A Working Model for the Demonstration of Endocrine Interrelationships

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In view of the tremendous strides in endocrine gland physiology within the past two decades it is becoming increasingly difficult to effectively present the complex interrelationships of the activities of the various hormones.

In attempting to contrive some means whereby a hypothetical explanation of the endocrine interrelationships of the female reproductive system could be visually demonstrated, an apparatus was devised which, even though incomplete, proved to be useful. It may indicate to others possibilities for various similar demonstrations.

The demonstration may be assembled easily in any laboratory where glass and rubber tubing and some inexpensive jars are available.

The apparatus consists of a piece of fiberboard, 36 inches wide and 45 inches high, the surface of which was painted white. Diagrammatic drawings of the anterior lobe of the pituitary, ovaries, uterus, mammary glands and pelvis were made on stiff cardboard and painted, in outline, with show-card colors, Fig. 1. Holes, through which the glass tubing would pass, were drilled through the drawings and fiberboard. Lengths of glass tubing were so bent as to form connections between the various organs as the figure indicates. Rubber tubing was connected to the ends of the glass tubing, which were inserted through the drilled holes. One end of the tubing was attached to a pressure bottle containing a colored fluid and the other end put into an empty waste bottle.

Figure 2 shows a side view of the general arrangement of the pressure bottles containing the various colored fluids. Pressure for forcing the fluids through the tubing was obtained by the use of a rubber bulb, (B) and a control jar, (A).

When the chart was to be put into operation all of the glass tubes were drained and the fluid returned to the pressure bottles. The rubber stoppers were pushed down tightly and the rubber tubing leaving each jar was clamped with a Castaloy pinchcock. A small amount of pressure was built up and pinchcock No. 1 was removed. This allowed the colored fluid to pass through the first tubing, indicating the initiation of ovarian function due to the release of follicle stimulating hormone from the pituitary. The follicle stimulating factor stimulates the periodic development of the graafian follicles and secretion of theelin by the developing follicles.

Jar No. 1 was then clamped and pinchcock No. 2 was removed to indicate the activity of theelin. Theelin is essential for the development and maintenance of the gonadal accessories. It promotes endometrial proliferation and secretory activity of the serous glands of the uterus; it increases uterine and tubal contractility.

