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STUDIES OF THE UREA CYCLE ENZYMES OF THE LIVER OF DEVELOPING C57B AND ALBINO MICE

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STUDIES OF THE UREA CYCLE ENZYMES OF THE LIVER OF DEVELOPING C57B AND ALBINO MICE

by

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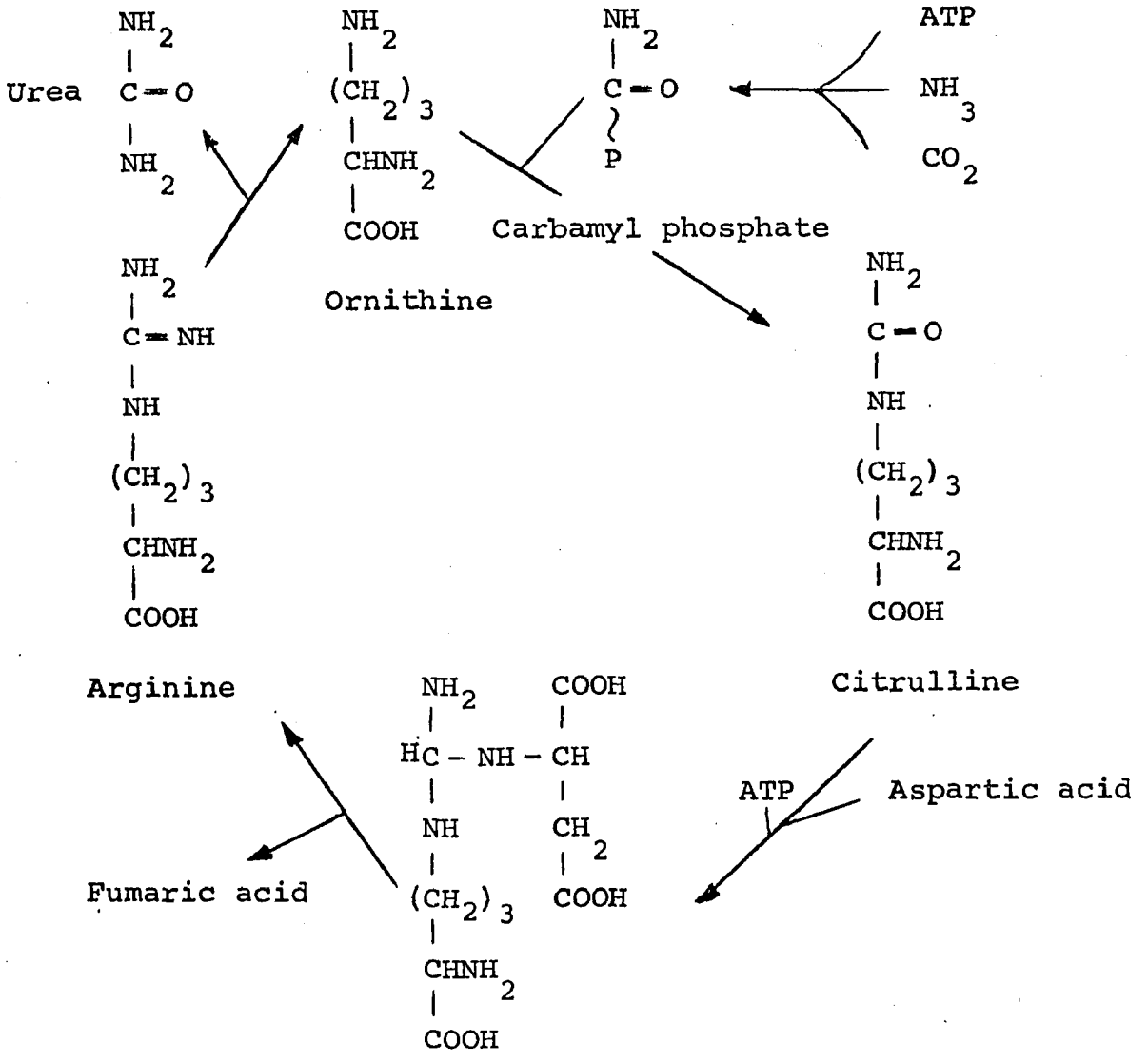
SECTION I

INTRODUCTION

During the course of development, a series of changes occur in the enzymatic patterns of an organism which can be demonstrated by determining the enzyme activity of tissue homogenates. Numerous studies have described and analyzed changes in enzymatic activities during development (Boell, 1955; Moog, 1958; Kretchmer et al., 1963; Eliasson, 1962a, b, 1963; and many others).

In mammals, since the period of differentiation is usually indicated by an increase in protein metabolism and since much is known about the detoxication of nitrogenous end products, the urea cycle enzymes which are related to the latter process are worthy of investigation. Early studies in biosynthesis of urea were described by Krebs and Henseleit (1932) who demonstrated that the formation of urea in liver tissue slices involved a series of reactions which is now known as the ornithine cycle. Each step of this process is catalyzed by a specific enzyme. The four urea cycle enzymes which have been chosen for this study are ornithine transcarbamylase, arginine synthetase system (which refers to condensing and cleavage enzyme),



The Ornithine Cycle

argininosuccinate cleavage enzyme and arginase.

The purpose of this investigation was to determine the relationship between age and the level of these four enzymes in the liver tissue of mice of C57B and an albino strain. Mice were used in this problem because many intensive studies have been done on their morphological development. Therefore, the study of enzymatic changes during

development may give more understanding to the relationship between the structure of cell organelles and their biochemical functions. In addition, their small size facilitates handling in the laboratory. Moreover, their high rate of breeding provides as many animals as needed for the experiments. Since mice are mammals some understanding of this animal might be the basic knowledge leading to more understanding in the study of other higher vertebrates or even in human development.

The liver was the organ selected for this study of the enzymes, even though there is abundant evidence for the existance of the urea cycle enzymes in various tissues of an organism (Greenberg, 1951; Ratner, 1955 and Jones et al., 1961). The fact that liver appears early in embryonic development makes it possible to study the very early embryo. Furthermore, many earlier studies have shown that the liver is an important site of urea synthesis (Krebs and Henseleit, 1932; Krebs, 1952 and Greenberg, 1951).

With all these facts in mind, this investigation was undertaken to reveal the enzymatic level of the urea cycle enzymes in mice at pre- and post-natal ages.

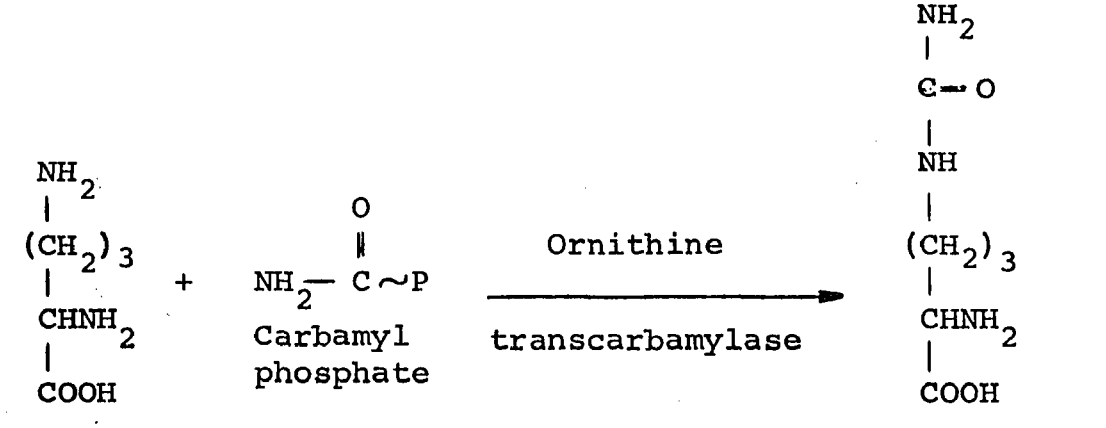
SECTION II

REVIEW OF THE LITERATURE

In a review of the literature related to the subject of this investigation it was found that in most cases, specific information on urea cycle enzymes was not concerned directly with mice. However, many results with other animals have been obtained, and those that are pertinent have been included.

ORNITHINE TRANSCARBAMYLASE

Synthesis of citrulline in the liver is accomplished by the condensation of ornithine and carbamyl phosphate in the presence of ornithine transcarbamylase (Cohen and Grisolia, 1950; Grisolia, Burris and Cohen, 1951). The reaction may be formulated as shown:



L-ornithine L-citrulline

From the evidence available at present it can be stated with reasonable certainty that the liver of ureotelic animals is the only organ to possess ornithine transcarbamylase in large amount (Cohen and Grisolia, 1952; Smith and Reichard, 1956; Burnett and Cohen, 1957; Brown and Cohen, 1960, and Jones et al., 1961). A variety of other tissues e.g. kidney, pancreas, salivary gland, etc., have also been reported to have measurable amounts of this enzyme (Jones, Anderson, Anderson and Hodes, 1961). Reichard (1957) concluded that ornithine transcarbamylase could be considered as essentially a hepatic enzyme. Accumulating data indicates that this enzyme has a high degree of substrate specificity (Smith and Reichard, 1956; Burnett and Cohen, 1957). It has also been demonstrated that the enzyme is very stable; repeated freezing and thawing resulted in little or no loss of the enzyme's activity (Jones et al, 1961).

Much has been written about the localization of ornithine transcarbamylase in mitochondria. The hypothesis that this enzyme was located exclusively in mitochondria was suggested by observing that isolated mitochondria or a mitochondria-containing preparation would synthesize citrulline from ornithine (Müller and Leuthardth, 1949). The works of Grisolia and Cohen (1952), Burnett and Cohen

(1957), Caravaca and Grisolia (1960), as well as the results of Cohen and Brown's experiment (1959), also confirmed that this enzyme is located in mitochondria of liver tissue.

In a study of the change of the level of ornithine transcarbamylase activity of the liver of fetal, neonatal, and adult rats and pigs, Kennan and Cohen (1959) demonstrated that there was detectable activity in all animals studied. Their results showed a linear increase of enzymatic activity in rats before birth and an exponential increase during the first three days after birth. In pig embryos, there was a linear increase before birth and no significant change after birth.

Other investigators (Jones et al., 1961) have confirmed the above result by observing the increase of rat liver ornithine transcarbamylase activity. They found that the activity of this enzyme is about one third of the adult level at birth and reaches the maximum adult level between 1 and 2 weeks.

In an investigation of ornithine transcarbamylase activity in chick embryos, Gordon (1956) demonstrated a detectable amount of activity in the nine day embryo. Drel (1963) found ornithine transcarbamylase in the chick embryo in high concentration on the 9th day of development

and noted that during the 7th-15th days of development the enzymatic activity decreased. Recently, Drel and Agafonova (1964) verified the presence of this enzyme on the 7th day and a reduction of 10-15% of the activity after the 16th day.

Of considerable interest are the results of changes in the quantity of protein intake by rats. Schimke (1962) found that starvation resulted in increased enzymatic activity of ornithine transcarbamylase while a protein-free diet resulted in a decreased level of the enzyme. He also noted that fasting and a protein-free diet caused a decrease of body weight and liver weight. Subsequent work by the same author (1963) showed that an arginine-free diet was associated with the activity of this enzyme and increased the ornithine transcarbamylase activity. This change might be related to catabolism of structural proteins (Baldwin, 1957, p. 252). In 1950, Schneider and Hogeboom studied the fractionation of liver homogenates into subcellular components and revealed that there was no effect of dietary protein on the mitochondrial ornithine transcarbamylase.

A group of investigators (Sato, Zaroff, and Mills, 1960) studied the activity of ornithine transcarbamylase of Chang's liver cells, HeLa cells and L-cells in vitro. They demonstrated that growing, attached, cells have very little

or no ornithine transcarbamylase activity while the non-growing, unattached, cells account for the majority of the activity. Addition of ornithine to the culture medium raised the activity of the unattached cells to a higher level than that which would be found in the same cell in a medium without ornithine. However, they suggested that since these cells are maintained in culture, it is impossible to suggest any single reason for the ornithine effect.

According to Gorini and Maas's (1958) experiments with Escherichia coli, the formation of ornithine transcarbamylase was inhibited by the presence of arginine. They suggested that the kinetics of the reaction demonstrated that the endogenous arginine, produced by the activity of the cycle, acts to inhibit formation of the enzyme.

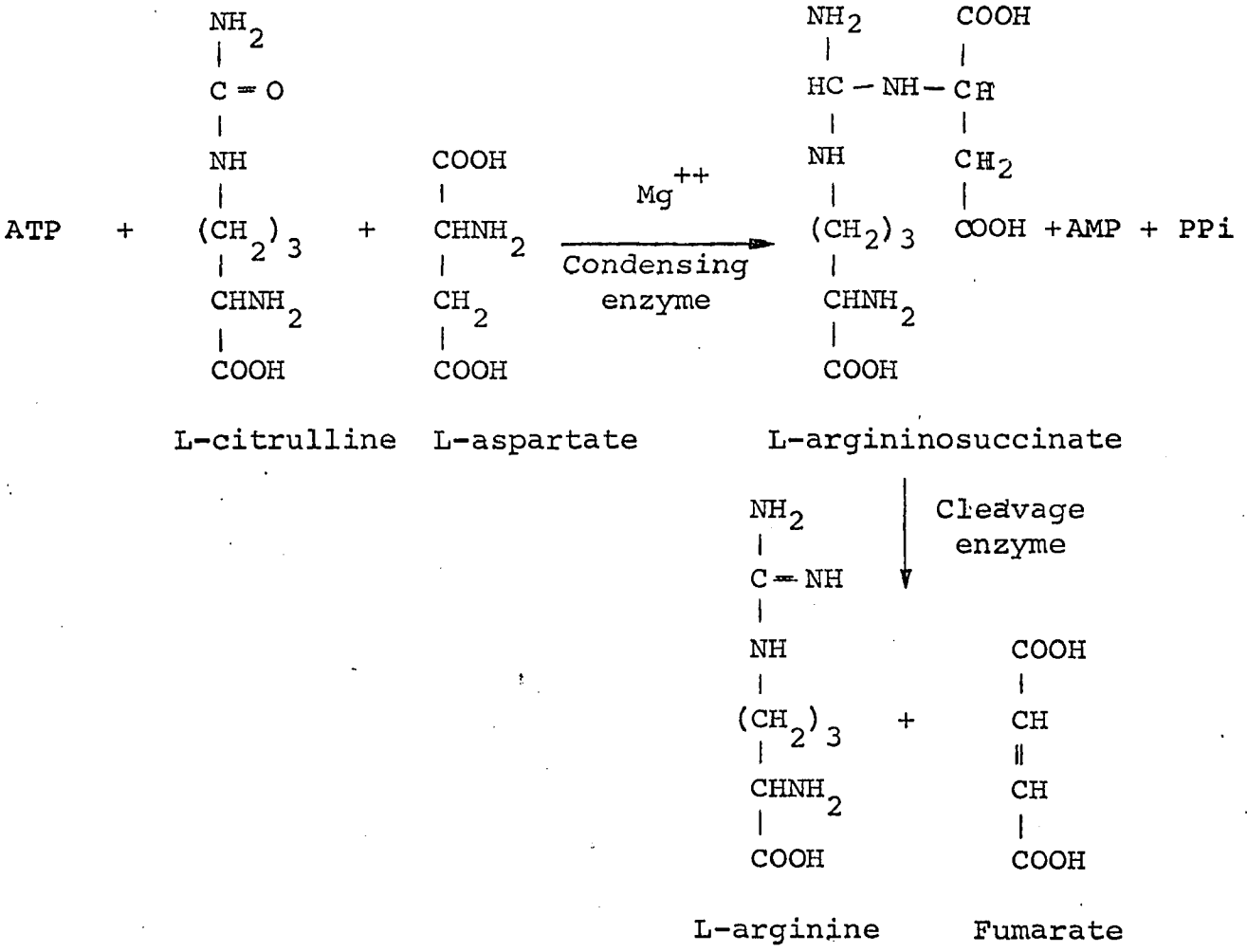
Ornithine transcarbamylase was also found to occur in lower and higher plants. Levenberg (1961) found ornithine transcarbamylase in homogenates of a common mushroom. Working in cell-free extract of a blue green alga, Holm-Hansen, Osmund and Brown (1963) were able to detect the activity of ornithine transcarbamylase.

This enzyme seems to occur widely in nature. Studies of occurrence of ornithine transcarbamylase during embryogenesis may be hoped to reveal the relationship of time

course and biosynthesis of urea in ureotelic animals and the acquisition of a highly specialized function during the course of maturation of embryonic liver cells.

ARGININE SYNTHETASE SYSTEM

The term arginine synthetase system is used here to refer to the condensing and cleavage enzymes of Ratner et al. (1949, 1951, 1953, 1954, 1955, and 1956) which effect the conversion of citrulline and aspartate to arginine via argininosuccinate:



The arginine synthetase systme was found to occur in mammalian liver and kidney (Ratner and Petrack, 1953; Ratner, 1955). It is also present in amphibian liver (Brown and Cohen, 1958). Ratner (1955) and Schimke (1962) demonstrated that the arginine synthetase enzymes are associated with soluble protein in the liver cell.

Evidence from several reports indicated that the overall synthesis of arginine from citrulline is the rate limiting reaction (Gornall and Hunter, 1943; Pearl and McDermott, 1958; Brown and Cohen, 1959). It has also been demonstrated that this enzyme system exhibits a high degree of substrate specificity (Ratner and Pappas, 1949; Ratner and Petrack, 1951). The same group of authors also showed that the enzymes are fairly stable at low temperature (Ratner and Pappas, 1949).

Studying factors affecting the level of arginine synthetase system in rat liver, Schimke (1963) found that feeding a protein-rich diet resulted in increasing the level of activity of this enzyme system. The same result was obtained in starvation and corticosteroid administration. In the protein-free diet experiment, Schimke (1962) demonstrated a decrease in the enzyme activity level. It is clear from the above results that there is an association between the changing level of arginine synthetase activity

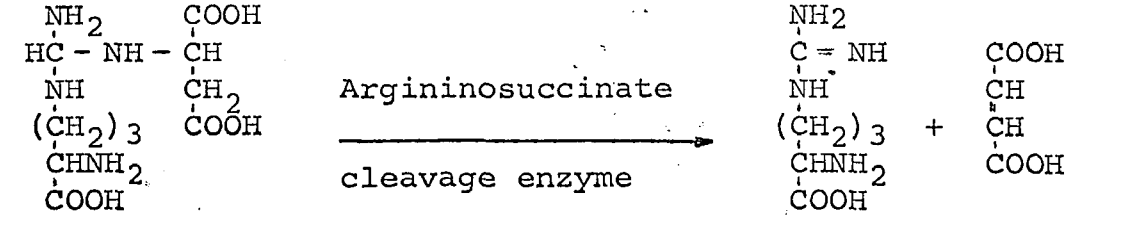
and the dietary intake of protein.

In 1959, Kennan and Cohen studied the arginine synthetase system in the pig and rat during the course of development. They found that enzyme activity was present in all stages of the pig embryo studied while in the rat, enzyme activity was detectable shortly before birth. In both cases, the enzyme activity increased rapidly to the full adult level shortly after birth. In an investigation of other species of animals, Brown and Cohen (1959) demonstrated that the increase from a low to a high level of activity of the arginine synthetase system occurred at the onset of metamorphosis in amphibians.

Although there are a limited number of studies on this enzyme system, it is clear that the activity of the arginine synthetase system, like all other enzymes in the urea cycle, varies during the course of development.

ARGININOSUCCINATE CLEAVAGE ENZYME

This enzyme catalyzes the following reaction:



L-argininosuccinate

L-arginine

Fumarate

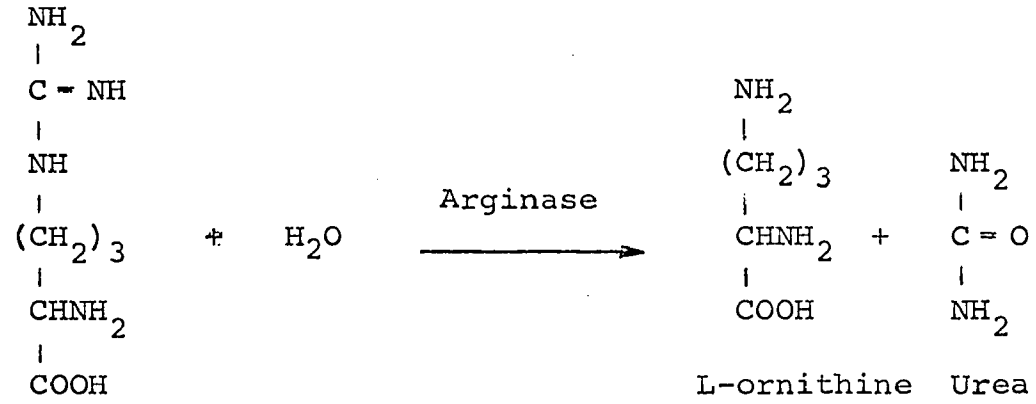
A large number of studies have indicated that this enzyme is widely distributed in nature. According to Ratner and her coworkers (1954, 1955), argininosuccinate cleavage enzyme is present in all mammalian liver and kidney.

Considerable work has shown that argininosuccinate cleavage enzyme is not located in mitochondria (Ratner, 1955; Brown and Cohen, 1959). The enzyme catalyzes the nonhydrolytic, nonoxidative cleavage of a C-N bond (Cohen and Brown, 1959).

According to the experiments of Ratner, et al. (1953) argininosuccinate cleavage enzyme showed a high substrate specificity. Like the overall arginine synthetase system as noted in the previous section, a series of investigations by Schimke (1962, 1963) revealed a correlation between the level of argininosuccinate cleavage enzyme and dietary protein intake. For example, in an arginine-free diet experiment, there was a significant increase in argininosuccinate cleavage enzyme activity level. Enzyme activity also varies with age (Brown and Cohen, 1959), with certain hormonal changes (Schimke, 1963), and is seen to increase during amphibian metamorphosis (Brown and Cohen, 1959).

ARGINASE

The role of arginase in urea synthesis in ureotelic animals has been a very thoroughly investigated problem in the field of biochemistry. Arginase is one of the most specific hydolases, decomposing L- but not D-arginine and producing L-ornithine and urea in the ornithine cycle (Kossel and Dakin, 1904).



L-arginine L-ornithine Urea

This enzyme is present in the animal kingdom and also occurs in plants as well as in molds (Cohen and Brown, (1960). In ureotelic animals, arginase is found in various organs. For instance, Hunter (1929) found arginase in the heart and kidney of several species of fish. The recent work of Kusen et al. (1963) demonstrated the presence of arginase in the mucous membrane of the rumen wall of cattle. Working with rats, pigs, dogs, horses and cows, Lange and Kossmann (1963) found arginase in the lung tissue of these animals.

In studying the presence of this enzyme in different organs, one finds much evidence that the liver is the major site of this enzyme. The works of Hunter (1924, 1929) and Greenberg (1951) revealed that arginase is present in large amounts in the liver compared to small amounts in other organs of all animals. Stern et al. (1952) found a large amount of arginase in the liver and small amount in the kidney of calves. All these findings confirm that the liver is the main site of arginase.

Investigations of arginase activity of the developing chick embryo revealed that considerable arginase was present in the liver, internal organs and body (Drel, 1963, and Ceska, et al., 1959). Among those sources, the highest activity was found in the liver. It gradually decreased in the course of embryonic development, and the hepatic arginase disappeared completely in the 15th day of incubation while it was still found in other organs such as the kidney (Drel, 1963). This experiment confirmed the earlier studies of Clark and Fischer (1957), who showed that the arginase activity in the developing chick could be detected until the 18th day of incubation. In 1959, Goldie reported that the arginase was found on the 7th day of incubation and remained through the 18th day in the case of liver arginase, but kidney arginase could be measured

through the hatching period. In a series of experiments with young chick embryos Eliasson (1962a, b, 1963) found that from the second to the sixth days of incubation the arginase activity increased. The author concluded that the result of the increased arginase activity during development of the chick embryo was due to synthesis of specific enzyme protein rather than a change in the presence of specific inhibitors or functional properties of the enzyme.

The study of the distribution of arginase between the nucleus and the cytoplasm of the liver of rats has been pursued by several authors (Dounce, 1943, and Stern et al., 1952). The amount of arginase from nucleated fragment is less than that from the cytoplasm. Experiments with kidney cells of several species of animals (lambs, dogs, chicken and rats) also showed the same results, i.e. there was very little arginase activity in the nuclear fraction. This meant that the major portion of the activity of this enzyme was located in the cytoplasm of the kidney cells (Dounce and Beyer, 1948). Other investigators found differences in the location of arginase in the cells. Stern et al. (1952), working with fowl and calves, found that in the case of calves the arginase activity was almost equal in the nuclear fraction

and the cellular homogenate. In fowl, the arginase activity of the cellular homogenate was much greater than that of the nuclear fraction.

