# BRAINS AND BRAIN PRESERVATIVES

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## PART I.

### PHYSICAL CHANGES IN HUMAN AND OTHER BRAINS COLLECTED UNDER DIFFERENT CONDITIONS AND PRESERVED IN VARIOUS FORMALIN PREPARATIONS.

Anatomical and anthropological investigations on the brain to determine the homologies and differences in the organ and all its parts, between man and other animals, and between races and other groups of mankind, make large collections of brains necessary. Such collections imply the use of means by which the brains can be kept indefinitely in good condition for study. An ideal means would be one which would allow every specimen to preserve its form, size, weight, and all macroscopical as well as minute features. The need for such an agent has long been felt and led from dry preparations to the use of various liquid preservatives, among which, subsequently to the introduction of that chemical in 1894 by Blum, have been solutions containing formaldehyde.

The commercial solutions of formaldehyde, known ordinarily as formol, or formalin, have, even when much diluted, the quality of rapidly penetrating and hardening brain tissue, allowing but little alteration in the form of the organ and preserving much of its color. Furthermore, when hardened, specimens can be kept in the formalin solution without further noticeable change quite indefinitely and the preservative is not expensive. The chemical, however, is not wholly without objections; some persons are affected adversely by its fumes, the volume and weight of the brain are increased somewhat in its solutions, and it does not serve best the purposes of histology; yet the other advantages of formalin are so great that, until something more efficient be discovered, it can not well be dispensed with for brain preservation.

Efforts have been made to correct the faults of formalin by the addition of other substances to its solutions, or by following these, after the desired hardening of the brain had been effected, with other preservatives. It has been combined with or followed by various proportions of alcohol (Parker & Floyd, Marie, Gerota, etc.), potassium bichromate, or Müller's fluid (Diedrichs, G. Retzius), glycerin (Lanzillotti-Buonsanti, Chencinski), sodium acetate with sodium chloride and alcohol (Stroud, Wilder), sodium chloride and zinc chloride (Fisk), sodium chloride alone (Spitzka), and bichloride of mercury.[a] All of these combinations have been reported upon favorably. The effects of several formalin solutions have been observed[b] with some detail, but of no single solution do we possess exact and sufficiently detailed data as to its action on the brain, especially physically, and its action on the brains of persons of different ages, or on those of different animals, or finally on those collected under widely different conditions of the organ, or of temperature. Yet it is important to be acquainted with such facts. It is desirable to know which really is the best solution or combination for at least most of the specimens, so that such a preparation alone may be used. Such knowledge would tend to bring about not only a much-desired unity of procedure, but also a general understanding, at any stage, of the state of our material, so far as formalin preservation is concerned. The use of a single solution with well-known effects would regulate our records and methods, and allow of a degree of accuracy in weight determinations and measurements not now possible.

With these facts in mind, and remembering the excellent work by Donaldson in 1894 on the physical changes in the brain produced by various preservatives in use before the introduction of formalin, the writer, in establishing a brain collection in the Department of Anthropology of the United States National Museum, has endeavored to make a series of tests with several solutions, the main component of which was Merck's formalin.

The material accruing to the brain collection of the Museum is heterogeneous, ranging from man's brains[c] to those of the lowest mammals,[d] and from aged individuals to embryos, hence it was particularly suitable for experiments. Besides this it is always possible

[a] Still other compositions were employed for the purposes of histology and pathology—see summary in Tellyesnitzki. Special methods, also, having no bearing on the theme of this paper, were devised for the preservation of the natural color of various organs.

[b] See Dexler, p. 382, after Flatau; records of the weight of the brain in 1 per cent, 5 per cent, and 10 per cent formalin solutions in 1, 3, 30, 90, 150, and 450 days.

[c] Of these, unfortunately, not a sufficient number were received in good condition during the progress of the experiments.

[d] The term "mammal" is used, for want of a better term, throughout this paper as a designation for other mammals than man.

in a city to obtain in fresh condition large numbers of heads of slaughtered animals. Utilizing both resources, a double plan was followed. A number of different formalin solutions was made up, some in concentrations used by other workers and a few empirically as to strength, and each solution was used on a series of brains as they were received, including specimens of every nature. The second procedure was to obtain a large number of brains, as far as possible in the same condition, from some one fair-sized animal, and to subject uniform series of such brains to the action of different solutions. The results of this latter inquiry appear in the second part of this paper.

There are numerous factors which, as Donaldson has already shown, affect the changes in the brain in the same solution. One of these is the degree of freshness of the brain; another is the temperature of the air (large differences); and still another is the presence or absence of the soft membranes. Only the last of these conditions was capable of being fully regulated in the National Museum collection. The subjects from which brains are here obtained come from different sources, and it is impossible to get all the brains equally fresh; and as to cold and heat, the collecting continues throughout the year, and the laboratories are not so fitted as to keep up an even temperature. Yet no specimens were included in the tests that were sufficiently advanced in decomposition to make their hardening and preservation doubtful; and the changes of temperature in the laboratory where the brain collection is stored would not exceed 40° F. as the maximum in the course of the year. The brain was always laid into the preservative with the soft membranes intact or but slightly injured.

The regular procedure in cases of the first category was as follows: The brain, being extracted without the dura mater, was immediately weighed; the solution in which it was to be laid was prepared beforehand; a layer of absorbent cotton was placed on the bottom of the glass jar to be used, and a quantity of the preservative poured in; the brain was then placed into the solution, with its base downward on the cotton, so as to rest easily (the cerebellum and cerebrum in the larger brains being separated by a thin layer of cotton), and a sufficient quantity of the preservative was added to rise 1 to 1½ inches above the specimen. The jar was then closed, labeled, and placed on a shelf, where it remained for one week. No injection through the arteries or into the ventricles was practiced, because it would have been impossible with all the specimens, and it was not found essential. On the eighth day the brain was taken out, drained in a fixed manner, and then weighed; the old cotton and solution were replaced with new, in same quantity, the brain was put back into the jar and placed again on the shelf. One month after receiving the specimen the same procedure was repeated. Other weighings were taken in some cases, during as

well as after the first month, with always the same method of drainage, but without a change of solution.

The method of draining steadily adhered to and applicable to specimens of all sizes, is to take the brain carefully into one or both hands, and then swing the arms with a somewhat rapid motion from fore backward, by which most of the liquid attached to the brain is thrown off; this takes only a brief time, after which the brain is placed for five minutes upon a dry cotton towel. This procedure gives a good and fairly uniform drainage, and is preferable to the use of funnels.

In the second category of cases one of several additional procedures introduced was proportioning the quantity of the preservative, in cubic centimeters, to the weight of brains, in grams.

The solutions chosen for the specimens here dealt with were 3 per cent, 5 per cent, 10 per cent, and 15 per cent formalin (commercial solution of formaldehyde) in distilled water; two solutions of formalin, 5 per cent, to which was added salt, in one case enough to raise the specific gravity to 1,035,[a] and in the other to 1,030; and in addition the writer used several combinations of formalin with solutions of ordinary alum (potassium and aluminium sulphate), which was chosen for its astringent effects on organic tissues. In two series a saturated solution of alum[b] was mixed with one part of water, and in another with two parts of water.

The changes to which most attention was paid, and which probably represent best the physical changes, were, as with Donaldson, and Flatau, those of weight. The general and specific results follow:

The changes in the weight of brains in all the mixtures showed (1) *a characteristic type for every solution*, and (2) *a noticeable variation for every solution*.

(1) In every solution the first three to five days were with all brains the period of the most rapid changes in weight. In probably all of the solutions here reported upon, and with all brains, there was an initial stage of gain. This reached more or less promptly its maximum, and was followed by a general, long-continuing loss. A period of stability was established but slowly. So far as the observations went (two years), absolute stability in weight of the specimens was not reached. In every solution the daily changes in the brain weight formed a characteristic curve. This will be better illustrated in Part II.

In all the simple solutions of formalin in water, up to 15 per cent of the former (the strongest tested), the initial gain was well marked. It was larger with the weakest solution and decreased as the propor-

[a] Near the specific gravity of the whole brain; after Spitzka.

[b] A saturated solution of alum was prepared by placing an excess of that salt in a large jar of water, stirring well, allowing the mixture to stand at ordinary temperature for several days, and filtering just before using.

tion of formalin increased, which showed that the effect of formalin on the brain was to hinder its enlargement (apparently due to water alone) and probably, in addition, to promote the loss of some of the constituents of the organ. After the culmination of the process of gain, which, as shown by further experiments, was always completed before nine days, a gradual progressive loss followed, which in percentage was alike with the different solutions. The ultimate weight of the brain depends, in consequence of this similarity of loss, very largely on the height of the initial rise in weight. If this had been large, as with the 3 per cent solution, the ultimate weight (within two years) would still be above the original; but if the gain was smaller, as with the 15 per cent formalin solution, the ultimate weight of the specimen would be found more or less below its weight immediately after extraction from the skull.

Whenever a marked increase in the weight of the brain took place, there was also a noticeable increase in its volume.

The effect of adding alum or salt to formalin solutions was to decrease or, with larger quantities, almost entirely to do away with the initial gain, and to augment the subsequent absolute loss of brain weight. The percentage of the loss in weight, however, remained related to that in the simple formalin solutions. Simultaneously with the loss of weight in the stronger concentrations was also visible a decrease in the volume of the organ. No direct relation was found between these phenomena and the specific gravity of the solutions. It appears that alum, sodium chloride, and, according to more recent experiences, other salts also, as well as alcohol, act on the brain physically much like greater proportions of formaldehyde; hence the use of such means with formalin permits the obtaining of similar physical results with correspondingly smaller proportions of this chemical.

A renewal of the preservative generally affected slightly the changes in the brain, causing a temporary rise in weight.

As to the rapidity of hardening and other visible changes in the brain, the differences between the several liquids were not great. A moderate toughening of the brain was in every one of the preservatives observable on the second day, and a good hardening, with fresh adult specimens, was generally reached within a week. In the salt-formalin solution the brains were, at least for a time, slightly softer, in the alum-formalin solution slightly more resistant, than those preserved in simple solutions of formalin of the same strength. A higher percentage of formalin was favorable to a more rapid and perhaps a slightly greater hardening. On the whole, should one be given specimens of the same size, but each hardened in a different solution of those here dealt with, after they had lain a few months in the liquid, it would be quite impossible by the hardening alone, as perceptible through the unaided touch, to distinguish any of the preparations.

The hardening of small mammal and bird brains was effected much like that of the larger specimens. In hardening fœtal human brains, the best results were obtained by the aid of stronger alum solutions.

The color of the brain (except so far as it may be due to hemoglobin, which is bleached) was affected but little by any of the solutions employed. Sodium chloride produced a lighter color or bleaching of the tissues; alum a slightly grayish tinge of the surface. Alum was more effective than salt in showing the differentiation of the gray and white matter.

(2) With all the care exercised, the ratio of change in any given series in which the same preservative had been used was not uniform. A large portion of the irregularity must be attributed to the physical status, and some probably to the chemical condition of the organ. When the two halves of any brain were treated in the same preservative, the results were always much alike.

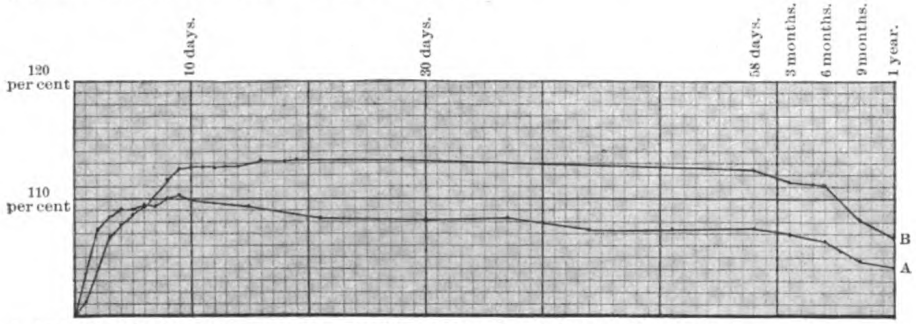
The physical condition of the brain includes its size and the quantity of blood or other liquids it may contain. The size of the brain has been found in general to have a pronounced influence upon the weight and volume changes in the organ. The larger the brain, the smaller the per gram changes, and the opposite. While there are individual exceptions, the cases conforming to the rule (see detail tables) are too numerous to leave any doubt on this point. What the causes of this phenomenon are is not yet clear, though presumably the larger brains have a firmer structure- that is, could better resist absorption[a]—and the very small brains are of necessity preserved in relatively much larger quantities of fluid, which may aid solution. It is possible that it is mainly if not entirely the size which accounts for the differences between the changes in three principal series of brains —those of human beings, of mammals, and of birds—but this needs further experimentation before a final decision can be obtained.

The degree of brain congestion must be a factor affecting the brain changes, but not enough specimens came to hand to throw much light on this point. Theoretically, a congested brain ought to gain less and lose more than a normal one, in any preservative. Higher degrees of congestion, not uncommon in human specimens, are rare in other larger mammals and are practically never met with in the smaller animals.

Besides the differences in the changes of various brains in the same preservative, accountable for by marked differences in the physical characteristics of the organ, others are met with harder to explain. In some instances, as with *Lepus cuniculus*, *Cathartes aura*, and a few others (see detailed lists), there is a suggestion that the difference

[a] In a number of instances the hemispheres of small brains, preserved in weak formalin solution (1 or 2 per cent) in the laboratory, have burst through the great absorption.

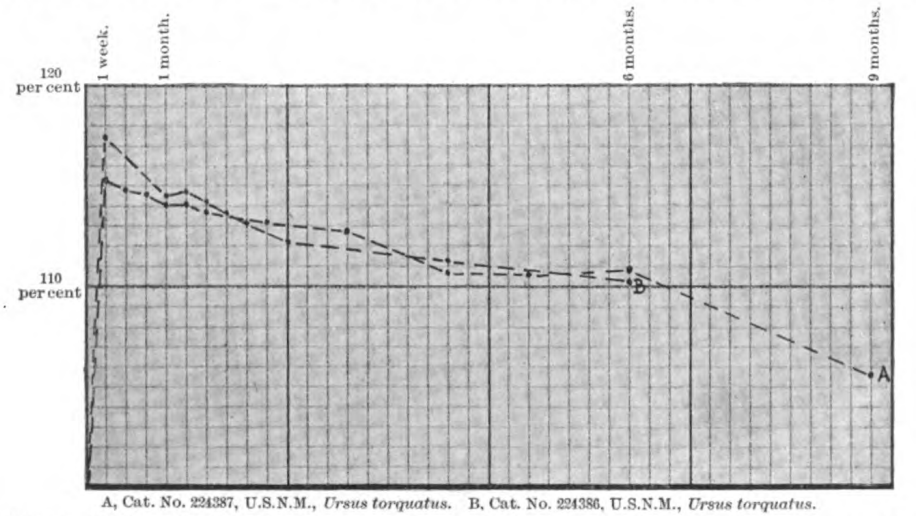
may be that of species, which opens a large field of inquiry. But, in other instances, members of the same species, and that even when collected and preserved under much the same conditions, show pronounced differences, and these can hardly be accounted for on other basis than chemical. The following figures show two such instances, (1) in human and (2) in bear's brains:




A=brain of a full-blooded negro woman. Received Oct. 6, 1903. Original weight 1,066 grams.
B=brain of a mixed-blooded (about ¾ white, ¼ negro) woman. Received Oct. 14, 1903. Original weight 1,106 grams.

