V. THE NATURE OF THE ACTION ON A PHOTOGRAPHIC PLATE OF SAWDUST AND CHOLESTEROL IRRADIATED BY A MERCURY VAPOUR QUARTZ LAMP.

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THIS work was undertaken as the result of observations by Hume and Smith [1924] indicating that pine sawdust which had been irradiated by a mercury vapour quartz lamp developed anti-rachitic properties. For some time it was supposed by them that the activity of the irradiated sawdust might be due to secondary radiations or some emanations given out by the particles of wood exposed to ultra-violet rays.

This view was countenanced by the statement of Kugelmass and McQuarrie [1924] that anti-rachitic substances, *e.g.* cod-liver oil, egg-yolk and sperm oil, were capable of fogging a photographic plate even when the plate was exposed through a quartz cover sealed in such a way as to preclude the action of a volatile substance.

That certain animal and vegetable substances are capable of producing fog on a photographic plate is not new. Russell [1906] studied the phenomenon and showed that the action was intensified by a previous exposure of the substance to sunlight or a carbon arc. Temperature increased the effect.

The substances with which Russell worked were woods of various kinds, coal, wool, fur and feathers. He observed an effect whether the plate was in contact with the substance or at a distance from it, or when air was drawn over the substance on to the plate. He also found that, given sufficient exposure of the plate, whatever produced the fogging could travel round the edges of an opaque mask, and that glass and mica prevented its passage. He believed the effect to be due to the evolution of hydrogen peroxide.

Experiments with pine sawdust.

These confirm the conclusions of Russell.

Sawdust in a glass dish without a cover was exposed to a 4 amp. mercury vapour quartz lamp at 15 inches for 15 minutes. The glass dish was taken to the dark-room and a photographic plate (Eclipse orthochromatic superspeed, as used throughout these experiments) was laid, sensitive side downwards on the sawdust. Between it and the dust was placed a piece of thin zinc sheet covered with black plate-wrapping paper. The whole was then placed in a light-tight box, wrapped in a photographer's black cloth, and kept in a room

at 37° for six hours. After development with pyro-metol developer for 5 minutes at room temperature, an image of the zinc plate was found, and a pattern of the grains of sawdust where the zinc was not opposed. In the negative the granules showed black and the spaces between white.

The experiment was repeated with the plate inclined at an angle. The exposures and development were the same as in the previous experiment. A pattern of the sawdust was again visible where contact of the sawdust and plate existed, but on the parts of the plate apart from the sawdust, fogging, diminishing in density as the distance between the plate and sawdust increased, was alone visible.

A Petri dish of sawdust without a lid was irradiated under a mercury vapour quartz lamp for 15 minutes and placed on a block of paraffin wax. A quartz Petri dish lid was then warmed and pressed down over the sawdust, so that it melted the paraffin wax, and its edge was firmly embedded all round. Any places which did not seem to be air-tight, were made so by means of a hot knife. The photographic plate was fastened down on to the quartz plate with an elastic band, a strip of black paper being placed between in order to show an image. The whole was placed in a light-tight box and then in the warm room (37°) for 6 hours. On development there was no sign of fogging. The experiment was repeated with an exposure of 18 hours of the plate to the substance, with the same result.

Air was sucked slowly over a covered dish of sawdust and through a blackened tube so as to impinge upon a plate protected from the light by a blackened bell-jar. The suction was continued for 24 hours, and the plate then developed. It showed a patch of fog under the inlet tube the border of which was a sharp line on the side nearest the inlet, the patch extending in a fan-shaped outline of diminishing intensity towards the outlet tube, showing that the current of air sucked the emanation from the sawdust in the direction of the draught.

The same experiment was repeated having a Richardson's gas-washing bottle containing potassium iodide starch solution to receive the air from the sawdust instead of the photographic plate and bell-jar. In 20 minutes there was a tinge of blue visible, and ultimately the liquid became the typical starch iodine blue.

Experiments were also carried out with fur, skin, feathers and wool. In these the irradiated substances were fastened to the plate with elastic bands.

With the exception of a rather doubtful result from white wool knitted into a pattern, no effect was produced on the plates.

These observations show that, provided the possibility of a vapour passing from the sawdust to the plate is excluded, no photographic effect occurs, or in other words, secondary radiations capable of traversing quartz are not produced.

Russell's view that the action is due to the formation of hydrogen peroxide or ozone is supported.

Experiments with cholesterol.

In view of the observations of Steenbock [1925] and Hess and Weinstock [1925] on the use of irradiated cholesterol as an anti-rachitic, similar experiments were made with cholesterol.

Cholesterol was gently melted on a roughened glass plate, and after irradiation placed in contact with a photographic plate. The fog produced was intense. When however the plate was separated by quartz, as in the third experiment above, no fogging occurred.

CONCLUSIONS.

1. The action on a photographic plate of sawdust after irradiation by ultra-violet rays is not due to any secondary radiations given out by it, which are capable of passing through a plate of quartz.

2. The action appears to be due to the production and subsequent gradual emanation of either hydrogen peroxide or ozone.

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