Examination of arginase activity of a fractionated water homogenate of rat liver by Schein and Young (1952) revealed that the highest activity was present in the nuclei, followed by mitochondria, microsome and supernatant fractions. Rosenthal et al. (1956) found that when a divalent cation was added to the suspension media the arginase activity was no longer detected in the nuclear and microsomal fractions but in the supernatant. They concluded that arginase is usually present in the soluble portion of the cytoplasm but electrolyte in the media caused the arginase to be associated with nuclei of the cells, leading to the wrong conclusion as to the location of arginase activity. This experiment was confirmed by Carruther et al. (1959) and was accepted by de Duve et al. (1955).

By using radioactive guanidino-C^{14}-L-arginine as a tracer, Schimke et al. (1963) were able to demonstrate that in rat liver, arginase was continually synthesized and degraded. The half-life of arginase was 4.5-5.2 days, compared to 2.4-3.0 days for total liver protein.

In most species of animals, the arginase that first

appears in the early embryo can function as it would in the adult but at a low level of activity which gradually increases until it reaches the adult level (Baldwin, 1936). Surveys of changes in the level of this enzyme have been done mostly on rats and frogs. Kennan and Cohen (1959) in studing the arginase activity in the liver of pigs and rats at different ages varying from fetal, neonatal and adult found that in rats, the arginase activity was very low until late fetal life. On the contrary, the arginase activity in the pig liver appeared in the youngest embryo studied (twenty eight days). These results suggest that there is considerable variation between species concerning the time of appearance of this enzyme.

In general, the arginase level in animals is correlated with age and diet. The studies concerning arginase level were done in white rats by Lightbody in 1938. His experiment showed an increase of liver arginase activity during the first four days after birth, and then a decrease for a certain period of time. The activity increased again soon after weaning when the young rats were fed with laboratory food.

Experiments on frogs by Munro (1939), Dolphin and Friden (1955) and Brown et al. (1959) showed a similar increase of liver arginase during the metamorphosis of

tadpoles. In this case, the increase of enzymatic activity can also be correlated with dietary change.

Arginase also varies according to protein catabolism and hormonal stimuli (Rosenthal and Vars, 1954; Schimke, 1963). Similar variation was found in the arginase of the earthworm (Cohen and Lewis, 1950; Bishop and Campbell, 1965). Schimke (1963) and Riggs and Walker (1963), working on rat liver showed that there was an alteration of the arginase activity after the administration of a corticosteroid. Similar findings have been reported by Freedland et al. (1962) and Freedland (1964).

In studies of protein catabolism, the work of Lightbody and Kleinman (1939) elucidated that in white rats, increased ingestion of protein caused increases in liver arginase activity and that the ingestion of protein was correlated with the size of the liver. Similar results have been obtained by Mandelstam and Yudkin, (1952), Ashida and Harper, (1961), and Schimke, (1961, 1962, 1963). This suggests that an increase in enzymatic activity may be one factor in adaptation to varying dietary protein intake. Another experiment confirming the adaptive nature of arginase was that of Roeder (1957). By adding arginine into the air sac of the egg, Roeder found an increase in arginase activity in the developing chick embryo.

In studies at the cellular level, Klein (1960, 1961), and Schimke (1964) found an increase of arginase activity in cells that were cultivated *in vitro* following the addition of the specific substrate to the culture media. Apparently, arginase is an adaptive enzyme which can be influenced by several factors and varies widely among species as well as during the course of development of an individual.

SECTION III

MATERIALS AND METHODS

ANIMALS

Mice (Mus musculus L.) of C57B (characterized by thoroughly black fur) and normal albino strains were used in the present experiment. Animals were housed in 12 x 14 inch plastic cages which were layered with wood shavings. Purina laboratory chow and water were freely available.

Males and females of the same litter were separated after weaning. In brother and sister matings used to maintain the colony, the male was returned to female's cage for 24 hours. Mice were sacrificed at the desired body weight.

PREPARATION OF HOMOGENATE

The mice were weighed, lightly chloroformed and then killed by decapitation. The liver was removed, weighed, and homogenized in distilled water with a glass homogenizer (Kontes Duall Tissue Grinder). The concentrated homogenate was diluted to 5% with distilled water and then transferred to a chilled centrifuge tube. After centrifugation at the rate of 2500 rpm for 10 minutes, the supernatant solution was decanted into a chilled tube and kept refrigerated

until used.

INCUBATION AND COLOR DEVELOPMENT

The assay methods were based on the colorimetric determination of citrulline and urea by the method of Archibald (1944) as modified by Ratner (1955) with diacetyl monoxime for citrulline (490 mu absorption) and 1-phenyl-1, 2-propane-dione-2-oxime for urea (540 mu absorption). The method used in this investigation followed that of Brown and Cohen (1959) for the assay of urea cycle enzymes in tadpole liver. However, using different species and homogenates instead of extracts necessitated some changes in the assay conditions for maximal results of enzyme activities.

Optical density was read in 0.5 inch cuvettes in a Bausch and Lomb Spectronic 20 colorimeter. The colors produced with urea and citrulline were light sensitive therefore they had to be protected from light during boiling and cooling. The amount of product formed was read from a calibration curve of known amounts of urea or citrulline.

The specific activity was expressed as micromoles of product formed per minute per milligram of liver wet weight under the assay conditions.

ORNITHINE TRANSCARBAMYLASE

The activity of this enzyme was assayed by measuring the amount of citrulline formed. The incubation tube contained 20 micromoles of L-ornithine (pH 8.0), 90 micromoles of glycylglycine buffer (pH 8.0), 20 micromoles of carbamylphosphate dilithium salt and 1.0 ml of 0.5% liver homogenate. Because of the instability of carbamylphosphate salt in aqueous solution, it was prepared just before use. The incubation period was 15 minutes at 38°C. After incubation, 2.0 ml of sulfuric-phosphoric acid mixture (3 vol. H_3PO_4 85% : 1 vol. conc. H_2SO_4 : 1 vol. H_2O) was added to stop the reaction. The tube was heated for 10 minutes in a boiling water bath then cooled in running tap water for 10 minutes. Control tubes were inactivated with sulfuric-phosphoric acid before incubation. The optical density was read at 490 mu. The amount of citrulline formed was determined from a calibration curve of known amounts of citrulline.

The specific activity of ornithine transcarbamylase was defined as micromoles of citrulline produced per minute per milligram of liver wet weight.

ARGININE SYNTHETASE SYSTEM

The incubation tube contained 5 micromoles $MgSO_4$, 5 micromoles citrulline (pH 7.0), 5 micromoles aspartate

(pH 7.0), 50 micromoles potassium phosphate buffer of pH 7.0, 5 micromoles adenosine triphosphate (ATP), 3 micromoles arginase (Nutritional Biochemicals Corporation, Cleveland, Ohio) and 1.0 ml 2.5% liver homogenate. The mixture was incubated for 60 minutes at 38°C. The reaction was stopped by adding 2.0 ml sulfuric-phosphoric acid followed by 0.2 ml color reagent (1-phenyl-1, 2-propanedi-one-2-oxime). Heating in a boiling water bath and cooling in tap water was 60 and 30 minutes respectively. The optical density was read at 540 mu with a control which was inactivated before incubation and specific activity was determined from a calibration curve of known amount of urea.

The specific activity was defined as the amount of urea formed per minute per milligram of liver wet weight.

ARGININOSUCCINATE CLEAVAGE ENZYME

The reaction system of argininosuccinate cleavage enzyme consisted of 20 micromoles argininosuccinate substrate (pH 7.0), 50 micromoles potassium phosphate buffer of pH 7.0, 3 micromoles arginase (N.B.C., Cleveland, Ohio), and 1.0 ml of 5% liver homogenate. The arginine resulting from this reaction was broken down into urea and ornithine by arginase during the 30 minutes of incubation.

To stop the reaction and develop the color 2.0 ml sulfuric-phosphoric acid and 0.2 ml of 1-phenyl-1, 2-propanedione-2-oxime were added respectively. The mixture was boiled in a water bath for 60 minutes and cooled for 30 minutes at room temperature before reading the optical density at 540 mu.

The specific activity of this enzyme was estimated from the micromoles of urea formed per minute per milligram of tissue wet weight.

ARGINASE

Arginase activity was determined by measuring the amount of one of the products (urea) of the reaction by the 1-phenyl-1, 2-propanedione-2-oxime method.

The assay solution consisted of 1.0 ml 0.5% liver homogenate, 20 micromoles arginine hydrochloride substrate (pH 9.5) and 50 micromoles sodium glycinate buffer (pH 9.5). After 30 minutes of incubation at 38°C, the reaction was stopped, color reagent added, and the solution was heated and cooled as previously described. The optical density was read at 540 mu. The amount of urea produced by arginase was estimated from a calibration curve of known amounts of urea.

The specific activity of arginase was defined as micromoles of urea formed per minute per milligram of liver wet weight under the assay conditions.

SECTION IV

RESULTS

Sensitivity curves (Figs. 21 and 22 in appendix) were established for the Bausch and Lomb Spectronic 20 colorimeter using the reagents employed for ascertaining urea cycle enzyme activities with known amounts of urea or citrulline. Optimum sensitivity for urea and citrulline was found at 540 and 490 mu respectively. This agreed with the data of Archibald (1944) and of Ratner (1955).

Calibration curves were constructed by adding fixed increments of urea (0.2-2.6 micromoles) and citrulline (0.2-1.4 micromoles) to reagents used in the test solutions. Corresponding differences in optical density of the solutions, when presented graphically, formed essentially linear curves (Figs. 23 and 24 in appendix).

Determination of the age of mice used in this investigation was based upon the body weight and external morphological characteristics. In both strains (albino and C57B), the body weight reached the adult value at about two months of age. The sex of animals showed little or no influence on the body weight, therefore, the values expressed here are considered representative for the weight of any animal.

Fig. 25 (in appendix) shows that the body weight increases in a linear pattern corresponding to the age of the animal in animals of the age groups studied.

All determinations were performed on replicates and the values cited are the means of several experiments. Each point plotted in the figures represents the average value obtained from ten different mice of a particular age group.

Since the final catabolism of protein to urea takes place primarily in the liver, emphasis was placed on the specific activity per milligram of liver tissue and standard deviations were reported for these values. Because urea formation is a metabolic adaptation of a system providing detoxification for all body tissues, it should result in a change in activity of the enzyme system on the basis of total body requirements, which may be related to body weight. Therefore, the activity per gram of body weight was reported.

Comparison of mice of C57B and albino strains exhibited appreciable differences in enzyme activity. Although in both cases, there was a similar pattern of increasing enzyme activity during the period of growth and development, that the level of the activity and the time relationships were different can be seen in the graphical presentations.

ORNITHINE TRANSCARBAMYLASE

Albino mouse

The second step of urea synthesis is catalyzed by ornithine transcarbamylase. The activity of this enzyme, expressed in term of specific activity per milligram of liver wet weight, is given in detail in Fig. 1 and Table 1 (in appendix).

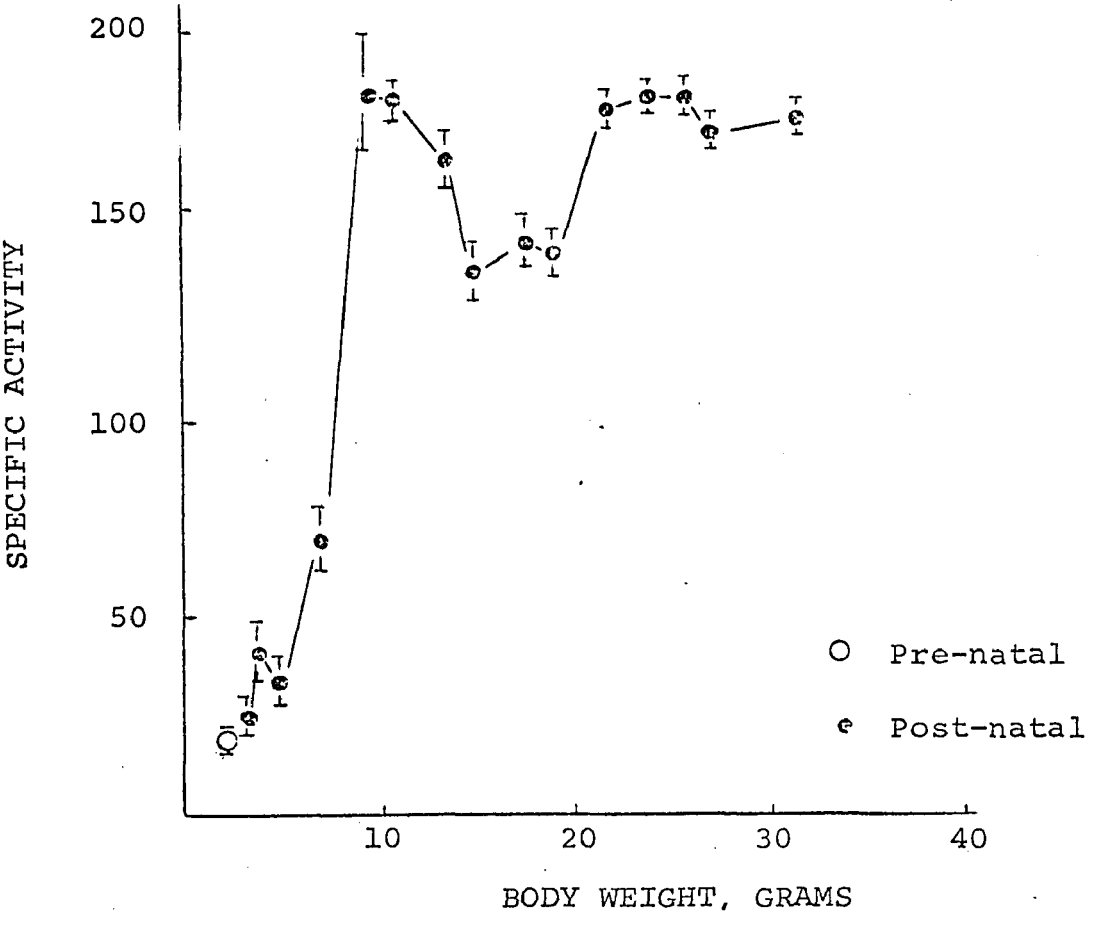


Fig. 1 Albino mouse liver ornithine transcarbamylase specific activity in micromoles x 10^{-3} of citrulline produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

Liver ornithine transcarbamylase was found in the earliest embryo studied (less than one gram stage). The activity rose steadily up to the 6-8 gram stage. The mean value of specific activity during this period of development was about forty per cent of the adult value. Beyond the 6-8 gram stage, there was a conspicuous increase of ornithine transcarbamylase activity. At this point, the specific activity reached the maximum adult level which was nearly triple as much as that of the preceding stage. After a decline of about 25% at the 12-18 gram stage, the ornithine transcarbamylase specific activity once again increased to the adult value. With little variation, the specific activity was maintained around this value throughout the later stage of development.

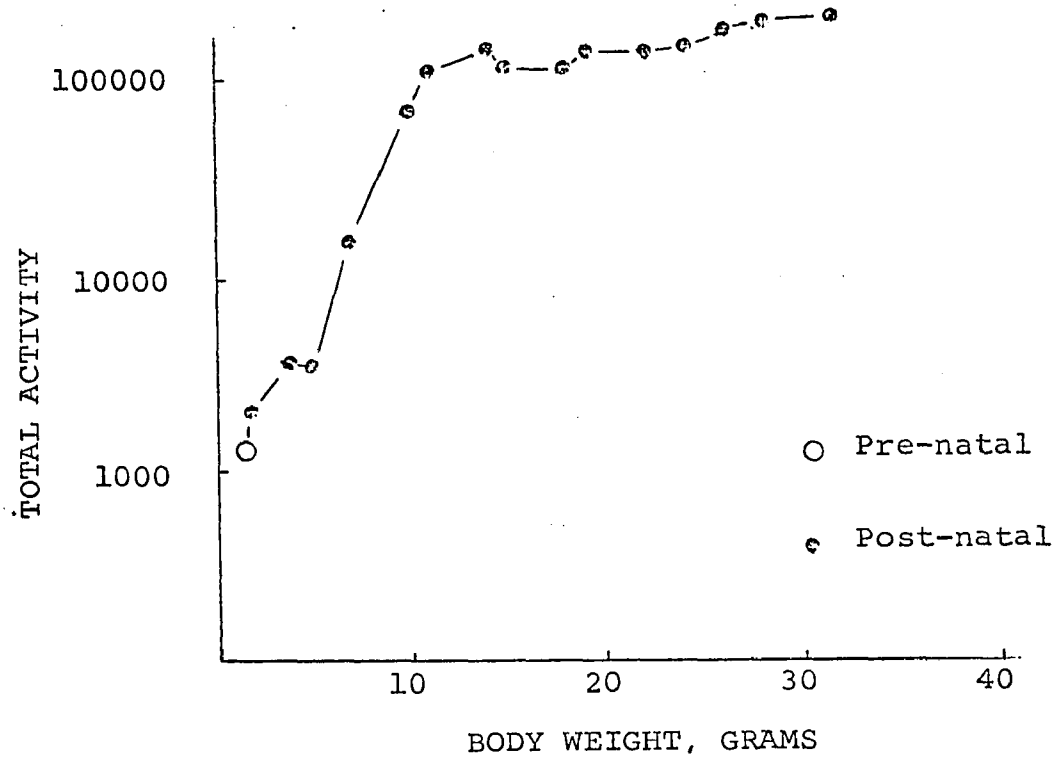


Fig. 2 Albino mouse liver ornithine transcarbamylase total activity (specific activity x total liver wet weight).

The pattern of total activity (Fig. 2) of ornithine transcarbamylase was affected by two factors: the mass of liver tissue, and the specific activity. A rapid rise in total activity corresponded to the increasing specific activity at the 8-10 gram stage. The graph (Fig. 2) also shows that the increasing weight of the liver tissue during the declining period of ornithine transcarbamylase specific activity (12-18 gram stage) prevented a decrease of the total activity and the total activity rose continuously during subsequent growth and maturation.

C57B mouse

Table 2 (in appendix) shows the ornithine transcarbamylase activity of the liver of C57B mice. This enzyme was found in all species examined. It is clear from the data that the mean peak of liver ornithine transcarbamylase

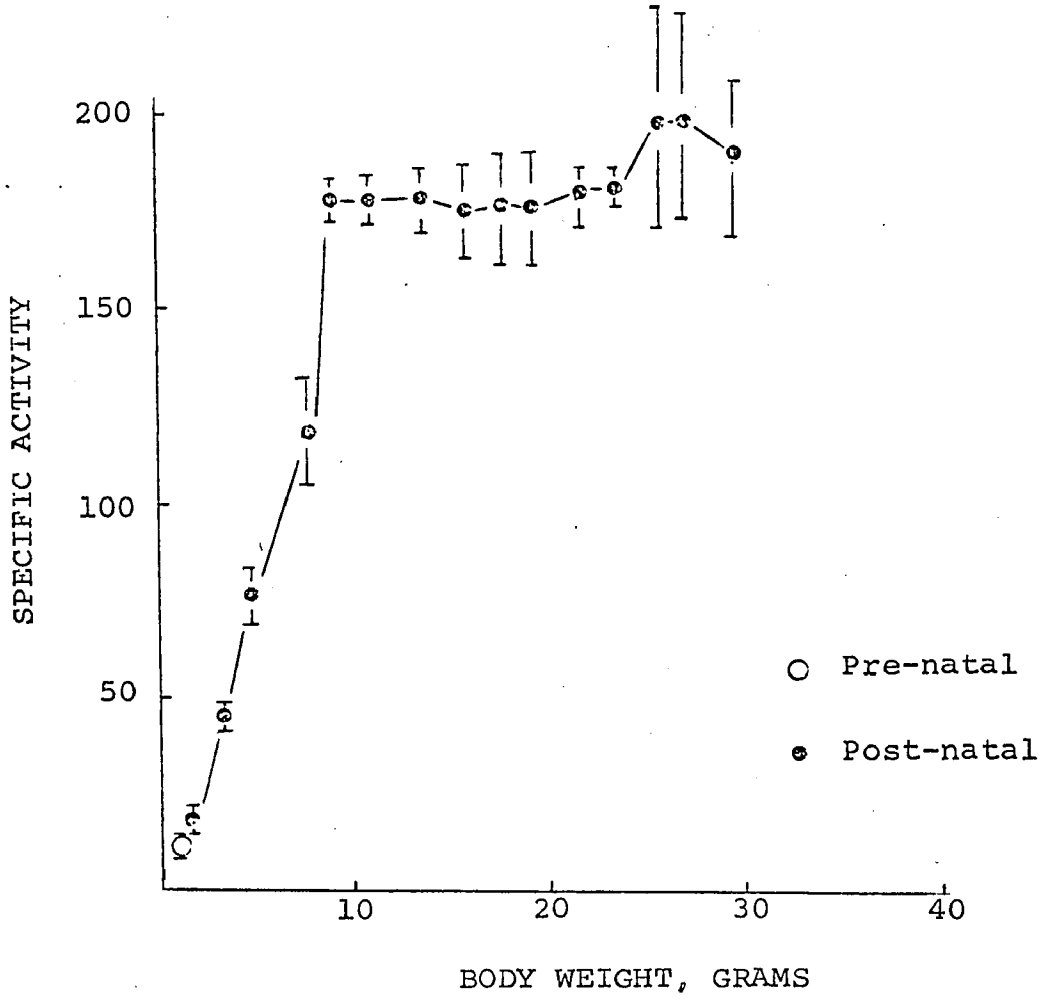


Fig. 3 C57B mouse liver ornithine transcarbamylase specific activity in micromoles x 10^{-3} of citrulline produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

activity is about 10% of the adult level at birth (Fig. 3). The greatest rise in specific activity or ornithine transcarbamylase occurred at the 8-10 gram stage. The total

increase of specific activity from new born to the 8-10 gram stage is approximately 150%. This is a significant change during development despite considerable variation in each group. The adult level of ornithine transcarbamylase specific activity was attained at the 8-10 gram stage and it remained close to this value thereafter.

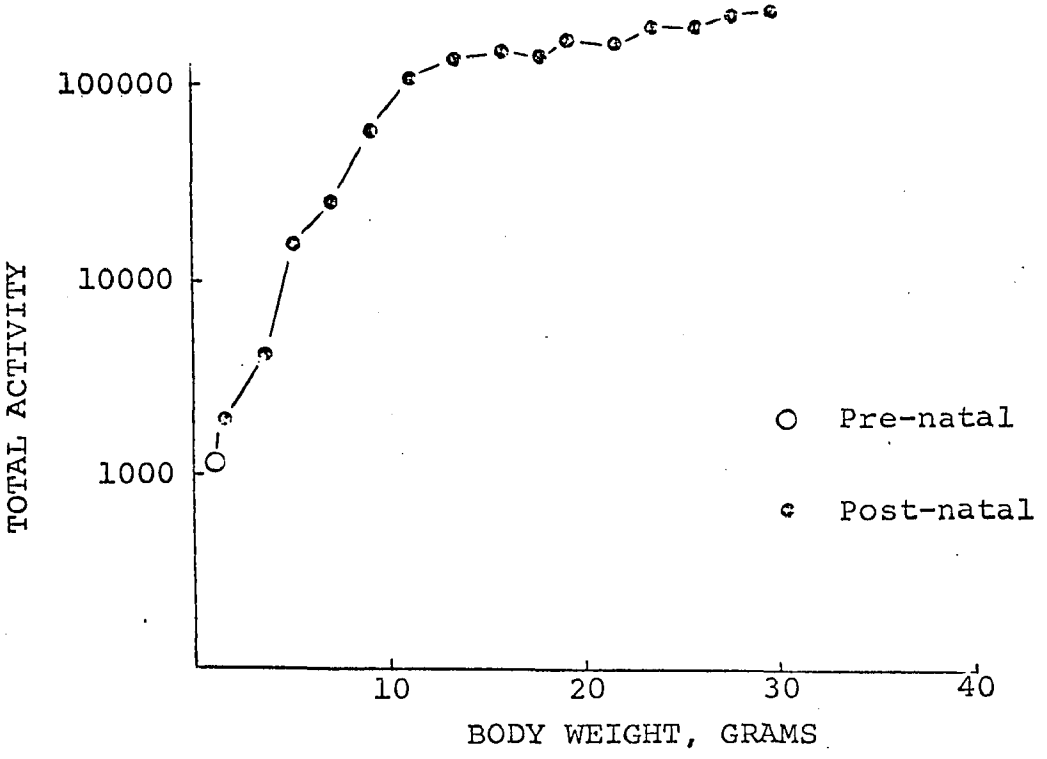


Fig. 4 C57B mouse liver ornithine transcarbamylase total activity (specific activity x total liver wet weight).

Fig. 4 illustrates a steady increase in total activity of liver ornithine transcarbamylase. The pattern of the plot of mean total activity provides strong support for the view that the rapid increase of total activity during development is due to the increase of specific activity and

an increase in the mass of liver tissue. It was interesting to note that the continuing increase in total activity was due to the increasing liver weight. As soon as the liver attains adult size, the level of total activity was influenced by only one factor, the specific activity.

Table 2 (in appendix) also indicates the magnitude of ornithine transcarbamylase activity per gram of body weight. The activity per gram of body weight increased rapidly and reached the adult value at the 8-10 gram stage.