FIG. 1.—CURVES SHOWING DIFFERENCES IN WEIGHT CHANGES OF TWO HUMAN BRAINS IN 5 PER CENT FORMALIN SOLUTIONS.

The principal source of chemical difference between brains capable of affecting their behavior in preservatives is, undoubtedly, decomposition. Concerning individual or perhaps even racial chemical differences in the organ, before decomposition, there is as yet no

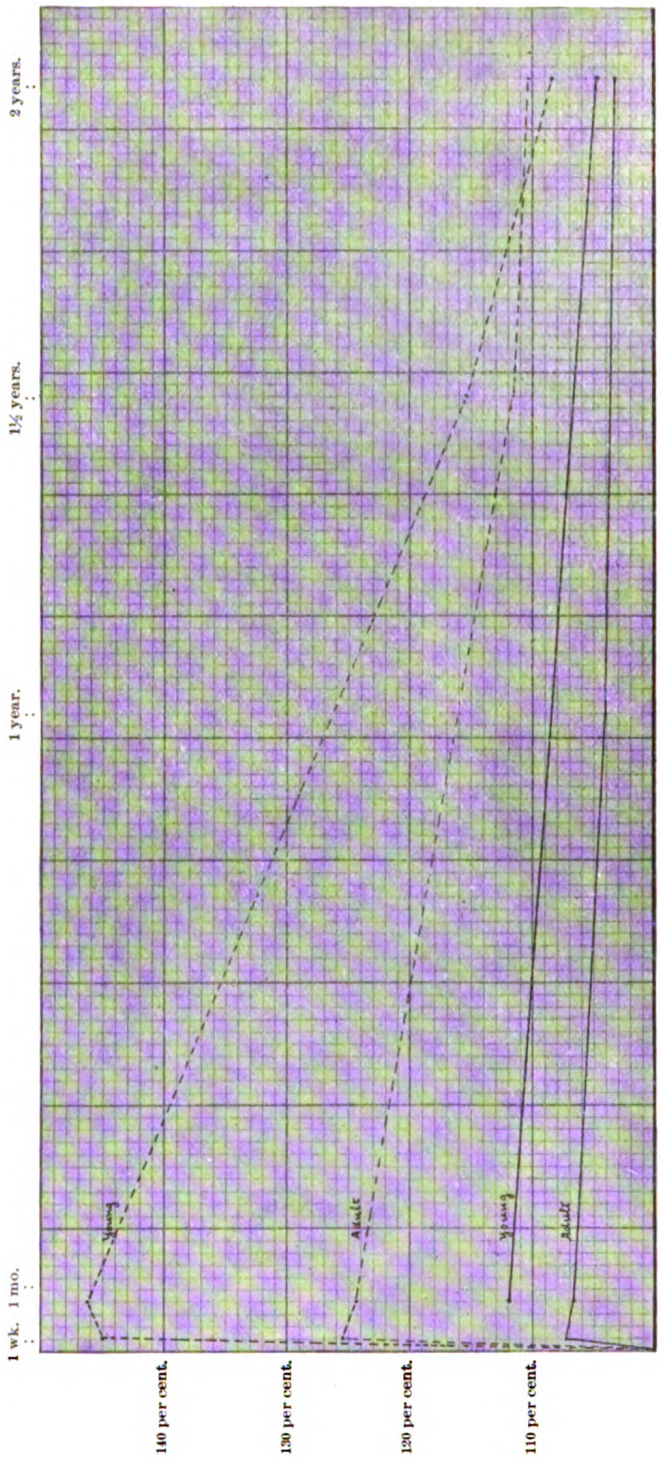



A, Cat. No. 224387, U.S.N.M., *Ursus torquatus*. B, Cat. No. 224386, U.S.N.M., *Ursus torquatus*.

FIG. 2.—CURVES SHOWING DIFFERENCES IN WEIGHT CHANGES OF TWO BEAR BRAINS IN 3 PER CENT FORMALIN SOLUTION.

knowledge. The subject presents an attractive and important field for investigation.

The behavior of the brains of the young differs, in general, from that of the adults in the various solutions. Most of the young show a greater initial increase in weight and all suffer a greater eventual loss (see fig. 3).



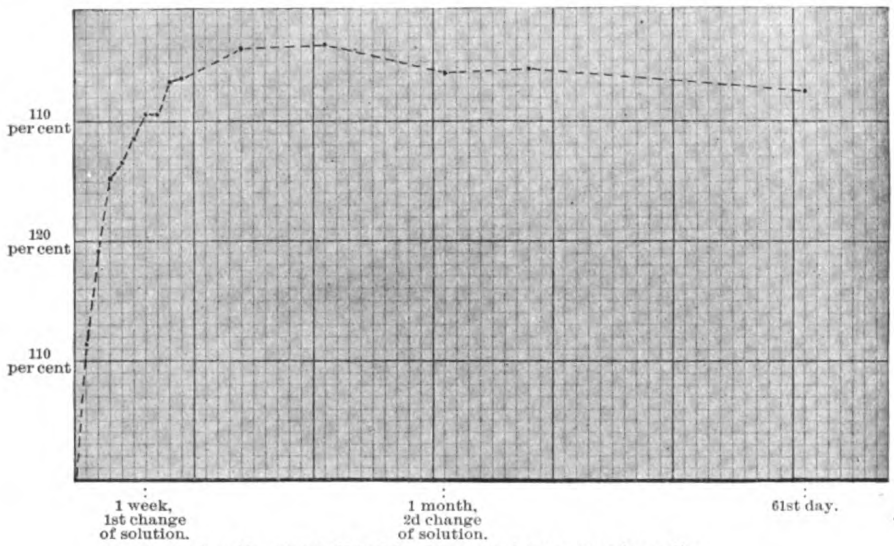

Human, ——— Mammal, - - - - - -

FIG. 3.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 3 PER CENT FORMALIN SOLUTION.

## BRIEF DETAILS CONCERNING THE VARIOUS PRESERVATIVES.

### THREE PER CENT FORMALIN SOLUTION.

All specimens increased in weight, mammal brains more than human; brains of the young, human and mammal, increased more than those of adults. A decrease in weight in all classes of specimens set in within the first month and continued slowly as far as observed (two years). In every instance the weight of the brain at the end of two years was still greater than the original.




Cat. No. 224803, U.S.N.M. *Phoca vitul*, 3 per cent formalin.

FIG. 4.—CURVE SHOWING CHANGES IN BRAIN WEIGHTS IN 3 PER CENT FORMALIN SOLUTION.

### FIVE PER CENT FORMALIN SOLUTION.

All specimens rose in weight, but the young, at least, less so than in the 3 per cent solution; mammal brains augmented more than human; some of the brains of the young showed a greater increase, some a little less than the average of the corresponding series of adults. A decrease in weight in all specimens set in within the first month, and continued slowly for at least eighteen months. At the end of one to one and one-half years the weight of the adult human and mammal brains was in most instances still above the original; in the case of the young, in one human and one mammal it was above, in one human and one mammal well below, the original.

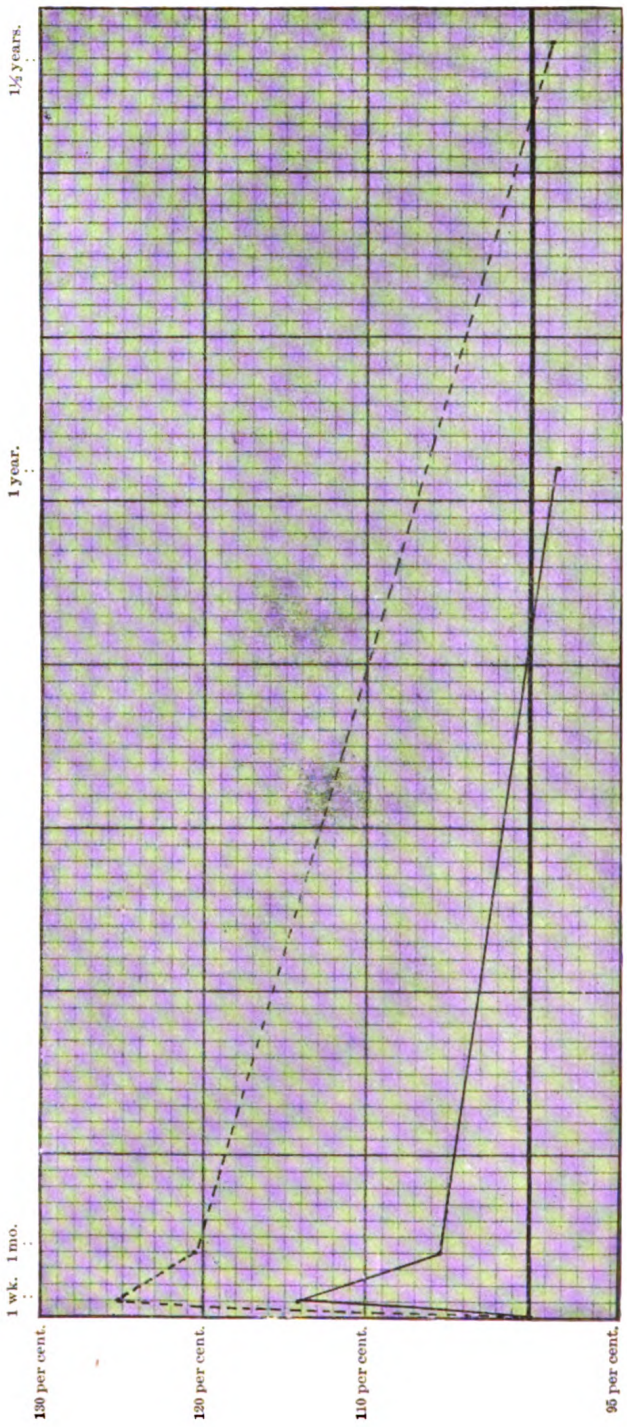



FIG. 5a.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 5 PER CENT FORMALIN SOLUTION.

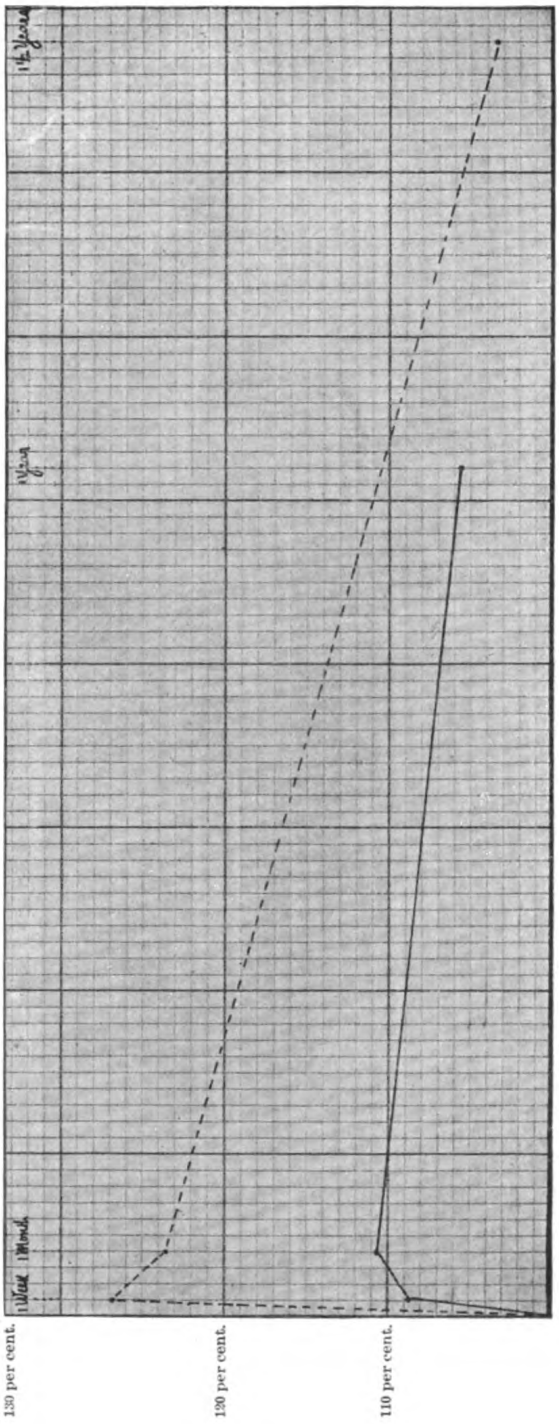



FIG. 50.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 5 PER CENT FORMALIN SOLUTION.

