

and for the *in vitro* testing of growth promoting or growth inhibiting substances.

Summary. Suspensions of five virulent strains of *My. tuberculosis var. hominis* were

found to rapidly produce subsurface growth when inoculated into synthetic medium. One avirulent rapidly growing strain grew in a similar manner.

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Response of Rats to Diets Containing Propylene Glycol and Glycerol.

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The present paper is a brief preliminary report regarding some of the principal observations in connection with experiments which were started in 1941 in an attempt to compare the physiological effects of propylene glycol and glycerol when fed to rats at different levels of intake.

The first series of growth experiments covered a period of 20 weeks. The basal ration consisted, in parts per 100, of casein 20, salt mixture 4, Cell-U-Flour 2, butter fat 6, cod liver oil 2, brewer's yeast 6, and corn starch 60. Each experimental group consisted of 6 to 10 young rats. The basal ration was modified by replacing corn starch with glycerol and propylene glycol, respectively, at levels of 1, 3, 6, 10, 15, 20, 30, 40, 50, and 60 parts per 100 of total ration. Consequently, the first series of experiments comprised 21 dietary groups.

In a second series of experiments, groups of young rats were fed 4 basal diets identical with that of the first series with the exception that in 3 of these starch was replaced by glucose, sucrose, or dextrin, respectively. In this series, propylene glycol and glycerol were fed only at a 30% level, replacing, in each case, 30 parts of the carbohydrate.

A third series of feeding trials was conducted in which propylene glycol and glycerol were fed in isocaloric amounts at a level approximating 30% of the diet.

In the first series of experiments, no marked differences in growth response could be detected until the alcohols were fed at the 30% level. At this level the glycerol-fed animals grew at an approximately normal rate, while

the propylene glycol animals grew less rapidly. Young rats, starting at 21 to 28 days of age, lost weight and died in a few days when the diet contained 40, 50, or 60% of propylene glycol. When young rats received diets containing comparable amounts of glycerol, growth was depressed and some animals eventually died but the majority of the animals survived the experimental period. Older (half grown) animals were able to tolerate the higher levels of propylene glycol but their growth responses were never equal to those of the animals receiving comparable amounts of glycerol.

When rats received propylene glycol and glycerol diets during alternate weeks (at the 30% level), growth responses were generally increased during glycerol periods and depressed during propylene glycol periods. While glycerol diets were consumed more rapidly because of palatability, calculations show that the glycerol-fed rats made greater gains per caloric unit of food intake. No differences could be noted when other carbohydrates replaced corn starch in the basal ration. Livers from glycerol-fed rats were invariably richer in glycogen than livers from rats receiving comparable amounts of propylene glycol.

A series of metabolism studies was also conducted in which groups of half-grown rats were fed comparable diets containing increasing amounts of glycerol or propylene glycol during alternate weeks. Without exception, rats excreted in their urine the greatest percentage of the ingested water, the greatest percentage of the thiamine intake, and the greatest percentage of the polyhydric alcohol

intake during the weeks in which the propylene glycol-containing diets were fed. At the highest level of intake, more than 25% of the ingested propylene glycol was accounted for in the urine while in no instance was more than 1.5% of the ingested glycerol accounted for. This finding may partially explain an earlier observation that glycerol-fed rats made the greatest body weight gains per caloric unit of food intake.

While those groups of rats receiving the glycerol-containing diets gave birth to a greater number of litters and a greater number of young per litter, they were also more successful in weaning a higher percentage of the young than were similar groups of rats subsisting on comparable propylene glycol-containing diets. Reproduction and subsequent rearing of young were abnormally low with all groups of animals, including those on the purified basal ration. An attempt was made to correct this situation by addition of vitamin and mineral supplements without success. Consequently, further attempts to continue reproduction studies with purified

diets were abandoned.

Reproduction studies with diets composed of the breeding colony diet (70%) and glycerol (30%) or propylene glycol (30%) resulted in some very significant differences. Rats which have received the glycerol-containing diet are now in the fifth generation, while second generation young have not yet been successfully weaned by the propylene glycol fed mothers. A more extensive series of diets which contain proteins, minerals, and vitamins from natural food sources and in which part of the energy is furnished as glycerol or as propylene glycol is now under investigation. A report on this phase of the investigation, together with the details of the studies herein reported, including pathological findings, will be forthcoming.

The concentrations of glycerol and propylene glycol in some of these diets were much greater than concentrations ordinarily ingested, but the information obtained may have a pertinent bearing on the relative toxicity of the two polyhydric alcohols.

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Comparative Effectiveness of Calcium and Strontium in Plasma Coagulation.

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The classic work of Arthus and Pagés¹ and Ringer and Sainsbury² established the importance of calcium for blood coagulation. These investigators also tried to replace this ion by strontium. They found that this element is less effective in producing blood clotting than calcium. Their experiments were of a qualitative nature, and the subject was later studied under more quantitative conditions by Mal-

lenby,³ using bird plasma, and by Heard,⁴ using oxalated cat blood. Both found that the coagulation time with strontium was considerably longer than with equivalent amounts of calcium. Woehler⁵ has reviewed further work on this subject. It appears, however, that no comparative study has been undertaken on human blood plasma with the more quantitative methods developed in recent years.

Methods. The following experiments were conducted on the oxalated plasma of seven

¹ Arthus, M., and Pagés, C., *Arch. de Physiol.*, 1890, **12**, 739.

² Ringer, S., and Sainsbury, H., *J. Physiol.*, 1890, **11**, 369.

³ Mallenby, J., *J. Physiol.*, 1909, **38**, 28.

⁴ Heard, W. N., *J. Physiol.*, 1917, **51**, 294.

⁵ Woehler, E., *Erg. d. Physiol.*, 1929, **28**, 443.