of cells regardless of their distribution in organs and tissues. It would seem that *histologic adaptation* best expresses the specialization of a virus with regard to the kind of cell in which it grows, since histology is the science of kinds of cells.

The third type of virus adaptation is related to the species of animal which the virus invades or in which it produces a disease. This adaptation, like the others, appears to be distinctive for each virus. The rabies virus is broadly adapted in this respect, being capable of invading probably all species of mammals and birds. The distemper virus, which is more restricted, produces a disease only in members of the weasel family, the raccoons and the Canidae. The virus of the oral papillomatosis of dogs appears to be capable of invading only the dog. The adaptation to growth in a host-species or in a range of host-species might well be termed the *zoologic adaptation* of a virus.

While the cytologic adaptation of a virus seems to undergo little or no variation, the histologic and the zoologic adaptations seem to be subject to extensive natural variation. Within the ranges of the latter two adaptations, great experimental change can be effected in a virus by the selection of the species of animal injected and by the choice of tissue used as virus in serial host-to-host transfers. The distemper virus may be highly adapted to ferrets by host-to-host passage, becoming highly virulent for that animal and at the same time becoming a harmless, immunizing agent for members of the canine family. Distinctly different, artificially modified distemper viruses are produced by ferret-passage, depending upon whether the virus is passed serially through ferrets by subcutaneous injection and the use of spleen as inoculum; by intracranial injection and the use of brain tissue as transmission material; or whether it is passed by skin-to-skin inoculation. Such viruses are identical in their zoologic adaptation but differ in their histologic adaptation. A clear separation of these adaptations seems essential to qualify the nature of both natural and experimental viruses.

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URETHANE: ABSENCE OF PARALLELISM WITH THE ANTI-SULFONAMIDE ACTION OF p-AMINOBENZOIC ACID

The demonstration by Johnson[1] that urethane (ethyl carbamate) exerts an anti-sulfanilamide effect on systems involving luminous bacteria led to the assumption that urethane should exert an anti-sulfonamide action by inhibiting the *in vivo* protective action of sulfonamides against streptococcal or other infections. That this assumption is not correct has been demonstrated in this laboratory.

[1] Science, 95: 104, 1942.

p-Aminobenzoic acid (0.5 grams per kilo) completely inhibits the protective action of sulfanilamide (2.0 grams per kilogram) against a streptococcus infection (produced by the injection of 0.1 cc of a 24-hour broth culture of Strep. hemolyticus). Urethane (0.5 grams per kilogram) fails to inhibit the anti-streptococcal action of sulfanilamide (2.0 grams per kilogram). Approximately 500 mice were used to establish this point.

The failure to demonstrate an anti-sulfanilamide action by urethane in an *in vivo* system involving protection against streptococcus infections limits the applicability of data obtained from the study of luciferase systems to the broader aspects of sulfonamide action. The basic mechanisms involved in the luciferase system are not necessarily those involved in the anti-bacterial action of sulfonamides generally.

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BLUEBERRY STORAGE

During 1941 the Maine Agricultural Experiment Station conducted blueberry storage studies under controlled atmosphere and controlled temperature. These studies showed a great variation in the keeping quality of the different clones of low-bush blueberries and varieties of high-bush blueberries. The low-bush showed the greatest variation, as some of the clones with poor flavor when they were put in storage had good flavor when the storage period was completed. With other clones the reverse was observed. The fully mature and overripe berries did not keep well in storage and while they appeared good when removed from storage they became soft and wet before the berries could be retailed. In these experiments, the named varieties of high-bush blueberries did not store as well as some of the high-bush selections made in Maine.

The blueberries which were stored at 5° C and in an atmosphere with an oxygen content of 5 per cent. or slightly less were in the best condition at the end of the experiment. Carbon dioxide contents of from 13 to 15 per cent. in the atmosphere were not detrimental in these studies. These conditions are similar to those used by Van Doren *et al.*[1] in the storage of cherries, and the temperature was slightly higher than that recommended by Levine *et al.*[2] for the storage of

[1] A. Van Doren, M. B. Hoffman and R. M. Smock, *Proc. Amer. Soc. Hort. Sci.*, 38: 231–238, 1941.