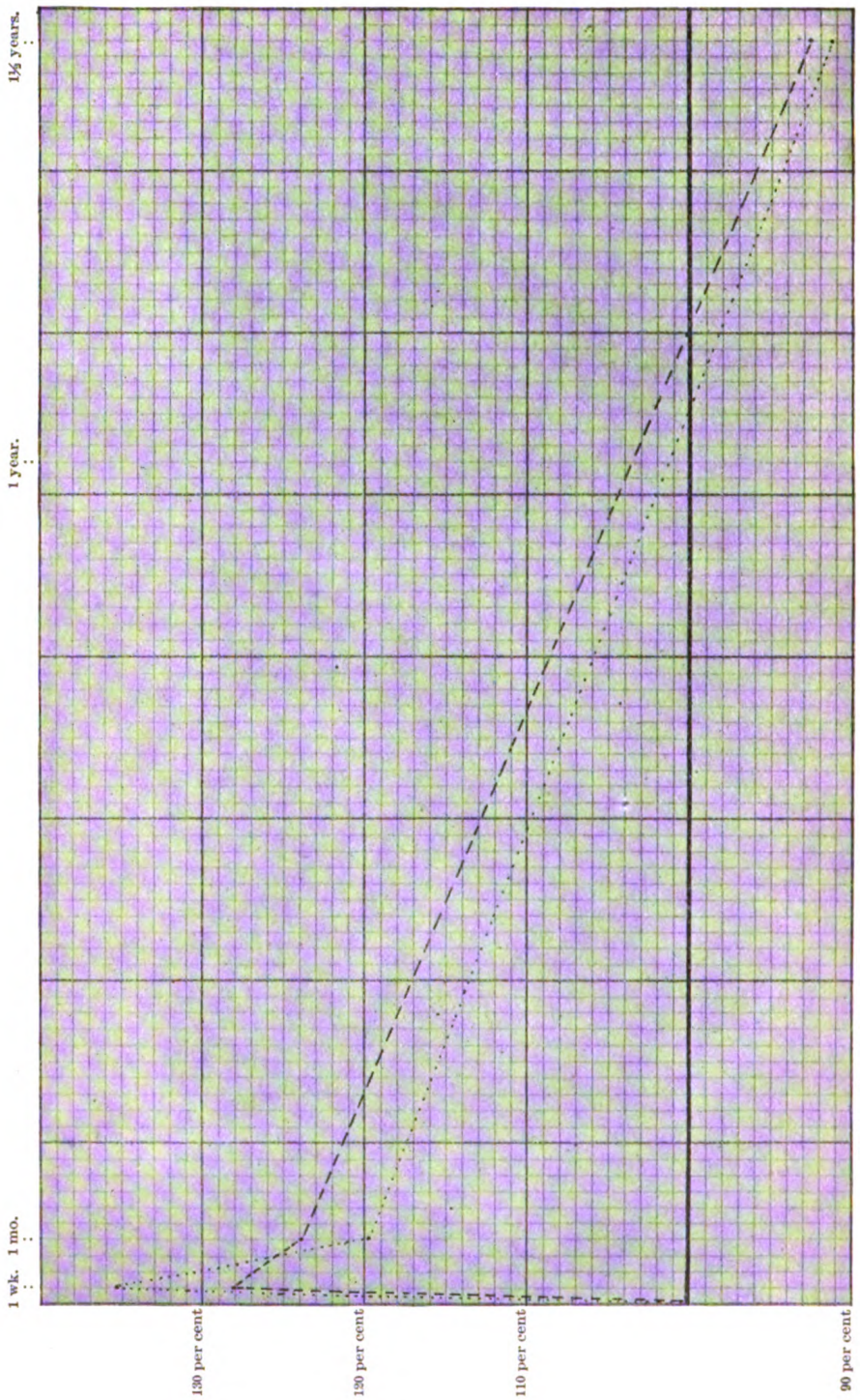



FIG. 6.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 10 PER CENT FORMALIN SOLUTION.

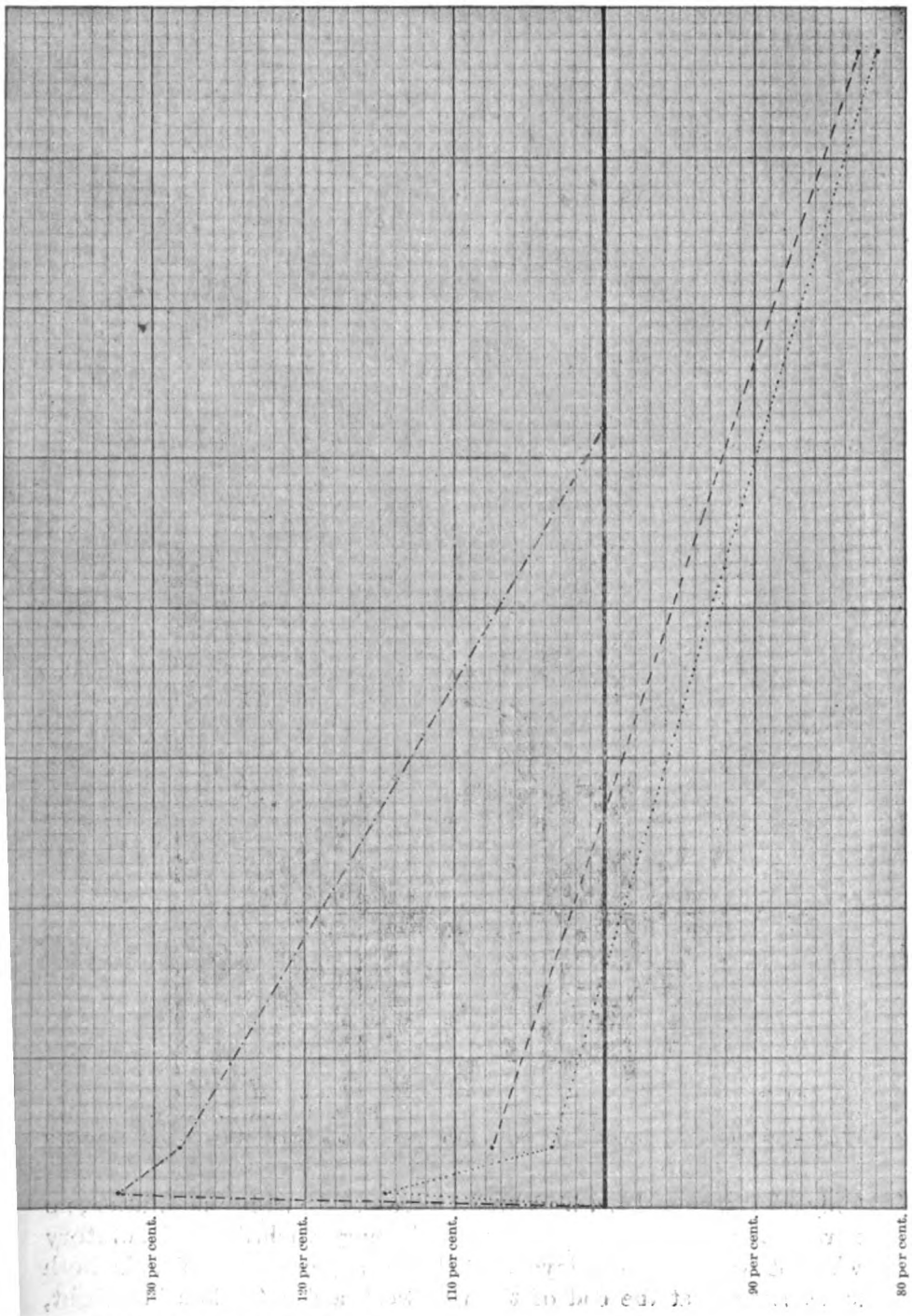



FIG. 7.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 15 PER CENT FORMALIN SOLUTION.

TEN PER CENT AND 15 PER CENT FORMALIN SOLUTIONS.

In these the number of mammals was rather small and all were of small size, which had an effect on the figures. All the specimens increased in weight, as in the 3 per cent and 5 per cent formalin solutions, during the early part of the first month, and slowly and continuously declined afterwards. The ultimate weight reached was in every case, and particularly in the 15 per cent liquid, lower than with the weaker solutions. It was greater in the birds than in the mammals. Experiments on the larger and more uniform brains of sheep showed plainly a progressively less initial augmentation and lower subsequent fall in weight with the increase in strength of the formalin to 10 and 15 per cent.

1,030 AND 1,035 SPECIFIC GRAVITY SALT SOLUTIONS, WITH 5 PER CENT FORMALIN.

These two solutions acted practically alike; the 1,030 sp. gr. liquid was more largely used, for the reason that fewer brains will float in it.

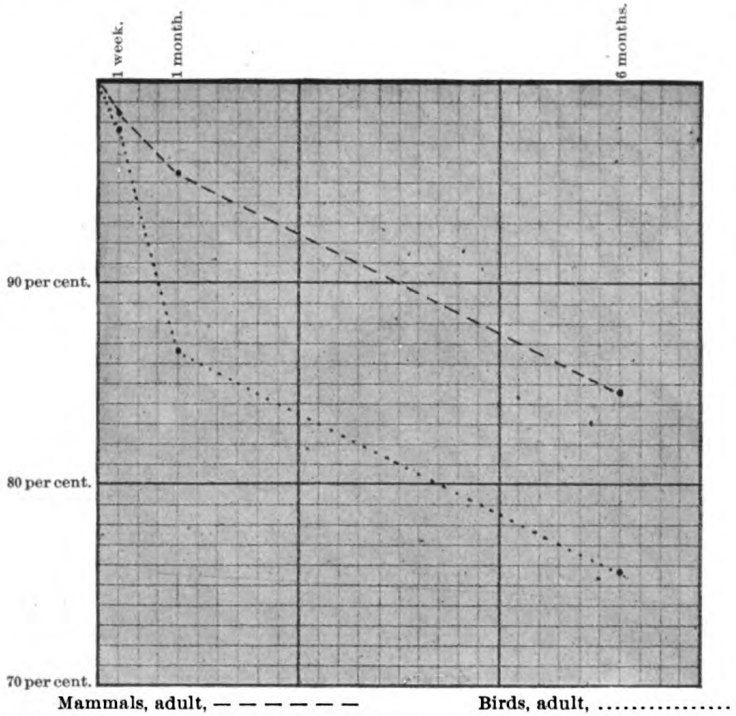


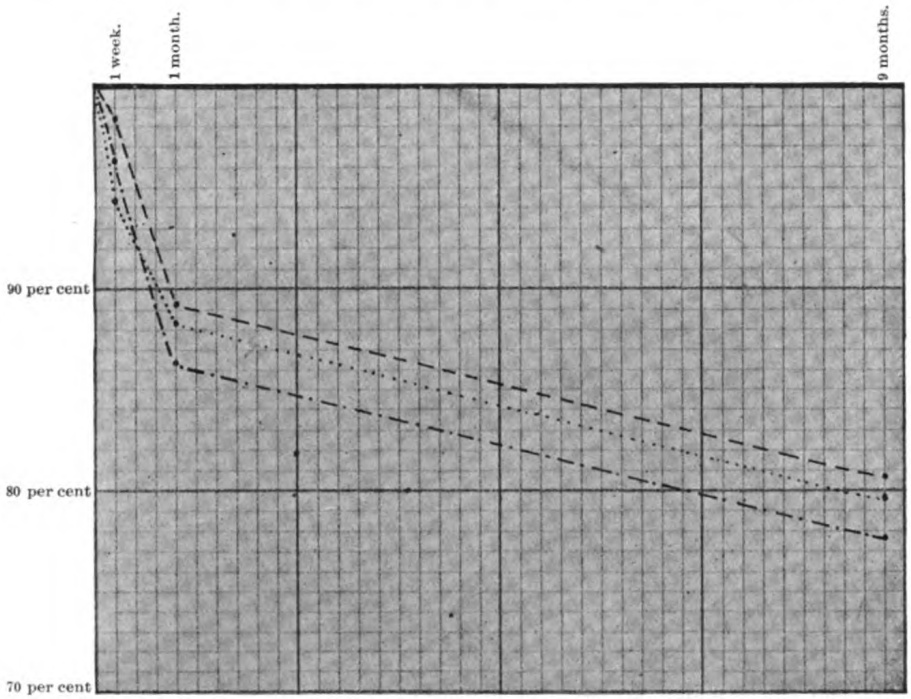

FIG. 8.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 1,030 SPECIFIC GRAVITY SALT FORMALIN SOLUTION.

Only adult mammal and bird brains were preserved in the solution, no normal human or young specimens having reached the laboratory while it was being employed. A large majority of brains in both series showed at the end of the first week a decided loss in weight,

and this gradually progressed. The bird brains showed greater loss than those of mammals. On the whole the effects of the solution resemble those of the alum-formalin combinations.

ONE-HALF SATURATED SOLUTION OF ALUM, WITH 5 PER CENT FORMALIN.

The various series of specimens in this solution behaved in the same way as those in one-half saturated solution of alum with 10 per cent




Mammals, adult, — — — — — Birds, adult, ..... Mammals, young, — · — · — · — ·

FIG. 9.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN ONE-HALF SATURATED SOLUTION OF ALUM, WITH 5 PER CENT FORMALIN.

formalin, except that the loss was throughout slightly less. An increased amount of formalin with this alum solution favored somewhat a loss of weight of the specimens.

ONE-HALF SATURATED SOLUTION OF ALUM, WITH 10 PER CENT FORMALIN.

At the end of the first week one human specimen showed a small increase, another a slight diminution in weight; among the mammals, two adults and two young showed a very slight increase, the rest of the mammals and all the birds a decrease in the original weight. Apparently there was an initial rise, but it was slight and of short

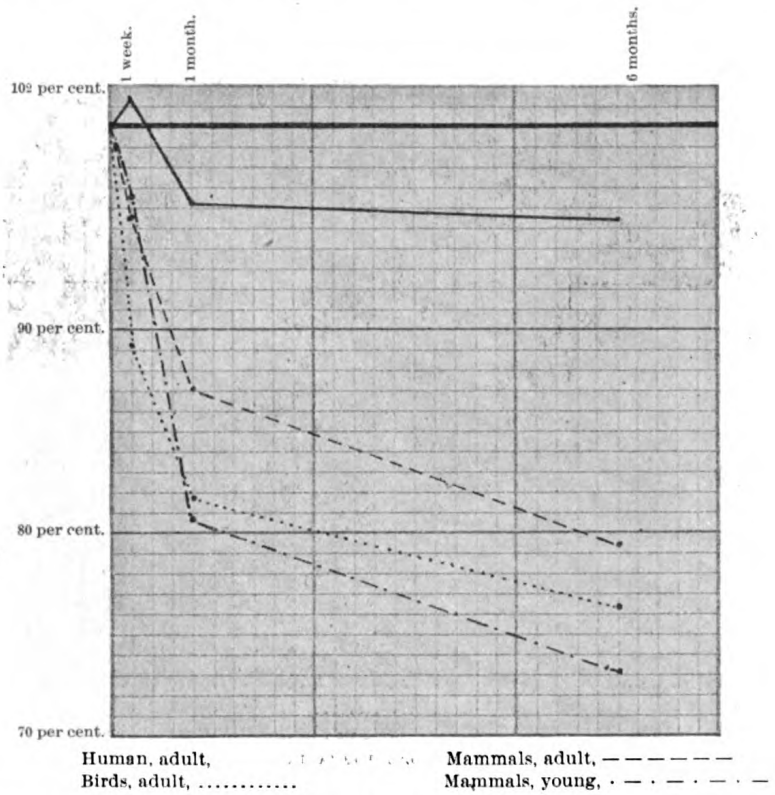



FIG. 10.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN ONE-HALF SATURATED SOLUTION OF ALUM, WITH 10 PER CENT FORMALIN.

duration. The brains of adult birds lost more than those of full-grown mammals, and these lost more than the adult human brains. Brains of young mammals lost more than those of full-grown. The ultimate deficiency in weight was greater than in any of the simple formalin solutions.

ONE-THIRD SATURATED SOLUTION OF ALUM, WITH 5 PER CENT FORMALIN.

This preservative influenced the weight in the various series of specimens much as did the one-half saturated alum solutions, only the loss of weight was on the whole still slightly smaller. The one adult human brain preserved in this liquid showed a slight initial increase, but in the mammal and bird brains there was at the end of a week in

most cases already a decided loss. The brains of the young, both human and mammal, with one exception, lost more than those of the adults. The brains of adult mammals and birds behaved generally much alike in this solution.

