

cinoma of the breast set a pathological limit to the amount of estrone which can be long tolerated. The mouse is not susceptible to spontaneous carcinoma of the uterus. Slye in 39,000 autopsies had only one possible case. No other workers have produced carcinoma of the uterus without direct irritation of the organ, nor have they maintained animals so long on so large a dose of estrone. As we were not able to maintain a group treated with estrone alone, we are limited in analyzing the factors in the production of these carcinomas of the uterus. 1:2:5:6 dibenzanthracene alone painted on the skin does not produce carcinoma of the uterus. Carcinoma of the cervix uteri was produced without direct irritation of the organ by prolonged treatment with massive doses of estrone in conjunction with 1:2:5:6 dibenzanthracene.

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Observations on the Virus Recovered from 1934-35 Poliomyelitis Epidemic in Los Angeles.

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Attempts were made to recover virus from 19 autopsy cases during the recent epidemic of poliomyelitis in Los Angeles. Seven of these were successful in 1934, four in 1935, as judged by the following results upon inoculation of the emulsified human cord into *Macacus rhesus* monkeys:

(1) Occurrence of pyrexia, roughness of coat, hyperirritability and tremor with subsequent development of paralysis.

(2) Transmission of the virus in successive animal passage of selected strains.

(3) The histopathology was characteristic in that oedema and hemorrhage, perivascular and diffuse infiltration, and necrosis of nerve cells were apparent.

Since the 1934-35 epidemic of poliomyelitis in Southern California has been described as being especially mild in its clinical manifestations with a corresponding low mortality rate and a low residual paralysis rate, it seemed desirable to compare the viruses recov-

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ered from this epidemic with other strains of poliomyelitis virus. To date these Los Angeles strains and the "M.V." strain from the Rockefeller Institute have been compared with reference to symptomatology and pathology produced and comparative immunologic studies have been made in detail with one Californian strain, the "McK" recovered from an autopsy in 1935. Observations include (a) symptomatology as shown by incubation period, temperature changes, type and degree of paralysis, residual paralysis rate and death rate; (b) histopathology produced in the brain and cord, (c) immunity produced and (d) neutralizing substance developed.

Symptomatology. Both pyrexia and paralysis appeared in monkeys on an average of 2 days later with the "McK" strain than with the "M.V." strain. In comparing the paralysis and recovery rate in monkeys infected with these 2 strains, it was found that monkeys inoculated with the "M.V." strain showed a partial paralysis rate of 3.7%, a complete paralysis rate of 96.3%, with 4.7% of the total number recovering, while the monkeys inoculated with the "McK" strain showed a partial paralysis rate of 78%, a complete paralysis rate of 22%, with 84% recovering. The other Los Angeles strains compared favorably in the above characteristics with the "McK" strain.

Histopathology. Although the "M.V." strain and the Los Angeles strains observed in this study exhibit histopathology characteristic of poliomyelitis, monkeys inoculated with the Los Angeles strains of virus show a less degree of cell destruction with comparatively a greater amount of diffuse and perivascular infiltration than was apparent in monkeys inoculated with the "M.V." strain of virus. Similar observations were made by Van Wart, Courville and Hall¹ in their study of the pathology occurring in human autopsy cases during the Los Angeles epidemic.

Immunity. Table I shows the results of cross immunity tests with animals recovered from intracerebral inoculation with Los Angeles strains of virus. It is seen that such recovered animals exhibited an increased immunity upon reinoculation by the intracerebral method with the Los Angeles strain, 100% recovering, while only 84% recovered from first inoculation with the Los Angeles virus. Likewise such animals developed a marked increase of resistance to subsequent intracerebral inoculation with "M.V." virus, 70% recovering while 4.7% recovered from first inoculation with "M.V." virus.

¹ Van Wart, R., Courville, C., and Hall, E. M., *Am. J. Pub. Health*, 1934, **24**, 1207.

