick embryo extract. Pieces of this tissue were then exposed to a 10^{-2} dilution of the virus. A saline extract of embryos infected with the fourth embryo passage of a standard guinea pig passage of eastern equine encephalomyelitis was used as source of virus. This tissue explant was then placed in a special chamber. This was formed by drilling the center out of a metal plate and sandwiching it between 2 formvar coated glass slides. The medium consisted of 20% chicken serum. Within the next 24 hours of incubation at a temperature of 37°C, the cells had grown out poorly and were already beginning to be destroyed. The cells were fixed by exposure to osmic acid vapor and were either examined directly or were first coated with chromium to sharpen the image. The fluid taken from the tissue culture chamber taken just before osmic acid fixation of the preparation shows a high titer of infectivity for the chick embryo. (Table I). The titers obtained indicate that considerable multiplication of the virus has taken place. This is indicated by the following figures. An inoculum of chick embryo extract would at the most titer $10^{-3.5}$ This inoculum was used in our experiments at a 10^{-4} dilution which was further diluted at least 10^{-1}. The virus, however, was recovered regularly from the tissue culture at 10^{-6} which would be at least 100 times as much virus as was added.

Several things are notable about these pictures: (a) Many particles of uniform

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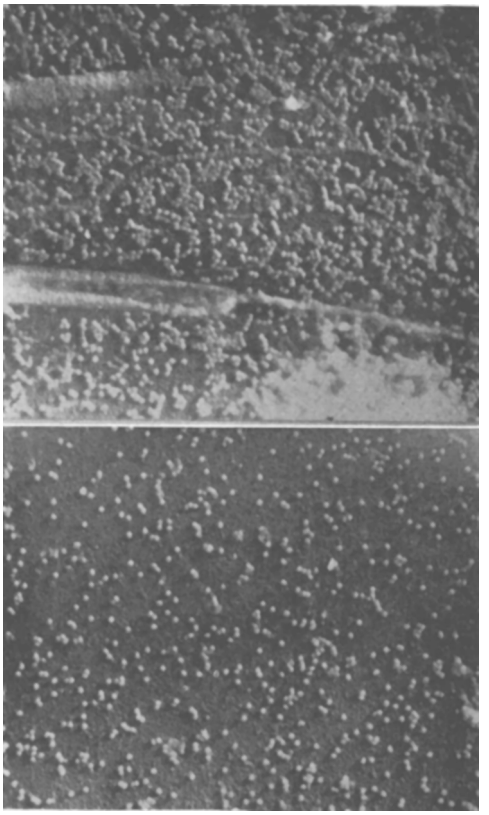

FIG. 2. (top). Chromium shadowed preparation of the same slide. Individual particles may be seen breaking off cell at bottom. × 10,300.

FIG. 3. (bottom). Area near a cell. Virus has been scattered over formvar screen. Dividing forms seen throughout.

size similar to those described in purified preparations[6] are associated with destroyed cells and have spilled out into the surrounding areas. The extensive cellular destruction is similar to that produced by infection of the embryo.[7] Such particles have not been seen in similar preparations of cells infected with the viruses of Newcastle disease of chickens, influenza, or mumps. (b) Examination of the pictures shows numerous pairs of particles with occasional chains and small clumps. The general appearance is much like that of a smear of ordinary diplococci. Further, it is relatively easy both in the shadowed and unshadowed pictures to trace a series of stages in the division of the pairs which suggests that multiplication may take place by simple binary fission. (c) These results make it probable that some viruses may be studied by electron microscopy of tissue culture preparations without previous purification from tissue extracts.

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17087 P. Reimplantation of Eyes in Fishes (*Bathygobius soporator*) with Recovery of Vision.*

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The early demonstration by Matthey,[1] that the grafted adult urodele eye is capable of recovering visual function has since been extensively confirmed.[2] With regard to fishes and the anuran amphibians, on the other hand, repeated failure of numerous attempts by various investigators to obtain visual recovery after eye transplantation, even in young tadpole stages, has given rise to the impression that the optic nerve of the grafted eye in these forms lacks the power for functional regeneration.[2]

Recently, however, the writer was able to show that good visual recovery can be

* The experiments were conducted at the Lerner Marine Laboratory of the American Museum of Natural History, at Bimini, British West Indies. They were aided by a grant from the Dr. Wallace C. and Clara A. Abbott Memorial Fund of the University of Chicago.

[1] Matthey, R., *Compt. rend. Soc. Biol.*, 1926, **94**, 4.

[2] Stone, L. S., *Trans. N. Y. Acad. Sci.*, 1941, **3**, 208.