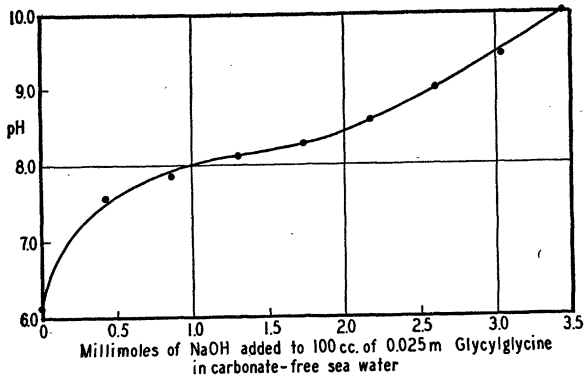

FIG. 1

and were made isosmotic with sea water. Even in the highest concentrations that we employed, namely, 0.25 molar glycylglycine at pH 8.2, cleavage was 100 per cent. Later development is, however, distinctly abnormal in the solutions stronger than 0.10 molar. Between 0.05 and 0.10 molar there is an apparent effect of the glycylglycine in producing thick-walled blastulae and gastrulae. Below 0.05 molar, there is no evidence of any particular effect. For most purposes (*e.g.*, respiration experiments) a 0.005 to 0.02 molar solution provides sufficient buffer action. Veronal[9] which was tried, since it has also a pH of 8.0, causes abnormal development in a concentration of 0.002 molar; although cleavage may proceed in a 0.01 molar solution.

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UNIVERSAL JOINTS FOR SKELETONS

SEVERAL attempts have been made to produce a mechanical joint for mounted skeletons that would permit motion in all three planes. A joint mechanism was sought that would give movements similar to those observed in a living body, yet without being so large as to be cumbersome nor so flimsy as to be unable to withstand the rigorous handling of freshman medical students.

Fig. 1 shows a joint mechanism that has been successful in three years of service in the medical school laboratory. Twelve of these devices are in good working order on the laboratory skeletons. In the sketch in Fig. 1 is seen a wrist joint assembled in such a fashion as to allow flexion and extension of the hand as well as abduction and adduction. Pronation and supination are obtained by a device modeled after one which has been used by others.

Abduction and adduction are obtained by a sliding joint, which is seen dissembled in Fig. 2. The part A has two rivets which fit into slots in the part B and

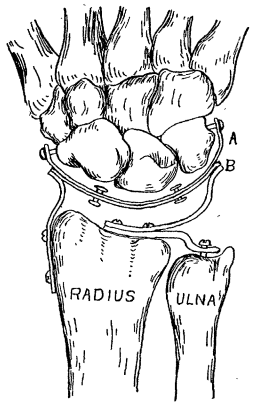

FIG. 1

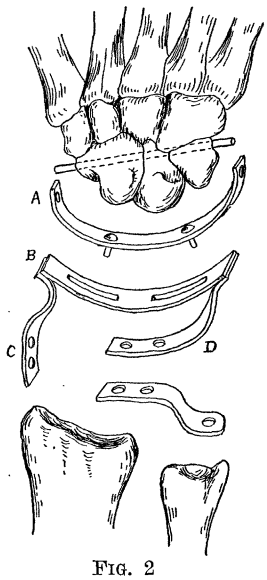

FIG. 2

their ends are headed to hold them in the slots. The length of the two slots can be varied, depending upon the amount of abduction desired. The part B is held stationary to the radius bone by the parts C and D, which are attached to the bone by small brass screws. B is attached to C and D by solder. Such a device allows the part A, which is attached to the hand, to slide back and forth upon the part B and simulate the abduction and adduction of the living hand.

The part A is attached to the carpal bones of the hand by an axle or pin passing through the proximal three carpal bones, as seen by the dotted line in Fig. 2. The ends of the pin are inserted into the holes in the metal piece A, and these ends are flattened to prevent them from pulling out of the holes. A complete flexion or extension of the hand can thus be obtained, as the pin through the carpus acts similarly to an axle.

The same method was utilized in a joint for the shoulder to obtain medial and lateral rotation of the arm as well as flexion and extension, and abduction and adduction.

The parts used in this joint can be made of sheet brass or of any durable iron alloy in bands about one thirty-second of an inch in thickness.

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Amino Acid Manufactures, of the University of California at Los Angeles, was used in these experiments.

[9] L. Michaelis, *Jour. Biol. Chem.*, 87: 33, 1930.