the fused sample in glass volumetric flasks may cause contamination of the silicon from glass to the sample; (ii) the impossibility of making a 0.1% congo red solution in alcohol. In regard to the latter, we substituted an aqueous solution of congo red. The present procedure eliminates the first problem by affording no opportunity for contamination by silicon ordinarily present in glassware. Therefore, the present data represent the actual amounts of silicon in the tissues. In view of our handling of these problems, no valid comparisons can be made between the methods of King(1,2) and the modifications thereof, which have been used here.

Values for silicon in the present study are lower than those found in serum by King(2) an in urine by Fregert(5). This is probably due to the complete elimination of silicon contamination from our samples. Our data for the silicon content of tissues differ from those reported by Holt *et al.*(3). These workers did not mention the method they used for determination of silicon, but we presume it was that of King *et al.*(2).

Recently, Sauer *et al.*(4) determined the silicon content of the tissues of guinea pig. Their values were: 59 μg Si/g of dried tissue of lung; 33 μg Si/g of muscle; 25 μg Si/g of kidney. Since our data on silicon content of human brain and rat brain(9) are similar, it is probable that the silicon content of the brains of guinea pigs and rats are also similar. Their higher values for the content for guinea pig brain may be due to contamination with extraneous silicon.

In the illustration of balance data used here (Table III), more than 90% of food silicon appeared in the feces. Appreciable amounts of silicon were excreted in the urine. All tissues, including blood were found to contain silicon. Of all tissues studied, bone has been found to have the highest content of silicon.

*Summary.* 1. The silicon content of the tissues of man and rat were reinvestigated by a modified King's method, in which contact with glassware was avoided. 2. All tissues studied, except bone, contained between 2-10 μg silicon/g of dried tissue. Bone contained approximately 100 μg silicon/g of dried tissue. 3. In a single balance study, 90% of the silicon in rat food was excreted in the feces; some silicon was excreted in the urine.

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## Silicon in Biological Material. II. Variations in Silicon Contents in Tissues of Rat at Different Ages. (27470)

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An increase in collagen content of animal tissues with increasing age has been reported by several workers(1-7). Silicic acid has been observed to have both a stimulating and an inhibiting effect upon synthesis of collagen in tissue culture(8). Saline precipitation of acid soluble collagen of rat tendon in a fibrinous state is said to have been prevented by

addition of quartz(9). Brown(10) has stated that the silicon content of human skin diminishes with age. In children less than a year old, MacCardle *et al.*(11) found no silicon in the cornified layers of the epidermis and only a small amount in other portions. The silicon content steadily increased up to about age 20, notably in the cornified epidermis. Silicon in the non-cornified dermis was found chiefly in the nuclei. In the dermis, silicon content diminished with age. Nothing has been reported regarding changes in silicon content in any other tissue with increasing age. We are presently concerned with such changes.

*Methods and procedure.* Male rats, Wistar strain, age 5 weeks and 30 months old were used in this study. The rats were fed Purina chow and water. The animals were sacrificed by chloroform inhalation. Tissues from kidney, brain, liver, muscle (thigh), tail tendon, spleen, lung and skin were removed with special caution with avoidance of contamination by silicon from outside sources(12). Neither glassware nor tap water were used in any of the manipulations. Samples were dried in stainless steel pans. Silicon was determined by a modification of King's method (12). In the case of dermis determinations, the epidermis was removed by the method of Baumberger *et al.*(13).

*Results and discussion.* From Table I it may be noted that with increasing age, the silicon content rose significantly in kidney, brain, liver, spleen, lung and femur and fell significantly in skin. A similar decrease in the silicon of human skin was reported by Brown(10) and by MacCardle(11). With age, a 3-fold increase in renal silicon was observed; a 50% increase in brain and spleen; a 100% rise in both the liver and lung and a 33% rise in femur. The 100% rise in silicon content of the lung of old rat might possibly be due to environmental silicosis. In muscle and tendon, no significant changes in silicon were found with age. In skin, there was a 60% decrease between 5 weeks and 30 months of age. The dermis sample of the 30-month-old rat contained less silicon than the corresponding whole skin. Values were not significantly different. In the young animal the epidermis was too thin to be separated from the dermis. The significance of the presence of silicon in animal tissues is under consideration. The results of some of the analyses in the older rat have been compared to the results obtained on similar tissues by other authors using different methods(12).

