attainment of a great age and a correspondingly great size.

Pearl's conclusions about the natural term of life in *Drosophila* are probably broadly correct, but as he had perforce to keep his insects in confined spaces, there are certain factors incident to overcrowding which he apparently overlooked. For five or six years a skilled experimenter in my laboratory has been rearing the tadpoles of the common frog with the view of testing their reactions to certain changes in the environment. Rearing tadpoles has been a schoolboy sport since time immemorial, but the average experimenter finds that he begins with a large amount of spawn from half of which tadpoles hatch out; these steadily diminish in number as they grow older, until in the end the triumphant schoolboy points to a dozen or half a dozen young frogs as the outcome of the experiments. But in my laboratory it is now possible to start with a culture dish containing 50 tadpoles and to bring 48 successfully through the metamorphosis. Sometimes extensive mortality occurs in a particular dish; when this case is investigated it is found to be due to some chemical contamination of the water. There is no inherent reason why tadpoles should die at any stage in their growth.

It is noteworthy that marine mammals, in spite of the fact that some of them such as the fin whale attain the largest dimensions (100 ft. in length with corresponding girth) ever attained by any animal living or extinct, nevertheless have a definite limit to their growth and presumably to their lives. For it has been shown (1) that when fin whales are born they are 20 ft. in length, (2) that they attain a length of 50 ft. in about a year, (3) that the union of the epiphyses with the bodies of the vertebræ, which sets a definite limit to growth and ultimately to life, occurs when the animal is eight years old.

In conclusion, we may say that Mr. Szabó's paper is interesting and suggestive of further experiments, but that his thought needs clarifying. The probable truth contained in it is that at various stages in the life history the coming into action of new powers of development, involving very active metabolism and often a resorption of old tissues, impose such a strain on the whole of the animal economy as temporarily to weaken the constitution, and that at such periods the weaker individuals succumb to adverse environmental influences. Szabó mentions such a period of weakness in the human race at the end of the first year. Apart from the strain involved in weaning and the adaptation to a new diet, there is the strain involved in cutting the teeth. Once we ourselves had startling light thrown on this subject. When resident in Canada, we met with an American Indian woman who was the mother of numerous offspring, all of whom she nursed for the full period. But as she pathetically explained to us, "she lost them all". Further investigation revealed the fact that the infants died when one year old or thereabouts, and that the cause of death was the strain of cutting a large number of teeth at one time. The simultaneous cutting of the teeth was due to the fact that when nursing one child she was in her sixth month of pregnancy with another, and Nature could not supply sufficient food to nourish the child in the womb and at the same time develop the teeth of the suckling child: these were held back in development, with catastrophic results to the child.

As to why some germs are more vigorous than others is a question too large to be discussed in this article, but it is, in our opinion, a subject of transcendent importance both for animal and human life, and is certainly not to be explained by 'chance'.

E. W. MACBRIDE.

Pharmacology of Thallium.

THALLIUM salts have been used chiefly as a depilatory in ringworm of the scalp in children and as a poison for the extermination of rodents. Munch and Silver have recently reviewed the literature on the use of thallium, reporting at the same time some personal experiments on its toxicity and use as a rodent poison.* The salts most usually employed have been thallous acetate or sulphate.

Thallium is extremely toxic to animals but has less action on bacteria. In acute poisoning in man and animals, there is marked interference with locomotion, paresis or paralysis of the lower limbs, loss of appetite, decreased gastric activity, emesis, diarrhœa changing to obstinate constipation, a blue line on the gums, albuminuria, nephritis, and marked respiratory depression. Death occurs from respiratory failure, the heart and circulation not being involved. Post-mortem hæmorrhages into the lungs and marked irritation of the gastro-intestinal tract have been recorded. In chronic poisoning, the kidneys and central and sympathetic nervous systems are affected, leading to pains in the muscles and nerves, changes in the endocrine organs, and loss of hair: disturbances of calcium metabolism have also been reported. The action of thallium is cumulative: elimination is slow, two to three months being required for complete removal from the body of medicinal doses.

Thallium has been abandoned for treatment of night sweats in phthisis owing to its toxicity. It is still used as a depilatory in the treatment of ringworm in children: the maximum permissible as well as minimum effective dose is 8 mgm. per kgm. body weight, but even with this dose, toxic reactions frequently occur.

The lethal dose for rats and mice by oral administration and for rabbits by intravenous injection is about 25 mgm. per kgm. body weight: dogs are more sensitive, 10–15 mgm. per kgm. causing death. Rats usually die in three days after eating poisoned food: increasing the dose does not accelerate the fatal issue. Thallium is therefore a comparatively slow poison.

Poisoned bait was readily consumed by laboratory rats, but when tested in the field, prairie dogs did not consume different samples with equal avidity. The reason for the difference between different samples was not determined: presumably prairie dogs are more susceptible to foreign tastes or odours than rats; both the thallium salt and the nature of the food material with which it is mixed probably play a part in making the bait attractive.

Although thallium is as toxic to rodents as strychnine and several times more toxic than arsenious oxide or redsquill powder, Munch and Silver advise that it should not be used indiscriminately as a rat poison, owing to its extreme toxicity to human beings. Where its use is found necessary for the control of highly resistant species of rodents, such as prairie dogs or ground squirrels, which refuse strychnine bait, it should be entrusted only to those who will exercise appropriate care in handling it.

* "The Pharmacology of Thallium and its Use in Rodent Control." By James C. Munch and James Silver. *Technical Bulletin*, No. 238. United States Department of Agriculture, Washington, D.C., 1931.