TABLE I.
Immunity in Monkeys Recovered from Los Angeles Strains of Virus.

Reinoculation with	No Symptoms %	Slight Symptoms with Recovery %	Total Recovered %
Los Angeles Virus	68	32	100
"M.V." Virus	40	30	70

Neutralizing Antibody. Serum from patients recovered from poliomyelitis acquired during the Los Angeles epidemic neutralized the "McK" strain of virus in 70% of 30 patients tested at a serum dilution of 1 to 20 while at the same dilution it neutralized "M.V." virus in only 30% of the cases tested. It is of further interest to note that serum of monkeys recovered from experimental infection with the Los Angeles strain neutralized "McK" virus in 70% of 30 monkeys tested while it neutralized "M.V." virus in only 40% of the same monkeys.

Variation in the Severity. The foregoing observations on the symptoms and pathology produced by the strains of virus recovered from the recent poliomyelitis epidemic in Los Angeles indicate that they are viruses giving classical symptoms of poliomyelitis in monkeys, differing only in degree from the "M.V." and certain other strains recorded in the literature.

That strains of poliomyelitis virus vary in the symptomatology produced in monkeys is apparent from a review of the results of investigators in this field since some strains are described as "weak" and others as "strong". All workers known by the writers, who have employed the "M.V." strain have recorded severe symptoms and a low recovery rate similar to the findings observed for the "M.V." strain in this study. Jungeblut,² using the Aycock strain, finds the severe paralysis rate of inoculated animals high and the recovery rate low, less than 10% (personal communication). Trask and Paul³ also state that the "Wfd" strain which originated in the Los Angeles epidemic is one of low "virulence—in so far as intracerebral infectiveness is concerned." This is one of the strains used in our current study which we also found to produce mild symptoms in animals. Paul, Trask and Webster⁴ further report that the "McC" strain recovered from nasal washings during the Los Angeles epidemic produces mild symptoms in monkeys. All strains from the Los Angeles epidemic, observed by us to date, have been

² Jungeblut, C. W., *J. Infect. Dis.*, 1936, **58**, 150.

³ Trask, J. D., and Paul, J. R., *J. Bact.*, 1936, **31**, 527.

⁴ Paul, J. R., Trask, J. D., and Webster, L. T., *J. Exp. Med.*, 1935, **62**, 245.

found to produce mild symptoms in experimental studies with *Macacus rhesus* monkeys.

Variation in Immunity. Burnet and Macnamara⁵ have recorded the existence of immunologic differences between a strain of poliomyelitis virus isolated in Australia and the "M.V." strain.

In the present study it is seen that monkeys recovered from infection with Los Angeles strain of virus demonstrate immunity and neutralizing antibody to both the Los Angeles and the "M.V." virus but that these are higher when tested with Los Angeles virus than when tested with "M.V." virus. Likewise convalescent patients from the Los Angeles epidemic demonstrate a higher neutralizing antibody titre to Los Angeles virus than to "M.V." virus. There is, therefore, demonstrated a definite immunologic relationship between the Los Angeles and the "M.V." strains with, however, minor variations in the degree of immunity produced against local and "M.V." virus.

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Functional Boundaries in the Sensori-Motor Cortex of the Monkey.*

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The method of local strychninization of the cerebral cortex of the monkey has already established the existence of functional boundaries between the major subdivisions of the sensori-motor cortex, so far as sensation is concerned.

Further study of the problem by the same method, supplemented by recording the action potentials of the cortex, has confirmed the existence of functional boundaries on the "sensory" side and established the existence of such boundaries on the "motor" side.

Strychnine applied locally to any region of the cortex induces in that region typical changes of the "spontaneous" action potentials, notably the appearance of "strychnine-spikes". Though the structural dissimilarity of the various cortical regions precludes the

⁵ Burnet, F. M., and Macnamara, J., *Brit. J. Exp. Path.*, 1931, **12**, 57.

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