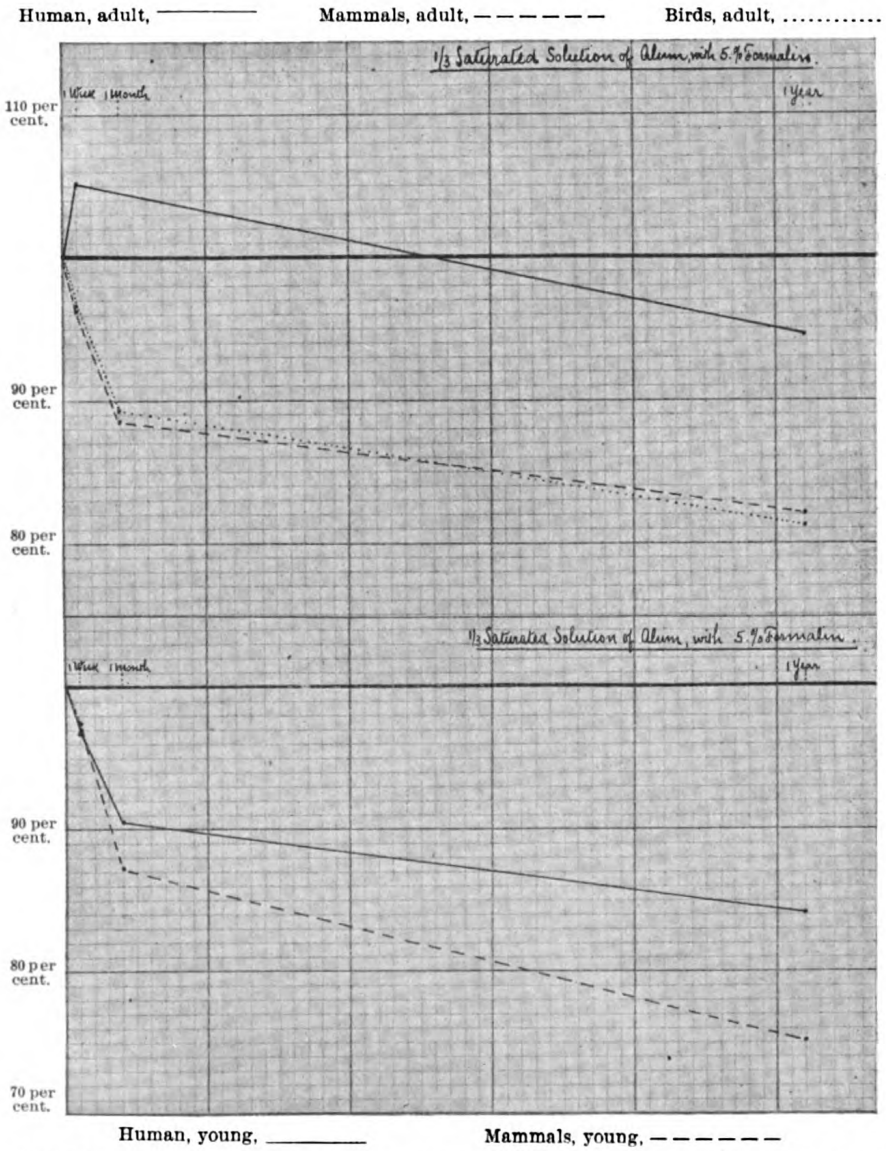



FIG. 11.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

The data here recorded make it plain that no single formalin brain preservative meets all the requirements, even for macroscopical purposes alone. If it is desired to preserve specimens of a mixed (human and comparative) collection near their actual weight and volume, two

or three solutions of different concentration for brains of widely different mass would seem to be needed.

Highly diluted (less than 5 per cent) and again highly concentrated (over 15 per cent) formalin solutions, and large additions of salts, are disadvantageous and ought not to be employed.

Addition of alum to the formalin solution favors the process of hardening, and is to be recommended in preserving brains of the young, particularly of human fœtuses.

Among the numerous points left to be determined are the effects of additional solutions, the influence of different quantities of the preservative, and the exact daily changes during the first month at least in the specimens. Experiments made in the laboratory during the past summer with fifteen series of sheep brains and reported in Part II, will throw some light on these matters.

The changes in individual brains of this first series are given in the following tables:

## DETAIL DATA.

*Solution: 3 per cent of formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. | Weight of brain after 18 months. | Per cent of original weight. | Weight of brain after 2 years. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | | *Grams.* | | *Grams.* | |
| 220374 | Negro (full blood) | July 28, 1903 | About 55 years. | Some congestion. | 1,125.0 | 1,207.0 | 107.29 | 1,202.0 | 106.84 | −0.42 | 1,171.7 | 104.1 | ..... | ..... | 1,163.5 | 103.41 |
| 224395 | Vulpes pribilofensis. | Aug. 17, 1903 | Adult | Medium | 40.0 | 55.0 | 137.50 | 54.0 | 135.00 | −1.82 | ..... | ..... | ..... | ..... | 44.5 | 111.25 |
| 224386 | Ursus torquatus | Aug. 29, 1903 | 3 years | do | 269.0 | 316.0 | 117.47 | 308.0 | 114.50 | −2.53 | ..... | ..... | ..... | ..... | 295.3 | 109.78 |
| 224387 | do | Sept. 11, 1903 | do | do | 282.0 | 325.0 | 115.25 | 321.5 | 114.00 | −1.08 | ..... | ..... | ..... | ..... | 303.0 | 106.73 |
| 224388 | Macropus sp? | Sept. 8, 1903 | Adult | do | 37.0 | 49.0 | 132.43 | 47.5 | 128.38 | −3.06 | ..... | ..... | ..... | ..... | 40.5 | 109.46 |
| 224821 | Odocoileus virginianus. | Oct. 28, 1903 | do | do | 203.0 | 234.0 | 115.27 | 236.5 | 116.50 | +1.07 | ..... | ..... | 213.3 | 105.07 | ..... | ..... |
| 224389 | Odocoileus truei | Sept. 26, 1903 | do | do | 129.0 | 168.0 | 130.24 | 172.0 | 133.33 | +2.38 | ..... | ..... | 146.8 | 113.80 | ..... | ..... |
| 224907 | Sus scrofa | Oct. 30, 1903 | do | Moderate congestion. | 186.0 | 233.5 | 125.54 | 238.0 | 127.96 | +1.92 | ..... | ..... | 216.2 | 116.24 | ..... | ..... |
| 224427 | Lepus | Oct. 5, 1903 | do | Medium | 11.5 | 15.5 | 134.78 | 15.6 | 135.65 | +.64 | ..... | ..... | 12.8 | 111.30 | ..... | ..... |
| 224382 | Ursus americanus | Aug. 14, 1903 | Nearly adult. | do | 230.0 | 273.0 | 118.69 | 264.0 | 114.78 | −3.30 | ..... | ..... | ..... | ..... | 256.5 | 111.52 |
| 224380 | Felis onca | Aug. 1, 1903 | Adolescent | do | 165.0 | 210.0 | 127.27 | 205.0 | 124.24 | −2.38 | ..... | ..... | ..... | ..... | 185.5 | 112.42 |
| 224381 | do | Aug. 5, 1903 | do | do | 160.0 | 203.0 | 126.87 | 199.0 | 124.37 | −1.93 | ..... | ..... | ..... | ..... | 179.0 | 111.87 |
| 218039 | Negro child | May 8, 1903 | New born | do | 375.0 | ..... | ..... | 420.0 | 112.00 | ? | ..... | ..... | ..... | ..... | 393.2 | 104.85 |
| 224385 | Ursus japonicus | Aug. 11, 1903 | Young | do | 230.0 | 272.0 | 118.26 | 267.0 | 116.08 | −1.84 | ..... | ..... | ..... | ..... | 248.5 | 108.04 |
| 224391 | Odocoileus hemionus. | Oct. 13, 1903 | do | do | 116.5 | 167.0 | 143.35 | 168.0 | 144.20 | +.59 | ..... | ..... | ..... | ..... | ..... | ..... |
| 224428 | Lepus | Oct. 5, 1903 | do | do | 6.9 | 10.3 | 149.27 | 10.1 | 146.37 | −1.94 | ..... | ..... | 7.7 | 111.60 | ..... | ..... |
| 224429 | do | do | do | do | 6.8 | 11.5 | 169.12 | 11.3 | 166.17 | −1.74 | ..... | ..... | 8.85 | 130.15 | ..... | ..... |
| 224430 | Cavia cutleri | Oct. 7, 1903 | ? | do | 4.8 | ..... | ..... | 7.3 | 152.08 | ? | ..... | ..... | 5.07 | 105.63 | ..... | ..... |
| 224431 | do | do | ? | do | 4.9 | ..... | ..... | 7.5 | 153.06 | ? | ..... | ..... | 5.60 | 114.29 | ..... | ..... |

*Solution: 3 per cent of formalin*—Continued.

AVERAGES.

| Subject. | Per cent of original weight— At the end of first week. | At the end of first month. | After 1 year. | After 18 months. | After 2 years. | Subject. | Per cent of original weight— At the end of first week. | At the end of first month. | After 1 year. | After 18 months. | After 2 years. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ADULT. | | | | | | YOUNG. | | | | | |
| Human subjects | (1) 107.29 | (1) 106.84 | (1) 104.10 | | (1) 103.41 | Human subjects | | (1) 112.00 | | | (1) 104.85 |
| Mammals | (11) 125.57 | (11) 124.43 | | (4) 111.60 | (7) 110.43 | Mammals | (4) 115.00 | (6) 146.33 | | (1) 115.42 | (1) 108.04 |

*Solution: 5 per cent of formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. | Weight of brain after 18 months. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | | *Grams.* | |
| 219999 | White man | July 15, 1903 | 51 years | Medium | 1,100.0 | 1,507.0 | 107.64 | 1,464.0 | | | | | | |
| 222091 | Negro woman (full blood) | Oct. 6, 1903 | 59 years | Some congestion | 1,066.0 | 1,166.5 | 109.42 | 1,153.0 | 108.16 | −1.16 | 1,110.0 | 104.12 | | |
| 222576 | Negro woman (one-eighth or less negro). | Oct. 14, 1903 | 43 years | Medium | 1,103.7 | 1,209.0 | 109.54 | 1,252.0 | 113.43 | +3.55 | 1,181.3 | 107.02 | | |
| 224742 | Ursus horribilis | Feb. 6, 1904 | Adult | do | 389.0 | 466.0 | 119.79 | 473.0 | 121.59 | +1.50 | | | 437.0 | 112.40 |
| 224824 | Canis nubilis | Dec. 19, 1903 | do | do | 115.5 | | | 145.0 | 125.54 | | | | 128.5 | 111.25 |
| 224826 | "Black and tan" terrier | Dec. 15, 1903 | do | do | 70.0 | 86.0 | 122.86 | 84.5 | 120.71 | 1.75 | | | 68.0 | 97.14 |
| 224822 | "Retriever" dog | Dec. 19, 1903 | do | do | 90.5 | | | 110.0 | 121.54 | | | | 90.5 | 100.0 |
| 224825 | Fox terrier | Dec. 15, 1903 | do | do | 67.0 | 80.3 | 119.40 | 78.3 | 116.86 | −2.49 | | | 65.0 | 97.01 |
| 224814 | "Black and tan" dog | Dec. 23, 1903 | do | do | 61.5 | 76.0 | 123.57 | 75.0 | 121.95 | −1.32 | | | 62.0 | 100.81 |
| 224815 | Felis pardalis | Dec. 24, 1903 | do | do | 63.5 | | | 76.5 | 120.47 | | | | 68.5 | 107.87 |
| 224438 | Lepus | Oct. 28, 1903 | do | do | 8.7 | 12.4 | 142.53 | 11.7 | 134.48 | −5.65 | | | 9.95 | 114.37 |
| 222600 | Capromys pilorides | Nov. 27, 1903 | do | do | 11.1 | 14.8 | 133.33 | 14.15 | 127.48 | −4.39 | | | 11.7 | 105.41 |
| 224447 | Sciuropterus volans | Nov. 23, 1903 | do | do | 1.92 | 2.88 | 150.0 | 2.7 | 140.62 | −6.25 | | | 1.9 | 98.96 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 224448 | Sciurus hudsonicus | Nov. 24, 1903 | do | do | | 4.02 | 5.76 | 143.28 | 5.5 | 136.81 | −4.52 | | | 4.1 | 101.99 |
| 224743 | Alces americanus | Jan. 25, 1904 | do | do | | 407.0 | 473.0 | 116.21 | 471.0 | 115.72 | −.45 | | | 420.5 | 103.32 |
| 224823 | Odocoileus virginianus | Nov. 20, 1903 | do | do | | 219.5 | 248.0 | 112.98 | 251.0 | 111.35 | +1.21 | | | 212.2 | 96.6 |
| 224828 | do | Nov. 10, 1903 | do | do | | 177.5 | 199.7 | 112.71 | 197.5 | 111.27 | −1.11 | | | 178.0 | 100.28 |
| 224718 | White boy | Mar. 26, 1904 | 11 years | Congestion | | 1,350.0 | 1,522.0 | 112.74 | | | | 1,365.4 | 101.14 | | |
| 221172 | Negro child (full blood or near). | Oct. 31, 1903 | 5 years | Pronounced congestion of cerebrum. | | 1,039.0 | 1,197.0 | 115.21 | 1,180.0 | 113.57 | −.59 | | | | |
| 224719 | Colored child (about one-fourth white). | Mar. 23, 1904 | 3 years | Medium | | 1,020.0 | 1,167.0 | 114.41 | 993.0 | 97.35 | −14.91 | 974.0 | 95.49 | | |
| 224910 | Fox terrier puppy | Dec. 31, 1903 | Young | do | | 53.0 | 68.5 | 129.24 | 67.4 | 127.17 | −1.61 | | | 51.0 | 96.22 |
| 229998 | Shropshire sheep | Jan. 21, 1904 | 9 months | do | | 112.8 | 137.0 | 121.45 | 136.0 | 120.65 | −.73 | | | 114.5 | 101.51 |

AVERAGES.

| Subject. | Per cent of original weight at the end of— | | | Subject. | Per cent of original weight at the end of— | | | |
|---|---|---|---|---|---|---|---|---|
| | First week. | First month. | 1 year. | 18 months. | | First week. | First month. | 1 year. | 18 months. |
| ADULT. | | | | | YOUNG. | | | | |
| Human subjects | (3) 108.87 | (2) 110.80 | (2) 105.6 | | Human subjects | (3) 114.12 | (2) 105.46 | (2) 98.31 | |
| Mammals | (11) 126.95 | (14) 123.53 | | (14) 103.39 | Mammals | (2) 125.35 | (2) 123.91 | | (2) 98.86 |

