14343

Vitamin B_1 Deficiency and Attempts to Produce Poliomyelitis in White Rats.

JOHN A. TOOMEY, WILLIAM O. FROHRING, AND WILLIAM S. TAKACS.

From the Division of Contagious Diseases, City Hospital, the Department of Pediatrics, Western Reserve University, Cleveland, O., and the Research Laboratories, S.M.A. Corporation, Chagrin Falls, Ohio.

The experiments reported in this paper are the first of a series, the purpose of which is to determine whether Flexner's M.V. strain, which has been acclimated to Eastern cotton rats, could in turn be acclimated to white rats by some vitamin deficiency or imbalance.

This first series was with B_1-deficient animals. White rats were fed a vitamin B_1 test diet made up as follows: sucrose—62.1%; vitamin free casein—18.6%; peanut oil—7.8%; salt mixture—4.2%; cod liver oil—2.3%; and alkaline autoclaved brewer's yeast—5.0%. When the animals first started this diet, they were from 22 to 26 days old and weighed between 40 and 50 g.

We had ascertained that white rats from our colony had to be kept on this diet 30 days before they developed full-blown B_1 deficiency. If the diet were continued the animals would start to die beginning about the thirty-eighth day. This left 8 days in which to demonstrate additive effects of poliomyelitis virus. Signs and symptoms should appear after the fifth or at least before the eighth day following injection of virus, which occurred on the thirtieth day of the diet. There was sufficient time since reactions begin to appear in Eastern cotton rats about the fourth to fifth day after injections with Flexner's M.V. cotton rat-adapted strain.

A second difficulty arose. Vitamin B_1-deficient rats have a polyneuritis. It might be difficult to distinguish this condition from that produced by poliomyelitis virus, especially since the early clinical appearance of white rats which are vitamin B_1-deficient and cotton rats infected with poliomyelitis are alike, *i.e.*, they are furred, have tremors, apraxia and weakness. There are two definite points of differentiation. Twisting the tail of vitamin B_1-deficient animals sends them into a typical rolling movement not seen in poliomyelitis virus-infected animals that have paralysis; vitamin B_1-deficient rats never go on to a stage of typical flaccid paralysis with dragging of the hind legs as occurs in cotton rats after virus injections.

Experiment 1 (a). Before injecting virus suspension, a number of materials, such as normal cotton rat brain-cord suspensions, normal white rat brain-cord suspensions, etc., had to be investigated for their non-specific reactions.

The dose of specific or non-specific suspension always given in this and the following experiments was: 0.06 cc intrathecally, 0.06 cc intranasally, 0.5 cc subcutaneously, and 1.0 cc intraperitoneally. Brains and cords were always ground in normal saline for the test dose.

To conserve space, vitamin B_1-deficient white rats will be termed "deficient" rats and Flexner's M.V. cotton rat-adapted strain suspension will simply be termed "virus suspension." Normal cotton rat brain cord suspension will be termed "normal suspension." Brain and cord suspension from deficient rats will be termed "deficient suspension."

"Normal suspensions" from white rats (1a, Table I), "normal suspensions" from cotton rats (1b, Table I), and enteric toxin sometimes used in our laboratory to enhance the virulence of virus (1h, Table I) were tested.

A latent virus might have been present in the brains and cords of "deficient" animals that died and sub-transfers were made of injected and uninjected "deficient suspensions" (1c and d, Table I) into other "deficient" animals.

Something might be catalyzed in the central nervous systems of rats fed deficient diets and an autocatalytic enzyme produced which would

TABLE I.
Reactions in White Rats to Injection with Control Materials.

Exp. No.	Control injections	Into	Deficient white rats	Results: Dead	Results: Between days
1a	"Normal Suspension"	white rat	4	4	5-23
1b	" "	cotton "	10	10	9-23
1c	"Deficient Suspension"	white rats from Exp. 1b	4	4	8-27
1d	" "	" " " " 1c	10*	5	6-62
1e	" "	5 killed white rats from Exp. 1d	5	5	19-25
1f	" "	white rats from Exp. 1e	10	10	9-23
1g	" "	" " " " 1f	4	4	13-27
1h	Enteric Toxin		10	10	6-70

* 5 killed on the 10th day for transfer material.

TABLE II.
Attempt to Acclimate Flexner's M.V. Rat Adapted Strain to White Rats.

Exp. No.	Virus Injections	Into	Deficient white rats	Results: Dead	Results: Between days
2a	"Virus Suspension"		4	4	15-30
2b	"Deficient Suspension"	white rats virus inj., Exp. 2a	11	10*	6-16
2c	" "	" " Exp. 2b	5	5	12-19
2d	" "	" " " 2c	10	9†	8-23
2e	" "	" " " 2d, showing weakness	6	6	2-7
2f	" "	" " " 2e	5	5	5-28
2g	" "	" " " 2f	10	10	6-13
2h	" "	" " " 2g	10	10	8-41

*1 died first day from accident.
†1 died thirteenth day—had weakness.

in turn cause paralysis in other "deficient" rats. Serial transfers were therefore made from "deficient" rats into other "deficient" animals (1e, 1f, and 1g, Table I.)

Results. The results are outlined in Table I. It could be concluded that no factor, either latent or otherwise, was found in the central nervous system of either normal or vitamin B_1-deficient white rats or normal cotton rats which would cause paralysis in white rats; nor did enteric toxin cause any such reaction.

In the next experiment "deficient" animals were injected with "virus suspension" and when these animals died an emulsion of their cords in saline was injected into "deficient" white rats. Serial transfers were attempted as outlined in Table II.

One of the animals of Experiment 2d that died on the thirteenth day had questionable weakness of the hind legs. Cord suspensions of this animal injected into other "deficient" animals (2e, Table II), did not produce paralysis, although these animals died sooner than did those in previous experiments. This was suggestive since it resembled the way in which other virus strains affected the Eastern cotton rat as they become acclimated to that animal. If this represented a beginning acclimation, the next series of injections would probably produce paralysis at least in some animals. Three more generations were tried without producing any such result.

Results. In the virus injection experiment, there was suggestive weakness in only one animal which may have been due to injury. Under the conditions of our experiment, there was no evidence that vitamin B_1 deficiency would in any way make white rats more susceptible to Flexner's M.V. poliomyelitis cotton rat-adapted strain.