is composed of dune sand, probably derived from the Loup Fork (Tertiary) beds. These hills seem to have been formed largely at some previous epoch and to have become stabilized and occupied by vegetation. Through the influence of man, mostly on account of prairie fires and overgrazing, many of these ancient dunes have become rejuvenated to the detriment of those responsible for it.

After giving the results of his careful measurements of wind, rainfall, evaporation, temperature and other ecological factors, Professor Pool takes up in detail the vegetation of the region. It is a pleasure to note the author's caution in using the word "formation." He rightly believes in using this term only for large units, referring the "formations" of many authors to associations. The characteristic upland formation is the prairie-grass formation, which is contrasted sharply with the short-grass formation of the plains, the two embracing most of the great climatic grasslands between our eastern forests and the mountains. These two great formations have similar physiognomy, but different component species; the limiting factors are the available water and competition, and not temperature, as supposed by Merriam. The chief association is the bunch-grass association, dominated especially by *Andropogon scoparius;* this is the vegetation that prevailed generally before the advent of the white man, and is regarded as the temporary climax of the region. The vegetation of this association is open, the grasses occurring in tufts or bunches, but it is supposed that ultimately some closed prairie-grass association will prevail. There is evidence of this in the spear grass association (dominated by *Stipa comata* and *Koeleria cristata*), and farther west in the grama-buffalo grass association (dominated by *Bouteloua* and *Bulbilis*).

Doubtless the most interesting features of the sand hills are the blow-outs. These are retrogressive features and are due, as noted above, especially to prairie fires and overgrazing. At first through the death of the plants there are small patches of bare sand. Later the sand is scooped out by the wind, forming conical or crateriform depressions, known as blow-outs. As the sand is scooped out, more sand falls in from the sides, so that the blow-out is increased in circumference, as well as in depth. Extreme cases are recorded where the depth may be as much as 100 feet and the circumference 600 feet. When wind erosion becomes checked, vegetation again gets a foothold, the chief pioneers being *Redfieldia flexuosa, Psoralea lanceolata* and *Calamovilfa longifolia.* After a time these pioneers are followed by the bunch-grass association; after this vegetational changes are much less rapid. One of the chief features of interest in the woodland formations along the streams is the overlap of the deciduous eastern forest and the yellow pine (*Pinus ponderosa scopulorum*) forest of the west. The lowland formations are much like those elsewhere, as to both content and succession, except that a meadow type represents the temporary climax; probably one of the more eastern of the prairie grass associations represents a more ultimate condition.

Professor Pool is to be congratulated on his thorough and sane treatment of his problem. His contribution is solid and satisfying, and is a pleasant contrast to the many ephemeral disquisitions which even yet masquerade too frequently under the name of ecology.

H. C. COWLES

SPECIAL ARTICLES

THE EFFECTS OF SMALL REPEATED INTRAPERITONEAL INJECTIONS OF WITTE'S PEPTONE SOLUTIONS IN GUINEA-PIGS[1]

THE experiments reported in this preliminary paper form a group in a series which has been planned to determine the organic effects of parenteral introduction of certain substances which may be produced within the tissues of an organism, or which may be absorbed from the gastro-intestinal tract. The fact that Longcope[2] has reported that parenteral diges-

[1] From the laboratories of the Cincinnati General Hospital and the department of pathology of the University of Cincinnati.

[2] Longcope, *Jour. Exp. Med.,* 1913 (18), 678.

tion of egg-albumen may (under certain circumstances) produce organic renal and hepatic changes may mean that splitting of the whole protein leads to these changes, that the effects are the results of the irritant action of substances set free during splitting, or that moieties of the protein molecule by making abnormal combinations may act as irritants, or in some other undetermined way embarrass the activities of the cells of the tissues in which they occur.

In two former publications, Newburgh and I[3] reported the results of a series of injections of indol and tyrosin in animals, and stated that we were able to discover little if any change in any of the parenchymatous organs. In the present series use has been made of solutions of albumose as represented by Witte's peptone.

The protocols follow: In them the expression "peptone solutions" means one prepared as follows and then sterilized:

Witte's peptone	1 gram.
Sodium chloride	0.5 "
Distilled water	100.0 c.c.

Guinea-pig 1.—Weight 400 grams. This animal received 17 daily injections each of 1.5 c.c. of the peptone solution, a total of 25.5 c.c., or .255 gram of albumose. It died suddenly on the day following the last injection. The cause of death was not discovered. The post-mortem was done while the animal was still warm, and showed no other changes than a slight mediastinal edema, moderate hyperplasia of the lymph-nodes and congestion of the lungs, liver, spleen and kidneys. Microscopic examination (Lab. No. 1078) of the tissues showed edema and congestion with occasional small hemorrhages in the kidneys, with a few areas of small round cell infiltration; enormous congestion of the adrenals; edema and focal necroses of the thymus; and hyperplastic changes associated with congestion in the lymph glands and spleen. The spleen was more than normally pigmented.

[3] Woolley and Newburgh, *J. A. M. A.*, 1911 (56), 1796; and Newburgh and Woolley, *Cin. Lancet-Clinic*, April 13, 1912.