*Solution: 10 per cent of formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. | Weight of brain after 18 months. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | | *Grams.* | |
| 222599 | Trichosurus fuliginosus | Oct. 29, 1903 | Adult | Medium | 12.9 | 15.2 | 117.82 | 14.66 | 134.64 | - 3.55 | | | 12.35 | 95.73 |
| 224436 | Lepus | Oct. 27, 1903 | do | do | 8.0 | 9.85 | 123.12 | ? | ? | ? | | | 7.3 | 91.25 |
| 224437 | Sciurus carolinensis | Oct. 28, 1903 | do | do | 6.7 | 9.3 | 138.80 | ? | ? | ? | | | 6.1 | 91.04 |
| 224715 | Sciuropterus volans | Nov. 9, 1903 | do | do | 2.0 | ? | ? | 2.33 | 116.50 | ? | | | 1.95 | 97.50 |
| 221446 | Sciurus hudsonicus | Nov. 16, 1903 | do | do | 4.43 | 5.87 | 132.50 | 5.58 | 125.96 | − 4.94 | | | 3.9 | 88.03 |
| 224444 | Lutreola vison | Nov. 11, 1903 | do | Congestion | 7.9 | ? | ? | 9.38 | 118.73 | ? | | | 7.3 | 92.41 |
| 224440 | Corvus brachyrhynchus | Nov. 10, 1903 | do | Medium | 7.3 | 9.4 | 128.76 | 9.75 | 133.56 | + 3.72 | | | 6.75 | 92.46 |
| 224443 | do | Nov. 11, 1903 | do | do | 8.9 | ? | ? | 10.68 | 120.00 | ? | | | 8.39 | 94.27 |
| 224445 | Corvus monedula | Nov. 14, 1903 | do | do | 5.35 | ? | ? | 6.35 | 118.69 | ? | | | 5.26 | 98.32 |
| 224442 | Mimus polyglottus | Nov. 10, 1903 | do | do | 1.35 | ? | ? | 1.58 | 117.03 | ? | | | 1.25 | 92.59 |
| 224441 | Amazona panamensis | do | do | do | 8.35 | 11.8 | 141.31 | 10.43 | 124.91 | −11.61 | | | 6.80 | 81.44 |
| 224439 | Callopsittacus novæ hollandiæ | Nov. 4, 1903 | do | do | 2.75 | ? | ? | ? | ? | ? | | | 2.55 | 92.73 |
| 224433 | Colinus virginianus | Oct. 30, 1903 | do | do | 1.2 | ? | ? | 1.26 | 105.0 | ? | | | 1.05 | 87.50 |
| 224435 | Fulica americana | Oct. 24, 1903 | Not fully adult. | do | 2.7 | 3.4 | 125.93 | 3.05 | 112.96 | −10.30 | | | 2.5 | 92.59 |
| 224926 | Amazona leucocephala | Jan. 19, 1904 | Young | do | 7.2 | 8.5 | 118.05 | 7.92 | 110.0 | − 6.82 | | | 6.2 | 86.11 |

AVERAGES.

| Subject. | Per cent of original weight at the end of— | | | Subject. | Per cent of original weight at the end of— | | |
|---|---|---|---|---|---|---|---|
| | First week. | First month. | 18 months. | | First week. | First month. | 18 months. |
| ADULT. | | | | YOUNG. | | | |
| Mammals | (4) 128.06 | (4) 123.96 | (6) 92.66 | Mammals | | | |
| Birds | (2) 135.04 | (6) 119.86 | (7) 91.33 | Birds | (2) 121.99 | (2) 111.48 | (2) 89.35 |

*Solution: 15 per cent of formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. | Weight of brain after 18 months. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | | *Grams.* | |
| 224936 | Sciurus hudsonicus | Feb. 26, 1904 | Adult | Medium | 4.1 | ? | ? | 4.25 | 103.66 | ? | | | 3.4 | 82.93 |
| 224915 | Sciurus rufiventer | Jan. 2, 1904 | do | do | 9.05 | ? | ? | 10.17 | 112.37 | ? | | | 8.09 | 89.39 |
| 224914 | Mus musculus | Dec. 18, 1903 | do | do | .45 | 0.49 | 108.89 | ? | ? | ? | | | .35 | 77.78 |
| 224951 | Geomys bursarius | Apr. 18, 1904 | do | do | 2.83 | ? | ? | 3.1 | 109.54 | ? | 2.8 | 98.94 | | |
| 224818 | Dasyurus maculatus | Jan. 2, 1904 | do | do | 4.07 | ? | ? | 4.28 | 106.16 | ? | | | 3.35 | 82.31 |
| 224954 | Acanthis cannabina | Apr. 29, 1904 | do | do | .69 | ? | ? | .8 | 115.94 | ? | | | | |
| 224940 | Munia oryzivora | Mar. 15, 1904 | do | do | .75 | ? | ? | .68 | 90.67 | ? | | | .65 | 86.67 |
| 224931 | Serinus | Feb. 5, 1904 | do | do | .56 | ? | ? | .53 | 94.64 | ? | | | .48 | 85.71 |
| 224906 | Alauda arvensis | Dec. 16, 1903 | do | do | .7 | .78 | 111.43 | .71 | 101.43 | −8.98 | | | .6 | 85.71 |
| 224450 | Zonotrichia albicollis | Nov. 30, 1903 | do | do | 1.07 | 1.2 | 112.15 | 1.07 | 100.00 | −10.84 | | | .8 | 74.77 |
| 224923 | Turtur risorius | Jan. 12, 1904 | do | do | 1.05 | ? | ? | 1.03 | 98.09 | ? | | | .83 | 79.05 |
| 224918 | Pigmy pouter pigeon | Jan. 5, 1904 | do | do | 2.0 | ? | ? | 1.99 | 99.50 | ? | | | 1.6 | 80.00 |
| 224945 | Ice pigeon | Mar. 29, 1904 | do | do | 2.12 | ? | ? | 2.0 | 94.34 | ? | | | | |
| 224902 | Psittacus erithacus | Dec. 3, 1903 | do | do | 9.75 | 11.18 | 114.66 | 10.56 | 108.31 | −5.55 | | | 8.0 | 82.05 |
| 224919 | Amazona leucocephala | Jan. 7, 1904 | do | do | 6.9 | 8.27 | 119.85 | 7.28 | 105.51 | −11.97 | | | 5.5 | 79.71 |
| 224920 | do | Jan. 9, 1904 | do | do | 6.02 | 7.87 | 118.88 | 7.15 | 108.00 | −9.15 | | | 5.3 | 80.06 |
| 224922 | Melopsittacus undulatus | Jan. 12, 1904 | do | do | 1.2 | ? | ? | 1.18 | 98.33 | ? | | | .96 | 81.67 |
| 224747 | Aquila chrysætos | Feb. 6, 1904 | do | do | 18.06 | 19.35 | 107.14 | 18.65 | 103.27 | −3.62 | | | 15.9 | 88.04 |
| 224912 | Falco sparverius | Dec. 22, 1903 | do | do | 2.75 | ? | ? | 3.34 | 121.45 | ? | | | | |
| 224449 | Cathartes aura | Nov. 27, 1903 | do | do | 11.6 | ? | ? | 12.11 | 104.39 | ? | | | 8.9 | 76.72 |
| 224827 | Bubo virginianus | Dec. 16, 1903 | do | do | 13.65 | 16.7 | 122.34 | 15.23 | 111.57 | −8.81 | | | 11.1 | 81.32 |
| 224924 | Pavo cristatus | Jan. 12, 1904 | do | do | 6.7 | ? | ? | 7.0 | 104.48 | ? | | | 5.65 | 84.33 |
| 224938 | "Brahma chicken" | Mar. 12, 1904 | do | do | 4.22 | 4.74 | 112.32 | 4.28 | 101.42 | −9.71 | | | 3.6 | 85.31 |
| 224925 | Aix galericulata | Jan. 12, 1904 | do | do | 4.22 | ? | ? | 4.42 | 104.74 | ? | | | 34.0 | 80.57 |
| 224949 | "White Pekin" duck | Apr. 15, 1904 | do | do | 6.18 | ? | ? | 6.57 | 106.31 | ? | | | | |
| 224744 | Canis occidentalis | Apr. 22, 1904 | 30 days | do | 46.0 | 61.0 | 132.48 | 59.0 | 128.26 | −3.28 | 46.0 | 100.0 | | |

*Solution: 15 per cent of formalin*—Continued.

AVERAGES.

| Subject. | Per cent of original weight at the end of— | | | | Subject. | Per cent of original weight at the end of— | | | |
|---|---|---|---|---|---|---|---|---|---|
| | First week. | First month. | 1 year. | 18 months. | | First week. | First month. | 1 year. | 18 months. |
| ADULT. | | | | | YOUNG. | | | | |
| Mammals | | (4) 107.68 | | (4) 83.10 | Mammals | (1) 132.48 | (1) 128.26 | (1) 100.00 | |
| Birds | (8) 114.85 | (20) 108.61 | | (16) 81.98 | Birds | | | | |

*Solution: 1,030 specific gravity salt solution with 5 per cent formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 6 months. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | |
| 228209 | Midas œdipus | Apr. 24, 1905 | Adult | Medium | 8.8 | 8.6 | 97.72 | 8.0 | 90.91 | − 8.14 | | |
| 228139 | Lemur macaco | Feb. 6, 1905 | do | do | 25.5 | 25.8 | 101.17 | 25.5 | 100.00 | − 1.17 | 23.0 | 90.19 |
| 228143 | Lemur varius | Feb. 17, 1905 | do | do | 24.0 | 24.8 | 103.33 | 23.9 | 99.58 | − 3.63 | 21.7 | 90.42 |
| 228160 | Mustela americana | May 4, 1905 | do | do | 15.3 | 15.1 | 94.92 | 14.7 | 96.08 | − 2.65 | | |
| 228150 | Melursus ursinus | Mar. 11, 1905 | do | do | 267.0 | 251.0 | 94.00 | 248.5 | 93.07 | − 1.00 | 235.0 | 88.01 |
| 228136 | Felis yagouaroundi | Feb. 1, 1905 | do | do | 40.0 | 39.0 | 97.50 | 38.0 | 95.00 | − 2.56 | 34.0 | 85.00 |
| 228134 | Felis onca | Jan. 30, 1905 | do | do | 159.5 | 155.5 | 97.49 | 152.5 | 95.61 | − 1.93 | 136.0 | 85.26 |
| 228131 | do | Jan. 19, 1905 | do | do | 121.0 | 119.0 | 98.34 | 117.0 | 96.69 | − 1.68 | 105.5 | 87.19 |
| 228154 | Lynx canadensis | Mar. 29, 1905 | do | do | 69.5 | 67.5 | 97.12 | 66.5 | 95.68 | − 1.48 | | |
| 228129 | do | Jan. 27, 1905 | do | do | 56.7 | 56.0 | 98.76 | 54.0 | 95.23 | − 3.57 | 46.3 | 81.66 |
| 228132 | Hystrix cristata | Jan. 30, 1905 | do | do | 24.2 | 23.5 | 97.11 | 22.5 | 92.98 | − 4.26 | 18.3 | 75.62 |
| 228158 | Perodipus richardsoni | Apr. 18, 1905 | do | do | 7.3 | 7.22 | 98.90 | 6.65 | 91.09 | − 7.90 | | |
| 228144 | do | Feb. 18, 1905 | do | do | 11.97 | 11.8 | 98.58 | 11.05 | 92.31 | − 6.36 | 9.23 | 77.19 |
| 228135 | Capromys pilorides | Jan. 31, 1905 | do | do | 11.09 | 11.2 | 100.99 | 9.95 | 89.72 | −11.16 | 9.18 | 82.78 |
| 228133 | do | Jan. 30, 1905 | do | do | 10.55 | 10.6 | 100.47 | 10.72 | 101.61 | + 1.13 | 8.6 | 81.52 |
| 228151 | Ovis tragelaphus | Mar. 11, 1905 | do | do | 209.5 | 205.5 | 98.09 | 201.5 | 96.18 | − 1.95 | 184.0 | 87.33 |
| 228155 | Boselaphus tragocamelus | Apr. 6, 1905 | do | do | 258.0 | 249.0 | 96.51 | 235.0 | 91.08 | − 5.62 | | |
| 228147 | Odocoileus columbianus | Feb. 27, 1905 | do | do | 188.3 | 183.0 | 97.18 | 182.0 | 96.65 | − .55 | 170.5 | 90.55 |
| 228140 | Odocoileus truei | Feb. 6, 1905 | do | do | 127.4 | 127.0 | 99.68 | 125.5 | 98.51 | − 1.18 | 113.5 | 89.09 |
| 228149 | Petrogale sp.? | Mar. 6, 1905 | do | do | 39.8 | 40.0 | 100.50 | 38.5 | 96.73 | − 3.75 | 35.0 | 87.94 |
| 228148 | do | Mar. 2, 1905 | do | do | 34.5 | 33.0 | 95.65 | 32.5 | 94.20 | − 1.52 | 30.0 | 86.96 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 228142 | Onychogale frenata | Feb. 9, 1905 | ....do | .....do | 16.2 | 15.95 | 98.45 | 15.7 | 96.91 | − 1.57 | 13.5 | 83.33 |
| 228128 | Trichosurus vulpecula | Jan. 20, 1905 | ....do | .....do | 9.7 | 9.8 | 101.03 | 9.5 | 97.94 | − 3.06 | 7.75 | 79.90 |
| 228141 | .....do | Feb. 8, 1905 | ....do | .....do | 11.0 | 11.05 | 100.46 | 10.62 | 96.54 | + 5.67 | 8.65 | 78.64 |
| 224996 | Cyanocitta cristata | Jan. 9, 1905 | ....do | .....do | 2.98 | 2.9 | 97.32 | 2.65 | 88.92 | − 8.62 | 2.2 | 75.50 |
| 228208 | Fringilla celebs | Apr. 24, 1905 | ....do | .....do | .78 | .74 | 94.87 | .5 | 64.10 | − 32.43 | ..... | ..... |
| 228206 | Turtle dove | Apr. 17, 1905 | ....do | .....do | 1.35 | 1.2 | 88.89 | 1.05 | 77.78 | − 12.50 | ..... | ..... |
| 224997 | Melopsittacus undulatus | Jan. 25, 1905 | ....do | .....do | 1.4 | 1.35 | 96.43 | 1.2 | 85.71 | −11.11 | .95 | 67.86 |
| 224995 | Buteo lineatus | Jan. 5, 1905 | ....do | .....do | 7.4 | 7.14 | 96.48 | 6.52 | 88.11 | − 8.69 | 5.4 | 72.97 |
| 228201 | Cathartes aura | Jan. 30, 1905 | ....do | .....do | 10.8 | 11.05 | 102.31 | 9.6 | 88.89 | −13.13 | 8.9 | 82.41 |
| 228202 | .....do | Feb. 11, 1905 | ....do | .....do | 9.85 | 10.1 | 102.53 | 9.3 | 94.42 | − 7.92 | 7.45 | 75.63 |
| 228137 | Ardea tricolor ruficollis | Feb. 2, 1905 | ....do | .....do | 3.45 | 3.35 | 97.10 | 3.19 | 92.46 | − 4.78 | 2.5 | 72.46 |
| 228159 | .....do | Apr. 27, 1905 | ....do | .....do | 3.4 | 3.1 | 91.17 | 2.7 | 79.41 | −12.91 | ..... | ..... |
| 228153 | Botaurus lentiginosus | Mar. 23, 1905 | ....do | .....do | 5.15 | 5.15 | 100.00 | 4.7 | 91.26 | − 8.74 | ..... | ..... |
| 228145 | Tantalus loculator | Feb. 23, 1905 | ....do | .....do | 14.85 | 15.0 | 101.01 | 14.75 | 99.32 | − 2.00 | 12.5 | 84.18 |
| 228207 | "Black Minorcka" rooster | Apr. 19, 1905 | ....do | .....do | 3.8 | 3.55 | 93.42 | 3.2 | 84.21 | − 9.86 | ..... | ..... |
| 228204 | Lophortyx californicus | Apr. 10, 1905 | ....do | .....do | 1.5 | 1.6 | 106.67 | 1.35 | 90.00 | −15.62 | ..... | ..... |
| 228205 | Callipepla squamata | Apr. 11, 1905 | ....do | .....do | 1.5 | 1.55 | 103.33 | 1.3 | 86.67 | −16.13 | ..... | ..... |
| 228146 | Cygnus gigbus | Feb. 23, 1905 | ....do | .....do | 16.4 | 16.27 | 99.21 | 16.2 | 98.78 | − .44 | 13.5 | 82.32 |
| 228203 | .....do | Mar. 28, 1905 | ....do | .....do | 14.4 | 14.0 | 97.29 | 13.7 | 95.14 | − 2.14 | ..... | ..... |
| 228156 | Anas carolinensis | Apr. 14, 1905 | ....do | .....do | 4.0 | 3.7 | 92.50 | 2.7 | 67.50 | −27.03 | ..... | ..... |
| 228152 | .....do | Mar. 14, 1905 | ....do | .....do | 3.45 | ? | ? | 2.9 | 84.06 | ? | 2.45 | 71.01 |
| 228130 | Anas obscura | Jan. 28, 1905 | ....do | .....do | 7.25 | 7.17 | 98.89 | 6.6 | 91.03 | − 7.95 | 5.35 | 73.79 |