[2] A. S. Levine, C. R. Fellers and C. I. Gunness, *Proc. Amer. Soc. Hort. Sci.*, 38: 239–242, 1941.

cranberries. Commercially, blueberries may be kept for 2 to 4 weeks or from the middle of August to the first of September. For home use blueberries were stored for several months in sealed glass jars placed in the home refrigerator. The temperature in the home refrigerator was above the optimum for storage, but a very satisfactory result was obtained. The author enjoyed a delicious pie made from berries that had been kept in the home refrigerator for six months.

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SCIENTIFIC BOOKS

OVERFISHING

The Overfishing Problem. By E. S. RUSSELL, Director of Fishery Investigations, Ministry of Agriculture and Fisheries, Great Britain. 130 pp. Cambridge Press, 1942. New York: The Macmillan Company.

SELDOM does one find so clear and understandable, so forthright and unpretentious and so readable and entertaining a condensation of more than a half a century of scientific research as is found in Dr. Russell's little book embodying the De Lamar lectures delivered before the School of Hygiene of the Johns Hopkins University in March, 1939; nor could one conceive of a subject of greater importance to the fisheries of the United States with their potential six-billion-pound yield of war-time food than "the overfishing problem" which is the subject of these lectures.

Although the specific illustrations and the supporting scientific data were drawn chiefly from the fisheries of Great Britain, in the North Sea and from the Arctic Coast of Norway and Iceland, to the Atlantic shelf of Africa, the general principles which control anywhere in the world the development, the rise to maximum production and the ultimate decline of sea fisheries under intensive exploitation are clearly defined in such a way that the American reader will find frequent application to familiar conditions in home waters. Each of the lectures—(1) the exploitation of the fish stocks, (2) the depletion of the older grounds, (3) age analysis of fish populations, mortality rates and rate of growth, (4) the overfishing problem in its modern formulation, and (5) the regulation of the sea fisheries—is complete in itself and affords a leisurely hour's reading. Such a reading, however, will provoke many hours of thoughtful reflection, and such reflection should lead to profitable action on the part of American fishery interests.

In his conclusion, Dr. Russell says:

> We have seen in the course of these lectures that the state of overfishing exists in many of the trawl fisheries in Northwestern European waters. Two things are wrong. First, there is too much fishing, resulting in catches below the possible steady maximum, and second, the incidence of fishing falls too early in the fishes' life, resulting in a great destruction of undersized fish which ought to be left in the sea to grow. Mesh regulations, if sufficiently drastic, will cure the second evil so far as round fish are concerned, and they may well be reinforced by suitable size limits. For the first evil, there is only one radical cure, namely a reduction of the amount of fishing.

This is a familiar theme to fishery biologists in the United States who have reached identical conclusions from extensive data gathered over a period of years by the old Bureau of Fisheries and the present Fish and Wildlife Service. It is on the basis of such research that Herrington has recommended increased mesh sizes and minimum size limits for the New England trawl fisheries, and minimum size limits for lobsters; restrictions on the intensity of fishing have been recommended by Dahlgren for the Alaska herring and by Nesbit for the Atlantic shad and other shore species. The latter recommendation is based on a fundamental principle which Dr. Russell fully develops: ". . . that up to a point you can increase yield by increasing fishing, but after this maximum is reached the more you fish the less weight of fish you catch." From a series of simple theoretical calculations and from a great number of practical illustrations taken from many years' records of the British fisheries, he draws the general conclusion "that there must be for every fish an optimum rate of fishing. When the rate exceeds the optimum the yield will fall in spite of the increased effort expended."

Dr. Russell cites a well-known example of the benefits of a reduced fishing rate in the Northern Pacific halibut fishery in which legal control of the rate of fishing has been applied under the treaties made between the United States and Canada in 1924 and 1930, renewed in 1937. He recalls to us the fact that the formerly depleted halibut fishery was restored under regulation. On the southern banks the abundance of halibut increased by as much as 60 per cent. So great was the general increase in the stock that the fishermen are able to catch their limit in five months instead of in nine and the commission now estimates that the earnings of halibut fishermen are $1,000,000 a year greater than they would have been without regulation.