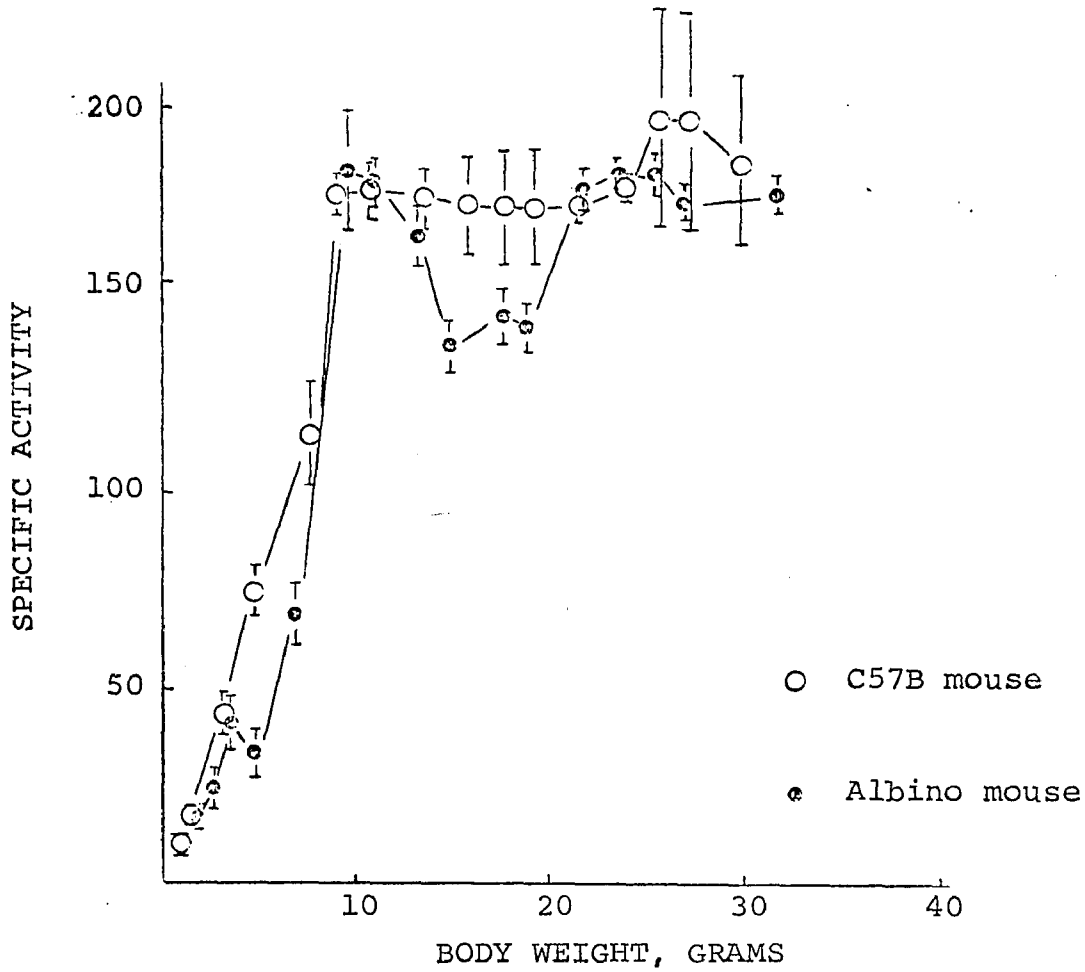


Fig. 5 Ornithine transcarbamylase specific activity in micromoles x 10^{-3} of citrulline produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

ARGININE SYNTHETASE SYSTEM

Albino mouse

Little or no arginine synthetase system activity can be demonstrated in the mouse embryo of slightly less than one gram of body weight. With the maximum amount of homogenate permitted by the assay procedure and with a 60 minutes incubation period, only 0-1 micromole of urea can be measured. However, beyond one gram stage (at approximately 18 days of gestation or two days before birth), the activity became appreciable.

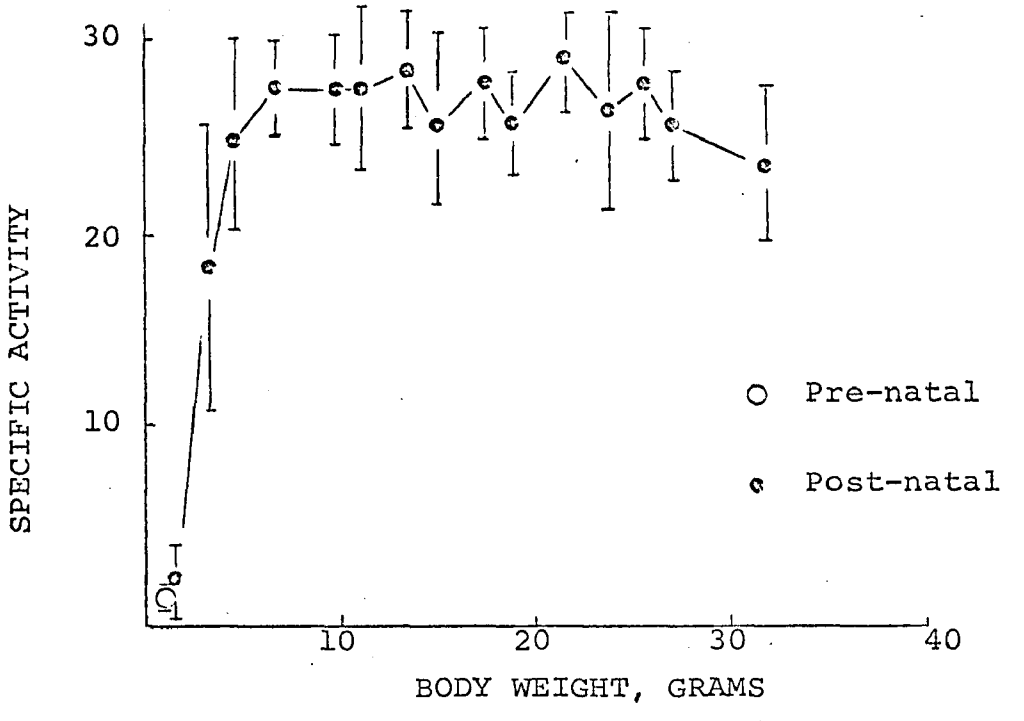


Fig. 6 Albino mouse liver arginine synthetase system specific activity in micromoles x 10^{-7} of urea produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

The data plotted in Fig. 6 show that the specific activity of this system increased rapidly in a linear fashion and reached the presumable adult value at 4-6 gram stage. The specific activity remained close to this value with no further variation up to the 6-10 gram stage. In later stages of development there was a slight fluctuation of specific activity.

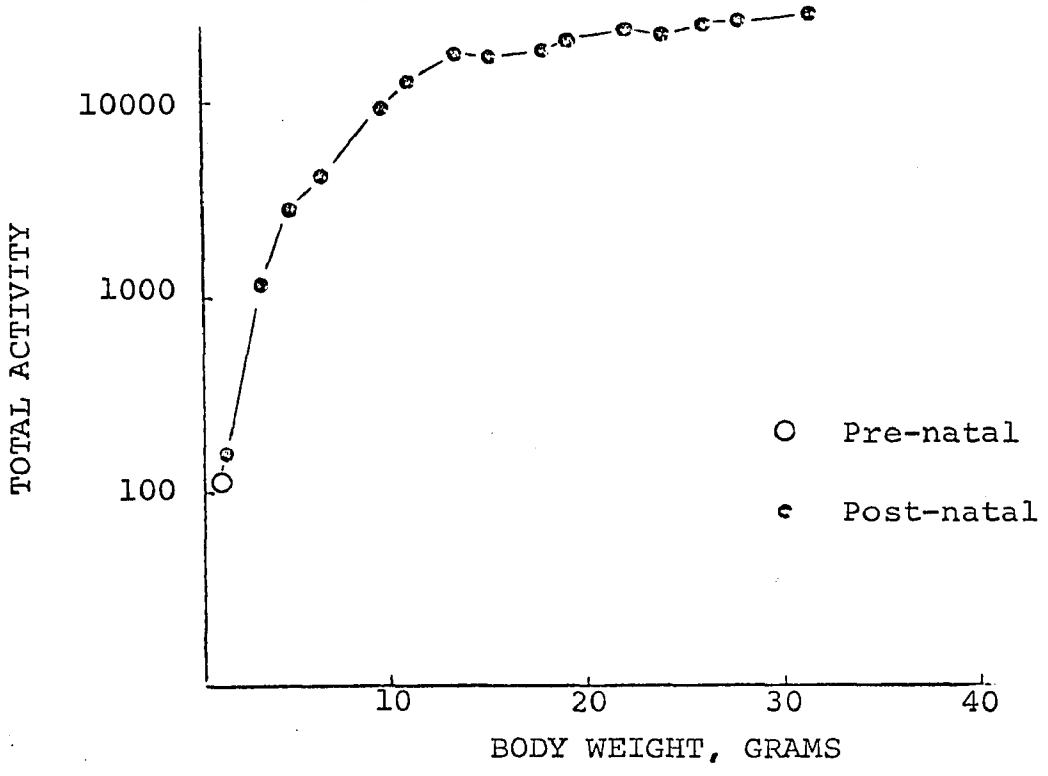


Fig. 7 Albino mouse liver arginine synthetase system total activity (specific activity x total liver wet weight).

As indicated in Table 3 (in appendix) and Fig. 7, there was a progressive, almost linear, rise in the total activity of the arginine synthetase system of albino mice after parturition. The increasing rate continued until

10-12 gram stage, at which point the total activity fluctuation corresponded to the decrease and increase in specific activity.

C57B mouse

Immediately after birth the specific activity of the arginine synthetase system increased to a level several times higher than that of the embryonic stage (Fig. 8, Table 4 in appendix). The specific activity reached the adult level at about the 4-6 gram stage and remained at

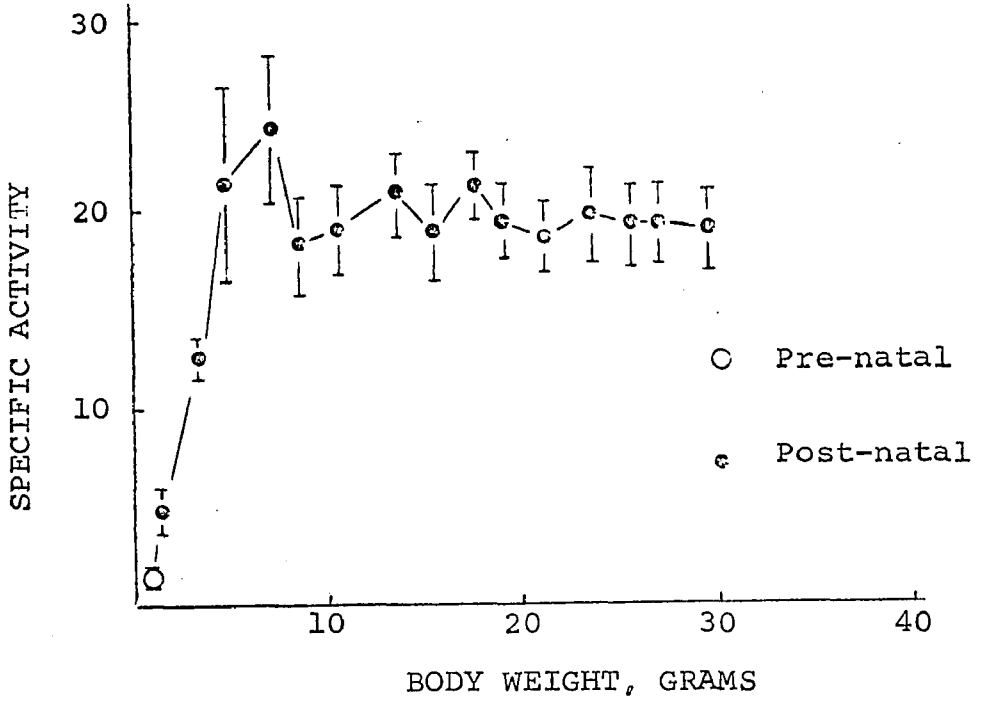


Fig. 8 C57B mouse liver arginine synthetase system specific activity in micromoles x 10^{-7} of urea produced per minute per milligram of liver wet weight, ± S.D. of the mean.

this level with little variation through the adult life.

Fig. 9 shows that the total activity of this enzyme rose steadily but at a lower rate than that of the albino

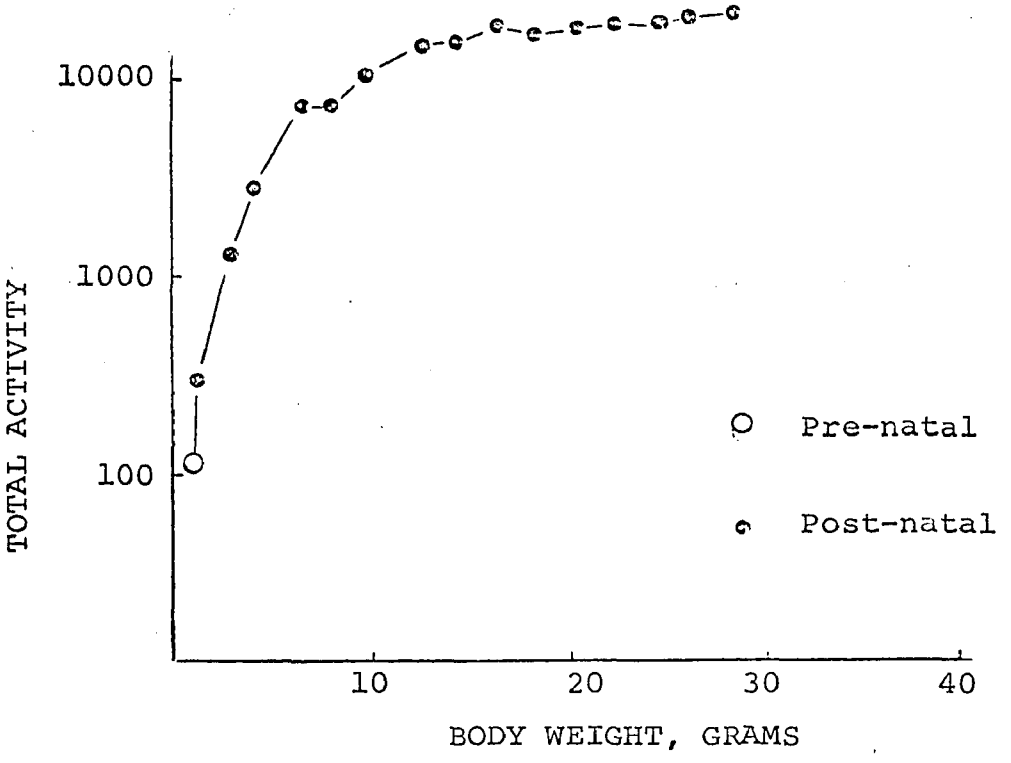


Fig. 9 C57B mouse liver arginine synthetase system total activity (specific activity x total liver wet weight).

strain. The total activity acquired the adult level at 8-10 gram stage and was maintained near this level for the succeeding developmental period.

ARGININOSUCCINATE CLEAVAGE ENZYME

Albino mouse

In this strain of mice, activity of the argininosuccinate cleavage enzyme was found in the fetus weighing

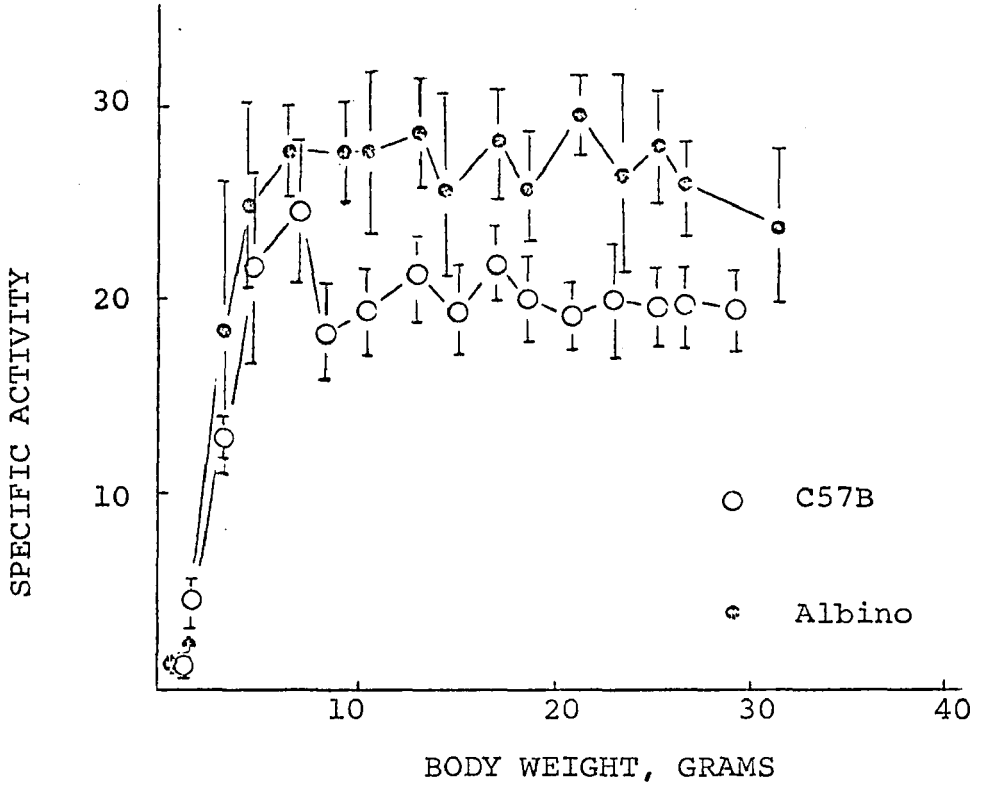


Fig. 10 Mouse liver arginine synthetase system specific activity x 10^{-7} micromoles of urea producer per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

approximately one gram and increased to about one-fifth of the adult level at birth. There was a linear increase in enzyme activity in the neonatal period which reached the adult level at about the 6-8 gram stage. The level of specific activity did not change much during the subsequent development.

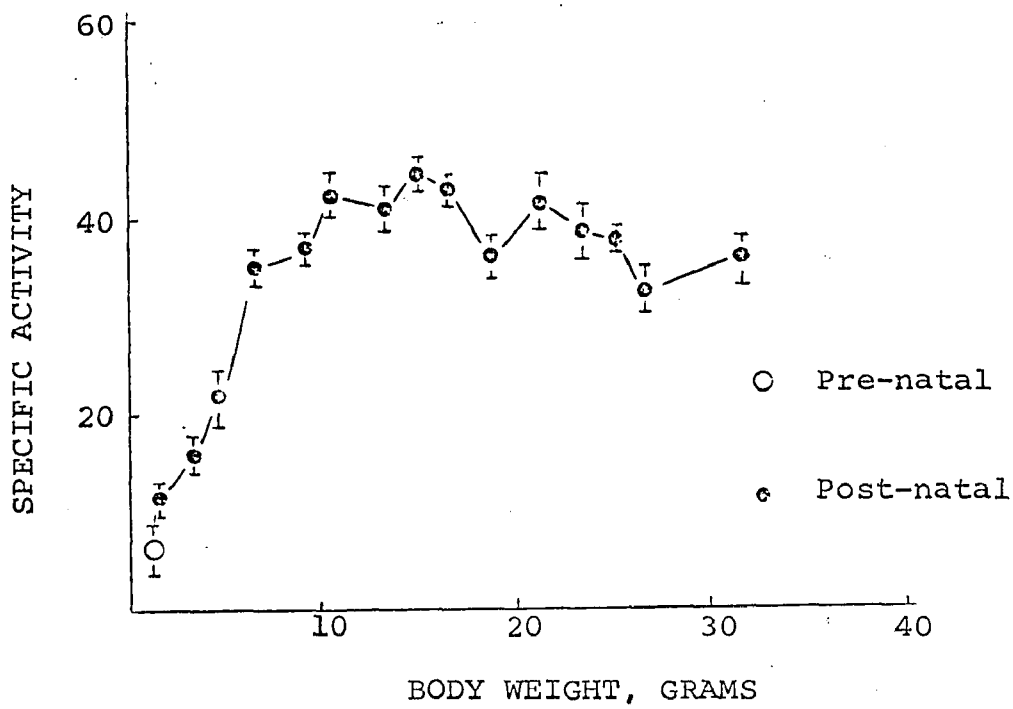


Fig. 11 Albino mouse liver argininosuccinate cleavage enzyme specific activity in micromoles x 10^{-7} of urea, produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

As illustrated in Fig. 11, the specific activity variation with age of argininosuccinate cleavage enzyme was similar to that of the overall arginine synthetase system. The specific activity of the argininosuccinate cleavage enzyme increased shortly after birth and in a

manner paralleling the overall system (Fig. 6).

Fig. 12 depicts the changes in total activity of this enzyme in the albino mouse. A very rapid increase took place after birth up to 8-10 gram stage. This increase in total activity was accompanied by an increase in specific activity coupled with an increase in the mass of liver tissue.

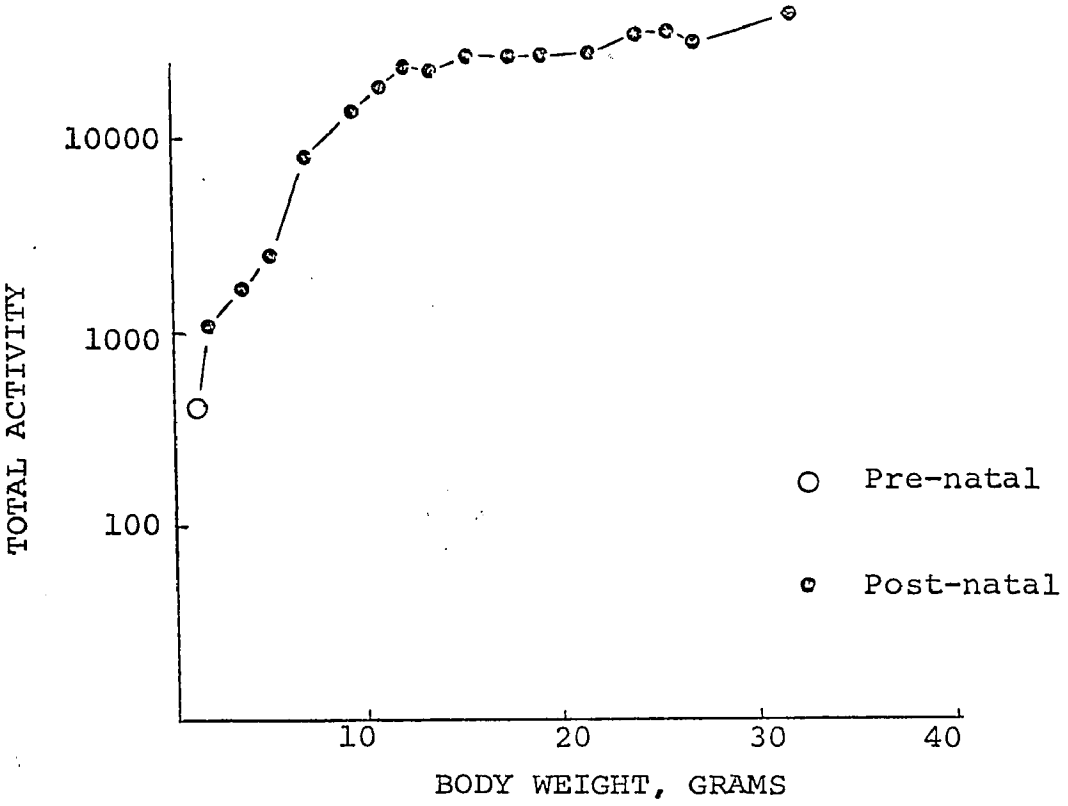


Fig. 12 Albino mouse liver argininosuccinate cleavage enzyme total activity (specific activity x total liver wet weight).

