

bility of animals toward radiation damage is affected both by level of dietary fat and its content in EFA. As long as a severe deficiency of EFA is not fully developed, mice injected with  $P^{32}$  and fed a fat-free diet exhibit better survival than mice fed diets containing high levels of fats, saturated or unsaturated. At present, this adverse effect of fat-rich diets is difficult to explain. It is conceivable that radiation damage may be more severe (or less easily reversible) in animals whose tissues are being progressively depleted of EFA.

**Summary.** Mice were maintained on various experimental diets and injected with single dose of radioactive phosphate (4-5  $\mu\text{C/g}$ ). Higher % of survivors and longer survival time were observed in animals on fat-free diet as compared with those fed diets containing 30% corn oil, or 30% hydrogenated coconut oil. However, with these high-fat diets, as well as with diets containing only minimal amounts of fats, a better survival was demonstrable when highly unsaturated fatty acids were present. It appears that, provided that defi-

nite amounts of these fatty acids are included, a low-fat diet should be beneficial in alleviating effects of internal radiation by  $P^{32}$ .

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## Pineal-Like Effects of Central Nervous System Tissue Extracts.\* (25850)

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Ranzenhofer *et al.*(1) showed that chicken spinal cord contains something that retards gonadal and comb growth. Retardation of gonadal growth is one of the properties of certain pineal-tissue extracts(2,3). Another effect of such pineal extracts is to elevate blood glutathione and eosinophil counts in schizophrenic patients(2,4). It was therefore decided to study effects of steer-brain extracts on these measurements.

**Material and methods.** Patients used were all schizophrenic and had been hospitalized for at least a decade. Measurements of blood glutathione level, and of eosinophil count were made as previously described(4). Extracts

used were as follows: (a) in 4 patients, extracts of steer-brain "septal" tissue<sup>†</sup> made by Heath's modification(5) of technic for making pineal extract reported elsewhere(4); (b) in 2 patients extracts of whole steer brain (excluding the pineal)<sup>‡</sup> made according to method previously described for pineal extract(4).

**Observations.** In 4 patients given "septal" extract the amount of extract given daily was derived from 42.5, 85 or 170 g of tissue/day. Dose of extract equivalent to 42.5 g/day caused no significant changes (Case B; Case K); dose of extract equivalent to 85 g of septal tissue/day caused changes in blood gluta-

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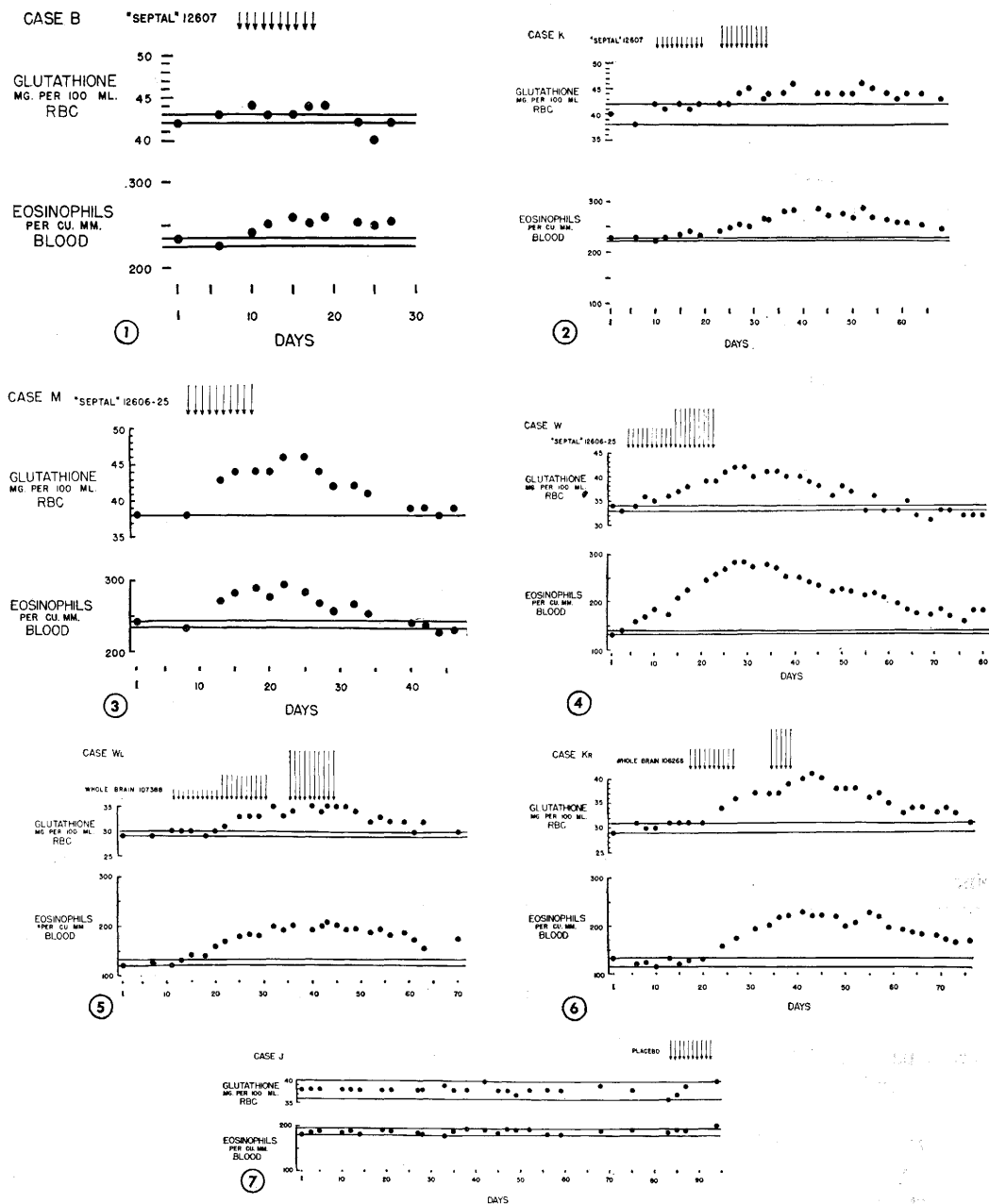
<sup>†</sup> Supplied by Upjohn Co.

