

manometer, suppose a decrease in volume Δv_1 increases the pressure h . Then

$$(\Delta v_1 - \pi r^2 \frac{h}{2}) = v_1 h, \text{ or}$$

$$v_1 = \frac{p}{h} (\Delta v_1 - \pi r^2 \frac{h}{2})$$

Therefore the volume of the organ, v_0 , is equal to

$$v_0 = v - v_1 = \frac{p}{h} (\Delta v - \Delta v_1)$$

In general, if the increase in volume of the organ causes an increase of pressure h_x , then Δv_x , the increase in volume of the organ, is given by

$$\Delta v_x = \frac{h_x}{h} \Delta v_1$$

and the percentage increase in volume of the organ becomes

$$\frac{100\Delta v_x}{v_0} = 100 \frac{h_x}{h} \frac{\Delta v_1}{v_0}$$

It is possible to use any liquid, such as alcohol, to increase the sensitivity, or to increase the specific gravity with sodium chloride, so as to indicate changes of pressure directly in units of 1000 dynes for each centimeter.

Summary: A photographic method of recording plethysmograms is described. The use of a U-tube liquid manometer, with its low inertia and low interval friction, furnishes a rapidly acting system for recording small intrinsic changes in pressure. These changes of pressure may be converted into changes in volume by the use of equations.

4474

Studies on Growth. Growth Factors in Liver.

CLAIRE E. GRAHAM AND WENDELL H. GRIFFITH.

From the Department of Biological Chemistry, St. Louis University School of Medicine, St. Louis.

Recent investigations have emphasized the value of liver as a dietary supplement in diets apparently adequate with respect to vitamins A and D. No definite information is available, however, concerning the nature of the water soluble substances also present in liver.¹ This is a preliminary report of a study of the nutritional

¹ Osborne, T. B., and Mendel, L. B., *J. Biol. Chem.*, 1917, **xxxii**, 309; 1923-24, **lviii**, 363.

factors concerned with the growth of young white rats, and particularly of the presence of such growth factors in liver.

Young male and female rats, 4 to 5 weeks of age, were used. The basal diet was the fat-free diet of Evans and Burr² (purified casein, 25; commercial sucrose, 75; Osborne and Mendel salt mixture, 4). In every case this diet was supplemented daily with 9 drops of cod liver oil. The rats were kept in individual raised cages.

Rats placed upon this basal diet failed to survive. The addition of 0.15 gm. of dried yeast permitted survival but not growth. Growth occurred with the further addition of autoclaved liver or yeast. Rats fed the basal diet plus 0.5 gm. of dried liver daily grew

TABLE I.
Comparison of growth of rats on purified and unpurified diets.

Diet	No. of rats	Sex	Weight when 90 days of age		Weight when 120 days of age		Remarks
			Range in weight	Mean weight	Range in weight	Mean weight	
Mixed stock diet	12	♀	gm. 138-186	gm. 156	gm. 158-204	gm. 179	Increasing in wgt. Maximum wgt.
Basal diet plus 0.15 gm. yeast	17	♀	119-176	144	132-196	158	
Basal diet plus 0.50 gm. liver	7	♀	112-152	132	137-170	149	"
Basal diet plus 0.5 to 1.0 gm. yeast							
Mixed stock diet	6	♂	182-274	211	210-342	260	Increasing in wgt.
Basal diet plus 0.15 gm. yeast	9	♂	162-194	173	164-240	206	
Basal diet plus 0.50 gm. liver							

² Evans, H. M., and Burr, G. O., *Proc. Soc. Exp. Biol. and Med.*, 1927, **xxiv**, 741.

well for 20 to 30 days only. When this diet was supplemented with an extract containing vitamin B₁, prepared by the method of Seidell,³ growth was resumed. Similar results were obtained using autoclaved liver. These experiments demonstrated that the limiting factor in liver was vitamin B₁ and that the liver was rich in vitamin B₂.

The purified diet supplemented with liver or yeast was lacking in some essential growth factor. Female rats on the mixed stock diet averaged 179 gm. in weight when 120 days of age and were still increasing in weight (Table I). Female rats on the purified diet reached an average maximum weight of 150 to 160 gm. after 90 days (when 120 days of age). Approximately the same results were obtained by supplementing the basal diet daily with 0.5 gm. of yeast, or with 1.0 gm. of yeast, or with 0.15 gm. of yeast plus 0.5 gm. of liver. These rats resumed growth when changed to the stock diet. The use of commercial casein has uniformly resulted in improved but subnormal growth. Our results differ from those of Evans and Burr,² who obtained normal growth by the addition of liver and yeast to the fat-free diet and also from those of Palmer and Kennedy,⁴ who recently reported excellent growth following the addition of yeast alone to this same basal diet.

4475

Calcium and Phosphorus Studies in a Case of Clinical Hyperparathyroidism.

GENEVIEVE STEARNS AND J. D. BOYD.

From the Department of Pediatrics, State University of Iowa.

The subject of this study was a boy of 19, with progressing bowing of the legs, and other evidence of bone softening. On admission the serum calcium was 16.8, serum inorganic phosphorus 3.0 mg. per 100 cc. Notwithstanding a high calcium intake, the patient was losing about 0.5 gm. of calcium a day. The urinary calcium was 2 to 3 times the normal output while the fecal calcium nearly equalled the intake. There was a retention of phosphorus but the urinary phosphorus was above normal.

On the basis of the laboratory and roentgenological findings, a clinical diagnosis of hyperparathyroidism with resultant generalized

³ Seidell, A., *J. Am. Chem. Soc.*, 1922, xliv, 2042.

⁴ Palmer, L. S., and Kennedy, C., *Proc. Soc. Exp. Biol. and Med.*, 1929, xxvi, 427.