C57B mouse

The specific activity of argininosuccinate cleavage enzyme in the C57B mouse is similar to the pattern of the albino mouse. Once again the specific activity increased

markedly after birth from an undetectable level in the very young embryonic mouse. The adult level was achieved a little sooner in the C57B strain (at the 4-6 gram stage) than that of the albino strain (6-8 gram stage). The

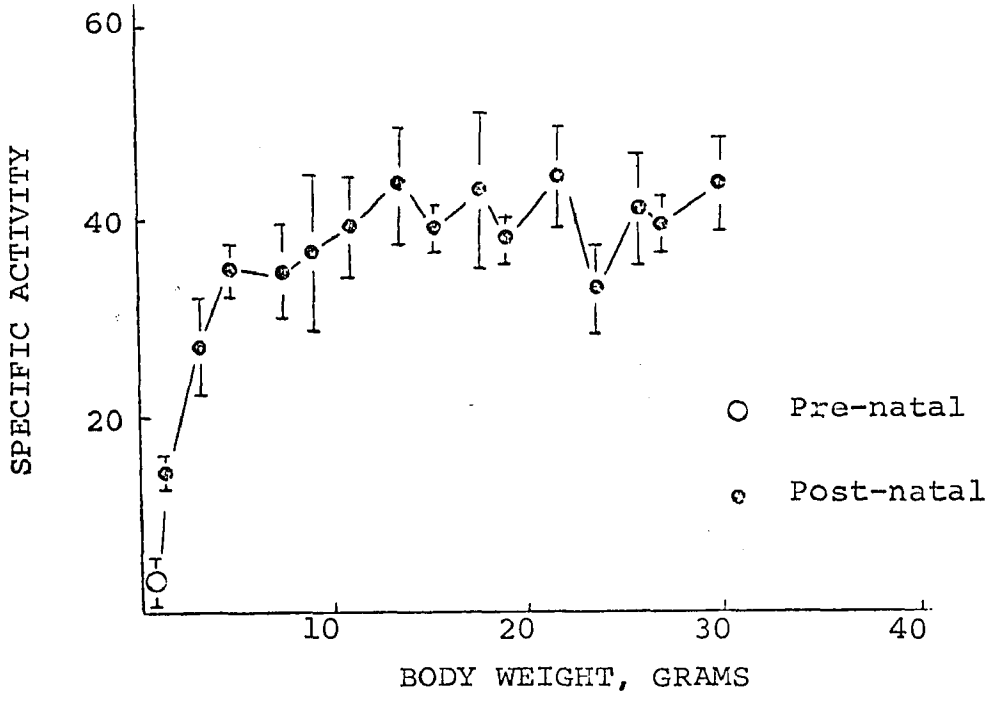


Fig. 13 C57B mouse liver argininosuccinate cleavage enzyme specific activity in micromoles x 10^{-7} of urea produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

specific activity reached the highest peak at the 12-14 gram stage. As the body weight increased beyond 14 gram, there was a fluctuation of enzymatic activity in all subsequent stages (Fig. 13).

The graphic presentation in Fig. 14 shows a linear increase in total activity of C57B argininosuccinate cleavage enzyme. A marked increase was apparent at birth,

and by the 6 gram stage, the total activity approached the level of the mature mouse.

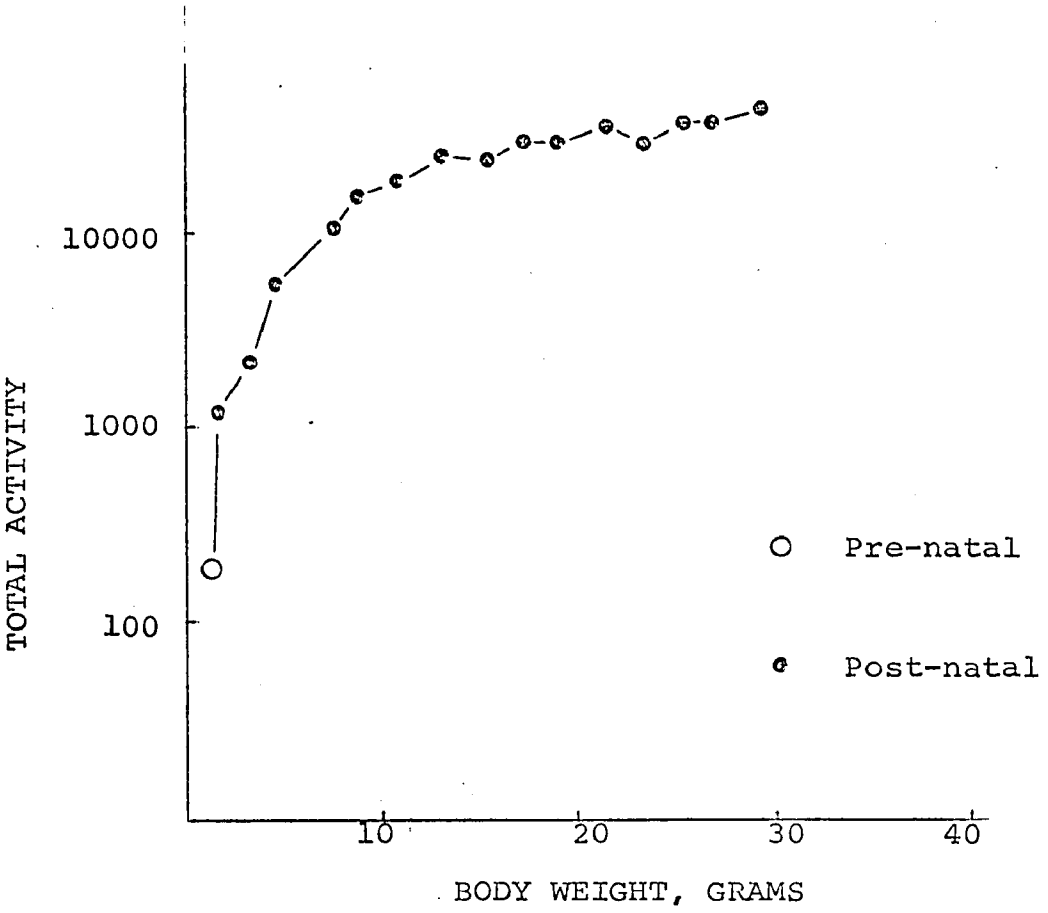


Fig. 14 C57B mouse liver argininosuccinate cleavage enzyme total activity (specific activity x total liver wet weight).

ARGINASE

Albino mouse

Arginase activity in the liver was present in all ages of the mouse studied. As shown in Fig. 16 and Table 7 (in appendix) the activity rose steadily during 1-6 gram stage. However, after the 6-8 gram stage, the level of arginase activity fell to about half of the peak value.

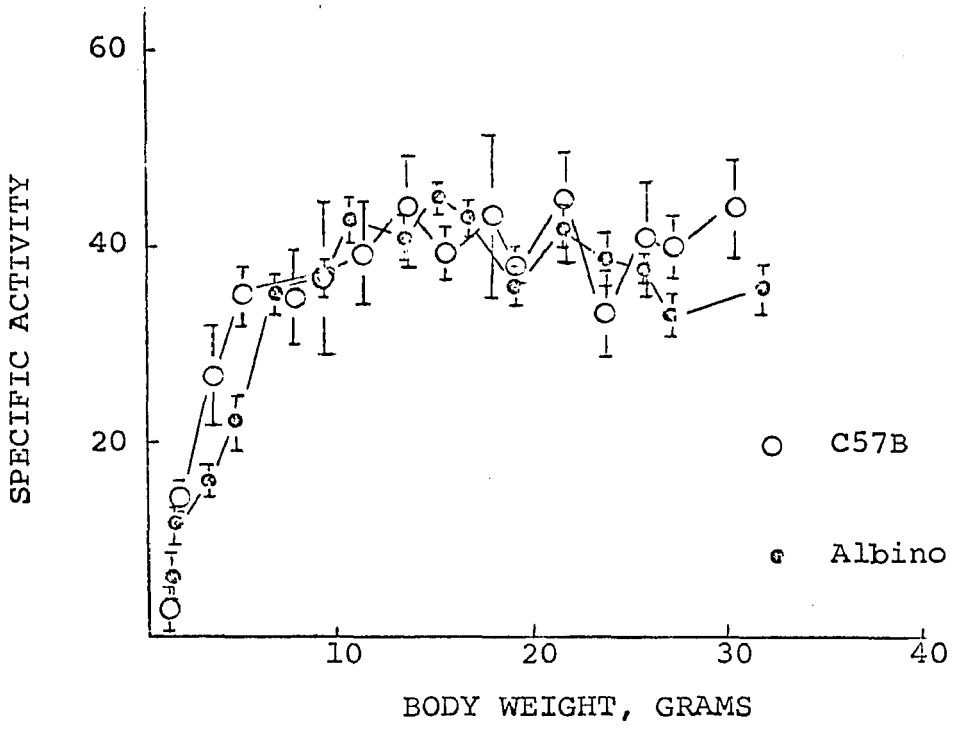


Fig. 15 Mouse liver argininosuccinate cleavage enzyme specific activity x 10^{-7} micromoles of urea produced per minute per gram liver wet weight, $\pm$ S.D. of the mean.

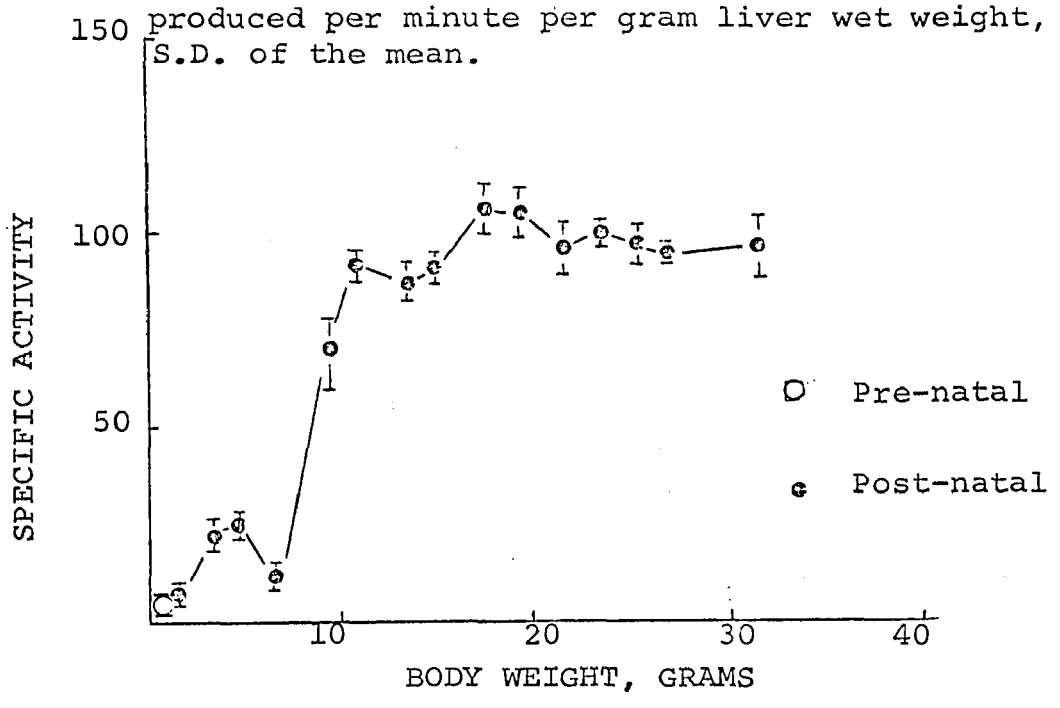


Fig. 16 Albino mouse liver arginase specific activity in micromoles x 10^{-3} of urea produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

Having declined at the 6-8 gram stage-- almost to the value of the 2-4 gram stage-- the arginase activity increased to about seventy per cent of the adult value and this level was maintained up to the 15 gram stage. Between the 15 and 20 gram stage the activity of this enzyme increased to the adult level. As body weight increased beyond 20 grams, the mean specific activity of arginase remained almost constant.

The total activity is the product of the size of the liver and the specific activity, therefore the arginase total activity showed a rapid increase during the neonatal period when liver size was increasing. However, the marked decrease of the specific activity at the 6-8 gram stage was so great that the increase in liver size could not maintain the total activity at the level of the 4-6 gram stage, therefore there was a temporary decrease of the total activity at this period (6-8 gram stage). Following the 6-8 gram stage a fairly regular logarithmic increase of the total activity was noted during the later stages of development (Fig. 17).

C57B mouse

Fig. 18 shows that liver arginase activity could be detected in all ages of the C57B mouse studied. The pattern of changing levels of enzymatic activity during

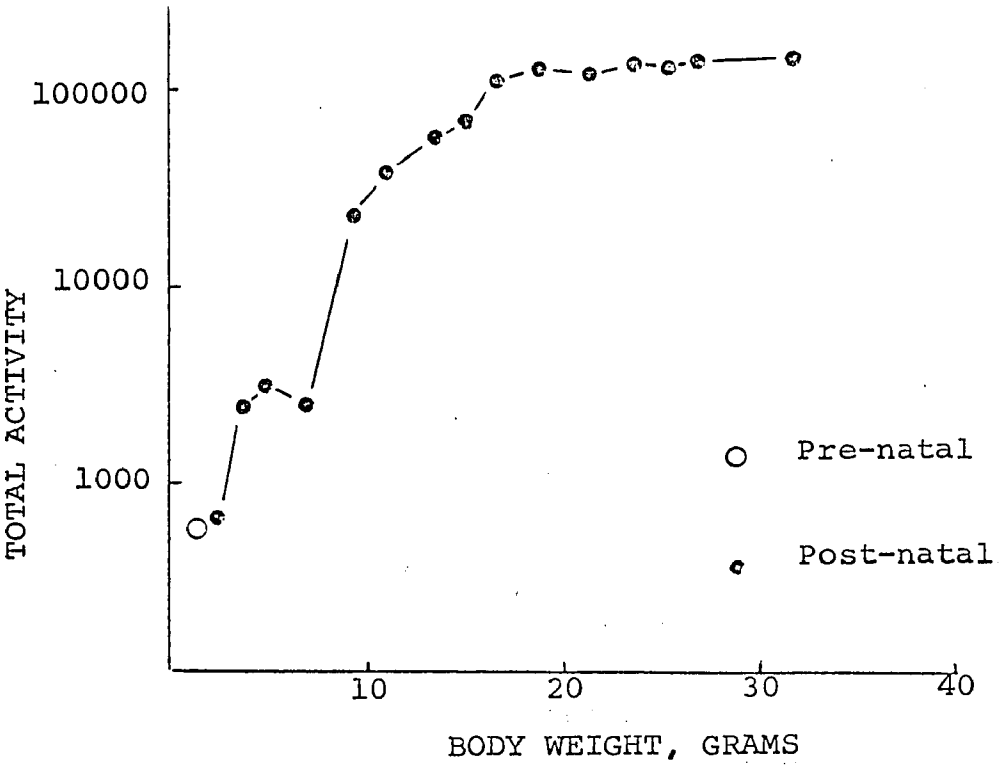


Fig. 17 Albino mouse liver arginase total activity (specific activity x total liver wet weight).

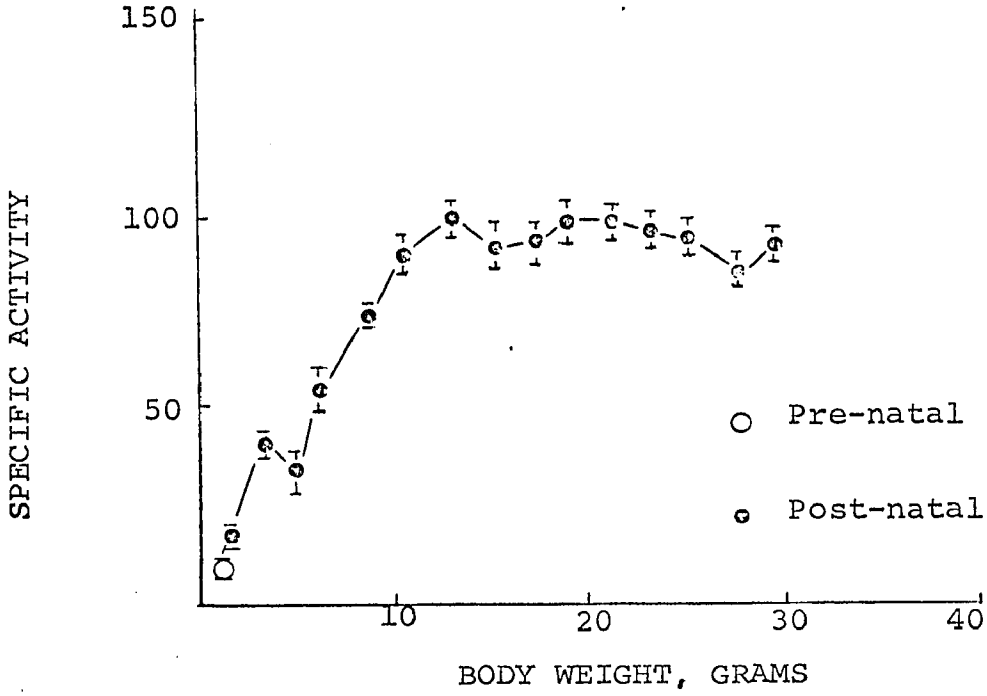


Fig. 18 C57B mouse liver arginase specific activity in micromoles x 10^{-3} of urea produced per minute per milligram of liver wet weight, $\pm$ S.D. of the mean.

the course of development was similar to that noted in the albino mice: i.e. the activity was very low at the embryonic stage and increased rapidly during the neonatal period up to the 2-4 gram stage of development. Further continuous increases of specific activity were noted until the four gram stage, when there was a temporary reduction of arginase activity, followed by another rise in the specific activity. By the 8-10 gram stage, the enzyme activity approached the adult level. It dropped at the 14-16 gram stage for a brief period of time but in later stages of development did not differ more than 10% from the mean value of the adult specific activity in either direction.

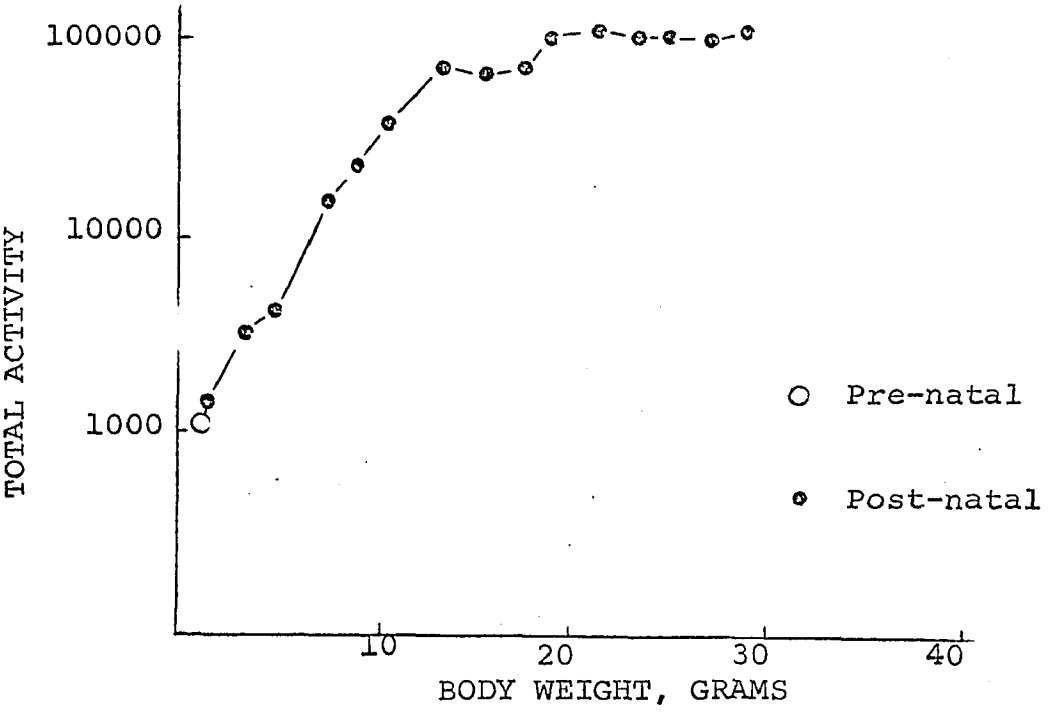


Fig. 19 C57B mouse liver arginase total activity (specific activity x total liver wet weight).

Examination of Fig. 19 shows that the total activity of arginase increased rapidly during the embryonic and neonatal period. This was due to the increase of specific activity and an increase in the mass of liver tissue. As the specific activity approached the adult value at 8-10 gram stage, the continuing increase total activity was affected only by the increase of liver tissue.

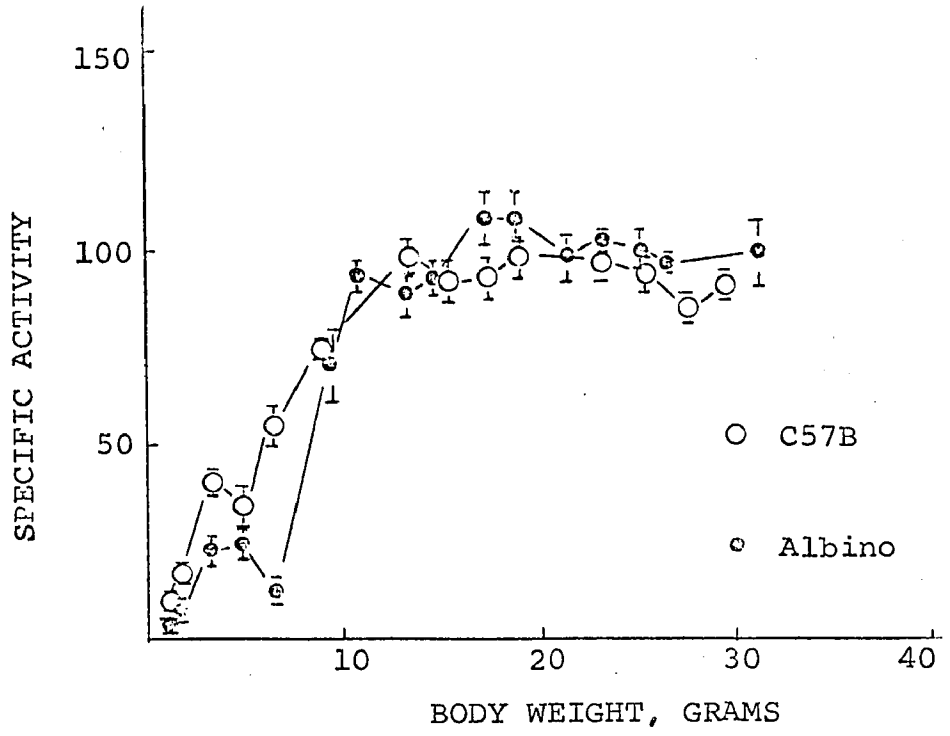


Fig. 20 Mouse liver arginase specific activity x 10^{-3} micromoles of urea produced per minute per milligram liver wet weight, $\pm$ S.D. of the mean.

SECTION V

DISCUSSION

Before discussing the experimental results of this study, it should be noted that the activity of an enzyme *in vivo* may differ markedly from that obtained *in vitro*. The enzyme in the cell is not the freely suspended protein as that in the test tube. Substrate concentration and activation at the site of enzyme reaction *in vivo* may be too small to saturate the enzyme so that the maximum rate may not be obtained. However, under the experimental conditions, successive time intervals and substrate concentration are provided for maintaining enzyme saturation during the experiment. Consequently, the observed rates might not much differ from those corresponding activities *in vivo*.

In the present investigation, analysis of the pattern of urea cycle enzymes of mouse liver homogenates during the course of development was determined by observations of the activity levels of the enzymes. The enzymes were analysed at 2 gram intervals from very early embryonic to adult stages. This investigation has demonstrated that the activities of the enzymes studied showed great differences between the embryonic stages and the adult mouse. Embryonic

mouse liver is characterized by a low level of specific activity in the urea cycle enzymes studied while the adult mouse possesses a high level of specific activity.

In the studies of ornithine transcarbamylase and arginase, specific activities in both the albino and C57B strains were low in the youngest embryos studied. There were precipitous increases in specific activities of liver ornithine transcarbamylase and arginase of both strains of mice following birth. With respect to the increasing rate of these two enzyme activities, the results reported here seem to agree with those of other workers. Kennan and Cohen (1959) and Jones et al. (1961) have reported that these two enzymes (ornithine transcarbamylase and arginase) in livers of several animals e.g. pig and rat, increase progressively in specific activity with maturation. In rat homogenates, ornithine transcarbamylase specific activity, was about one third of the adult value at birth, followed by an increase to the adult level within 1 or 2 weeks (Jones et al., 1961). Similarly arginase, the terminal enzyme of the urea cycle, also was found at a low level of specific activity in the embryonic stage and increased markedly after birth (Lightbody, 1938, and Kennan and Cohen, 1959).

Several investigators (Brown and Cohen, 1958, and Moog, 1952) noted that in addition to participating in the primary biochemical mechanism for the synthesis of urea, certain enzymes in the urea cycle e.g. arginase and ornithine transcarbamylase may be involved in protein synthesis. Therefore, one might expect to find these enzymes in all tissues of the embryo (Goldie, 1957). This possible explanation appears to satisfactorily explain the presence of arginase and ornithine transcarbamylase in the very early embryonic liver of the albino and the C57B mouse.

In contrast to the behaviors of ornithine transcarbamylase and arginase, the arginine synthetase system and argininosuccinate cleavage enzyme in both strains of mice displayed a very different pattern. These latter two enzymes were absent or barely detected in the early embryos studied. Detectable activities of these enzymes were found just prior to birth. Then they increased abruptly and reached the maximum adult value in a short time after birth.