AVERAGES.

| Subject. | Per cent of original weight at the end of— | | | Subject. | Per cent of original weight at the end of— | | |
|---|---|---|---|---|---|---|---|
| | First week. | First month. | Sixth month. | | First week. | First month. | Sixth month. |
| ADULT. | | | | YOUNG. | | | |
| Mammals | (24) 98.49 | (24) 95.43 | (19) 84.69 | Mammals | | | |
| Birds | (18) 97.75 | (19) 86.72 | (10) 75.81 | Birds | | | |

*Solution: 1,035 specific gravity salt solution, with 5 per cent formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 6 months. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | |
| 228125 | Procyon lotor | Jan. 10, 1905 | Adult | Medium | 36.1 | 35.2 | 97.51 | 34.3 | 95.01 | −2.56 | 31.0 | 85.87 |
| 228127 | Nasua rufa | Jan. 18, 1905 | do | do | 34.0 | 33.9 | 99.70 | 32.5 | 95.58 | −4.13 | 29.3 | 86.18 |
| 228123 | Felis pardalis | Jan. 9, 1905 | do | do | 62.7 | 63.1 | 100.63 | 61.5 | 98.09 | −2.54 | 55.5 | 88.52 |
| 228122 | Felis cacomitli | Jan. 7, 1905 | do | do | 41.9 | 40.9 | 97.61 | 39.0 | 93.08 | −4.65 | 36.0 | 85.92 |
| 228124 | Thylacynus cynocephalus | Jan. 11, 1905 | do | do | 43.0 | 42.3 | 98.37 | 41.8 | 97.21 | −1.18 | 40.2 | 93.49 |
| 228121 | Botaurus lentiginosus | Jan. 6, 1905 | do | do | 4.4 | 4.19 | 95.23 | 3.9 | 88.63 | −6.92 | 3.3 | 75.00 |

AVERAGES.

| Subject. | Per cent of original weight at the end of— | | | Subject. | Per cent of original weight at the end of— | | |
|---|---|---|---|---|---|---|---|
| | First week. | First month. | Sixth month. | | First week. | First month. | Sixth month. |
| ADULT. | | | | YOUNG. | | | |
| Mammals | (5) 98.76 | (5) 95.79 | (5) 88.00 | Mammals | | | |
| Birds | (1) 95.23 | (1) 88.63 | (1) 75.00 | Birds | | | |

*Solution: One-half saturated solution of alum, with 5 per cent formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 9 months. | Per cent of original weight. | Weight of brain after 1 year. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | | *Grams.* | |
| 224959 | Cercocebus fuliginosus | Sept. 2, 1904 | Adult | Medium | 105.0 | 110.0 | 104.76 | 90.5 | 86.19 | −17.74 | 83.0 | 79.05 | | |
| 228117 | do | Dec. 15, 1904 | do | do | 108.0 | 121.0 | 112.03 | 109.8 | 101.67 | − 9.26 | | | | |
| 228085 | Macacus fascicularis | Oct. 17, 1904 | do | do | 69.75 | 70.5 | 101.09 | 63.9 | 91.61 | − 9.36 | 60.0 | 86.02 | | |
| 228080 | Cercopithecus callitrichus | Sept. 26, 1904 | do | do | 71.9 | 76.5 | 106.39 | 69.5 | 96.66 | − 9.15 | 64.0 | 89.01 | | |
| 224971 | Marmoset | Oct. 24, 1904 | do | do | 8.8 | 8.02 | 91.13 | 7.6 | 86.36 | − 5.24 | 7.15 | 81.25 | | |
| 224970 | do | Oct. 21, 1904 | do | do | 7.1 | 6.65 | 93.66 | 6.15 | 86.62 | − 7.52 | 5.77 | 81.26 | | |
| 224969 | do | do | do | do | 7.35 | 6.67 | 90.74 | 5.8 | 78.91 | −13.05 | 5.33 | 72.51 | | |
| 224961 | do | Oct. 5, 1904 | do | do | 7.77 | 7.77 | 100.0 | 6.89 | 88.67 | −11.33 | 6.2 | 79.79 | | |
| 224964 | Putorius nigripes | Oct. 14, 1904 | do | do | 7.8 | 7.2 | 92.31 | 6.7 | 85.89 | − 6.95 | 6.4 | 82.05 | | |
| 228103 | Potos caudivolvulus | Nov. 17, 1904 | do | do | 35.1 | 35.55 | 101.29 | 32.0 | 91.17 | − 9.99 | 29.0 | 82.62 | | |
| 228082 | Fox terrier | Oct. 7, 1904 | do | Slightly congested. | 65.7 | 67.7 | 103.04 | 61.2 | 91.63 | − 9.61 | 58.2 | 88.59 | | |
| 224816 | Vulpes velox | Mar. 5, 1904 | do | Medium | 33.35 | 36.4 | 109.15 | 33.0 | 98.95 | − 9.34 | | | | |
| 228118 | Canis mesomelas | Dec. 17, 1904 | do | do | 60.6 | 64.2 | 105.96 | 53.0 | 87.46 | −17.48 | | | | |
| 224974 | Lepus | Nov. 4, 1904 | do | do | 9.14 | 8.36 | 91.46 | ? | ? | ? | 6.8 | 74.40 | | |
| 228090 | Dasyprocta agouti | Nov. 2, 1904 | do | do | 19.1 | 19.05 | 99.74 | ? | ? | ? | 16.5 | 86.38 | | |
| 228114 | Myoprocta acouchy | Dec. 12, 1904 | do | do | 9.9 | 8.79 | 88.78 | 8.49 | 85.76 | − 3.42 | | | | |
| 224976 | Fiber zibethicus | Nov. 8, 1904 | do | do | 5.59 | 5.07 | 90.70 | 4.7 | 84.07 | − 7.30 | 4.25 | 76.03 | | |
| 224966 | Mus norvegicus | Oct. 17, 1904 | do | do | 2.6 | 2.3 | 88.46 | 2.05 | 78.85 | −10.87 | 2.0 | 76.92 | | |
| 224977 | Sciuropterus volans | Nov. 9, 1904 | do | Above medium. | 1.8 | 1.59 | 88.33 | 1.55 | 86.11 | − 2.52 | 1.38 | 76.67 | | |
| 228073 | Ovis canadensis | Aug. 30, 1904 | do | Medium | 198.0 | 187.3 | 94.59 | 171.5 | 86.62 | − 8.44 | | | 157.0 | 79.29 |
| 228068 | Antilope cervicapra | Aug. 17, 1904 | do | do | 114.0 | 113.8 | 99.82 | 110.8 | 97.19 | − 2.64 | | | 91.0 | 79.82 |
| 228092 | Alces americanus | Nov. 4, 1904 | do | do | 337.2 | 345.7 | 102.52 | 285.3 | 84.61 | −17.48 | 256.5 | 76.07 | | |
| 228074 | Cervus canadensis | Sept. 23, 1904 | Adult (7 years). | do | 461.1 | 468.5 | 101.63 | 449.0 | 97.59 | − 4.17 | 429.0 | 93.04 | | |
| 228079 | Cervus dama | Sept. 24, 1904 | Adult | do | 224.5 | 224.8 | 100.13 | 216.0 | 96.21 | − 3.92 | 189.5 | 84.41 | | |
| 228087 | Odocoileus virginianus | Oct. 22, 1904 | do | do | 174.7 | 170.7 | 97.71 | 156.0 | 89.29 | − 8.61 | 137.5 | 78.71 | | |
| 228113 | Capreolus caprea | Dec. 12, 1904 | do | do | 94.5 | 88.5 | 93.65 | 82.0 | 86.77 | − 7.35 | | | | |
| 228078 | Odocoileus hemionus | Sept. 17, 1904 | do | do | 128.2 | 118.7 | 92.59 | 102.5 | 79.95 | −13.65 | 92.0 | 71.76 | | |
| 228072 | do | Aug. 29, 1904 | do | do | 112.0 | 125.1 | 111.69 | 112.1 | 100.09 | −10.40 | | | 96.0 | 85.71 |
| 228070 | Tayassu tajacu | Aug. 23, 1904 | do | do | 101.0 | 102.07 | 101.06 | 91.6 | 90.69 | −10.26 | | | 85.0 | 84.16 |
| 224965 | Cyanocitta cristata | Oct. 15, 1904 | do | do | 3.02 | 2.87 | 95.03 | 2.8 | 92.71 | − 2.44 | 2.6 | 86.09 | | |
| 224975 | Munia | Nov. 7, 1904 | do | do | .52 | .37 | 71.15 | .33 | 63.46 | −10.81 | .35 | 67.31 | | |
| 228083 | Lanius collurio | Oct. 11, 1904 | do | do | 2.38 | 2.25 | 94.54 | 2.08 | 87.39 | − 7.56 | 1.85 | 77.73 | | |
| 228097 | Paroaria larvata | Nov. 15, 1904 | do | do | 1.15 | .99 | 86.09 | .99 | 86.09 | | .85 | 73.91 | | |

*Solution: One-half saturated solution of alum, with 5 per cent formalin*—Continued.

