

counter weight M. This fixture is attached with set screw L and hence is adjustable for any knife bevel without disturbing the relation of the turning gears G and H. H, an elliptical fiber gear, is actuated by a small geared motor which runs continually; the butterfly gear turns H intermittently through one-sixth of the arc every 15 seconds. Hence the knife is turned over every 90 seconds and the actual rotation takes only 5 seconds so that little time is lost from the sharpening procedure.

The drip pan is of light galvanized material and is attached to the under-surface of the glass plate by 6 small vacuum cups.

The solutions are supplied to the plate by a drip bottle F. The bottle support also carries a "Mercury" windshield wiper assembly D, including the spring tension which makes for efficiency and avoids unnecessary dragging on the plate.

The machine operates smoothly and very quietly. The knife is turned quickly and without effort. Little attention from the technician is necessary except for the changing of the knife and various grinding compounds. Simplification of the apparatus reduces the cost of construction to a range well within the means of the smaller laboratory.

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Effect of Phosphoric Acid Esters on Fracture Healing.*

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The erythrocytes contain an abundance of phosphoric esters hydrolyzable by phosphatase,¹ but the plasma contains only 0.2-0.5 mg phosphorus per 100 cc² in the form of phosphatase hydrolyzable esters. The phosphatase activity of a fracture callus increases rapidly beginning 3-4 days after the injury.^{3, 4, 5} Although the site

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¹ Kay, H. D., and Robison, R., *Biochem. J.*, 1924, **18**, 755.

² Martland, M., and Robison, R., *Biochem. J.*, 1926, **20**, 847.

³ Wilkins, W. E., and Regen, E., *PROC. SOC. EXP. BIOL. AND MED.*, 1924, **32**, 1373.

⁴ Botterell, E. H., and King, E. J., *The Lancet*, 1935, **7**, 1267.

⁵ Tollman, J. P., Drummon, D. H., McIntyre, A. R., and Bisgard, J. D., *Arch. Surg.*, 1940, **40**, 43.

of an old fibrous non-united fracture may exhibit low phosphatase activity⁶ and infected fractures contain somewhat reduced amounts of this enzyme⁶ there is no evidence that defective calcification of bone or delay in fracture healing is primarily a result of a quantitative deficiency of this enzyme. It appears possible that one of the factors limiting the speed of the calcification process is the low content of plasma with respect to the substrate of bone phosphatase and this consideration suggested that some cases of delayed or nonunion of fractures might be so explained. It seemed desirable, therefore, to investigate the effect of the intravenous injection of sodium beta-glycerophosphate on the healing of fresh fractures.

The right radius of rabbits, weighing between 4.25 and 4.75 lb, was fractured while the animals were anesthetized. The fractures were produced by grasping the middle of the shaft of the bone between two adjacent and parallel Kocher forceps and exerting steady rotation of the forceps in opposite direction until the bone was heard to break. A few animals, in which breaks of both the radius and ulna were produced, or which displayed marked bruising of the skin, were discarded. Roentgenological examination showed that the fractures usually were transverse and that the fragments were in good alignment with little comminution of the bone. The undamaged ulna served as an effective splint and the animals were able to use the limb upon recovery from the anesthesia.

Twenty-seven animals of the experimental group received 6-14 daily injections, by ear vein, of 0.1 g sodium beta-glycerophosphate in 4 cc of solution. Twenty-two animals with similar fractures served as controls and received a like number of injections of 4 cc of physiological saline. All animals were sacrificed on the day following the last injection. Roentgenograms of the limbs, taken before and after removal of the soft tissues, did not reveal any marked differences except for a larger callus about the fracture of the bones of the animals treated with sodium beta-glycerophosphate. However, the fracture callus of the animals receiving 8-14 treatments with sodium beta-glycerophosphate was larger and more firm to palpation than that of the control animals. After the bones were cleaned, even though some of the callus was lost when the periosteum was removed, the healing of the fracture appeared to have progressed further in the animals treated with glycerophosphate. This judgment was based upon the observation that the hard callus of the treated animals was larger and the fracture defect was more

⁶ Drummond, D. H., Tollman, J. P., Bisgard, J. D., and Ross, D., *Arch. Surg.*, 1940, 40, 49.

nearly bridged over in the treated animals than in the controls. A more objective means of estimating the degree of healing of fractures would be desirable. However, the observations indicated that in the majority of cases the drug exerted a positive effect even though the fractures with which we were dealing normally progress to rapid healing. Four determinations of serum inorganic phosphate and calcium, made at regular intervals during the course of 12 daily injections of 0.1 g of glycerophosphate, showed no consistent differences from the results obtained with untreated animals.

Sodium beta-glycerophosphate, when given by intravenous injection over a long time or in large doses, is not toxic. The liver, intestine, urinary bladder, kidney, heart and aorta of a rabbit which received 55 daily injections of 0.1 g of the drug were normal grossly and microscopically. Similar results were obtained with 3 rabbits following 6 daily intravenous injections of 1.0 g of the substance. No symptoms were produced following 26 daily subcutaneous injections of 0.1 g of sodium beta-glycerophosphate into a rabbit and no pathological findings were noted at autopsy. A 17 kg dog received 10 daily intravenous injections of 10 g of the substance in 40 cc of solution. No ill effects were produced and when the animal was sacrificed, 2 months after the last injection, and no pathological alterations of any organ were observed. Large doses (12 to 24 cc of a solution containing 0.25 g of the substance per cc) are fatal in 2-5 days when given daily to rabbits by intraperitoneal injection.

Since sodium beta-glycerophosphate is innoxious in a wide range of dosage it should be safe to administer it to the human in order to determine its effect on those fractures which heal at a rate slower than usual.

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Activity of Certain Isomers of Thyroxin.*

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Investigations on compounds closely related structurally to thyroxin have been limited. An isomer of thyroxin, β - β -di (3,5-diiodo-

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