The development of the mammary duct system and the conditioning of the

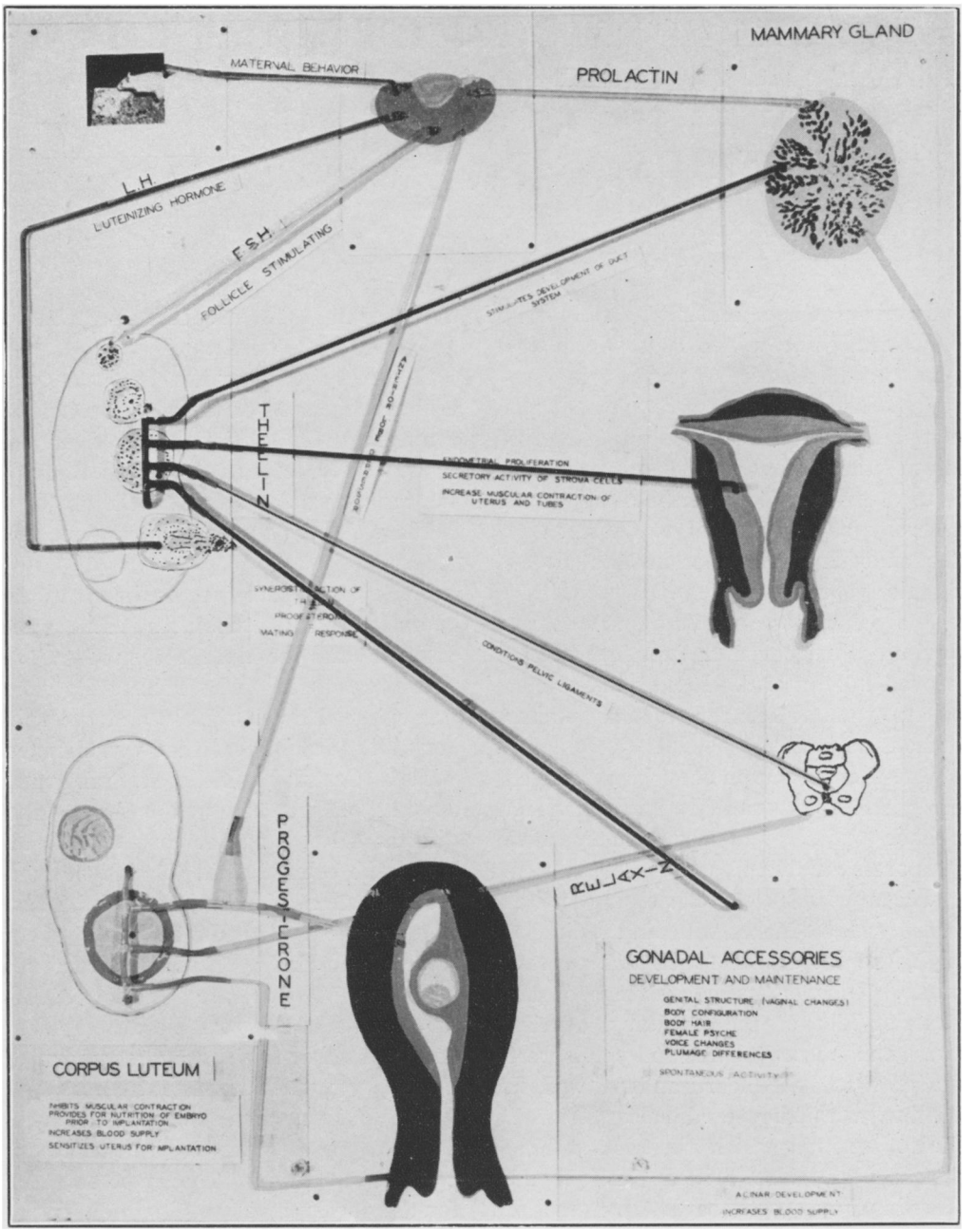

FIG. 1.

pelvic ligaments are also stimulated by theelin action.

Pinchcock No. 3 was next removed to allow the flow of the luteinizing hormone. This factor stimulates the periodic development of the corpora lutea and the secretion of theelin and progestin. The action of progesterone was demonstrated by removing pinchcock No. 4. Progesterone inhibits uterine