Factors which promote the appearance of urea cycle enzymes in fetal liver are conjectural. It seems probable that the nitrogen excretion from the fetus via the placenta is sufficient so that there would be no need for the presence of arginine synthetase system and argininosuccinate cleavage enzyme in the early embryo. Yet when the placental

connection is severed at birth, and the demand to excrete nitrogenous waste products appears, the fetal liver has already prepared to meet it. From the experimental results described it would appear that the fetal mouse cannot synthesize urea until the period of 2-3 days before birth, which probably corresponds to the onset of the functioning stage of the metanephric kidney of the mouse (Burns, 1955).

The results of the presence of high level of urea cycle enzymes (ornithine transcarbamylase, arginine synthetase system, argininosuccinate cleavage enzyme, and arginase) in the mature mouse may probably correspond to the amount of protein metabolism. The new born mouse is not yet endowed with all the metabolic equipment which characterizes its later development. In the young mouse, through the growing period, the major portion of protein consumed is probably for protein synthesis.

As it was indicated earlier in the section of literature cited, urea cycle enzymes are adaptive in nature and can be influenced by several factors e.g. dietary protein, and hormonal control (Schimke, 1961, 1962, 1963, 1964). Thus the present findings of a rise and fall of ornithine transcarbamylase and arginase at certain stages may be explained on the basis of a change of diet. In the mouse embryo, the first increase in all four urea cycle

enzymes studied appears at a late fetal stage, which rise in enzyme activity level must be in preparation for the milk-diet of the mouse during the nursing period.

In arginase, following the initial rise, there was a temporary decrease (at the 6-8 gram stage) in enzyme activity level in both strains of mouse studied. This reduction may mean that, while arginase synthesis may be continuing, the rate is slower than that of general protein synthesis which takes place during the growing process. On the other hand, it could also indicate that a small proportion of the ingested protein is used in metabolic processes in which urea is a catabolite and a larger proportion used to form body tissues.

The striking increase of urea cycle enzyme activities which occurs during the weaning period (about 10-12 gram stage) may be affected by the development of the function of the liver. Although the hepatic cell is capable of function at an early age, it does not assume its full degree of function until relatively late in development (Glinos, 1958). It can be suggested that this second increase anticipated the varied solid diet of the mouse on the weaning period. A similar case of enzyme development in 'anticipation of function' is seen in the case of alkaline phosphatase (Moog, 1944a, 1950, 1951, and 1953)

which it develops to its full activity during the post-natal period.

The specific activity of the arginine synthetase system (condensing and cleavage enzymes) is quite low when compared with the other enzymes in this cycle. This is to be expected because the condensing enzyme is known to be the rate-limiting reaction of the urea cycle (Brown and Cohen, 1958) and which can be influenced either by the new product or the pH. Since argininosuccinate was formed and then split immediately into arginine and fumarate, it can be assumed that arginine might be the inhibitor preventing the activity of the condensing enzyme and thus affecting the overall reaction. Evidence of arginine repression can be seen from the work of Schimke (1964).

In this investigation, a different developmental pattern for the urea cycle enzymes was found in the liver homogenates of the two strains of mice. The results indicate that both the level of the enzyme activity and the time of detection were different. In the case of the albino mouse, the urea cycle enzymes were found to shift from the low level at embryonic stages to the adult value later than that in the C57B strain. The data also revealed that the level of all enzymes of the albino strain were higher than that of the C57B strain. These differences

between the two strains of mice can be explained on the basis of genetic function. It is probable that genes affect development in certain phases of development by being involved in enzyme synthesis. That this may be so is suggested by the quantitative nature of gene action in certain cases, e.g. in Drosophila, there are different alleles for normal wings, for notched wings, and for absent wings (Stern, 1954). Such an example of the graded action of genes during development suggests that enzymes and their substrates may be controlled by the genes in quality and in quantity. Factors other than genetic, operating during embryogenesis which might determine the time and sequence of appearance of the different enzymes making up the urea cycle, are as yet unknown.

A general concept of the mechanism of change of enzyme activity level in different ages of mice may develop from observations such as those described here. It seems apparent that the phenomenon is complex and probably does not depend upon any single factor. The data suggest that the mechanism involves three main factors: (a) the function of an organ; (b) the maturation of tissue; and (c) the diet consumed by the animal. There is a substantial body of data which shows that enzyme development and functional differentiation during development go hand in hand (Boell, 1955).

Although any explanation for the observed increases of enzymatic activities is a matter of speculation, the study of the urea cycle enzymes in mice cited above illustrates a specific relation between development and enzyme activity. The changes in the level of urea cycle enzymes in the mouse liver enable the animals to successfully excrete their nitrogenous waste products from embryonic stages throughout later stages of development. Further investigations made on this and/or similar systems would undoubtedly contribute to further understanding of the chemical basis of development.

SECTION VI

SUMMARY

1. The patterns of liver urea cycle enzymes (ornithine transcarbamylase, arginine synthetase system, argininosuccinate cleavage enzyme and arginase) in C57B and albino mice were studied in detail. The analysis of these enzymes has furnished evidence that development of function and development of enzymes are correlated.

2. Ornithine transcarbamylase and arginase activities were detectable in the liver of the early embryonic stages. The specific activities increased rapidly after birth.

3. Arginine synthetase system and argininosuccinate cleavage enzymes exhibit similar patterns of enzymatic activity. Unlike ornithine transcarbamylase and arginase these two enzymes were detectable at late embryonic stages. The specific activity increased dramatically after birth and shortly reached the adult level.

4. The increasing level of all urea cycle enzymes following birth suggested that these enzymes fulfill qualitatively different roles during the post natal period. The relationship of enzyme activity with changing diet was discussed.

5. Different genotypes display different patterns of enzyme activity. As demonstrated in C57B and albino strains of mice, there were differences in enzyme activity level and the time of appearance of the enzyme in these two strains of mouse.

APPENDIX

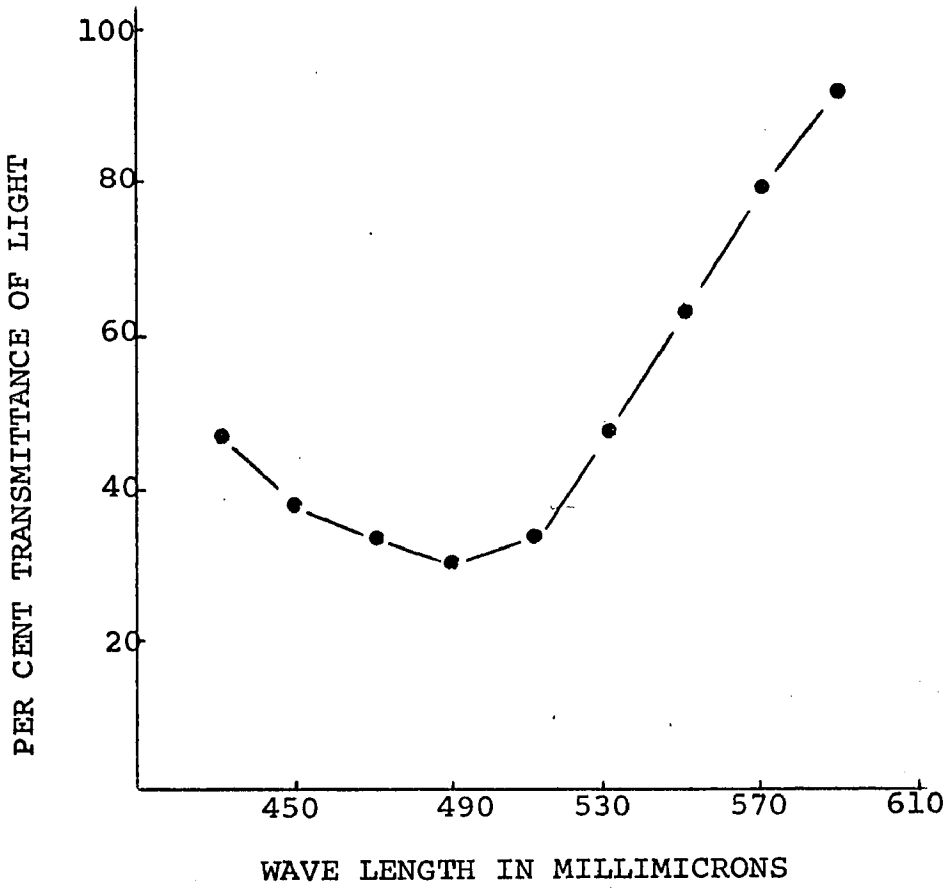


Fig.21 Transmittance spectrum of citrulline obtained by coupling with 2, 3-butanedione-2-oxime. All readings were made with a Bausch and Lomb Spectronic 20 colorimeter.

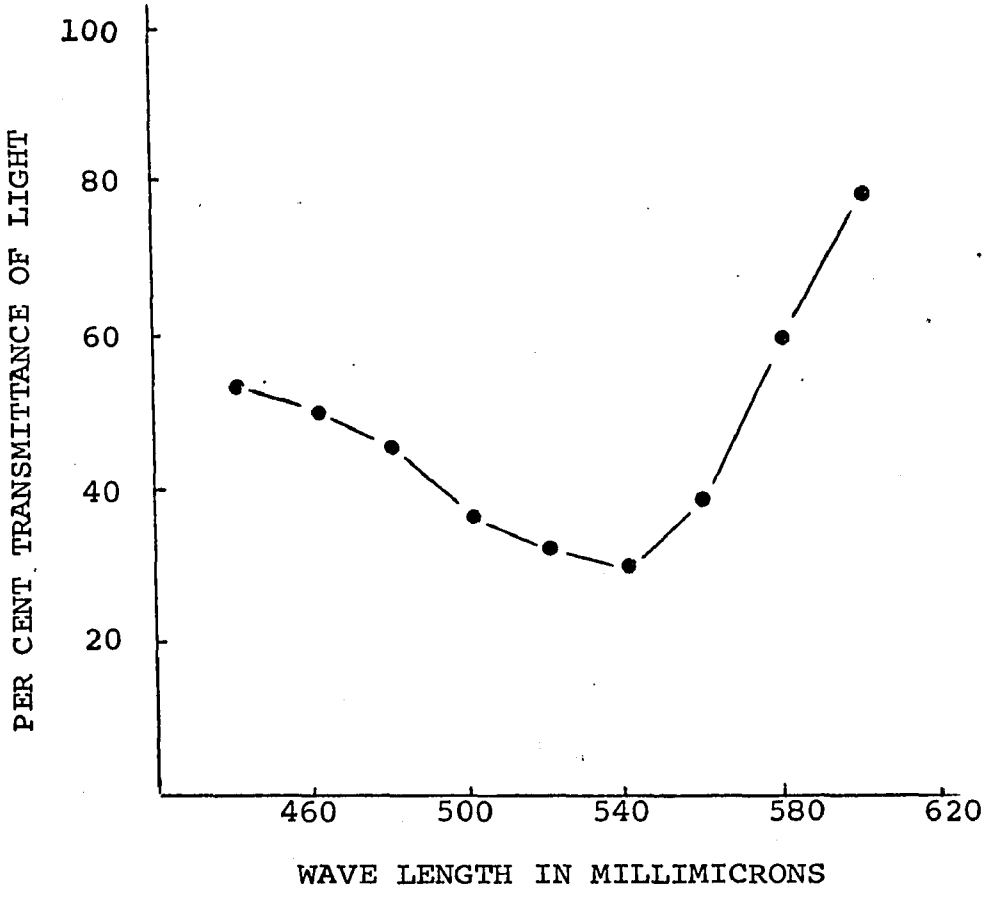


Fig.22 Transmittance spectrum of urea obtained by coupling urea with 1-phenyl-1, 2-propanedione-2-oxime. All readings were made with a Bausch and Lomb Spectronic 20 colorimeter.

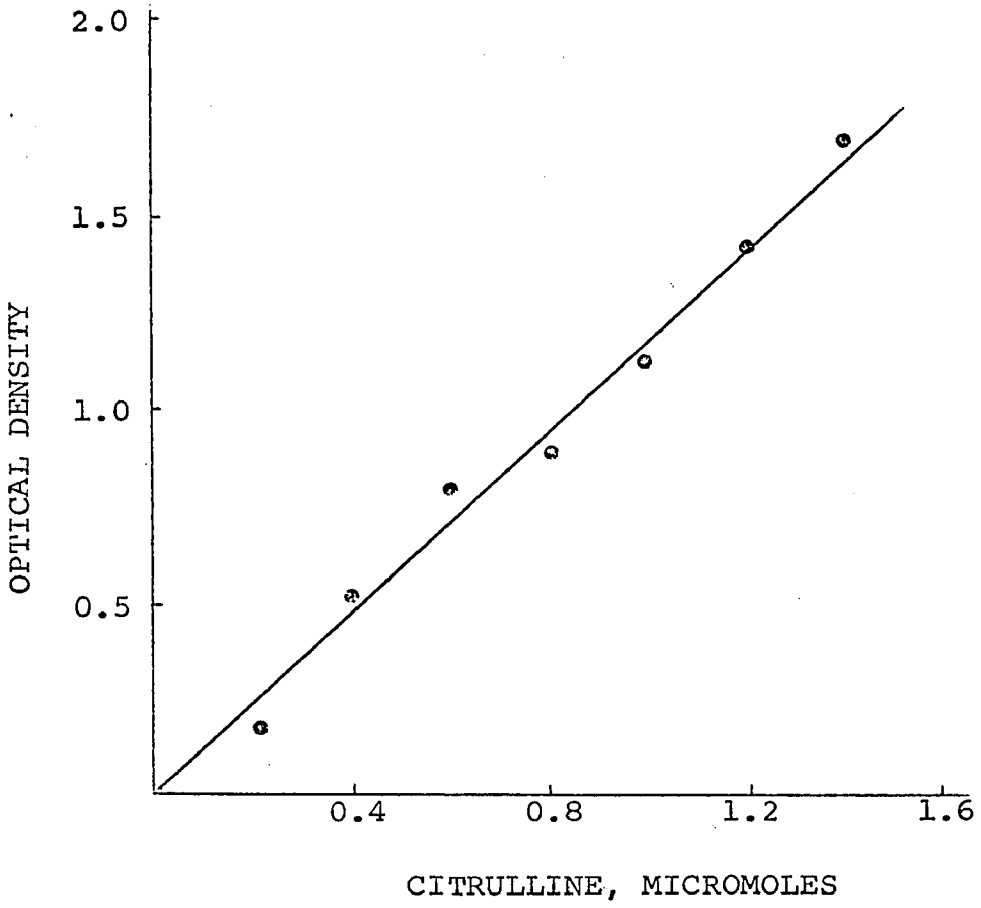


Fig. 23 Calibration curve for citrulline. Fixed increments (0.2-1.4 micromoles) of citrulline were reacted with 2, 3-butanedione-2-oxime. Ordinate, optical density at 490 mu plotted on 10 x 10 to the cm scale; abscissa, micromoles of citrulline. Each point on the curve is the arithmetic mean of 4 experiments.

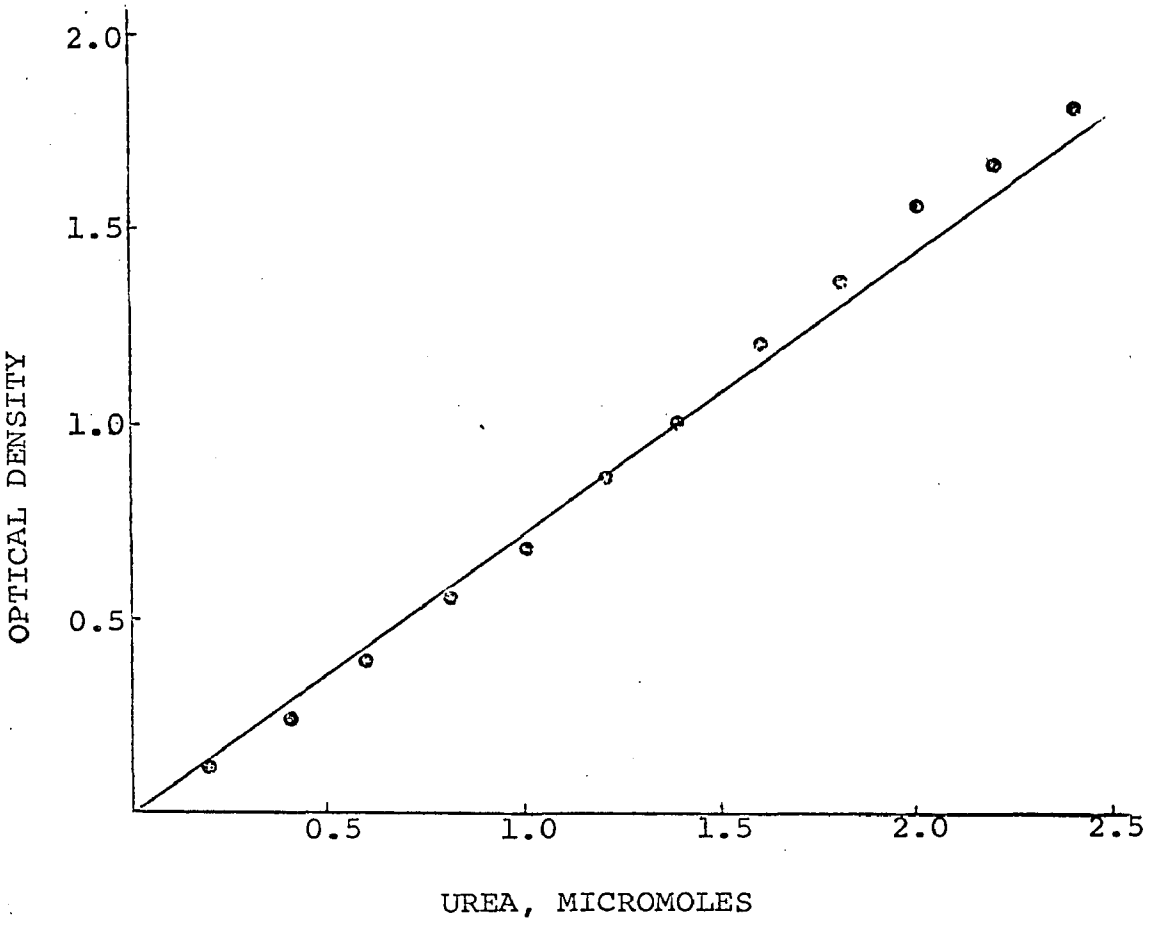


Fig. 24 Calibration curve for urea. Fixed increments (0.2-2.6 micromoles) of urea were reacted with 1-phenyl-1 2-propanedione-2-oxime. Ordinate, optical density at 540 mu plotted on a 10 x 10 to the cm scale; abscissa, micromoles of urea. Each point on the curve is the arithmetic mean of 4 experiments.

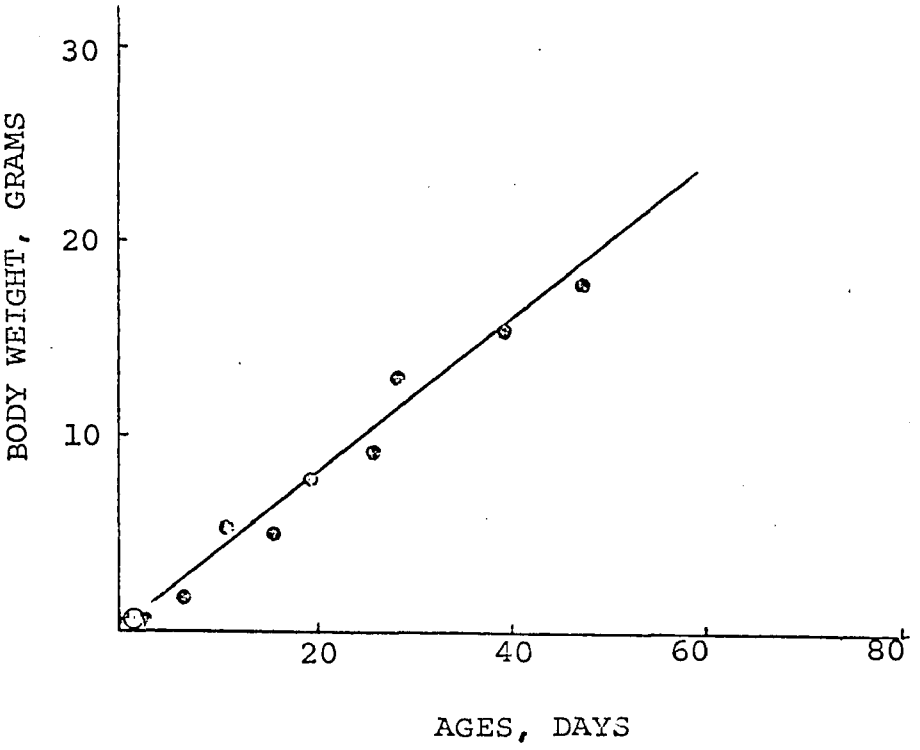


Fig.25 Body weight vs Age of mice. Ordinate, body weight in gram; abscissa, age in days. Each point on the curve is the arithmetic mean of 10 animals.

TABLE 1

ORNITHINE TRANSCARBAMYLASE ACTIVITY (ALBINO MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.33	67.2	8.4	0.564	17.10
	.34	51.5	10.	0.515	15.14
	.79	84.4	14.	1.181	14.95
	.86	83.3	18.6	1.549	18.01
Embryo	1.06	100.8	18.6	1.874	17.68
	1.25	104.1	20.	2.082	16.65
	1.33	98.3	22.2	2.182	16.40
	1.37	93.6	20.	1.872	13.66
	1.42	107.3	18.6	1.995	14.05
	1.48	97.8	20.	1.956	13.21
Mean =	1.02	88.83	17.04 $\pm$ 4.43	1.577	15.69
	1.35	108.5	18.6	2.018	13.27
	1.37	70.7	24.4	1.725	12.59
	1.4	101.3	27.2	2.755	19.68
	1.43	96.3	22.2	2.137	14.95
New-born	1.45	94.9	21.2	2.011	13.87
	1.45	95.5	18.6	1.776	12.25
	1.47	106.3	29.2	3.103	21.11
	1.52	108.5	18.6	2.018	13.27
	1.52	100.8	20.	2.016	13.26
	1.58	111.3	37.2	4.140	26.20
Mean =	1.45	97.91	24.46 $\pm$ 5.52	2.411	16.52

a = Body weight of live mouse in grams

b = Fresh wet weight of liver in milligrams

c = Specific activity expressed as micromoles of product produced per minute per milligram of liver wet weight

d = Total activity = Specific activity x total liver wet weight

e = Activity per gram = total activity per gram body weight

TABLE 1 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	2.04	90.0	21.2	1.908	9.35
	2.34	101.6	32.	3.251	13.89
	2.39	104.5	48.	5.016	20.98
	3.03	129.1	48.	6.198	20.45
2-4 gm	3.2	111.4	35.	3.899	12.18
	3.49	114.8	58.6	8.485	24.31
	3.56	128.3	45.2	5.799	16.28
	3.79	179.5	45.2	8.113	21.40
	3.89	117.	40.6	4.750	12.21
	2.9	137.	53.2	7.288	18.68
Mean =	3.16	124.32	42.7 $\pm$ 10.76	5.470	16.97
	4.24	157.7	54.0	8.515	20.08
	4.47	150.8	61.2	9.228	20.64
	4.56	163.7	34.6	5.664	12.42
	4.62	168.7	42.6	7.186	15.55
4-6 gm	5.08	159.1	12.0	1.909	3.75
	5.15	187.4	42.6	7.983	15.50
	5.32	180.5	14.6	2.635	4.95
	5.35	172.5	17.3	2.984	5.57
	5.37	169.5	13.2	2.237	4.16
	5.59	209.0	21.2	4.409	7.88
Mean =	4.97	171.89	31.27 $\pm$ 17.19	5.275	11.05
	6.02	219.1	54.0	11.83	19.65
	6.08	232.0	86.6	20.09	33.04
	6.36	254.1	77.2	19.61	30.84
	6.59	248.5	60.0	14.91	21.53
6-8 gm	6.69	222.7	86.0	19.15	28.62
	6.73	245.5	60.0	14.73	21.88
	6.85	251.5	54.0	13.58	19.82
	7.05	271.1	54.0	14.63	20.76
	7.50	249.9	81.4	20.34	27.12
	7.80	272.0	90.0	24.48	31.38
Mean =	6.76	246.64	70.32 $\pm$ 14.42	17.33	25.46