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 9 months. | Per cent of original weight. | Weight of brain after 1 year. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | | *Grams.* | |
| 228098 | Paroaria larvata | Nov. 15, 1904 | Adult | Medium | 1.25 | 1.1 | 88.00 | 1.03 | 82.40 | − 6.37 | .9 | 72.00 | ..... | ..... |
| 228099 | Paroaria cucullata | ....do | ....do | ....do | 1.15 | 1.04 | 90.43 | 1.07 | 93.04 | + 2.88 | .88 | 76.52 | ..... | ..... |
| 224973 | Merula merula | Oct. 27, 1904 | Adult | Medium | 1.6 | 1.5 | 93.75 | 1.45 | 90.62 | − 3.33 | 1.35 | 84.37 | ..... | ..... |
| 224968 | Ocyphaps lophotes | Oct. 19, 1904 | ....do | ....do | 1.72 | 1.67 | 97.09 | 1.62 | 94.18 | − 3.00 | 1.5 | 87.21 | ..... | ..... |
| 224962 | ....do | Oct. 8, 1904 | ....do | ....do | 1.67 | 1.59 | 95.21 | 1.39 | 83.23 | −12.58 | 1.3 | 77.84 | ..... | ..... |
| 224978 | Domestic pigeon | Nov. 9, 1904 | ....do | ....do | 1.97 | 1.77 | 89.85 | 1.67 | 84.77 | − 5.65 | 1.5 | 76.14 | ..... | ..... |
| 224958 | Amazona panamensis | Sept. 1, 1904 | ....do | Slight submedium. | 9.46 | ? | ? | 8.4 | 88.79 | ? | 7.6 | 80.34 | ..... | ..... |
| 224960 | ....do | Sept. 10, 1904 | ....do | Medium | 8.9 | 7.8 | 87.64 | 7.32 | 82.24 | − 6.16 | 6.8 | 76.40 | ..... | ..... |
| 224963 | Amazona leucocephala | Oct. 11, 1904 | ....do | ....do | 5.8 | 5.65 | 97.41 | 5.32 | 91.72 | − 5.34 | 5.15 | 88.79 | ..... | ..... |
| 224972 | ....do | Oct. 27, 1904 | ....do | ....do | 8.3 | 7.39 | 89.03 | 6.80 | 81.92 | − 7.99 | 6.25 | 75.30 | ..... | ..... |
| 224980 | Amazona oratrix | Nov. 10, 1904 | ....do | ....do | 10.35 | 9.2 | 88.89 | 8.4 | 81.16 | − 8.70 | 7.65 | 73.91 | ..... | ..... |
| 224981 | Syrnium varium | Nov. 21, 1904 | ....do | ....do | 12.5 | 12.89 | 103.12 | 11.75 | 94.00 | − 8.84 | 10.5 | 84.00 | ..... | ..... |
| 228081 | Strix pratincola | Oct. 6, 1904 | ....do | ....do | 6.7 | 6.85 | 102.24 | 5.95 | 88.81 | −13.14 | 5.4 | 80.59 | ..... | ..... |
| 228116 | Bubo virginianus | Dec. 14, 1904 | ....do | ....do | 14.42 | 16.9 | 117.19 | 14.3 | 99.17 | −15.39 | ..... | ..... | ..... | ..... |
| 228071 | Florida cærulea | Aug. 25, 1904 | ....do | ....do | 3.7 | 3.52 | 95.13 | 3.15 | 85.13 | −10.52 | ..... | ..... | ..... | ..... |
| 228091 | ....do | Nov. 2, 1904 | ....do | ....do | 3.78 | 3.72 | 98.41 | 3.4 | 89.95 | − 8.61 | 3.0 | 79.37 | ..... | ..... |
| 228093 | Plegadis guarana | Nov. 12, 1904 | ....do | ....do | 4.6 | 4.24 | 92.17 | 4.07 | 88.47 | − 4.01 | 3.6 | 78.26 | ..... | ..... |
| 224979 | Lophortyx californicus | Nov. 10, 1904 | ....do | ....do | 1.22 | 1.17 | 95.90 | 1.1 | 90.16 | − 5.99 | 1.0 | 81.97 | ..... | ..... |
| 228100 | Grosbeak | Nov. 16, 1904 | ....do | ....do | 1.1 | 1.12 | 101.82 | 1.16 | 105.45 | + 3.57 | .9 | 81.81 | ..... | ..... |
| 228102 | Rail | ....do | ....do | ....do | 1.4 | 1.39 | 99.28 | 1.30 | 92.86 | − 6.26 | 1.1 | 78.57 | ..... | ..... |
| 228096 | Larus argentatus | Nov. 12, 1904 | ....do | ....do | 7.35 | 6.84 | 93.06 | 6.45 | 87.75 | − 5.71 | 6.0 | 81.63 | ..... | ..... |
| 228064 | Phœnicopterus ruber | Aug. 8, 1904 | ....do | ....do | 10.26 | 9.85 | 96.00 | 8.95 | 87.23 | − 9.14 | ..... | ..... | ..... | ..... |
| 228067 | ....do | Aug. 17, 1904 | ....do | ....do | 10.55 | 10.25 | 97.15 | 9.4 | 89.09 | − 8.29 | ..... | ..... | ..... | ..... |
| 228101 | Cygnus olor | Nov. 16, 1904 | ....do | ....do | 14.5 | 13.94 | 96.14 | 12.9 | 88.96 | − 7.46 | 11.7 | 80.69 | ..... | ..... |
| 224999 | Shuffler duck | Oct. 28, 1904 | ....do | ....do | 4.19 | 3.85 | 91.88 | 3.6 | 85.92 | − 6.49 | 3.3 | 78.76 | ..... | ..... |
| 225000 | ....do | ....do | ....do | ....do | 4.09 | 3.72 | 90.95 | 3.5 | 85.57 | − 5.92 | 3.2 | 78.24 | ..... | ..... |
| 228095 | Nettion carolinensis | Nov. 12, 1904 | ....do | ....do | 3.15 | 3.05 | 96.82 | 2.92 | 92.69 | − 4.27 | 2.6 | 82.54 | ..... | ..... |
| 228094 | ....do | ....do | ....do | ....do | 2.95 | 2.92 | 98.98 | 2.80 | 94.91 | − 8.52 | 2.5 | 84.75 | ..... | ..... |
| 228104 | Casuarius galeatus | Nov. 22, 1904 | ....do | ....do | ? | 31.7 | ? | 29.0 | ? | − 8.52 | 27.0 | ..... | ..... | ..... |
| 228077 | Dromaius novæ hollandiæ | Sept. 17, 1904 | ....do | ....do | 20.3 | 18.3 | 90.14 | 17.1 | 84.23 | − 6.56 | 15.85 | 78.08 | ..... | ..... |
| 228089 | Felis serval | Oct. 25, 1904 | Nearly adult. | ....do | 50.5 | 48.9 | 96.83 | 42.7 | 84.55 | −12.68 | 38.0 | 75.25 | ..... | ..... |
| 228088 | Capreolus caprea | Oct. 24, 1904 | ....do | ....do | 103.5 | 98.5 | 95.17 | 88.45 | 85.46 | −10.20 | 80.5 | 77.78 | ..... | ..... |
| 228069 | Trichosurus vulpecula | Aug. 20, 1904 | Adolescent. | ....do | 8.97 | 8.45 | 94.20 | 7.95 | 88.63 | − 5.92 | ..... | ..... | ..... | ..... |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 228075 | Ovis tragelaphus | Sept. 8, 1904 | 1 year | do | 215.0 | 207.3 | 96.42 | 190.0 | 88.37 | − 8.35 | 181.0 | 84.18 | | | | |
| 228065 | Antilope cervicapra | Aug. 16, 1904 | Young | do | 98.5 | 96.55 | 98.02 | 81.6 | 82.08 | − 5.49 | | | | | | |
| 228069 | Cervus canadensis | Sept. 23, 1904 | do | do | 374.8 | 360.2 | 96.10 | 349.5 | 93.25 | − 2.97 | 308.0 | 82.17 | | | | |
| 228046 | Odocoileus virginianus | Oct. 22, 1904 | do | do | 133.0 | 126.2 | 94.88 | 111.8 | 84.06 | −13.47 | 95.0 | 71.43 | | | | |
| 228084 | Capreolus caprea | Oct. 12, 1904 | do | do | 90.0 | 86.7 | 96.33 | 75.5 | 83.89 | −12.92 | 68.5 | 76.11 | | | | |
| 228066 | do | Aug. 17, 1904 | do | do | 85.0 | 83.75 | 98.76 | 74.5 | 87.65 | −11.05 | | | | | | |

AVERAGES.

| Subject. | Per cent of original weight— | | | Subject. | Per cent of original weight— | | |
|---|---|---|---|---|---|---|---|
| | At the end of first week. | At the end of first month. | After 9 months. | | At the end of first week. | At the end of first month. | After 9 months. |
| ADULT. | | | | YOUNG. | | | |
| Mammals | (29) 96.43 | (28) 89.31 | (20) 80.83 | Mammals | (9) 96.30 | (9) 86.44 | (6) 77.82 |
| Birds | (32) 94.38 | (33) 88.31 | (29) 79.74 | Birds | | | |

*Solution: One-half saturated solution of alum, with 10 per cent formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 6 months. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | |
| 224845 | Negro man (full blood) | Nov. 1, 1904 | 45 years. | Medium | 1,540.0 | 1,528.5 | 99.22 | 1,475.6 | 95.78 | − 3.47 | 1,467.0 | 95.20 |
| 228040 | Negro woman (full blood) | Dec. 14, 1904 | Adult | do | 1,209.0 | 1,254.5 | 103.72 | 1,166.7 | 96.50 | − 7.00 | 1,157.0 | 95.70 |
| 228110 | Ateles geoffroyi | Dec. 6, 1904 | do | do | 95.5 | 93.5 | 97.90 | 86.5 | 90.57 | − 7.49 | 79.0 | 82.72 |
| 228106 | Lemur varius | Dec. 1, 1904 | do | do | 21.8 | 20.8 | 95.41 | 18.3 | 83.94 | −12.02 | 17.2 | 78.90 |
| 228112 | Phoca vitulina | Dec. 7, 1904 | do | do | 225.0 | 225.7 | 100.31 | 216.5 | 96.22 | − 4.08 | 179.4 | 79.73 |
| 224988 | Putorius putorius | Dec. 4, 1904 | do | do | 7.87 | 7.2 | 91.48 | 6.3 | 80.05 | −12.50 | 6.16 | 78.27 |
| 224993 | Sciurus carolinensis | Dec. 28, 1904 | do | do | 8.25 | 8.0 | 96.97 | 7.05 | 85.45 | −11.88 | 6.17 | 74.78 |
| 224987 | Microtis pennsylvanicus | Dec. 2, 1904 | do | do | .9 | .7 | 77.78 | .69 | 76.67 | − 1.43 | .66 | 73.33 |
| 228111 | Antilocapra americana | Dec. 6, 1904 | do | do | 130.2 | 129.2 | 99.23 | 121.0 | 92.93 | − 6.35 | 110.7 | 85.02 |
| 228115 | Trichosurus fuliginosus | Dec. 13, 1904 | do | do | 12.27 | 12.9 | 105.13 | 11.07 | 90.22 | −14.19 | 10.0 | 81.50 |
| 228120 | Dasyurus maculatus | Dec. 22, 1904 | do | do | 5.35 | 5.09 | 95.14 | 4.67 | 87.29 | − 8.24 | 4.30 | 80.37 |
| 224986 | Corvus brachyrhynchus | Nov. 30, 1904 | do | do | 8.55 | 8.2 | 95.91 | 7.69 | 89.94 | − 6.22 | 7.15 | 83.63 |
| 228105 | Xanthura luxuosa | Nov. 23, 1904 | do | do | 2.4 | 2.1 | 87.50 | 2.07 | 86.25 | − 1.43 | 1.84 | 76.67 |
| 224989 | Sylvia atricapilla | Dec. 5, 1904 | do | do | .75 | .67 | 89.33 | .60 | 80.00 | −10.45 | .51 | 68.00 |
| 224990 | Mimus polyglottus | do | do | do | 1.3 | 1.3 | 100.00 | 1.19 | 91.54 | − 8.46 | 1.07 | 82.31 |
| 224983 | Erithacus rubecula | Nov. 27, 1904 | do | do | .75 | .6 | 80.00 | .51 | 68.00 | −12.0 | .5 | 66.67 |
| 224992 | Leiothrix lutea | Dec. 17, 1904 | do | do | 1.07 | .9 | 84.11 | .82 | 76.63 | − 8.89 | .76 | 71.03 |
| 224985 | Columbigallina | Nov. 29, 1904 | do | do | .6 | .54 | 90.00 | .45 | 75.00 | −16.67 | .45 | 75.00 |
| 224982 | Megascops asio | Nov. 25, 1904 | do | do | 5.6 | 5.1 | 91.07 | 4.63 | 82.67 | − 9.22 | 4.35 | 77.68 |
| 224991 | Strix pratincola | Dec. 12, 1904 | do | do | 8.0 | 7.15 | 89.37 | 6.8 | 85.00 | − 4.90 | 6.4 | 80.00 |
| 224994 | Bonasa umbellus | Jan. 3, 1905 | do | do | 2.7 | 2.25 | 83.33 | 2.2 | 81.48 | − 2.22 | 2.1 | 77.78 |
| 224984 | Larus argentatus | Nov. 28, 1904 | do | do | 7.02 | 6.4 | 91.16 | 5.92 | 84.33 | − 7.50 | 5.65 | 80.48 |
| 228119 | Canis dingo | Dec. 21, 1904 | 20 days | do | 25.07 | 25.27 | 100.79 | 20.89 | 83.32 | −17.33 | 19.0 | 75.79 |
| 228109 | do | Dec. 5, 1904 | 4 days | do | 9.55 | 8.99 | 94.13 | 7.32 | 76.75 | −18.58 | 7.22 | 75.60 |
| 228108 | do | do | do | do | 9.25 | 8.45 | 91.35 | 7.19 | 77.73 | −14.91 | 6.46 | 69.84 |
| 228107 | do | do | do | do | 9.44 | 9.47 | 100.32 | 8.05 | 85.27 | −15.00 | 6.7 | 70.98 |

*Solution: One-half saturated solution of alum, with 10 per cent formalin*—Continued.

AVERAGES.

| Subject. | Per cent of original weight— At the end of 1 week. | At the end of 1 month. | After 6 months. | Subject. | Per cent of original weight— At the end of 1 week. | At the end of 1 month. | After 6 months. |
|---|---|---|---|---|---|---|---|
| ADULTS. | | | | YOUNG. | | | |
| Human subjects | (2) 101.47 | (2) 96.14 | (2) 95.45 | Human subjects | | | |
| Mammals | (9) 96.48 | (9) 87.04 | (9) 79.40 | Mammals | (4) 96.65 | (4) 80.77 | (4) 73.05 |
| Birds | (11) 89.25 | (11) 81.89 | (11) 76.30 | Birds | | | |

*Solution: One-third saturated solution of alum, with 5 per cent formalin.*

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | |
| 224753 | Negro man (full blood) | July 30, 1904 | 47 years | Pronounced serous congestion. | 1,300.0 | 1,366.0 | 105.07 | | | | 1,229.5 | 94.57 |
| 224811 | Papio doguera | July 5, 1904 | Adult | Medium | 182.0 | 171.5 | 94.23 | 152.5 | 83.79 | −11.08 | 144.0 | 79.12 |
| 228063 | Papio hamadryas | Aug. 1, 1904 | do | do | 142.0 | 148.6 | 104.64 | 133.6 | 94.08 | −10.10 | 122.0 | 85.92 |
| 224830 | Cynopithecus niger | June 27, 1904 | do | do | 110.0 | 115.0 | 104.54 | 96.2 | 87.45 | −16.35 | 88.5 | 80.45 |
| 224745 | Papio cynocephalus | Apr. 21, 1904 | do | do | 162.0 | 159.5 | 98.46 | 141.0 | 87.04 | −11.60 | 125.0 | 77.16 |
| 224799 | Ateles geoffroyi | June 2, 1904 | do | do | 91.0 | 90.05 | 98.90 | 78.0 | 85.71 | −13.38 | 71.5 | 78.57 |
| 224806 | Cercocebus fuliginosus | June 27, 1904 | do | do | 112.0 | 111.0 | 99.10 | 94.0 | 83.93 | −15.32 | 85.5 | 76.34 |
| 224812 | Cebus hypoleucus | July 6, 1904 | do | do | 75.0 | 66.8 | 89.06 | 59.3 | 79.06 | −11.23 | 56.5 | 75.32 |
| 224807 | Lemur varius | June 27, 1904 | do | do | 34.5 | 32.7 | 94.78 | 30.8 | 89.27 | − 5.81 | 29.0 | 84.66 |
| 224797 | Erinaceus europæus | June 16, 1904 | do | do | 3.28 | 3.12 | 96.59 | 3.0 | 92.87 | − 3.85 | 2.9 | 89.78 |
| 224798 | Mephitis mephitica | do | do | do | 6.52 | 6.16 | 94.48 | 5.85 | 85.58 | − 5.04 | 5.55 | 85.13 |
| 224831 | Helarctos malayanus | Apr. 21, 1904 | do | do | 385.5 | 391.0 | 101.43 | 369.0 | 95.72 | − 5.63 | | |
| 224804 | Vulpes pribilofensis | June 20, 1904 | do | do | 42.7 | ? | ? | 38.0 | 88.99 | ? | 35.8 | 83.84 |
| 224810 | Felis concolor | July 5, 1904 | do | do | 154.0 | 125.0 | 81.16 | 138.9 | 90 19 | +11.2 | 137.0 | 88.96 |
| 228055 | do | June 13, 1906 | do | do | 137.5 | 141.0 | 102.62 | 144.0 | 104.72 | + 2.13 | 118.5 | 86.18 |

