

sistance to subsequent infections of *Trichinella*. Investigations of this type are being carried on at present in this laboratory.

Summary and Conclusions. 1. Immature forms of *Trichinella spiralis* and *Rhabditis pellio* have been irradiated with varying doses of roentgen radiation. 2. It was found that, at proper dosages, the radiation permitted the organisms to grow to maturity, to undergo copulation, and to begin the development of embryos, but the radiation killed the embryos before their development was completed. 3. Based on the foregoing data, it should be possible to ascertain whether an intestinal infection of *Trichinella spiralis*, without the consequent muscle invasion, can produce resistance to subsequent infections of *Trichinella*.

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Experimental Study of Factors Inhibiting Differentiation of Proctodeum.

A. M. SCHECHTMAN AND J. A. CANNON.

From the Department of Zoology, University of California, Los Angeles.

Introduction. It was previously reported (Schechtman¹) that the ventrolateral blastoporal lip of the early gastrula (*Hyla regilla*) is capable of inducing a proctodeum in the belly epidermis of another embryo. The percentage of positive results was extremely variable: occasionally a group of 6 host embryos might develop an accessory proctodeum in all 6 cases; however, in most groups of 6, positive results occurred in only 1, 2, or 3 cases. This variability persisted in over 200 implantations carried out during the laying seasons of 3 consecutive years. In the entire group slightly more than 50% showed clear accessory proctodea. Accessory proctodea and tails were also produced by centrifuging late blastulae and early gastrulae (Schechtman²). An analysis of 983 such embryos by one of us (Cannon, unpublished) showed that only 4% were clearly positive. A striking characteristic of both implanted and centrifuged eggs is that accessory proctodea, with rare exceptions, develop on the belly region.

The aim of the present investigation was to determine the causes behind the great variability shown by the ventral blastoporal lip in

¹ Schechtman, A. M., PROC. SOC. EXP. BIOL. AND MED., 1939, **41**, 48.

² Schechtman, A. M., PROC. SOC. EXP. BIOL. AND MED., 1937, **37**, 153.

its capacity to induce proctodea. The observed fact that the induced proctodea are almost always in the belly region—never adjacent to or over the axial organs—suggested that the latter may inhibit the development of proctodea.

Experiments. In the transplantation experiments mentioned above, the orientation of the proctodeum-inductor could not readily be controlled since the material was placed in the blastocoele. In the present experiments the proctodeum-inductor was vitally-stained and placed in a superficial position in the presumptive ectoderm of early gastrulae, so that its orientation was never in question. The experiments were as follows:

(1) Two vitally stained *dorsal lips* (which contain presumptive chorda-somite material) were transplanted, one on either side of the ventral lip of a host. The implanted dorsal lips invaginated well, so that 2 separate accessory medullary plates developed in addition to the host's own medullary plate. Sections showed that 2 notochords were developed from the dorsal lip transplants. In some cases definite accessory gut lumina were formed. *The ventral lip, surrounded by the dorsal lip transplants, invaginated and took part in the formation of the posterior abdominal region, but never formed a proctodeum.* These embryos developed no tail buds.

(1-a) It seemed possible that inhibition of the proctodeum in the above cases might be due to the experimental manipulations; therefore the following control experiments were carried out. Presumptive *ectoderm* of the early gastrula was transplanted to the same positions as in (1), namely, on either side of the ventral lip. In every case proctodea were formed from the ventral lip material. Therefore, the absence of a proctodeum found in experiment (1) is not due to mere operative procedures.

(2) A *ventral lip* was transplanted in place of the dorsal lip, so that the early gastrula possessed two ventral lips. The transplanted ventral lip became part of the neural plate, extended back into the blastopore, and formed part of the archenteric roof. When the specimen was sectioned at a later stage, it showed two neural tubes, between which lay the implanted ventral lip material which formed a wedge of mesoderm between the two nerve tubes. *There was no indication of a proctodeum* in the region of the transplant, although the host's own ventral lip did form a proctodeum.

