24 (70). **"A preliminary study of the toxicological action of thorium": ARTHUR F. CHACE** and **WILLIAM J. GIES.**

Our experiments comprised the third series in a study, still in progress, of the toxicology of rare elements.[1] They were twenty-seven in number, and were performed on as many animals (frogs, mice, dogs). They were carried out before Baskerville's announcement of his discovery that thorium contains *two* new elements, named by him *berzelium* and *carolinium*. Publication of our results was deferred because of our desire and intention to complete the work with a study of the toxicological effects of these two new elements, which Professor Baskerville has generously agreed to furnish at a later stage in his investigations. The foregoing communication by Professor Sollmann has induced us, however, to present our results as they stand.

In some of the early experiments (1900) it was found that thorium (nitrate) had a uniform precipitative effect on various connective tissue mucoids. In a study with Professor Loeb (1902), on the antitoxic influence of ions, thorium (nitrate) was used as a tetravalent element, and was found to exert only very slight, almost inappreciable antitoxic effects in $\frac{5}{8}m$NaCl, with fertilized Fundulus eggs as the indicators. At that time we observed a strong precipitative effect of thorium on protoplasm, and a marked toxicity on various fishes, and on both fertilized and unfertilized Fundulus eggs in sea water, although these facts were not recorded in our paper.

In the experiments on frogs and warm-blooded animals the tetrachlorid was used exclusively. Of our results the following were in harmony with those reported by Brown and Sollmann: Thorium exerts marked astringent action. The chlorid is acid in reaction (in water). The aqueous solution of the chlorid blanched and hardened tissues, proteins were precipitated by it, and blood not only precipitated but blackened. Injected directly into the circulation even very small doses caused intravenous precipitation, and resulted fatally. Subcutaneous injection resulted in local necrosis. We have had no experiments with thorium in citrate solution nor on the excretion of thorium.

[1] We have already reported our observations on the toxicology of tellurium (1900) and of selenium (1902). Effects of radium are indicated on page 86 (150).

The following results extend the observations reported by Brown and Sollmann :

1. In *frogs* weighing about 25 gm. no effect was observed after introduction per os, when less than 40 mg. was introduced. This amount caused only slight symptoms. Subcutaneous injection of 40 mg. caused death in about 60 hours. Injection of the same amount per rectum appeared to be more quickly followed by toxic results than when introduction occurred through either of the former channels. Introduction per os caused irritation of the throat, increased gastric secretion, ejection of gastric contents and increased peristalsis. It required per os approximately 1.5 gm. per kilo to produce general toxic results, among which were anhydrosis, twitching, and progressive weakening of the muscles, with paralysis of the forelegs preceding paralysis of the hind ones. In fatal cases the reflexes were abolished in the usual order. The general toxic effects after introduction subcutaneously or per rectum were about the same as those following introduction by way of the stomach.

2. *In warm-blooded animals* (mice and dogs) relatively large doses administered subcutaneously caused restlessness, twitching of the muscles, progressive paralysis, labored breathing, stupor, death. Paralysis of fore-legs preceded loss of power in the hind legs. Injection of 5 gm. of the chlorid into a dog weighing 15 kilos failed to cause death. Ingestion of 2 gm. with 100 gm. of meat, by a dog weighing 6 kilos, was followed in two hours by vomiting. The ejected matter was gradually eaten during the next few hours with no other apparent effect thereafter than loss of appetite and increased desire for water.

3. The most constant and pronounced general effect of the tetrachlorid of thorium was a progressive weakening of all the voluntary muscles.

Eleventh meeting.[1]

Zoölogical Laboratory of Columbia University. April 19, 1905. President Wilson in the chair.

25 (71). **"The relation between normal and abnormal development of the frog's egg": T. H. MORGAN.**

The method of development of the frog's egg may be changed

[1] Reprinted from *Science*, 1905, xxi, p. 741 ; *American Medicine*, 1905, ix, p. 744 ; *Medical News*, 1905, lxxxvii, p. 87.