Guinea-pig 2.—Weight about 350 grams. This animal received 57 daily injections each of 1.5 c.c. of the peptone solution; a total of 85.5 c.c., or .855 gram of albumose. During the period of treatment it gave no sign of any untoward effects of the treatment. It ate well, lost no weight, and was finally chloroformed 72 hours after the last injection. The post-mortem was done while the body was still warm. The organs showed no abnormal macroscopic or microscopic (Lab. No. 1205) lesions, other than a moderate, generalized congestion associated with a very moderate edema of the parenchymatous organs. This, however, was no more than is usual after chloroform anesthesia.

Guinea-pig 3.—Weight about 400 grams. This animal received 30 daily intraperitoneal injections each of 1.5 c.c. of the peptone solution, a total of 5 c.c. or .45 gram of albumose. It was killed with chloroform. The post-mortem showed only a very moderate congestion and edema of the liver, spleen, kidneys and adrenals, and a slight hyperplasia of the mesenteric lymph glands. Microscopic examination (Lab. No. 1179) showed nothing abnormal except perhaps a slight degree of hyperplasia of the mesenteric lymph glands.

Guinea-pig 4.—Weight about 400 grams. This animal received 5 c.c. of the peptone solution each day for 7 days, 35 c.c., or .35 gram of albumose. It was killed with chloroform. At autopsy nothing was found which was abnormal. Microscopic examination (Lab. No. 1243) was equally negative.

Guinea-pig 5.—Weight about 350 grams. This animal was treated in the same manner as No. 4 for a period of 20 days, during which time it received a total of 100 c.c. of the peptone solution, or 1 gram of albumose. It was chloroformed and autopsied. During the period of treatment it lost 87 grams in weight. At autopsy nothing noticeable was found except a partially healed meager exudate on the surface of the spleen. The peritoneal cavity contained 2 c.c. of a clear fluid. Microscopic examination of the tissues (Lab. No. 1276) showed no lesions except in the case of the spleen, in which there was an increased amount

of pigment and a moderate hypertrophy of the Malpighian follicles. The capsule was thickened.

Guinea-pig 12.—Weight 412 grams. This animal received 50 intraperitoneal injections of 5 c.c. of the peptone solution in the course of two months, a total of 250 c.c., or 2.5 grams of albumose. After each injection it was submitted to deep chloro-anesthesia for 15 minutes. After 25 treatments the weight had increased to 455 grams. At the end of the treatments the weight was 485 grams. The post-mortem revealed nothing macroscopically abnormal, and physically the animal seemed to be in the best sort of condition. Histological examination (Lab. No. 1595) showed that there was a certain amount of anatomic modification of the tissues of some of the organs. The report was as follows: The kidney shows a well-marked edema and cloudy swelling. The glomerular spaces are dilated and the tufts compressed, and in the spaces there is considerable coagulated albuminous material. About the glomeruli there are frequent small accumulations of small round cells, and in the outer layers of the cortex there are occasional lines of interstitial fibrosis. The whole organ showed congestion. The liver showed a very well developed edema, to the extent that in many areas the cells show what seems to be hydropic changes. With this is associated congestion and very moderate interstitial fibrosis as exemplified in the occasional collections of small round cells in the perilobular connective tissues. The spleen shows enormous hyperplasia of the Malpighian follicles together with some increased pigmentation. Within the corpuscles there is evidence of cellular fragmentation. The adrenals show a few collections of formative cells in both medulla and cortex, chiefly in the latter. The other organs revealed nothing remarkable.

Guinea-pig 11.—Weight 445 grams. This animal was treated in exactly the same way as No. 12. After 25 treatments it weighed 482 grams and at the end of the experiment, 565 grams. The report of the histologic examination (No. 1609) stated that the changes were similar to those found in No. 12, except that there were a few retention cysts in the kidneys and that there was nothing of note in the adrenals except an intense congestion.[4]

In this series, which is admittedly small, there is evidence (which we are attempting to verify by an extended series of experiments) that albumose introduced parenterally into the guinea-pig has very little, if any, harmful effect unless the oxidative powers of the organism are below normal. In view of the results of Longcope's experiments, as compared with ours, it seems possible that the more complex proteins will produce effects in the absence of decreased oxidation which the less complex ones will not produce under similar circumstances.[5] We are carrying out a series of experiments which we hope will throw some light upon this problem.

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THE CULTURE OF DIDYMIUM XANTHOPUS (DITMAR) FR.

IN a recent attempt to isolate an ascomycetous fungus occurring abundantly on the seed pods of sweet clover (*Melilotus*) there appeared on one of the plates an organism that had spread over the surface of the synthetic medium. The striking feature was the network of anastomosing branches varying in width and height to about two millimeters. These were brownish yellow, and slightly raised above the surface of the agar, the whole having the appearance of the vascular system of some maple leaves, as seen on the ventral surface. Microscopical examination showed that these ridges were composed of granular protoplasm with no evidence of a containing vessel or cell wall. About ten days after discovery the culture was again examined and

[4] The histologic examinations in these cases were made by Dr. T. H. Kelly, who had no knowledge of the experimental procedures used in the individual cases. They were subsequently verified by one of us (P. G. W.).

[5] These results call to mind Opie's work along somewhat similar lines (*Trans. Assoc. Amer. Phys.*, 1910, XXV., 140).