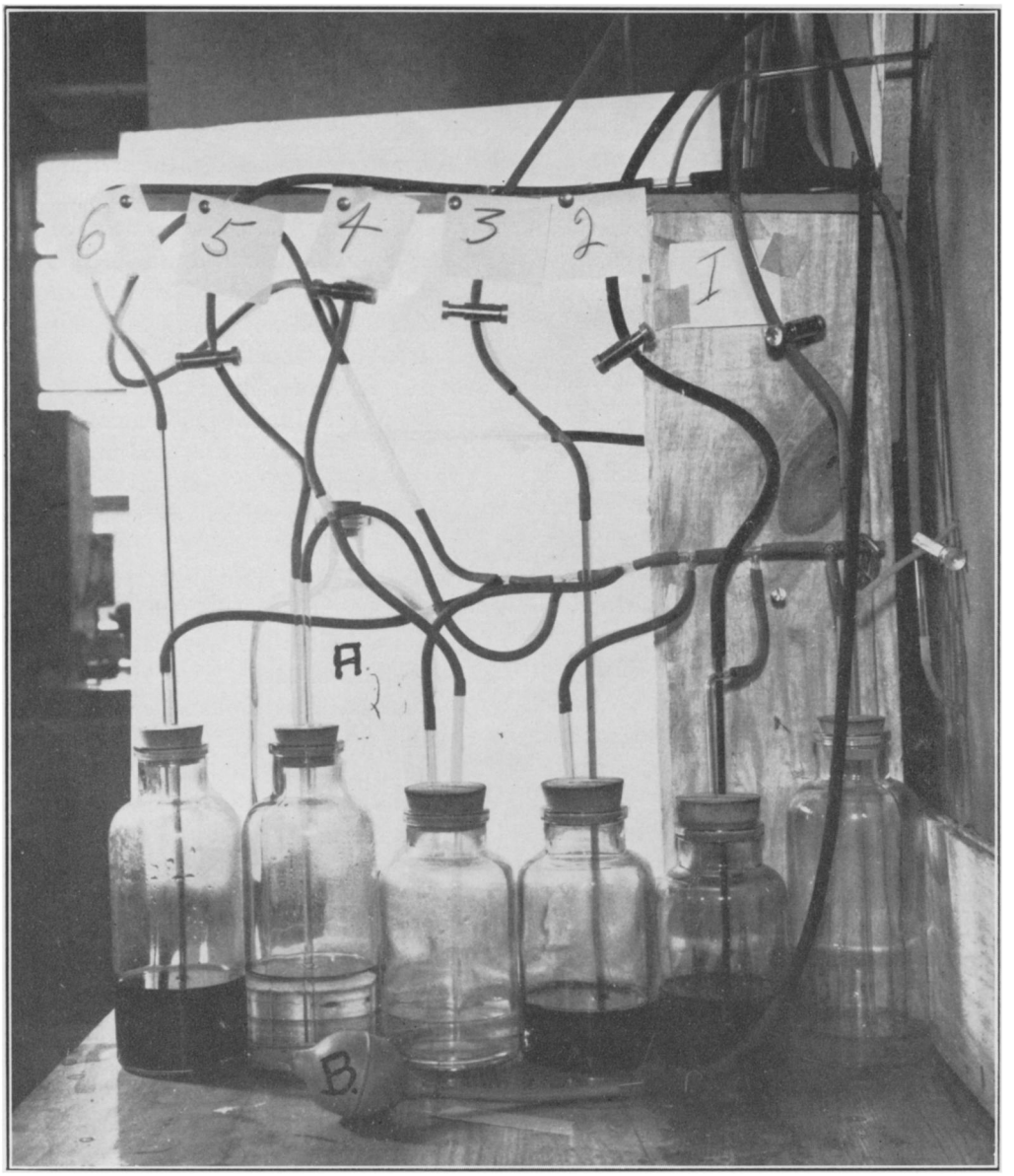

FIG. 2.

muscular contraction; provides nutrition for the ovum prior to implantation; increases the blood supply and sensitizes the uterus for implantation. In addition, it initiates acinar development in the mammary gland.

Another active substance secreted by the corpus luteum is Relaxin. This factor acts by completing the action initiated by theelin in relaxing the pelvic ligaments in certain mammals during pregnancy.

The removal of pinchcock No. 5 demonstrates the elaboration by the anterior pituitary of the lactogenic hormone which stimulates milk secretion by the

mammary glands.

Maternal behavior was demonstrated by the removal of pinchcock No. 6. Whether the anterior pituitary hormones are solely responsible for maternal behavior is to be questioned.

By the enlargement of the chart the activities of other factors of the anterior pituitary gland such as growth, diabetogenic and ketogenic hormones could be easily demonstrated.

THE OPAQUE PROJECTOR

An opaque projector is a device, which by means of a system of mirrors and lenses, casts upon a screen an enlarged image of pictures and objects which are not transparent. Improved models such as the Spencer delineascope, Bausch and Lomb balopticon and Leitz opaque projector, provide critical definition as well as high transmission of light, which means that the image is clear and the loss of light is much less than that suffered in the older models.

In most schools, the cost of equipment is an important item. When visual aids are considered, there are two costs: the initial cost, *i.e.,* the price paid for the projector; and the cost of the materials to be used. The initial cost of a good balopticon probably stands midway between that of an S.V.E. projector for miniature slides and film strips and that of a motion picture machine; but the material used for opaque projection is by far the cheapest and the easiest to procure. Today's magazines are excellent storehouses of illustrations, charts, maps and graphs which can be used so well in the classroom. The pages of the National Geographic, for instance, offer a wealth of pictorial reproductions covering many subjects and thus supply beautiful visual aids to classes in Biology and to many other classes as well. The problem of utilization of these helps is really one of organization, since the busy teacher is unable to use the material due to lack of time in which to sort it and storage space in which to preserve it.

To meet this difficulty, the writer suggests a series of cloth-bound boxes made in book form suitable for library shelves. These may be classified under fifty or more heads and alphabetically arranged. Teachers, then, may easily find suitable material and check it out as they do books. After having used this system for some time, teachers become picture conscious and are on the alert to pick up and preserve illustrative material, not only for their own department, but for others as well.

Some teachers may prefer to make a picture file for the Biology room. This will have a place for material pertaining to each unit of the course. Pictures will be arranged, not alphabetically, but in sequence. For example, all pictures, diagrams, charts, graphs, etc., relating to Protozoa will be filed together and in order. Sometimes, too, one finds material in text books which is excellent for projection. This cannot be filed but a card on which is typed the name of the book and the pages to be used, can be inserted in its proper place in the file. When the Protozoans are to be studied, the file is consulted and pictures, etc., relating to the day's lesson are selected and used. After class they are left on a table or placed on the bulletin board for student use.

There is great need for research to determine the effectiveness of the various types of visual aids. It is certain, however, that the use of an opaque projector in a Biology course is no more a guarantee of successful teaching, than is any other visual aid. The teacher must still teach, keeping in mind all the time that he is presenting the principles of life to