<sup>‡</sup> Supplied by Wilson Lab.

thione level and eosinophil count equivalent to or less than that produced by 5 g of pineal tissue (Cases K, M, W); dose of extract equivalent to 170 g/day caused greater

changes than the dose equivalent to 85 g in the same patient (Case W).

Giving whole brain extract (excluding pineal) caused changes in blood glutathione level



and eosinophil count varying with dose used. A dose equivalent to 10 g of brain tissue caused no change (Case Wl). A dose equivalent to 20 g caused small rises in blood glutathione and eosinophil levels (Cases Wl and Kr); doubling the dose caused further rises in these measurements (Cases Wl and Kr).

In all experiments, measurements returned to control level some weeks after cessation of injections. Placebo injections had no effect (Case J). Placebos in this and other cases were extracts made either from beef ovary, liver, or skeletal or cardiac muscle.

*Discussion.* Our data showed that brain tissue contains a substance that causes biochemical changes in schizophrenic patients identical with those produced by certain pineal extracts. As far as can be judged from these crude experiments, concentration of this material in brain is about a fifth to a tenth of that found in the pineal gland.

No such activity was found in extracts of beef liver, ovary or skeletal or cardiac muscle.

The question whether brain manufactures this material, or whether it is distributed through the brain from the pineal gland cannot be answered. However Holmgren has shown that secretory granules leave the pineal gland and migrate to the third ventricle. If secretory material entered the spinal fluid in

this fashion it could readily be distributed through the entire central nervous system. In this connection it is interesting that melatonin, another product of the pineal gland, is also widely distributed in nervous tissue(6).

*Summary and conclusions.* 1) Extracts from whole steer-brain (excluding pineal gland) cause the same changes in schizophrenic patients as do pineal extracts made the same way. Concentration of active material in brain tissue is very small. Substances which originate in the pineal gland appear to be widely distributed in the central nervous system. 2) Beef ovary, liver and skeletal and cardiac muscle contained no active material.

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### Action of Flavonoid Metabolites on Pituitary-Adrenal Axis.\* (25851)

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We showed that certain flavonoids accelerate thymus involution through action on pituitary-adrenal axis, while others lack this effect(1,2). This comparison permitted some conclusions relating this action to structural

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configuration. Metabolic studies with several flavonoids showed they are readily absorbed and degraded to a variety of phenolic acids (3-9). The effect of phenolic acid metabolites of certain flavonoids and compounds related to these metabolites on thymus involution is reported here.

*Methods.* Female albino rats, 22-26 days old were fed for 12-14 days a semi-synthetic diet previously described(2) with or without addition of a phenolic acid (1%). They were