TRANSPORT OF THERMAL ENERGY ACROSS THE ORGANIZATION CENTRE OF CHICK EMBRYO

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With 5 Figures in the Text

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I. Introduction

Host of experiments like delayed incubation, irradiations by X-rays and Ultra violet rays, effects of various chemicals etc. have been carried on the embryological development of chick. Like other external stimuli, thermal energy has been found to be a very effective agent producing abnormal morphogenetic movements in the embryogenesis. Grodzinski (1933, 1934) has studied the influence of low temperature and recorded the abnormal morphogenetic movement of the embryonic cells. Deuchar (1952) has recorded the effects of continuous temperature shock for short-non-lethal periods at different stages of gastrulation. Both the authors have employed the thermal energy by keeping the eggs in the incubator at required temperature and thus allowing the energy to flow through the shell.

The present experiment has been devised to study the ontogenetic pattern as resulted by the direct employment of the thermal energy to the embryo by means of inserting a red hot needle in the blastoderm. Thermal shock has been given to three different sections of the blastoderm to study (1) the relation between the pattern of abnormalities produced and the distance of the thermal shock generated on the blastoderm and (2) the capacity of the thermal energy to travel across the embryonic axis.

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II. Material and Methods

The experiments were conducted in ovo on White Leghorn eggs collected immediately after laying. After careful disinfection of the eggs by cotton soaked in alcohol, a square window hole was made on the shell, thereby exposing the embryo. Thermal shocks were given to the embryos by means of a needle, 1 m.m. in cross
section, heated to redness by a spirit lamp. Three zones were selected to study the effects as shown in the following schematic diagram (Fig. 1).

Immediately after the experiments, the window holes were sealed up with the cut shell and paraffin, transferred along with the controls to the incubator at a constant temperature of 37.5°C, and incubated for 48 hours.

After the required period of incubation, the embryos were dissected out and fixed in alcoholic Bouin's fluid. After taking the blastoderms through the routine of tissue preparations and embedding, 10 μ sections were made of them and stained in dilute Delafield's Haematoxylin. Total number of embryos studied was 80.

![Fig. 1](image_url). Schematic diagram to show the three regions where the thermal shock is given by a red hot needle. Dotted portion indicates the area opaca and the white portion area pellucida

### III. Results

*Series I.* Heat shock given to a point away from the differentiating centre:

The effects of the thermal exposure on embryos are chiefly manifested in the middle and the posterior regions of the blastoderm (Fig. 2). Growth of the embryo appears to be normal but the notochord is often found missing particularly in the posterior part of the embryo. In the anterior region the notochord is present but is ill developed. In some cases it becomes deformed and smaller in size. The notochord is formed by comparatively less number of cells. The formation of dermatomyotome is observed. Dorsal aortae are present. In the anterior region, the neural tube remains mostly unclosed though the aggregation of the nerve cells in this region are found to be normal. In some cases (nearly 30%) the neural tube is represented by a plate. Secondary induction is often impaired when it takes place in one side only. The lens material is not separated from the epiblast. Neither the gut nor the kidney is formed. Cardiac development is most normal though in some cases it is displaced anteriorly. A large number of cytolytic cells are found particularly in the middle and in the posterior part. The anterior part of the embryo is normal.