(3) Two *ventral lips* were placed one on either side of the dorsal lip of the host, in place of the dorsolateral lips. This specimen appeared quite normal throughout. The vitally stained and transplanted ventral lips became part of the neural folds of the trunk

region, which had a perfectly normal appearance in cross sections. Again *there was no evidence of proctodeum formation* from the ventral lip transplants.

(4) Strips of tissue composed of the ventral lip (mesentoderm, the proctodeal inductor), plus some adjacent presumptive ectoderm were transplanted into two positions: (a) in such a way that in the neurula the ventral lip (mesentoderm) part of the transplant lay close to the back (axial structures) of the host, with the ectodermal part extending ventrally onto the belly region of the host. (b) Turned 180° in relation to (a) so that the ventral lip part was far down on the belly and the ectodermal part close to the back (axial organs). *In cases (a) where the mesodermal part of the transplant was closer to the back, proctodea never formed.* But when this same region was reversed so that it lay down on the belly as in (b), proctodea resulted in each case. Four cases each for (a) and (b) were observed. While this number is small, we feel the clear-cut results plus the analogous results of the other experiments (in each of which 3-4 specimens were operated upon) leave little room for doubt that the axial materials inhibit the proctodeum-forming materials.

Discussion. Bautzman³ showed that ventral and ventrolateral lip mesoderm is less fixed or determined than dorsal lip mesoderm. Our results definitely confirm his. Thus in experiment (3) ventral lip material was converted into axial structures when placed in a new position. However, dorsal lip mesoderm as shown in experiment (1) goes on to form its normal components (somites and chorda) and induces a medullary plate in spite of its abnormal position. Bautzman worked with urodeles in which the blastoporal opening becomes the anus, and he therefore had no opportunity to notice an inhibitory effect on proctodeal inductors.

The above results suggest an explanation as to why only 50% proctodeal inductions were obtained when ventral lips were implanted into the blastocoele. Implants placed into the blastocoele are shifted about by the movements of gastrulation so that some would be carried closer to the host's axial organs. Our experiments show that implants near the axial organs would be inhibited, while those in a favorable (ventral) position would maintain their normal capacity for proctodeum induction. This would also explain the fact that secondary proctodea are nearly always found in the region of the belly rather than in the ectoderm overlying the somites or the medullary plate.

³ Bautzman, H., *Arch. Ent. Mech.*, 1937, **128**, 665.

A phenomenon worthy of mention is the disappearance (de-differentiation) of some secondary proctodea. The pigmented pit and its elevated border may regress to a flat pigmented spot which may in turn disappear. On the other hand, some induced proctodea persist and eventually communicate with the gut lumen.

Summary. Transplantation experiments show that the capacity of ventral blastoporal lips to induce a proctodeum is inhibited by the proximity of the rudiments of the axial organs. This suggests an explanation as to why, in previous experiments, proctodea were induced by only 50% of the transplants, and for the observed ventral position of accessory proctodea.

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Recently Isolated Strains of Pneumococci as Incitants of Experimental Pneumonia in Rats.*

W. J. NUNGESTER AND ALICE H. KEMPF.

From the Hygienic Laboratory, University of Michigan, Ann Arbor, Mich.

Although the infectivity of recently isolated strains of pneumococci has been tested both in routine injection of mice for type-identification, and in special studies,¹ the difference in ability of recovered strains to produce experimental pneumonia in animals has not been determined.

We have compared experimental pneumonic infections in rats with the clinical course in the patient from whom the pneumococci were isolated, and have correlated certain characteristics of the disease in man and rat with the type of pneumococcus involved. Cultures were obtained from 23 patients with pneumonia, and from one with otitis media during the winters of 1937-38 by Mr. Gerhardt Burde, of the Michigan State Department of Health. The pneumococci were retyped, and used in these experiments within 2 weeks of their initial isolation.

Rats were inoculated intrabronchially in the left lobe of the lung with 10^{-5} cc of cultures of these organisms suspended in sterile mucin, according to a method previously described.² Surviving

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¹ Rosenau, M. J., Felton, L. D., and Atwater, R. M., *Am. J. Hyg.*, 1926, **6**, 463.

² Nungester, W. J., and Jourdonais, L. F., *J. Infect. Dis.*, 1936, **59**, 258.