TABLE 1 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	8.29	454.5	181.4	82.4	99.4
	8.30	359.8	146.0	52.5	63.0
	8.39	332.3	196.0	65.1	77.6
	8.86	375.0	146.0	54.7	61.7
8-10 gm	9.02	367.5	181.4	66.6	73.9
	9.07	539.7	242.0	130.6	143.9
	9.23	449.5	242.0	108.7	117.8
	9.40	430.2	184.0	79.1	84.2
	9.83	543.8	146.0	79.3	80.7
	9.89	493.1	181.4	89.4	90.4
Mean =	9.03	434.54	184.62 ± 34.79	80.8	89.3
	10.52	627.8	181.4	113.8	108.2
	10.52	621.5	190.0	118.0	112.2
	10.55	731.1	181.4	132.6	125.7
	10.56	648.0	192.0	124.4	117.8
10-12 gm	10.62	678.8	181.4	123.1	115.9
	10.92	615.3	181.4	111.6	102.2
	10.95	606.5	181.4	110.0	100.4
	11.07	807.5	172.6	139.3	125.9
	11.65	711.4	181.4	129.0	110.7
	11.70	789.2	190.0	149.9	128.1
Mean =	10.91	649.28	183.3 ± 5.49	125.2	114.7
	12.05	810.5	161.0	130.4	108.2
	12.10	870.5	172.0	149.7	123.7
	12.85	932.3	172.6	160.9	125.2
	13.20	905.8	162.0	146.7	111.1
12-14 gm	13.30	937.8	162.0	151.9	114.2
	13.44	935.2	162.0	151.5	112.7
	13.54	915.2	180.6	165.2	122.0
	13.56	930.0	180.0	167.4	123.4
	13.77	925.2	161.0	148.9	108.1
	13.82	858.7	172.6	148.2	107.2
Mean =	13.16	902.12	168.58 ± 7.51	152.1	115.6

TABLE 1 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	14.02	860.9	141.2	121.5	86.7
	14.10	893.5	130.5	116.6	82.6
	14.35	863.6	142.0	122.6	85.4
	14.55	887.2	140.0	124.2	85.3
14-16 gm	14.89	926.7	151.0	139.9	93.9
	15.25	958.4	144.0	138.0	90.4
	15.37	1001.3	122.0	122.1	79.4
	15.39	977.5	156.0	152.4	99.0
	15.60	1015.2	139.0	141.1	90.4
	15.76	1033.7	129.0	133.3	84.6
Mean =	14.93	941.80	139.47 ± 9.69	131.2	87.8
	16.28	952.2	152.0	144.7	88.9
	16.45	912.5	148.0	135.0	82.0
	16.50	1005.5	148.0	148.8	90.1
	16.95	899.6	146.6	131.8	77.8
16-18 gm	17.46	977.8	146.6	143.3	82.0
	17.53	1010.8	150.0	151.6	86.4
	17.54	905.4	150.0	135.8	80.1
	17.72	944.8	150.0	141.7	79.9
	17.85	1029.1	148.6	152.9	85.6
	17.93	891.6	148.6	132.4	73.8
Mean =	17.22	952.93	148.84 ± 5.05	141.8	87.7
	18.05	1105.5	135.0	149.2	82.6
	18.25	1300.1	149.0	193.7	10.6
	18.40	1095.2	142.0	155.5	84.5
	18.85	1200.8	142.0	170.5	90.4
18-20 gm	18.96	1182.5	140.0	165.5	87.3
	19.10	1208.2	155.0	187.2	98.0
	19.25	1005.8	146.0	146.8	76.2
	19.40	1220.9	146.0	178.2	91.8
	19.55	1007.2	146.0	147.0	75.2
	19.63	1225.7	146.0	178.9	91.1
Mean =	18.94	1155.19	144.7 ± 5.12	167.2	88.3

TABLE 1 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	20.05	1100.5	182.0	200.2	99.8
	20.34	1285.0	179.3	230.4	113.2
	20.50	1250.5	182.0	227.5	111.0
	20.60	1103.1	182.0	200.7	97.4
20-22 gm	20.75	1285.0	181.0	232.5	112.0
	21.30	1298.9	180.0	233.8	109.7
	21.40	1295.1	181.0	234.4	109.5
	21.70	1107.4	181.0	200.4	92.3
	21.85	1300.8	181.0	235.4	107.7
	21.92	1366.4	181.4	247.8	113.0
Mean =	21.04	1239.27	181.07 $\pm$ 2.98	224.3	106.6
	22.06	1201.8	185.0	222.3	100.7
	22.14	1424.3	174.2	248.1	112.0
	22.26	1420.6	186.0	264.2	118.7
	22.27	1213.6	189.4	229.8	103.2
22-24 gm	22.64	1401.3	184.0	257.8	113.8
	23.60	1405.2	180.0	252.9	107.1
	23.85	1358.5	188.0	255.3	107.0
	23.85	1305.4	188.0	245.4	102.8
	23.88	1295.8	181.2	234.7	98.3
	23.95	1375.5	181.0	248.9	103.9
Mean =	23.05	1340.2	183.68 $\pm$ 4.4	245.9	106.8
	24.15	1405.2	181.0	254.3	105.3
	24.17	1426.9	181.4	258.8	107.0
	24.18	1412.1	181.0	255.5	105.7
	24.49	1399.0	181.4	253.7	103.6
24-26 gm	25.16	1442.5	190.4	274.6	109.1
	25.16	1342.9	194.6	259.3	103.0
	25.70	1450.5	184.0	266.8	103.8
	25.76	1438.6	181.4	260.9	101.3
	25.93	1407.8	180.6	254.2	98.0
	25.96	1459.0	180.0	262.6	101.1
Mean =	25.06	1416.45	183.58 $\pm$ 14.74	260.1	103.9

TABLE 1 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	26.06	1335.7	183.2	244.7	93.8
	26.33	1505.2	172.0	258.8	98.3
	26.35	1534.2	184.0	282.2	107.1
	26.62	1450.6	170.0	246.6	92.6
26-28 gm	26.81	1545.1	170.0	262.6	97.9
	26.94	1482.7	181.0	268.3	99.6
	26.97	1519.0	179.5	272.6	101.0
	27.16	1601.5	174.0	278.6	102.5
	27.5	1572.8	166.0	261.0	94.9
	27.58	1613.4	189.4	305.5	100.7
Mean =	26.83	1516.02	176.91 $\pm$ 7.18	268.1	99.9
	28.6	1861.7	181.	336.9	117.8
	28.68	1654.	170.66	336.9	98.3
	29.75	1597.3	186.6	298.0	100.1
	29.80	1934.5	181.	350.1	117.4
28-30 gm	29.83	1633.	173.2	282.8	94.8
	30.96	1807.9	186.	336.2	108.6
	32.10	1774.5	176.	312.3	97.2
	33.24	1795.6	186.	333.9	100.4
	34.8	1936.4	181.	350.4	100.7
	39.5	1902.4	104.	350.0	88.6
Mean =	31.72	1789.76	180.54 $\pm$ 5.3	323.3	102.4

TABLE 2

ORNITHINE TRANSCARBAMYLASE ACTIVITY (C57B MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.58	70.6	10.4	.73	12.6
	.92	85.2	10.	.85	9.2
	1.15	111.5	12.2	1.36	11.8
	1.28	98.4	12.	1.18	9.2
Embryo	1.3	95.7	14.	1.33	10.3
	1.4	102.3	13.6	1.39	9.9
	1.42	100.8	12.	1.20	8.5
	1.48	108.9	12.	1.30	8.8
	1.5	101.1	10.	1.01	6.7
	1.5	98.4	10.	.98	6.5
Mean =	1.25	97.29	11.62 $\pm$ 1.39	1.13	9.3
	1.42	94.	20.	1.88	13.2
	1.45	101.2	18.6	1.88	12.9
	1.49	98.7	12.2	1.20	8.0
	1.5	108.5	13.6	1.47	9.8
New-born	1.53	100.4	20.	2.00	12.1
	1.61	134.9	22.2	2.99	18.6
	1.65	102.5	27.	2.76	16.7
	1.66	99.8	20.	1.99	12.0
	1.71	105.4	20.	2.10	12.3
	1.75	116.3	24.4	2.83	16.2
Mean =	1.57	106.17	19.8 $\pm$ 4.21	2.11	13.3
	2.03	106.3	45.2	4.80	23.6
	2.35	120.4	42.6	5.12	21.8
	2.42	104.	34.6	3.59	14.8
	2.61	94.9	42.6	4.04	15.4
2-4 gm	2.65	102.5	54.	5.53	20.8
	3.15	129.8	42.6	5.52	17.5
	3.62	139.5	40.	5.58	15.4
	3.85	155.1	42.6	6.60	17.1
	3.88	126.2	48.	6.05	15.6
	3.96	130.4	40.	5.21	13.1
Mean =	3.05	120.91	43.22 $\pm$ 4.89	5.21	17.5

TABLE 2 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	4.05	185.5	80.	14.8	36.6
	4.15	175.8	74.	13.0	31.3
	4.36	190.8	78.6	14.9	34.3
	4.78	200.2	80.	22.8	47.7
4-6 gm	4.85	190.2	80.	15.2	31.3
	5.26	212.9	54.	11.4	21.8
	5.50	233.5	74.	17.2	31.4
	5.54	266.1	78.6	17.7	32.0
	5.58	208.7	78.6	16.4	29.3
	5.80	211.5	80.	17.7	30.5
Mean =	4.98	204.52	75.78 $\pm$ 7.58	16.1	32.6
	6.50	280.2	122.	34.1	52.5
	6.52	258.5	154.6	39.9	61.2
	6.75	290.5	96.4	28.0	41.4
	7.00	293.	122.	35.7	51.0
6-8 gm	7.15	295.8	100.4	29.6	41.5
	7.24	488.4	114.5	55.9	77.3
	7.48	353.9	112.	39.6	52.9
	7.59	342.3	105.1	35.9	47.3
	7.75	344.4	122.	35.7	51.0
	7.85	410.5	128.	52.5	66.9
Mean =	7.18	335.79	117.7 $\pm$ 15.74	39.4	54.6
	8.15	352.5	181.4	63.9	78.4
	8.30	424.	181.4	76.9	92.6
	8.50	375.1	181.4	68.0	80.0
	8.86	543.4	182.	98.8	111.6
8-10 gm	8.95	553.	182.	100.6	112.4
	9.09	509.6	170.6	86.9	95.6
	9.12	429.7	181.4	77.9	85.4
	9.32	558.1	170.6	95.2	102.1
	9.40	493.3	181.4	89.4	95.1
	9.52	589.4	174.2	102.6	107.8
Mean =	8.92	482.63	178.64 $\pm$ 4.7	86.0	96.1

TABLE 2 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.	552.6	181.4	100.2	100.2
	10.	553.1	182.	100.6	100.6
	10.05	598.4	170.6	102.0	101.5
	10.08	596.1	182.	108.4	107.6
10-12 gm	10.77	637.9	182.	116.0	107.7
	10.95	675.	180.6	121.9	111.3
	11.14	754.	170.6	128.6	115.4
	11.20	670.2	182.	121.9	108.9
	11.60	695.8	188.4	131.0	113.0
	11.85	682.1	152.	103.6	87.4
Mean =	10.76	641.52	177.16 $\pm$ 9.84	113.4	105.4
	12.20	785.5	170.6	134.0	109.8
	12.28	850.6	202.8	172.5	140.4
	12.55	885.0	164.6	145.6	116.0
12-14 gm	12.92	899.1	181.4	163.0	126.2
	13.01	901.2	181.4	163.4	125.6
	13.15	809.6	182.	147.3	112.0
	13.68	875.6	170.6	149.3	109.1
	13.70	890.5	170.6	151.9	110.8
	13.95	895.2	181.4	162.3	116.4
Mean =	13.02	869.36	177.6 $\pm$ 10.31	154.3	118.6
	14.55	950.9	148.	140.7	96.7
	14.78	1100.2	180.	198.0	133.9
	14.90	1001.5	187.6	187.8	126.0
	14.95	989.2	170.	168.1	112.4
14-16 gm	15.05	943.2	188.	177.3	117.8
	15.10	1005.8	188.	189.0	125.2
	15.25	995.6	184.	183.1	120.1
	15.36	978.1	148.	144.7	94.2
	15.42	956.4	170.6	163.1	105.8
	15.75	1015.2	184.6	187.4	118.9
Mean =	15.11	993.61	174.88 $\pm$ 14.82	173.9	115.1

TABLE 2 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	16.01	977.8	188.0	183.8	114.8
	16.25	1015.8	188.	190.9	117.5
	16.50	1008.7	166.	167.4	101.4
	16.70	1059.8	181.4	192.2	115.1
16-18 gm	16.95	1020.8	148.	151.0	89.1
	17.20	1100.5	140.	154.7	89.5
	17.35	1025.2	181.4	185.9	107.1
	17.45	1185.9	181.4	215.1	123.2
	17.83	1215.6	181.4	220.5	123.6
	17.90	1203.9	186.6	224.6	125.5
Mean =	17.01	1081.4	174.22 $\pm$ 15.98	188.5	110.7
	18.25	1092.8	180.	196.7	107.7
	18.25	1100.5	182.	200.2	109.7
	18.40	1105.8	181.4	100.5	109.0
	18.50	1125.1	181.4	204.0	110.3
18-20 gm	18.58	1074.8	178.4	191.7	103.1
	19.05	1075.3	174.6	187.7	98.5
	19.35	1155.2	188.6	217.8	112.5
	19.55	1228.5	188.6	231.6	118.5
	19.75	1285.	142.	182.4	92.3
	19.95	1250.1	154.6	193.2	96.8
Mean =	18.96	1149.31	175.16 $\pm$ 15.57	200.6	105.8
	20.38	1100.5	182.4	200.7	98.4
	20.58	1092.5	181.4	198.1	96.2
	20.75	1158.5	181.4	210.1	101.2
	20.83	1259.8	174.6	219.9	105.5
20-22 gm	21.05	1139.8	174.6	199.0	94.5
	21.12	1235.6	174.6	215.7	102.1
	21.23	1048.5	157.4	165.0	77.7
	21.25	1280.3	181.4	232.2	109.2
	21.87	1010.6	181.4	183.3	83.8
	21.95	1275.4	174.6	222.6	101.4
Mean =	21.1	1160.15	176.38 $\pm$ 7.14	204.7	97.0

TABLE 2 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.18	1265.7	188.4	238.4	105.8
	22.50	1158.5	181.4	201.1	93.4
	22.68	1176.4	181.4	213.3	94.0
	22.7	1189.8	181.4	215.8	95.0
22-24 gm	23.08	1209.3	182.6	220.8	95.6
	23.12	1232.7	170.6	210.2	90.9
	23.42	1305.4	182.6	238.3	101.7
	23.56	1258.6	181.4	228.3	96.9
	23.78	1450.2	184.6	267.7	112.5
	23.95	1327.4	181.4	240.7	110.5
Mean =	23.09	1257.4	181.58 $\pm$ 4.23	228.4	98.6
	24.80	1141.	181.4	206.9	83.4
	24.85	1251.	181.4	226.9	91.3
	24.95	1295.	242.	313.3	125.6
	25.1	1235.8	181.4	224.1	89.3
24-26 gm	25.15	1245.5	181.4	225.9	89.8
	25.45	1224.2	242.	296.2	116.4
	25.56	1358.1	170.6	231.6	90.6
	25.7	1356.4	242.	328.2	127.7
	25.87	1324.2	181.4	240.2	92.8
	25.90	1384.5	181.4	251.3	97.0
Mean =	25.33	1281.57	198.5 $\pm$ 28.65	254.5	100.4
	26.05	1350.5	181.4	244.9	94.0
	26.39	1438.6	242.	348.1	131.9
	26.45	1324.2	181.4	240.2	90.8
	26.50	1315.8	181.4	238.6	90.0
26-28 gm	26.72	1399.6	230.	321.9	120.4
	26.82	1400.2	181.4	253.9	94.7
	27.12	1502.9	180.	270.5	99.7
	27.32	1348.9	242.	326.4	119.4
	27.35	1495.0	182.2	272.3	99.5
	27.98	1347.5	181.4	244.4	87.3
Mean =	26.81	1392.32	198.32 $\pm$ 26.16	276.1	102.8

TABLE 2 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	28.01	1501.5	242.0	363.3	129.7
	28.15	1450.5	174.6	253.2	89.9
	28.2	1496.4	181.4	271.4	96.2
	28.95	1505.1	181.4	273.0	94.3
28-30 gm	29.0	1488.2	171.2	254.7	87.8
	29.17	1500.2	212.0	318.0	109.0
	29.5	1429.5	181.4	259.3	87.9
	29.57	1439.8	180.0	259.1	87.6
	30.02	1435.8	186.0	267.0	88.9
	30.15	1499.8	181.4	272.0	90.2
Mean =	29.07	1474.68	189.14 $\pm$ 20.46	279.1	96.1

TABLE 3

ARGININE SYNTHETASE SYSTEM ACTIVITY (ALBINO MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.33	67.2	0	0	0
	.34	51.5	0	0	0
	.79	84.4	0	0	0
	.86	83.3	0	0	0
Embryo	1.06	100.8	1.2	0.120	1.14
	1.25	104.1	2.	0.280	1.66
	1.33	98.3	2.	0.187	1.40
	1.37	93.6	1.2	0.112	0.81
	1.43	107.3	3.6	0.386	2.72
	1.48	97.8	1.2	0.117	0.79
Mean =	1.02	88.83	1.12 $\pm$ .08	0.113	0.85
	1.35	93.5	1.2	0.112	0.83
	1.37	70.7	2.	0.141	1.03
	1.4	101.3	2.	0.202	1.44
	1.43	96.3	1.2	0.115	.80
New-born	1.45	94.9	3.6	0.341	2.35
	1.45	95.5	2.	0.191	1.31
	1.47	106.3	1.2	0.127	.86
	1.52	108.5	1.2	0.130	.85
	1.52	100.8	2.	0.201	1.32
	1.58	111.3	4.3	0.478	3.02
Mean =	1.45	97.91	2.07 $\pm$ 3.21	0.204	1.38
	2.04	90.	20.	1.800	8.82
	2.34	101.6	14.8	1.503	6.42
	2.39	104.5	16.4	1.713	7.17
	3.03	129.1	18.6	2.401	7.92
2-4 gm	3.2	111.4	18.6	2.072	6.47
	3.49	144.8	20.	2.896	8.29
	3.56	128.3	18.6	2.386	6.70
	3.79	179.5	18.6	3.338	8.80
	3.89	117.	24.6	2.878	7.39
	3.9	137.	18.6	2.548	6.53
Mean =	3.16	124.32	18.88 $\pm$ 7.64	2.353	7.45

TABLE 3 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	4.24	157.7	20.	3.154	7.43
	4.47	150.8	22.4	3.377	7.55
	4.56	163.7	20.	3.274	7.17
	4.62	168.7	38.6	6.511	14.09
4-6 gm	5.08	159.1	22.4	3.563	7.01
	5.15	187.4	24.6	4.610	8.95
	5.32	180.5	24.6	4.440	8.34
	5.35	172.5	24.6	4.243	7.93
	5.37	169.5	30.	5.085	9.46
	5.59	209.	24.6	5.141	9.19
Mean =	4.97	171.89	25.18 $\pm$ 5.23	4.340	8.71
	6.02	219.1	24.6	5.389	8.95
	6.08	232.	24.6	5.707	9.38
	6.36	254.1	32.	8.131	12.78
	6.59	248.5	24.6	6.113	9.27
6-8 gm	6.69	222.7	28.4	6.324	9.45
	6.73	245.5	30.	7.365	10.94
	6.85	251.5	30.	71545	11.01
	7.05	271.1	24.6	6.669	9.45
	7.5	249.9	32.	7.996	10.66
	7.8	272.	28.4	7.724	9.90
Mean =	6.76	246.64	27.92 $\pm$ 2.94	6.896	10.18
	8.29	454.5	28.4	12.90	15.57
	8.3	359.8	28.4	10.21	12.31
	8.39	332.3	24.6	8.17	9.74
	8.86	375.	20.	7.50	8.46
8-10 gm	9.02	367.5	28.4	10.43	11.57
	9.07	539.7	28.4	15.32	16.89
	9.23	449.5	34.	15.28	16.55
	9.4	430.2	28.4	12.21	12.99
	9.83	543.8	28.4	15.44	15.71
	9.89	493.1	30.	14.79	14.95
Mean =	9.02	434.54	27.9 $\pm$ 3.41	12.23	13.47

TABLE 3 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.52	627.8	30.	18.83	17.90
	10.52	621.5	30.	18.64	17.72
	10.55	631.1	22.	13.88	13.16
	10.56	648.	26.4	17.10	16.20
10-12 gm	10.62	638.8	18.6	11.88	11.18
	10.92	615.3	34.	20.92	19.15
	10.95	610.1	28.4	17.32	15.82
	11.07	707.5	34.	24.05	21.72
	11.65	663.5	30.	19.90	17.08
	11.7	729.2	26.4	19.25	16.45
Mean =	10.91	649.28	27.98 $\pm$ 4.62	18.18	16.64
	12.05	810.5	26.	21.07	17.48
	12.1	870.5	34.	29.59	24.46
	12.85	932.3	26.	24.23	18.86
	13.2	905.8	26.	23.55	17.84
12-14 gm	13.3	937.8	26.	24.38	18.33
	13.44	935.2	28.4	26.55	19.76
	13.54	915.2	34.	31.11	22.98
	13.56	930.	28.4	26.41	19.47
	13.77	925.2	32.	29.60	21.50
	13.82	858.7	28.4	24.38	17.64
Mean =	13.16	902.12	28.92 $\pm$ 3.09	26.09	19.83
	14.02	860.9	32.	27.54	19.64
	14.1	893.5	22.	19.65	13.94
	14.35	963.6	28.6	24.69	17.21
	14.55	887.2	24.6	21.82	15.00
14-16 gm	14.89	926.7	26.	24.09	16.18
	15.25	958.4	38.6	36.99	24.25
	15.37	1001.3	20.	20.02	13.02
	15.39	977.5	20.	19.55	12.70
	15.6	1015.2	20.	20.30	13.01
	15.76	1033.7	28.4	29.35	18.62
Mean =	14.92	941.8	26.08 $\pm$ 5.77	24.40	16.36

TABLE 3 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	16.28	952.2	28.6	27.23	16.72
	16.45	912.5	28.6	26.09	15.86
	16.5	1005.5	24.	24.13	14.62
	16.95	899.6	34.	30.58	18.04
16-18 gm	17.46	977.8	28.6	27.96	16.01
	17.53	1010.8	28.6	28.90	16.49
	17.54	905.4	24.	21.72	12.38
	17.72	944.8	34.	32.12	18.12
	17.85	1029.1	24.	24.69	13.83
Mean =	17.22	952.93	28.3 $\pm$ 3.47	26.89	15.63
	18.05	1105.5	32.	35.37	19.59
	18.25	1300.1	28.6	37.18	20.37
	18.4	1095.2	28.6	31.32	11.07
	18.85	1200.8	32.	38.42	20.38
18-20 gm	18.96	1182.5	24.	28.38	14.96
	19.1	1208.2	22.	26.58	13.91
	19.25	1005.8	24.	24.13	12.53
	19.4	1220.9	28.	34.91	17.99
	19.55	1007.2	24.	24.17	12.36
	19.63	1225.7	26.	31.86	16.23
Mean =	18.94	1155.19	26.92 $\pm$ 3.3	31.23	16.54
	20.05	1100.5	30.	33.01	16.46
	20.34	1285.	22.	28.27	13.89
	20.5	1250.5	28.6	35.76	17.44
	20.6	1103.1	28.6	31.54	15.31
20-22 gm	20.75	1285.	32.	41.12	19.81
	21.3	1298.9	34.	44.16	20.73
	21.4	1295.1	28.6	37.03	17.30
	21.7	1107.4	32.	35.43	16.33
	21.85	1300.8	28.6	37.20	17.02
	21.92	1366.4	28.6	39.07	17.82
Mean =	21.04	1239.27	29.3 $\pm$ 3.04	36.26	17.21

TABLE 3 (continued)

Body weight (gm) (a)		Liver wet wt. (gmg) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.06	1201.8	38.6	46.38	21.02
	22.14	1424.3	30.	42.72	19.29
	22.26	1420.6	24.6	34.94	15.69
	22.27	1213.6	22.	26.69	11.98
22-24 gm	22.64	1401.3	28.4	29.79	17.57
	23.6	1405.2	22.	30.91	13.09
	23.85	1358.5	24.6	33.41	14.01
	23.85	1305.4	34.	44.38	18.60
	23.88	1295.8	22.	28.50	11.93
	23.95	1375.5	20.	27.51	11.48
Mean =	23.05	1340.2	26.62 $\pm$ 5.73	35.52	15.47
	24.15	1405.2	22.	30.80	12.75
	24.17	1442.5	32.	49.04	19.49
	24.18	1412.1	30.	43.26	17.51
	24.49	1399.	30.	41.97	17.13
24-26 gm	25.16	1442.5	34.	49.04	19.49
	25.16	1342.9	22.	29.54	11.74
	25.7	1450.5	28.6	41.48	16.14
	25.76	1438.6	28.6	41.14	15.97
	25.93	1407.8	28.6	40.26	15.52
	25.96	1459.	28.6	41.72	16.07
Mean =	25.06	1416.45	28.5 $\pm$ 3.69	40.48	16.16
	26.06	1335.7	30.	40.07	15.37
	26.33	1505.2	24.6	37.02	14.06
	26.35	1534.2	30.	46.02	17.46
	26.62	1450.6	22.2	32.20	12.09
26-28 gm	26.81	1454.1	24.6	38.00	14.17
	26.94	1482.7	28.4	42.10	15.63
	26.97	1519.	30.	45.57	16.89
	27.16	1601.5	28.4	45.48	16.74
	27.5	1572.8	22.	34.60	12.58
	27.58	1613.4	24.6	39.68	14.39
Mean =	26.83	1516.02	26.48 $\pm$ 3.05	40.07	14.95