TABLE I. Silicon Content of Tissues of Male Rat ($\mu$g Si/g Dry Tissue).

| Tissue | Age 5-6 wk | Age 30 mo | P |
|---|---|---|---|
| Kidney | 1.46 ± .43* (5)† | 4.63 ± 1.84* (7) | <.01 |
| Brain | 2.02 ± .40 (6) | 2.87 ± .21 (6) | <.001 |
| Liver | 2.65 ± 1.08 (6) | 4.71 ± 1.75 (8) | <.05 |
| Muscle (thigh) | 3.02 ± .93 (6) | 4.31 ± 1.52 (7) | |
| Tendon (tail) | 3.96 ± 1.83 (8) | 4.78 ± 1.90 (7) | |
| Spleen | 3.75 ± .95 (6) | 5.49 ± 1.33 (7) | <.05 |
| Lung | 3.97 ± 1.70 (6) | 7.31 ± 1.29 (8) | <.01 |
| Skin (whole) | 9.04 ± 3.00 (6) | 3.60 ± .92 (5)<br>2.60 ± .56‡ | <.01 |
| Femur | 86.7 ±11.4 (6) | 115.2 ±16.1 (6) | <.01 |
| Rib | 90.2 ±20.2 (6) | 91.8 ±22.4 (6) | |

P values relating to age differences, when within 5% level of confidence, are listed. Statistical calculations are made according to Bailey(14).

* Mean ± stand. dev.

† No. of determinations corresponds to No. of animals.

‡ Epidermis removed.

*Summary.* The silicon content of several tissues of male rats, Wistar strain, 5 weeks and 30 months of age were determined by a modification of King's method, with special caution to avoid contamination with outside sources of silicon. It is shown by the data that, with increasing age, silicon content significantly increased in kidney, brain, liver, spleen, lung and femur, and decreased in skin.

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## Influence of Parental Dietary Iodine Level on Thyroid Activity of Eighteen-Day Chick Embryos.*† (27471)

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An iodine deficiency in the dam's diet has been reported to cause goiter in the chick embryo, retard embryo development and decrease hatchability(1). Furthermore, the level of parental dietary iodine grossly affected iodine-131 uptake by the embryonic thyroid, and this effect was influenced by the length of the trapping period(2,3,4). The fact that, with embryos from iodine deficient hens, relatively short trapping periods (2 hours) gave greater uptake values than longer trapping periods (4 hours) suggested that thyroids of iodine deficient embryos have the ability to synthesize and release thyroxine at a very rapid rate, and that this rapid release can confound measurements of thyroid activity by $I^{131}$ uptake technics. The work reported herein was designed to obtain information on rate of synthesis and release of thyroxine in 18-day chick embryos as influenced by parental iodine.

*Methods.* The hens involved in this experiment were the same hens used in previous studies(4) and had been on their respective diets for 32 weeks. The parental diets for Groups 1, 2 and 3 contained 17, 75 and 500 p.p.b. iodine, respectively. The earlier work (4) had shown that the embryonic thyroid glands in Group 1 exhibited the characteristic symptoms of goiter (hypertrophy and hyperplasia of the epithelial cells, lack of colloid, increased weight). The embryonic thyroid glands in Group 2 were larger than normal but not nearly as large as Group 1, and showed hyperplasia and less than normal colloid. Group 3 embryonic thyroid glands were judged normal.

The procedure for injection of $I^{131}$ was the same as reported previously(3,4) with the air cell used as site of injection.

Embryos were broken out at exactly the specified time following injection. The heart was exposed, and a sample of blood obtained by heart puncture with a heparinized needle and syringe. The thyroid glands were removed, trimmed and homogenized in a Potter homogenizer with 1 ml of bovine plasma. The bovine plasma was used to insure adequate protein for binding of thyroxine. The remainder of the embryo was transferred along with wash water to a Waring blender and homogenized. The homogenate was filtered

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