TABLE 3 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	28.6	1861.7	24.6	45.79	16.01
	28.68	1654.	30.	49.62	17.30
	29.75	1597.3	28.4	45.36	15.24
	29.80	1934.5	26.	50.29	16.87
28-30 gm	29.83	1633.3	22.	35.93	12.04
	30.96	1807.9	22.	39.77	12.84
	32.1	1774.5	22.	39.03	12.16
	33.24	1795.6	32.	57.45	17.28
	34.8	1936.4	18.6	36.01	10.34
	39.5	1902.4	22.	41.85	10.59
Mean =	31.72	1789.76	24.76 $\pm$ 4.03	44.11	14.07

TABLE 4

ARGININE SYNTHETASE SYSTEM ACTIVITY (C57B MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.58	70.6	0	0	0
	.92	85.2	0	0	0
	1.15	111.5	0	0	0
	1.28	98.4	0	0	0
Ebmryo	1.3	95.7	2.	0.191	1.47
	1.4	102.3	2.	0.204	1.46
	1.42	100.8	1.2	0.120	0.85
	1.48	108.9	3.6	0.392	2.64
	1.5	101.1	2.	0.202	1.34
	1.5	98.4	2.	0.196	1.31
Mean =	1.25	97.29	1.28 $\pm$ .08	0.112	0.90
	1.42	94.	4.	0.376	2.64
	1.45	101.2	3.6	0.364	2.51
	1.49	98.7	2.	0.197	1.32
	1.5	108.5	8.2	0.889	5.93
New-born	1.53	100.4	6.	0.602	3.93
	1.61	134.9	4.	0.539	3.35
	1.65	102.5	3.6	0.369	2.23
	1.66	99.8	3.6	0.359	2.16
	1.71	105.4	4.	0.421	2.46
	1.75	116.3	6.	0.697	3.98
Mean =	1.57	106.17	4.5 $\pm$ 1.88	0.481	3.05
	2.03	106.3	12.	1.275	6.28
	2.34	120.4	14.6	1.757	7.48
	2.42	104.	13.2	1.372	5.67
	2.61	94.9	12.	1.138	4.36
2-4 gm	2.65	102.5	14.6	1.496	5.64
	3.15	129.8	12.	1.557	4.94
	3.62	139.5	12.	1.674	4.62
	3.85	155.1	14.6	2.264	5.88
	3.88	126.2	12.	1.514	3.90
	3.96	130.4	12.	1.564	3.95
Mean =	3.05	120.91	12.9 $\pm$ 1.17	1.561	5.27

TABLE 4 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	4.05	185.5	20.	3.710	9.16
	4.15	175.8	19.4	3.410	8.12
	4.36	190.8	25.	4.770	10.94
	4.78	200.2	22.6	4.524	9.46
4-6 gm	4.85	190.2	24.6	4.678	9.64
	5.26	212.9	22.6	4.811	9.14
	5.5	233.5	20.	4.670	8.49
	5.54	226.1	22.6	5.109	9.22
	5.58	108.7	19.4	4.048	7.25
	5.8	221.5	19.4	4.297	7.40
Mean =	4.98	204.52	21.56 $\pm$ 6.57	4.403	8.89
	6.5	280.2	25.2	7.061	10.86
	6.52	258.5	18.6	4.808	7.37
	6.75	290.5	24.6	7.146	10.58
	7.	293.	20.	5.860	8.37
6-8 gm	7.15	295.8	22.4	6.625	9.26
	7.24	488.8	35.4	17.303	23.89
	7.48	353.9	28.4	10.050	13.43
	7.59	342.3	23.2	7.941	10.46
	7.75	344.4	24.6	8.472	10.93
	7.85	410.5	20.	8.210	10.45
Mean =	7.18	335.79	24.24 $\pm$ 4.63	8.347	11.56
	8.15	352.5	22.2	7.825	9.60
	8.3	424.	18.6	7.886	9.50
	8.5	375.1	24.	9.002	10.59
	8.86	543.4	20.	10.868	12.26
8-10 gm	8.95	553.	14.6	8.073	9.02
	9.09	509.6	20.	10.192	11.21
	9.12	429.7	15.2	6.531	7.16
	9.32	558.1	12.	6.697	7.18
	9.4	493.3	20.	9.866	10.49
	9.52	589.4	18.6	10.962	11.51
Mean =	8.92	482.63	18.52 $\pm$ 3.45	8.790	9.85

TABLE 4 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.	552.6	15.2	8.39	8.39
	10.	553.1	18.6	10.28	10.28
	10.05	598.4	17.3	10.35	10.30
	10.08	596.1	24.	14.30	14.19
10-12 gm	10.77	637.9	20.	12.75	11.84
	10.95	675.	22.2	14.98	13.68
	11.14	754.	18.6	14.02	12.58
	11.2	670.2	20.	13.40	11.96
	11.6	695.8	17.3	12.03	10.37
	11.85	682.1	24.	16.37	13.81
Mean =	10.76	641.52	19.72 ± 2.78	12.692	11.74
	12.2	785.5	24.	18.85	15.45
	12.28	850.6	22.	18.71	15.23
	12.55	885.	18.6	16.46	13.11
	12.83	898.3	24.	21.55	16.80
12-14 gm	12.92	899.1	22.	19.78	15.30
	13.01	901.2	17.3	15.59	11.98
	13.15	809.6	22.	17.81	13.54
	13.68	878.6	24.	21.08	15.41
	13.7	890.5	18.6	16.56	12.09
	13.95	895.2	18.6	16.65	11.93
Mean =	13.02	869.36	21.11 ± 2.46	18.30	14.08
	14.55	950.9	14.6	13.88	9.54
	14.78	1100.2	20.	22.00	14.88
	14.9	1001.5	24.6	24.63	16.53
	14.95	989.2	20.	19.78	13.23
14-16 gm	15.05	943.2	20.	18.86	12.53
	15.1	1005.8	18.6	18.70	12.38
	15.25	995.6	22.2	22.10	14.49
	15.36	978.1	15.2	14.86	9.67
	15.42	956.4	18.6	17.78	11.53
	15.75	1015.2	18.6	18.88	11.98
Mean =	15.11	993.61	19.24 ± 2.79	19.15	12.68

TABLE 4 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	16.01	977.8	20.	19.55	12.21
	16.25	1015.8	24.	24.37	15.00
	16.5	1008.7	18.6	18.76	11.37
	16.7	1059.8	24.	25.43	15.23
16-18 gm	16.95	1020.8	20.	20.41	12.04
	17.2	1100.5	20.	22.01	12.79
	17.35	1025.2	22.2	22.75	13.11
	17.45	1185.9	25.3	30.00	17.19
	17.83	1215.6	24.	29.17	16.36
	17.9	1203.9	22.2	26.72	14.93
Mean =	17.01	1081.4	22.03 ± 2.15	23.92	14.02
	18.25	1092.8	24.	26.22	14.37
	18.25	1100.5	19.6	21.56	11.81
	18.4	1105.8	18.6	20.56	11.17
	18.5	1125.1	22.2	24.97	13.50
18-20 gm	18.58	1074.8	20.	21.49	11.56
	19.05	1075.3	20.	21.50	11.28
	19.35	1155.2	24.	27.72	14.32
	19.55	1228.5	18.6	22.85	11.68
	19.75	1285.	15.2	19.53	9.88
	19.95	1250.1	18.6	23.25	11.65
Mean =	18.96	1149.31	20.08 ± 2.56	22.97	12.12
	20.38	1100.5	18.6	20.46	10.04
	20.58	1092.5	20.	21.85	10.61
	20.75	1158.5	17.3	20.04	9.65
	20.83	1259.8	18.6	23.43	11.24
20-22 gm	21.05	1139.8	18.6	21.20	10.07
	21.12	1235.6	24.	29.65	14.04
	21.23	1048.5	15.2	15.93	7.50
	21.25	1280.3	22.2	28.42	13.37
	21.87	1010.6	17.3	17.48	7.99
	21.95	1275.4	18.6	23.72	10.80
Mean =	21.1	1160.15	19.04 ± 2.38	22.22	10.53

TABLE 4 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.18	1265.7	22.2	28.09	12.66
	22.5	1158.5	20.	23.17	10.29
	22.68	1176.4	15.2	17.88	7.88
	22.7	1189.8	18.6	22.13	9.74
22-24 gm	23.08	1209.3	27.	32.65	14.14
	23.12	1232.7	18.6	22.92	9.91
	23.42	1305.4	18.6	24.28	10.36
	23.56	1258.6	20.	25.17	10.68
	23.78	1450.2	24.6	35.67	15.00
	23.95	1327.4	22.	29.20	12.19
Mean =	23.09	1257.4	20.68 $\pm$ 3.21	26.11	11.29
	24.8	1141.	17.2	19.62	7.91
	24.85	1251.	22.2	27.77	11.17
	24.95	1295.	24.	31.08	12.45
	25.1	1235.8	20.	24.71	9.84
24-26 gm	25.15	12.45.5	15.2	18.93	7.52
	25.45	1224.2	20.	24.48	9.62
	25.56	1358.1	22.2	30.14	11.79
	25.7	1356.4	18.6	25.22	9.81
	25.87	1324.2	20.	26.48	10.23
	25.9	1384.5	20.	27.69	10.69
Mean =	25.33	1281.57	19.94 $\pm$ 2.2	25.61	10.10
	26.05	1350.5	22.2	29.98	11.50
	26.39	1438.6	18.6	26.75	10.13
	26.45	1324.2	14.6	19.33	7.30
	26.5	1315.8	24.	31.57	11.91
26-28 gm	26.72	1399.6	20.	27.99	10.47
	26.82	1400.2	18.6	26.04	9.71
	27.12	1502.9	20.	30.05	11.08
	27.32	1348.9	24.	32.37	11.84
	27.35	1495.	18.6	27.80	10.16
	27.98	1347.5	17.2	23.17	8.28
Mean =	26.81	1392.32	19.78 $\pm$ 2.81	27.51	10.24

TABLE 4 (continued)

Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
28.01	1501.5	18.6	27.92	9.80
28.15	1450.5	22.2	32.30	11.44
28.2	1496.4	17.3	25.88	9.19
28.95	1505.1	21.1	31.75	10.97
28-30 gm 29.	1488.2	24.	35.71	12.32
29.17	1500.2	17.3	25.95	8.90
29.5	1429.5	22.2	31.73	10.75
29.57	1439.8	17.3	24.90	8.43
30.02	1435.8	15.2	21.82	7.27
30.15	1499.8	20.	29.99	9.95
Mean = 29.07	1474.68	19.52 $\pm$ 2.67	28.79	9.90

TABLE 5

ARGININOSUCCINATE CLEAVAGE ENZYME ACTIVITY (ALBINO MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.33	67.2	0	0	0
	.34	51.5	0	0	0
	.79	84.4	0	0	0
	.86	83.3	0	0	0
Embryo	1.06	100.8	8.	0.806	7.60
	1.25	104.1	12.	1.249	9.99
	1.33	98.3	6.4	0.629	4.73
	1.37	93.6	10.	0.936	6.83
	1.42	107.3	12.	1.287	9.06
	1.48	97.8	14.2	1.388	9.38
Mean =	1.02	88.83	6.26 $\pm$ 3.82	0.629	4.76
	1.35	93.5	12.	1.122	8.31
	1.37	70.7	14.6	1.032	7.53
	1.4	101.3	8.6	0.871	6.22
	1.43	96.3	10.	0.963	6.73
New-born	1.45	94.9	14.6	1.385	9.55
	1.45	95.5	12.	1.146	7.90
	1.47	106.3	12.	1.275	8.67
	1.52	108.5	10.	1.085	7.13
	1.52	100.8	8.6	0.866	5.70
	1.58	111.3	10.	1.113	7.04
Mean =	1.45	97.91	11.24 $\pm$ 2.07	1.086	7.48
	2.04	90.0	12.	1.080	5.29
	2.34	101.6	20.	2.032	8.68
	2.39	104.5	17.3	1.807	7.56
	3.03	129.1	18.6	2.401	7.92
2-4 gm	3.2	111.4	20.	2.228	6.96
	3.49	144.8	14.6	2.114	6.05
	3.56	128.3	14.6	1.873	5.26
	3.79	179.5	17.3	3.105	8.19
	3.89	117.	17.3	2.024	5.20
	3.9	137.	14.6	2.000	5.12
Mean =	3.16	124.32	16.63 $\pm$ 2.48	2.066	6.62

TABLE 5 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity x10^3 (d)	Activity per gm x10^2 (e)
	4.24	157.7	24.	3.784	8.92
	4.47	150.8	17.2	1.593	5.80
	4.56	163.7	21.1	3.454	7.77
	4.62	168.7	28.	1.723	10.22
4-6 gm	5.08	159.1	26.4	4.200	8.26
	5.15	187.4	20.	3.748	7.27
	5.32	180.5	20.	3.610	6.78
	5.35	172.5	24.	4.140	7.73
	5.37	169.5	22.	3.729	6.94
	5.59	209.	24.	5.016	8.97
Mean =	4.97	171.89	22.67 $\pm$ 3.07	3.899	7.87
	6.02	219.1	38.6	8.457	14.04
	6.08	232.	34.	7.888	12.97
	6.36	254.1	34.	8.639	13.58
	6.59	248.5	36.4	9.045	13.72
6-8 gm	6.69	222.7	32.	7.126	10.65
	6.73	245.5	34.	8.347	12.44
	6.85	251.5	38.6	9.707	14.17
	7.05	271.1	36.4	9.868	13.99
	7.5	249.9	34.	8.496	11.32
	7.8	272.	34.	9.148	11.85
Mean =	6.76	246.64	35.2 $\pm$ 2.08	8.682	12.87
	8.29	454.5	38.	17.27	20.83
	8.3	359.8	38.	13.67	16.47
	8.39	332.3	38.	12.62	15.05
	8.86	375.	38.	14.25	16.08
8-10 gm	9.02	367.5	36.4	13.37	14.83
	9.07	539.7	34.6	18.67	20.58
	9.23	449.5	40.	17.98	19.48
	9.4	430.2	34.6	14.88	15.83
	9.83	543.8	38.	20.66	21.02
Mean =	9.02	434.54	37.36 $\pm$ 1.59	16.21	17.91

TABLE 5 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.52	627.8	42.	26.36	25.06
	10.52	621.5	42.	26.10	24.81
	10.55	631.1	42.	26.50	25.10
	10.56	648.	44.	28.51	27.00
10-12 gm	10.62	638.8	40.	25.55	24.06
	10.92	615.3	48.	29.53	27.04
	10.95	610.1	46.4	28.30	25.85
	11.65	663.5	40.	26.54	22.78
	11.67	707.5	44.	31.13	26.67
	11.7	729.2	42.	30.62	26.17
Mean =	10.9	649.28	43.04 $\pm$ 2.46	27.92	25.45
	12.05	810.5	42.6	34.52	28.65
	12.10	870.5	42.6	37.08	30.64
	12.85	932.3	40.	37.29	29.02
	13.2	905.8	42.6	38.58	29.23
12-14 gm	13.3	937.8	42.6	39.95	30.03
	13.44	935.2	44.	41.14	30.61
	13.54	915.2	42.6	38.98	28.79
	13.56	930.	38.	35.34	26.06
	13.77	925.2	40.	37.00	26.87
	13.82	858.7	40.	34.34	24.85
Mean =	13.16	902.12	41.5 $\pm$ 1.76	37.42	28.47
	14.02	860.9	48.	41.32	29.47
	14.1	893.5	46.4	41.45	29.40
	14.35	863.6	40.	34.54	24.07
	14.55	887.2	44.	39.03	26.82
14-16 gm	14.89	926.7	46.4	42.99	28.87
	15.25	958.4	42.6	40.82	26.77
	15.37	1001.3	44.	44.05	28.66
	15.39	977.5	48.	46.92	30.48
	15.6	1015.2	48.	48.72	31.23
	15.76	1033.7	42.6	44.03	27.94
Mean =	14.92	941.8	45. $\pm$ 2.63	42.39	28.37

TABLE 5 (continued)

Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
16.28	952.2	45.	42.84	26.32
16.45	912.5	45.	41.06	24.96
16.5	1005.5	42.	42.23	25.59
16.95	899.6	40.	35.98	21.22
16-18 gm 17.46	977.8	48.	46.93	26.88
17.53	1010.8	42.6	43.06	24.56
17.54	905.4	42.6	38.57	21.98
17.72	944.8	45.	42.51	23.99
17.85	1029.1	38.6	39.72	22.25
17.93	891.6	42.6	37.98	21.18
Mean = 17.22	952.93	43.14 $\pm$ 2.58	41.09	23.89
18.05	1105.5	40.	44.22	24.49
18.25	1300.1	34.	44.20	24.22
18.4	1095.2	34.	37.23	20.23
18.85	1200.8	40.	48.03	25.48
18-20 gm 18.96	1182.5	34.	40.20	21.20
19.1	1208.2	34.	41.07	21.50
19.25	1005.8	36.4	36.61	19.01
19.4	1220.9	32.	39.06	20.13
19.55	1007.2	38.	38.27	19.57
19.63	1225.7	38.	46.57	23.72
Mean = 18.94	1155.19	36.04 $\pm$ 2.68	41.55	21.96
20.05	1100.5	34.	37.41	18.66
20.34	1285.	42.6	54.74	26.91
20.5	1250.5	45.	56.27	27.45
20.6	1103.1	40.	44.12	21.41
20-22 gm 20.75	1285.	40.	51.40	24.77
21.3	1298.9	45.	58.45	27.44
21.4	1295.1	42.6	55.17	25.78
21.7	1107.4	45.	49.83	22.96
21.85	1300.8	45.	58.53	26.78
21.92	1366.4	42.6	58.20	26.55
Mean = 21.04	1239.27	42.18 $\pm$ 3.42	40.41	24.87

TABLE 5 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.06	1201.8	42.	50.47	22.88
	22.14	1424.3	34.	48.42	21.87
	22.26	1420.6	45.6	64.77	29.10
	22.27	1213.6	38.6	46.84	21.03
22-24 gm	22.64	1401.3	42.	58.85	25.99
	23.6	1405.2	40.	56.10	23.77
	23.85	1358.5	40.	54.34	22.78
	23.8	1305.4	32.	41.77	17.51
	23.88	1295.8	40.	51.83	21.70
	23.95	1375.5	40.	55.02	22.97
Mean =	23.05	1340.2	39.42 $\pm$ 3.71	52.84	22.96
	24.15	1405.2	40.	56.20	23.27
	24.17	1426.9	38.	54.22	22.43
	24.18	1412.1	40.	56.48	23.35
	24.49	1399.	40.	55.96	22.85
24-26 gm	25.16	1342.9	40.	53.71	21.34
	25.16	1442.5	36.4	52.50	20.86
	25.7	1450.5	36.4	52.97	20.54
	25.76	1438.6	40.	57.54	22.33
	25.93	1407.8	36.4	51.24	19.76
	25.96	1459.	40.	58.36	22.48
Mean =	25.06	1416.45	38.72 $\pm$ 1.62	54.90	21.92
	26.06	1355.7	34.	45.41	17.42
	26.33	1505.2	32.	48.16	18.29
	26.35	1534.2	32.	49.09	18.63
	26.62	1450.6	40.	58.02	21.79
26-28 gm	26.81	1545.1	34.	52.53	19.59
	26.94	1482.7	30.6	45.37	16.84
	26.97	1519.	36.4	55.29	20.50
	27.16	1601.5	30.6	49.00	18.04
	27.5	1572.8	32.	50.32	18.30
	27.58	1613.4	32.	51.62	18.71
Mean =	26.83	1516.02	33.36 $\pm$ 2.77	50.48	18.81

TABLE 5 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	28.60	1861.7	36.4	67.76	23.69
	28.68	1654.	38.6	63.84	22.26
	29.75	1597.3	34.	54.30	18.25
	29.8	1934.5	34.	65.77	22.07
28-30 gm	29.83	1633.3	40.	65.33	21.90
	30.96	1807.9	34.	61.46	19.85
	32.1	1774.5	34.	60.33	18.79
	33.24	1795.6	36.4	65.35	19.66
	34.8	1936.4	34.	65.83	18.91
	39.5	1902.4	38.6	73.43	18.59
Mean	31.72	1789.76	36. $\pm$ 2.23	64.34	20.40

TABLE 6

ARGININOSUCCINATE CLEAVAGE ENZYME ACTIVITY (C57B MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.58	70.6	0	0	0
	.92	85.2	0	0	0
	1.15	111.5	0	0	0
	1.28	98.4	0	0	0
Embryo	1.3	95.7	0	0	0
	1.4	102.3	2.4	0.245	1.75
	1.42	100.8	6.	0.604	4.25
	1.48	108.9	6.	0.653	4.41
	1.5	101.1	10.	1.011	6.74
	1.5	98.4	12.	1.180	7.87
Mean =	1.25	97.29	3.64 $\pm$ 3.52	2.63	2.50
	1.42	94.	15.2	1.428	10.06
	1.45	101.2	10.	1.012	6.97
	1.49	98.7	20.	1.974	13.24
	1.5	108.5	14.6	1.584	10.56
New-born	1.53	100.4	14.6	1.465	9.58
	1.61	134.9	15.2	2.050	12.73
	1.65	102.5	10.	1.025	6.21
	1.66	99.8	15.2	1.516	9.13
	1.71	105.4	14.6	1.538	8.99
	1.75	116.3	14.6	1.697	9.70
Mean =	1.57	106.17	14.4 $\pm$ 2.49	1.529	9.72
	2.03	106.3	34.	3.614	17.80
	2.35	120.4	30.	3.612	15.37
	2.42	104.	28.6	2.974	12.29
	2.61	94.9	34.	3.226	12.36
2-4 gm	2.65	102.5	30.	3.075	11.60
	3.15	129.8	28.6	3.712	11.78
	3.62	139.5	22.	2.069	8.47
	3.85	155.1	20.	3.102	8.05
	3.88	126.2	20.	2.524	6.50
	3.96	130.4	22.	2.868	7.24
Mean =	3.05	120.91	26.92 $\pm$ 5.19	3.177	11.15

TABLE 6 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	4.05	185.5	38.	7.049	17.40
	4.15	175.8	40.2	1.067	17.02
	4.36	190.8	36.	6.868	15.75
	4.78	200.2	34.	6.806	14.24
4-6 gm	4.85	190.2	34.	6.466	13.33
	5.26	212.9	36.	7.664	14.57
	5.5	233.5	32.	7.472	13.58
	5.54	226.1	36.	8.139	14.69
	5.58	208.7	36.	7.513	13.46
	5.8	221.5	32.	70.88	12.22
Mean =	4.98	204.52	35.42 $\pm$ 2.41	7.213	14.62
	6.5	280.2	32.	8.96	13.79
	6.52	258.5	34.	8.78	13.48
	6.75	290.5	30.	8.71	12.91
	7.	293.	36.4	10.66	15.23
6-8 gm	7.15	295.8	36.4	10.76	15.05
	7.24	488.8	34.	16.61	22.95
	7.48	353.9	32.	11.32.	15.14
	7.59	342.3	34.	11.63	15.33
	7.75	344.4	34.	11.70	15.11
	7.85	410.5	48.6	19.95	25.41
Mean =	7.18	355.79	35.14 $\pm$ 4.85	11.91	16.44
	8.15	352.5	48.6	17.13	21.02
	8.3	424.	52.	22.04	26.56
	8.5	375.1	28.6	10.72	12.62
	8.86	543.4	30.	16.30	18.40
8-10 gm	8.95	553.	42.	23.22	24.95
	9.09	509.6	30.	15.28	16.81
	9.12	429.7	42.	18.04	19.78
	9.32	558.1	32.4	18.08	19.40
	9.4	493.3	36.4	17.95	19.10
	9.52	589.4	30.	17.68	18.57
Mean =	8.92	482.63	37.2 $\pm$ 8.05	17.64	19.72

TABLE 6 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.	552.6	50.	27.63	27.63
	10.	553.1	48.6	26.88	26.88
	10.05	598.4	36.4	21.78	21.67
	10.08	596.1	32.	19.07	18.92
10-12 gm	10.77	637.9	40.	25.51	23.69
	10.95	675.	42.	28.35	25.89
	11.14	754.	35.3	26.61	13,89
	11.2	670.2	36.4	24.39	21.78
	11.6	695.8	38.6	26.85	23.15
	11.85	682.1	40.	27.28	23.02
Mean =	10.76	641.52	39.93 ± 5.4	25.34	23.65
	12.2	785.5	58.	45.55	37.34
	12.28	850.6	52.	44.23	36.01
	12.55	885.	38.6	34.16	27.21
	12.83	898.3	48.	43.11	33.60
12-14 gm	12.92	899.1	38.6	34.70	26.86
	13.01	901.2	42.	37.85	29.09
	13.15	809.6	42.	34.00	25.85
	13.68	878.6	44.6	39.18	28.64
	13.7	890.5	38.6	34.37	25.09
	13.95	895.2	38.6	34.55	24.77
Mean =	13.02	869.36	44.1 ± 6.33	38.17	29.45
	14.55	950.9	44.	41.83	28.75
	14.78	1100.2	42.6	46.86	31.71
	14.9	1001.5	40.	40.06	26.88
	14.95	989.2	38.6	38.18	25.54
14-16 gm	15.05	943.2	32.	30.18	20.05
	15.1	1005.8	40.	40.23	26.64
	15.25	995.6	38.6	38.43	25.20
	15.36	987.1	40.	39.12	25.47
	15.42	956.4	40.	38.25	24.80
	15.75	1015.2	38.6	39.18	24.88
Mean =	15.11	993.61	39.44 ± 2.98	39.23	25.99

TABLE 6 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	16.01	977.8	58.	56.71	35.42
	16.25	1015.8	40.2	40.83	25.12
	16.5	1008.7	58.	58.50	35.45
	16.7	1059.8	48.	50.87	30.46
16-18 gm	16.95	1020.8	42.2	43.07	25.41
	17.2	1100.5	38.6	42.47	24.69
	17.35	1025.2	40.	41.00	23.63
	17.45	1185.9	38.6	45.77	26.23
	17.83	1215.6	32.4	39.38	22.08
	17.9	1203.9	38.6	46.47	25.96
Mean =	17.01	1081.4	43.46 $\pm$ 8.17	46.51	27.45
	18.25	1092.8	35.	38.24	20.95
	18.25	1100.5	42.4	46.44	25.44
	18.4	1105.8	38.6	42.68	23.19
	18.5	1125.1	38.6	43.42	23.47
18-20 gm	18.58	1074.8	40.	42.99	23.13
	19.05	1075.3	42.2	45.37	23.82
	19.35	1155.2	35.	40.43	20.89
	19.55	1228.5	38.6	47.42	24.25
	19.75	1285.	40.	51.40	26.02
	19.95	1250.1	38.6	48.25	24.18
Mean =	18.96	1149.31	38.88 $\pm$ 2.34	44.66	23.54
	20.38	1100.5	52.	57.22	28.07
	20.58	1092.5	48.2	52.65	25.58
	20.75	1158.5	38.6	44.71	21.55
	20.83	1259.8	50.	62.99	30.24
20-22 gm	21.05	1139.8	52.	59.26	28.15
	21.12	1235.6	38.6	47.69	22.58
	21.23	1048.5	42.	44.03	20.74
	21.25	1280.3	38.6	49.41	23.25
	21.87	1010.6	50.	50.53	23.10
	21.95	1275.4	48.2	61.47	28.00
Mean =	21.1	1160.15	45.82 $\pm$ 5.41	53.00	25.13

TABLE 6 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.18	1265.7	38.	48.09	21.68
	22.5	1158.5	22.	25.48	11.32
	22.68	1176.4	42.	49.40	21.78
	22.7	1189.8	38.6	45.92	20.23
22-24 gm	23.08	1209.3	32.	38.69	16.76
	23.12	1232.7	38.	46.84	20.26
	23.42	1305.4	28.6	37.33	15.94
	23.56	1258.6	34.	42.79	18.16
	23.78	1450.2	34.	42.47	17.73
	23.95	1327.4	32.	42.47	17.73
Mean =	23.09	1257.4	33.92 $\pm$ 5.46	42.63	18.46
	24.80	1141.	40.	45.64	18.40
	24.85	1251.	52.	65.05	26.17
	24.95	1295.	58.	75.11	30.10
	25.1	1235.8	36.4	44.98	17.92
24-26 gm	25.15	1245.5	38.	47.32	18.81
	25.45	1224.2	40.	48.96	19.24
	25.56	1358.1	36.4	49.43	19.34
	25.7	1356.4	40.	54.25	21.11
	15.87	1324.2	38.	50.31	19.45
	25.9	1384.5	40.	55.38	21.38
Mean =	25.33	1281.57	41.88 $\pm$ 6.83	53.64	21.19
	26.05	1350.5	32.	43.21	16.58
	26.39	1438.6	40.	57.54	21.80
	26.45	1324.2	36.4	48.20	18.22
	26.5	1315.8	42.	55.26	20.85
26-28 gm	26.72	1399.6	46.	64.38	24.09
	26.82	1400.2	38.6	54.04	20.15
	27.12	1502.9	40.	60.11	22.16
	27.32	1348.9	42.	56.65	20.73
	27.35	1495.	40.	59.80	21.86
	27.98	1347.5	38.6	52.01	18.58
Mean =	26.81	1392.32	39.56 $\pm$ 3.49	55.12	20.50

TABLE 6 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	28.01	1501.5	42.	63.06	22.51
	28.15	1450.5	38.6	55.98	19.88
	28.2	1496.4	52.	77.81	27.59
	28.95	1505.1	58.	87.29	30.15
28-30 gm	29.	1488.2	42.	62.50	21.55
	29.17	1500.2	46.2	69.30	23.76
	29.5	1429.5	40.	57.18	19.38
	29.57	1439.8	42.	60.47	20.45
	30.02	1435.8	46.2	66.33	22.09
	30.15	1499.8	40.	59.99	19.89
Mean =	29.07	1474.68	44.7 $\pm$ 5.81	65.99	22.72

TABLE 7

ARGINASE ACTIVITY (ALBINO MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.33	67.2	8.4	0.564	17.10
	.34	51.5	6.	0.309	9.08
	.79	84.4	6.	0.506	6.41
	.86	83.3	5.8	0.483	5.61
Embryo	1.06	100.8	6.	0.604	5.70
	1.25	104.1	10.	1.041	8.32
	1.33	98.3	8.4	0.825	6.20
	1.37	93.6	12.	1.123	8.19
	1.42	107.3	10.	1.073	7.55
	1.48	97.8	6.	0.586	3.96
Mean =	1.02	88.83	7.86 $\pm$ 2.12	0.711	7.81
	1.35	93.5	6.	0.561	4.15
	1.37	70.7	6.	0.424	3.09
	1.4	101.3	4.5	0.455	3.25
	1.43	96.3	8.6	0.828	5.79
New-born	1.45	94.9	9.8	0.930	6.41
	1.45	95.5	3.6	0.343	2.37
	1.47	106.3	14.2	1.509	10.26
	1.52	108.5	6.	0.651	4.28
	1.52	100.8	9.	0.907	5.96
	1.58	111.3	12.	1.335	8.45
Mean =	1.45	97.91	8.97 $\pm$ 3.42	0.784	5.40
	2.04	90.	18.6	1.674	8.20
	2.34	101.6	24.5	2.489	10.63
	2.39	104.5	40.	4.180	17.48
	3.03	129.1	20.	2.582	8.52
2-4 gm	3.2	111.4	28.5	3.174	9.92
	3.49	144.8	32.	4.633	13.27
	3.56	128.3	21.5	2.758	7.74
	3.79	179.5	30.	5.385	14.20
	3.89	117.	25.5	2.983	7.66
	3.9	137.	24.	3.288	8.43
Mean =	3.16	124.32	26.46 $\pm$ 6.07	3.314	10.60

TABLE 7 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	4.24	157.7	46.0	7.254	17.10
	4.47	150.8	28.0	4.222	9.44
	4.56	163.7	26.0	4.256	9.33
	4.62	168.7	34.0	5.735	12.41
4-6 gm	5.08	159.1	24.0	3.818	7.51
	5.15	187.4	24.0	4.497	8.73
	5.32	180.5	30.0	5.415	10.17
	5.35	172.5	26.0	4.485	8.38
	5.37	169.5	28.0	4.746	8.83
	5.59	209.0	24.0	5.016	8.97
Mean =	4.97	171.89	29.0 $\pm$ 6.39	4.944	10.09
	6.02	219.1	14.6	3.198	5.31
	6.08	232.0	13.0	3.016	4.96
	6.36	243.1	6.6	1.677	2.63
	6.59	248.5	8.2	2.037	3.09
6-8 gm	6.69	222.7	19.2	4.275	6.39
	6.73	245.5	10.6	2.602	3.86
	6.85	251.5	12.0	5.533	8.07
	7.05	271.1	6.6	1.789	2.53
	7.50	249.9	16.0	6.497	8.66
	7.80	272.0	16.2	4.406	5.64
Mean =	6.76	246.64	12.3 $\pm$ 4.09	3.503	5.11
	8.29	454.5	84.2	38.26	46.16
	8.30	359.8	84.0	30.22	36.41
	8.39	332.3	62.0	20.60	24.07
	8.86	375.0	52.6	19.72	22.25
8-10 gm	9.02	367.5	76.2	28.00	31.04
	9.07	539.7	67.8	36.59	40.34
	9.23	449.5	88.0	39.55	43.93
	9.40	430.2	56.0	24.09	25.60
	9.83	543.8	70.5	38.33	39.00
	9.89	493.1	62.0	30.57	31.92
Mean =	9.028	434.54	70.33 $\pm$ 11.79	30.58	34.07

TABLE 7 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.52	627.8	84.0	52.73	
	10.52	621.5	82.0	51.00	47.33
	10.55	631.1	80.0	50.48	57.68
	10.56	648.0	94.0	60.91	47.85
10-12 gm	10.62	638.8	85.4	54.55	51.36
	10.92	615.3	84.0	51.68	57.13
	10.95	610.1	75.8	46.24	52.35
	11.07	707.5	89.4	63.25	42.23
	11.65	663.5	80.0	53.08	45.56
	11.70	729.2	84.0	61.25	48.47
Mean =	10.91	649.28	83.66 $\pm$ 4.84	54.52	45.71
	12.05	810.5	89.0	72.13	58.04
	12.10	870.5	77.5	67.46	41.90
	12.85	932.3	80.0	74.58	52.17
	13.20	905.8	82.0	74.27	57.61
12-14 gm	13.30	937.8	84.0	78.77	55.75
	13.44	935.2	80.0	74.81	55.66
	13.54	915.2	62.0	56.74	56.26
	13.56	930.0	84.0	78.12	59.86
	13.77	925.2	75.0	69.39	50.39
	13.82	858.7	84.0	72.10	59.22
Mean =	13.16	902.12	79.75 $\pm$ 6.98	71.84	54.69
	14.02	860.9	94.0	80.92	50.55
	14.10	893.5	88.2	78.80	57.72
	14.35	863.6	84.0	72.54	51.21
	14.55	887.2	84.0	74.52	56.62
14-16 gm	14.89	926.7	90.0	83.40	55.89
	15.25	958.4	90.1	86.35	60.00
	15.37	1001.3	85.0	85.11	55.37
	15.39	977.5	85.0	83.08	50.83
	15.60	1015.2	92.2	93.60	56.01
	15.76	1033.7	77.5	80.11	53.98
Mean =	14.92	941.8	87.0 $\pm$ 4.61	81.84	54.82

TABLE 7 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	16.28	952.2	95.8	91.2	56.03
	16.45	912.5	100.3	100.6	61.18
	16.50	1005.5	111.32	121.9	73.93
	16.95	899.6	110.5	108.4	63.95
16-18 gm	17.46	977.8	119.06	126.1	72.27
	17.53	1010.8	111.5	122.8	70.05
	17.54	905.4	118.2	107.0	61.01
	17.72	944.8	111.4	114.6	64.72
	17.85	1029.1	100.3	103.2	57.82
	17.93	891.6	100.5	89.6	49.97
Mean =	17.22	952.93	108.88 $\pm$ 7.27	108.5	63.09
	18.05	1105.5	100.0	110.5	61.24
	18.25	1300.1	99.0	128.7	70.52
	18.40	1095.2	110.5	121.0	65.77
	18.85	1200.8	98.2	117.9	62.55
18-20 gm	18.96	1182.5	100.0	118.2	62.36
	19.10	1208.2	98.0	118.4	61.99
	19.25	1005.8	125.0	125.7	65.31
	19.40	1220.9	94.0	114.7	59.15
	19.55	1007.2	120.0	120.8	61.82
	19.63	1225.7	129.0	158.1	80.54
Mean =	18.94	1155.19	107.37 $\pm$ 12.14	123.4	65.12
	20.05	1100.5	98.0	107.8	53.79
	20.34	1285.0	80.5	103.4	50.85
	20.50	1250.5	105.1	131.4	64.11
	20.60	1103.1	102.2	112.7	54.72
20-22 gm	20.75	1285.0	110.5	141.9	68.43
	21.30	1298.9	96.0	124.6	58.54
	21.40	1295.1	114.5	148.2	69.29
	21.70	1107.4	88.9	98.4	45.36
	21.85	1300.8	99.2	129.0	59.05
	21.92	1366.4	96.0	124.6	58.54
Mean =	21.04	1239.27	98.71 $\pm$ 9.19	122.3	58.16

TABLE 7 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.06	1201.8	99.8	119.9	54.36
	22.14	1424.3	90.0	128.1	57.89
	22.26	1420.6	96.0	136.3	61.26
	22.27	1213.6	129.2	156.7	70.40
22-24 gm	22.64	1401.3	112.0	156.9	69.32
	23.60	1405.2	88.94	124.9	52.95
	23.85	1358.5	94.3	128.1	53.71
	23.85	1305.4	99.2	129.4	54.29
	23.88	1295.8	112.0	145.1	60.77
	23.95	1375.5	90.2	124.0	51.80
Mean =	23.05	1340.20	101.16 $\pm$ 3.86	135.0	58.68
	24.15	1405.2	98.0	137.7	57.02
	24.17	1426.9	121.4	173.2	71.66
	24.18	1412.1	102.0	144.0	59.56
	24.49	1399.0	94.0	131.5	53.69
24-26 gm	25.16	1442.5	112.0	161.5	64.21
	25.16	1342.9	89.4	120.0	47.71
	25.70	1450.5	94.0	136.3	53.05
	25.76	1438.6	100.5	144.5	56.12
	25.93	1407.8	94.0	132.3	51.03
	25.96	1459.0	104.1	151.8	58.50
Mean =	25.06	1416.45	100.94 $\pm$ 9.16	143.3	57.26
	26.06	1335.7	94.0	125.5	48.17
	26.33	1505.2	99.7	150.0	56.99
	26.35	1534.2	96.7	148.3	56.30
	26.62	1450.6	95.3	138.2	51.93
26-28 gm	26.81	1545.1	103.1	159.2	59.41
	26.94	1482.7	104.1	154.3	57.29
	26.97	1519.0	99.4	150.9	55.98
	27.16	1601.5	95.9	153.5	56.54
	27.50	1572.8	95.8	150.6	54.79
	27.58	1613.4	102.0	164.5	59.66
Mean =	26.83	1516.02	98.6 $\pm$ 3.3	149.5	55.71

TABLE 7 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	28.60	1861.7	95.8	178.3	62.36
	28.68	1654.0	94.0	155.4	54.21
	29.75	1597.3	102.0	162.9	54.76
	29.80	1934.5	97.1	187.8	63.03
28-30 gm	29.83	1633.3	121.4	198.2	66.47
	30.96	1807.9	94.0	169.9	54.89
	32.10	1774.5	97.1	172.3	53.67
	33.24	1795.6	109.2	196.0	57.39
	34.80	1936.4	93.1	180.2	51.80
	39.50	1902.4	105.0	199.7	50.57
Mean =	31.72	1789.76	100.87 $\pm$ 8.13	180.3	56.91

TABLE 8

ARGINASE ACTIVITY (C57B MICE)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	.58	70.6	10.	0.706	12.17
	.92	85.2	6.	0.511	5.55
	1.15	111.5	12.	1.338	11.63
	1.28	98.4	14.6	1.436	11.22
Ebmryo	1.3	95.7	12.	1.148	8.83
	1.4	102.3	10.	1.023	7.30
	1.42	100.8	8.4	0.846	5.96
	1.48	108.9	10.	1.089	7.35
	1.5	98.4	14.6	1.436	9.57
Mean =	1.25	97.19	10.96 $\pm$ 2.52	1.074	8.77
	1.42	94.	12.	1.128	7.94
	1.45	101.2	14.2	1.437	9.91
	1.49	98.7	10.	0.987	6.62
	1.5	108.5	14.2	1.540	10.27
New-born	1.53	100.4	15.8	1.586	10.36
	1.61	134.9	10.	1.349	8.37
	1.65	102.5	20.	2.050	12.42
	1.66	99.8	22.	2.195	13.22
	1.71	105.4	18.6	1.960	11.46
	1.75	116.3	10.	1.163	6.64
Mean =	1.57	106.17	14.68 $\pm$ 4.14	1.539	9.72
	2.03	106.3	40.	4.252	20.94
	2.35	120.4	44.	5.297	22.54
	2.42	104.	40.	4.160	17.19
	2.61	94.9	38.6	3.663	14.03
2-4 gm	2.65	102.5	31.5	3.228	12.18
	3.15	129.8	44.	5.711	18.13
	3.62	139.5	40.	5.580	15.14
	3.85	155.1	40.	6.204	16.11
	3.88	126.2	42.	5.300	13.66
	3.96	130.4	40.	5.216	13.17
Mean =	3.05	120.91	40.01 $\pm$ 3.32	4.861	16.33

TABLE 8 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	4.05	185.5	48.	8.904	21.98
	4.15	175.8	34.	5.977	14.44
	4.36	190.8	42.	8.013	18.37
	4.78	200.2	34.	6.806	12.24
4-6 gm	4.85	190.2	34.	6.466	13.33
	5.26	212.9	24.	5.109	9.71
	5.5	233.5	48.	1.120	20.37
	5.54	226.1	28.	6.330	11.42
	5.58	208.7	20.	4.174	7.48
	5.8	221.5	34.	7.531	12.98
Mean =	4.98	204.52	34.6 $\pm$ 8.85	6.043	14.43
	6.5	280.2	56.8	15.91	24.48
	6.52	258.5	44.	11.37	17.44
	6.75	290.5	56.8	16.50	24.44
	7.	293.	50.	14.65	20.92
6-8 gm	7.15	295.8	44.	13.01	18.20
	7.24	488.8	64.	31.28	43.20
	7.48	353.9	62.4	22.08	29.52
	7.59	342.3	56.8	19.44	25.61
	7.75	344.4	48.	16.53	21.33
	7.85	410.5	64.	26.27	33.46
Mean =	7.18	335.79	54.68 $\pm$ 7.36	18.706	25.86
	8.15	352.5	74.	26.08	32.00
	8.3	424.	72.5	30.74	37.03
	8.5	375.1	74.	27.75	32.65
	8.86	543.4	70.	38.03	42.93
	8.95	553.	75.	41.47	46.34
	9.09	509.6	76.2	38.83	42.71
	9.12	429.7	71.	30.50	33.45
	9.32	558.1	74.	41.29	44.31
	9.4	493.3	74.	36.50	38.83
	9.52	589.4	70.	41.25	43.33
Mean =	8.92	482.63	73.07 $\pm$ 2.008	35.24	39.36

TABLE 8 (continued)

Body weight (gm) (a)		Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	10.	552.6	92.	50.83	50.83
	10.	553.1	84.	46.46	46.46
	10.05	598.4	84.	50.26	50.01
	10.08	596.1	94.6	56.39	55.94
10-12 gm	10.77	637.9	92.	58.68	54.49
	10.95	675.	92.	62.10	56.71
	11.14	754.	84.	63.33	56.85
	11.2	670.2	98.6	66.08	59.00
	11.6	695.8	94.6	65.82	56.74
	11.85	682.1	94.	64.11	54.10
Mean =	10.76	641.52	90.98 $\pm$ 4.92	58.41	54.11
	12.2	785.5	112.	87.97	72.11
	12.28	850.6	98.6	83.86	68.29
	12.55	885.	104.4	92.39	73.62
	12.83	898.3	100.	89.83	70.01
12-14 gm	12.92	899.1	100.	89.91	69.58
	13.01	901.2	98.6	88.85	68.30
	13.15	809.6	100.	80.96	61.56
	13.68	878.6	84.	74.80	53.95
	13.7	890.5	94.6	84.24	61.49
	13.95	895.2	98.6	88.26	63.27
Mean =	13.02	869.36	99.08 $\pm$ 6.68	86.01	66.22
	14.55	950.9	84.	79.87	54.89
	14.78	1100.2	84.	92.41	62.52
	14.9	1001.5	77.5	77.61	52.09
	14.95	989.2	84.	83.09	55.58
14-16 gm	15.05	943.2	80.	75.45	50.13
	15.1	1005.8	100.	100.58	66.60
	15.25	995.6	88.2	87.81	57.58
	15.36	978.1	84.	82.16	53.48
	15.42	956.4	82.	78.42	50.85
	15.75	1015.2	74.	75.12	47.69
Mean =	15.11	993.61	83.77 $\pm$ 6.61	83.25	55.14

TABLE 8 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	16.01	977.8	84.	82.13	51.30
	16.25	1015.8	94.6	96.09	59.13
	16.5	1008.7	94.6	95.42	57.83
	16.7	1059.8	94.6	100.25	60.03
16-18 gm	16.95	1020.8	94.6	96.56	56.97
	17.2	1100.5	100.	110.05	63.98
	17.35	1025.2	95.8	98.21	56.60
	17.45	1185.9	94.6	112.18	64.29
	17.83	1215.6	88.	106.97	59.99
	17.9	1203.9	84.	101.12	56.49
Mean =	17.01	1081.4	92.48 ± 5.04	99.99	58.66
	18.25	1092.8	94.	102.7	56.28
	18.25	1100.5	110.	121.0	66.33
	18.40	1105.8	88.6	97.9	53.24
	18.50	1125.1	94.	105.7	57.16
18-20 gm	18.58	1074.8	120.	128.9	69.41
	19.05	1075.3	94.	101.0	53.05
	19.35	1155.2	94.	108.5	56.11
	19.55	1228.5	98.2	120.6	61.70
	19.75	1285.	94.	120.7	61.15
	19.95	1250.1	84.	105.0	52.63
Mean =	18.96	1149.31	97.08 ± 9.92	111.2	58.71
	20.38	1100.5	98.6	108.5	53.24
	20.58	1092.5	98.6	107.7	52.34
	20.75	1158.5	96.	111.2	53.59
	20.83	1259.8	100.6	126.7	60.84
20-22 gm	21.05	1139.8	100.6	114.6	54.47
	21.12	1235.6	94.	116.1	54.99
	21.23	1048.5	94.	98.5	46.42
	21.25	1280.3	92.2	118.0	55.54
	21.87	1010.6	94.	94.9	43.43
	21.95	1275.4	98.6	125.7	57.29
Mean =	21.1	1160.15	96.72 ± 2.9	112.2	53.21

TABLE 8 (continued)

Body weight (gm)	(a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	22.18	1265.7	98.4	124.5	56.15
	22.5	1158.5	100.	115.8	51.48
	22.68	1176.4	84.	98.8	43.57
	22.7	1189.8	98.4	117.0	51.57
22-24 gm	23.08	1209.3	98.4	118.9	51.55
	23.12	1232.7	94.	115.8	50.11
	23.42	1305.4	77.6	101.2	43.25
	23.56	1258.6	84.	105.7	44.87
	23.78	1450.2	112.	162.4	68.30
	23.95	1327.4	94.6	125.5	52.43
Mean =	23.09	1257.4	94.14 ± 9.42	118.6	51.33
	24.80	1141.	84.	95.8	38.64
	24.85	1251.	96.	120.5	48.52
	24.95	1295.	96.4	124.8	50.03
	25.1	1235.8	84.	103.8	41.35
24-26 gm	25.15	1245.5	98.	122.0	48.53
	25.45	1224.2	98.	119.9	47.14
	25.56	1358.1	74.	100.4	39.31
	25.7	1356.4	98.	132.9	51.72
	25.87	1324.2	100.	132.4	51.18
	25.9	1384.5	98.	135.6	52.38
Mean =	25.33	1281.57	92.68 ± 8.33	118.8	46.88
	26.05	1350.5	84.	113.4	43.54
	26.39	1438.6	70.	100.7	38.15
	26.45	1324.2	89.4	118.3	44.75
	26.50	1315.8	85.	111.8	42.20
26-28 gm	26.72	1399.6	84.	117.5	43.99
	26.82	1400.2	88.5	123.9	46.20
	27.12	1502.9	80.	120.2	44.33
	27.32	1348.9	88.	118.7	43.44
	27.35	1495.	90.	134.5	49.19
	27.98	1347.5	94.	126.6	45.26
Mean =	26.81	1392.32	85.29 ± 6.01	118.6	44.11

TABLE 8 (continued)

	Body weight (gm) (a)	Liver wet wt. (mgm) (b)	Specific Activity (c)	Total Activity $x10^3$ (d)	Activity per gm $x10^2$ (e)
	28.01	1501.5	96.8	145.3	51.89
	28.15	1450.5	94.	136.3	48.43
	28.20	1496.4	94.	140.6	49.88
	28.95	1505.1	84.	126.4	43.67
28-30 gm	29.	1488.2	94.	139.8	48.23
	29.17	1500.2	100.6	150.9	51.73
	29.50	1429.5	80.	114.3	38.76
	29.57	1439.8	80.	115.1	38.95
	30.02	1435.8	96.	137.8	45.91
	30.15	1499.8	84.	125.9	41.78
Mean =	29.07	1474.68	90.34 ± 7.16	133.2	45.92

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