*Solution: One-third saturated solution of alum, with 5 per cent formalin*—Continued.

| Catalogue No. | Subject. | Date of autopsy. | Age. | Condition of brain. | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Grams.* | *Grams.* | | *Grams.* | | | *Grams.* | |
| 224809 | Lynx ruffus | July 5, 1904 | Adult | Medium | 65.0 | 57.5 | 88.46 | 52.2 | 80.31 | − 9.22 | 50.5 | 77.69 |
| 224948 | Maltese cat | Apr. 13, 1904 | do | do | 21.55 | ? | ? | 20.35 | 94.43 | ? | | |
| 224953 | do | Apr. 29, 1904 | do | do | 29.65 | 26.5 | 89.37 | 24.0 | 80.94 | − 9.44 | | |
| 224939 | Sciurus rufiventer | Mar. 12, 1904 | do | do | 9.15 | 9.42 | 102.95 | 7.87 | 86.12 | −16.46 | | |
| 224944 | Sciurus hudsonicus | Mar. 22, 1904 | do | do | 4.05 | ? | ? | 3.5 | 86.42 | ? | | |
| 228054 | Odocoileus hemionus | June 11, 1904 | do | do | 78.0 | ? | ? | 70.8 | 90.77 | ? | 63.0 | 80.77 |
| 228061 | Macropus benneti | July 20, 1904 | do | do | 29.1 | ? | ? | 26.9 | 92.44 | ? | 24.0 | 82.47 |
| 224941 | Corvus brachyrhynchus | Mar. 16, 1904 | do | do | 8.75 | 9.08 | 103.77 | 8.21 | 93.83 | − 9.58 | 7.5 | 85.71 |
| 228052 | Xanthura luxuosa | June 9, 1904 | do | do | 2.4 | 2.18 | 90.83 | 2.03 | 84.58 | − 6.88 | 1.9 | 79.16 |
| 224746 | Munia oryzivora | Mar. 25, 1904 | do | do | .8 | ? | ? | .78 | 97.50 | ? | | |
| 228056 | Dacelo gigas | July 2, 1904 | do | do | 4.47 | ? | ? | 3.36 | 75.17 | ? | 3.1 | 69.35 |
| 224957 | Aquila chrysaetos | May 28, 1904 | do | do | 17.1 | 16.7 | 97.66 | 16.26 | 95.08 | − 2.64 | 15.2 | 88.89 |
| 224937 | Cathartes aura | Mar. 10, 1904 | do | do | 10.2 | 11.23 | (110.09) | 10.55 | (103.43) | − 6.06 | | |
| 224946 | Syrnium varium | Mar. 31, 1904 | do | do | 12.1 | ? | ? | 11.89 | 98.26 | ? | 10.5 | 86.78 |
| 228051 | Anhinga anhinga | June 9, 1904 | do | do | 4.55 | 4.2 | 92.31 | 3.65 | 80.22 | −13.10 | 3.45 | 75.82 |
| 224832 | Tantalus loculator | June 2, 1904 | do | do | 11.87 | 11.75 | 98.99 | 10.47 | 88.20 | −10.89 | 9.7 | 81.72 |
| 224942 | "Golden seabright" rooster | Mar. 16, 1904 | do | do | 2.43 | 2.32 | 95.47 | 2.17 | 89.30 | − 6.47 | 2.0 | 82.30 |
| 224749 | Colored child (about one-eighth negro) | June 17, 1904 | 20 months | do | 1,115.0 | 1,081.0 | 96.95 | 1,010.0 | 90.58 | − 6.57 | 937.0 | 84.04 |
| 224950 | Cuban poodle | Apr. 16, 1904 | Young | do | 35.8 | 38.53 | 107.62 | 29.9 | 83.52 | −22.40 | | |
| 224802 | Canis occidentalis | May 2, 1904 | 40 days | do | 46.3 | 44.5 | 96.11 | 45.3 | 97.84 | + 1.79 | 34.0 | 73.43 |
| 224796 | Vulpes pribilofensis | June 14, 1904 | 4 hours | do | 22.4 | 19.73 | 88.08 | 17.7 | 79.02 | −10.29 | 16.3 | 72.77 |
| 228060 | do | July 26, 1904 | 85 days | do | 37.5 | ? | ? | 32.5 | 86.67 | ? | 27.5 | 73.33 |
| 224805 | Cervus canadensis | June 23, 1904 | Young | Some congestion. | 209.0 | 206.5 | 98.80 | 185.0 | 88.51 | −10.41 | 169.0 | 80.86 |

AVERAGES.

| Subject. | Per cent of original weight at the end of— First week. | First month. | One year. | Subject. | Per cent of original weight at the end of— First week. | First month. | One year. |
|---|---|---|---|---|---|---|---|
| ADULT. | | | | YOUNG. | | | |
| Human subjects | (1)105.07 | | (1) 94.57 | Human subjects | (1) 96.95 | (1) 90.58 | (1) 84.04 |
| Mammals | (16) 96.30 | (21) 88.56 | (16) 82.02 | Mammals | (4) 97.65 | (5) 87.11 | (4) 75.10 |
| Birds | (6) 96.50 | (9) 89.13 | (8) 81.22 | Birds | | | |

## PART II.

### PHYSICAL CHANGES IN SHEEP BRAINS COLLECTED AND PRESERVED UNDER SIMILAR CONDITIONS IN VARIOUS FORMALIN PREPARATIONS.

The first part of this paper dealt with the effects of formalin preservatives on the weight of human, other mammal, and bird brains, adult as well as young, collected under various conditions. The results in any solution, although more or less characteristic for that particular liquid, were by no means uniform. It was found that, in general, the changes in the large brains were less than in the small ones, and those in the adult less than in the young. Some of the differences may eventually be found to be those of species or larger subdivisions of the animal kingdom; but beyond all this there was seen a considerable and unaccountable variation. This element was recognized long before the first experiments were completed. It rendered desirable a separate series of observations on the brains of some fair-sized animal, collected equally fresh, extracted and subsequently treated in the same manner, and kept in proportionately the same quantities of the preservative. Under such conditions the action of the various preservatives should be much clearer and more comparable, and the differences in the changes be reduced to the minimum; if noticeable disagreements still existed, they would point to differences in the structure of the brains or in their chemical composition.

It became possible to undertake the series of experiments during the early part of the summer just past. An arrangement was made with one of the city butchers to deliver every morning a small series of heads of sheep killed the night preceding. The brains, with the help of the laboratory aid, Mr. Docekal, were extracted in as short a time as possible and in the same manner (see Part I), then weighed and placed in a proportioned quantity of the preservative. Fifteen series were determined upon and the specimens were secured in a little over two weeks, during quite uniformly warm weather. Every series except two, which were smaller, consisted of eleven brains. Ten of the specimens were placed in a quantity of the preserative amounting to 3 c. c. for each gram weight of the specimen, while with one the quantity to the gram was made 6 c. c. Of the brains in 3 c. c. to the gram liquid, one of about average dimension was weighed every day the same hour, while the remaining nine and also the eleventh specimen were weighed at the end of seven and again at the end of

thirty days. Other weighings, as indicated in the detail tables, were taken thereafter. At the end of the seventh and the thirtieth day the solution and cotton were changed, as is done with all specimens in the museum collection. The drainage of each specimen was as uniform as practicable by the method outlined in the first part of this paper.

The solutions employed were:

1. Three per cent formalin.
2. Five per cent formalin.
3. Ten per cent formalin.
4. Fifteen per cent formalin.
5. Saturated solution of common salt with 5 per cent formalin.
6. 1,030 sp. gr. common salt solution with 5 per cent formalin.
7. 1,015 sp. gr. common salt solution with 5 per cent formalin.
8. Saturated solution of alum with 5 per cent formalin.
9. One-third saturated solution of alum with 5 per cent formalin.
10. One-fifth saturated solution of alum with 5 per cent formalin.
11. One-third saturated solution of alum with common salt up to sp. gr. 1,030, with 10 per cent formalin.
12. Saturated solution of alum with 5 per cent formalin.
13. Eighty parts of 95 per cent alcohol and 20 parts of 5 per cent formalin.
14. Sixty-five parts of 95 per cent alcohol and 35 parts of 3 per cent formalin (near that of Parker & Floyd).
15. Sodium acetate 130 grams, sodium chloride 110 grams, formalin 20 c. c., 95 per cent, alcohol 460 c. c., water 540 c. c. (Stroud, Wilder).

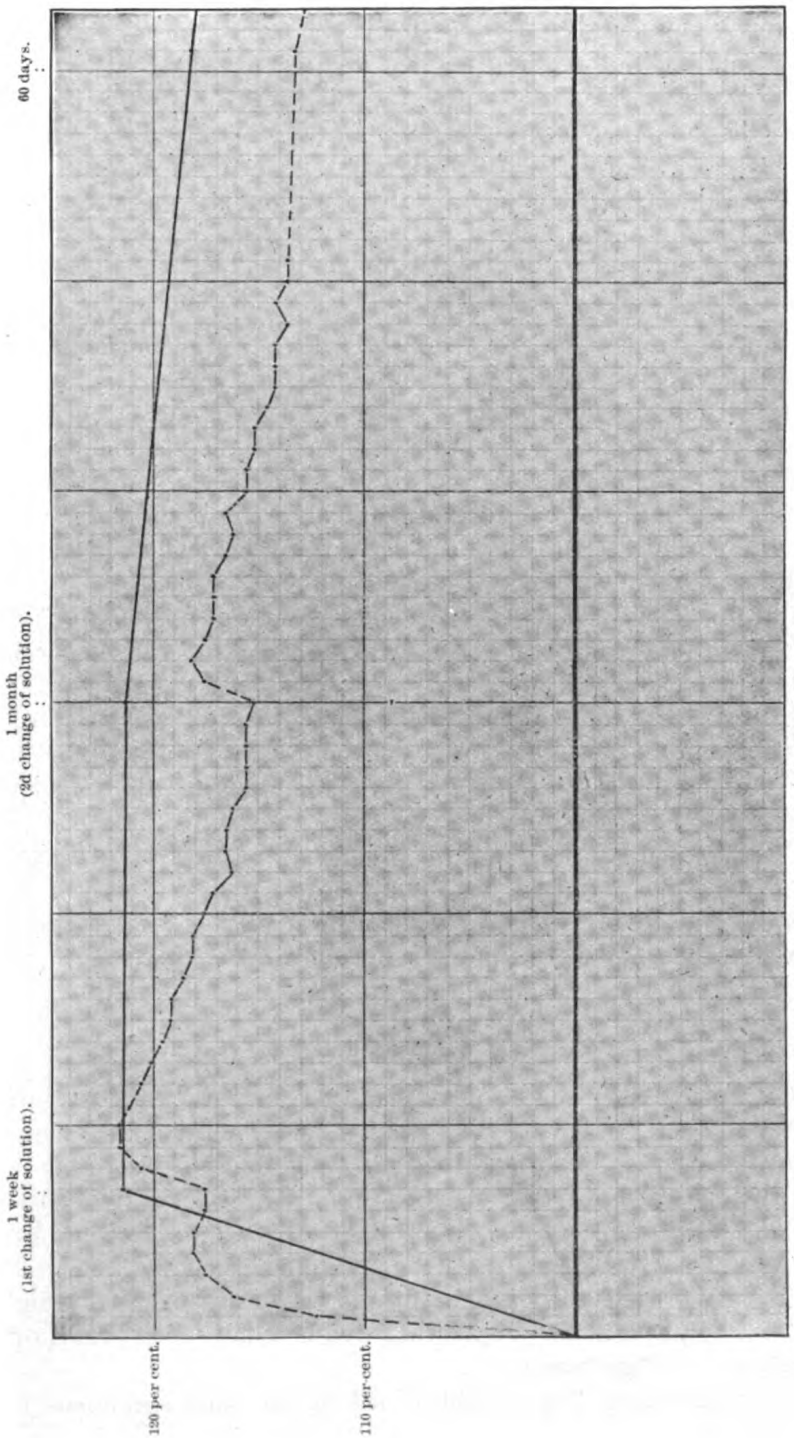
The results, in detail, were as follows:

### THREE PER CENT FORMALIN.

End of first week: The weight of brains in the 3 c. c. to the gram solution had risen in average 21 per cent, or over one-fifth of the original. Variation: From 118.55 per cent (specimen of 102 grams original weight) to 123.9 per cent (specimen of 102.5 grams)=5.37 per cent. The two heaviest brains (117.5 and 110.5 grams) gained, respectively, 20 and 18.55 per cent in weight, the two lightest ones (94 and 93.2 grams) 20.2 and 22.1 per cent. The brain in the 6 c. c. to the gram solution (100.5 grams original weight) increased 18.9 per cent, less than any other except one of the heaviest specimens, and the one weighed every day, which may have been affected thereby.

End of first month: Weight of five of the nine brains in the 3 c. c. to the gram solution is very slightly greater (+0.08 to +0.44 per cent); of three, slightly smaller (−0.42 to −1.15 per cent), and of one, equal. Variation: From 117.19 to 124.02 per cent[a]=6.8 per cent. The changes were not quite harmonious with those of the first week, or proportionate to the weight of the specimens. The brain in the 6

[a] As compared with original weight.




Average of 9 sheep brains, weighed at periods indicated by dots. — — — — — — — 1 sheep brain, weighed daily.

FIG. 12.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 3 PER CENT FORMALIN SOLUTION.

c. c. to the gram solution lost most and is now relatively the lightest of the whole series, excepting the one weighed every day.

The brain weighed daily showed a great gain during the first day, reached maximum on the fifth, and began to decline on the seventh; after change of solution it rose during two days, and then again began to lose, which was repeated identically after the one-month change.

FIVE PER CENT FORMALIN.

End of first week: Weight of brains in 3 c. c. to the gram solution had risen in average 17.9 per cent, or a little over one-sixth of the original. Variation: From 116.12 (specimen of 119.7 grams original weight) to 120 per cent (specimen of 99 grams original weight)=3.88 per cent. The two heaviest brains (119.7 and 117 grams) gained, respectively, 16.1 and 18.4 per cent in weight, the two lightest ones (98.5 and 95.5 grams) 17.8 and 19.4 per cent. The brain in the 6 c. c. to the gram solution (100.5 grams original weight) had risen 18.9 per cent; that weighed every day 17.8 per cent.

End of first month: Only one specimen showed a slight gain (+1.08 per cent), while in eight there was a loss (−0.36 to −2.39 per cent). Variation: From 113.87 to 119.66 per cent=5.79 per cent. The changes were not quite harmonious with those of the first week, or proportionate to the weight of the specimen. The brain in the 6 c. c. to the gram solution lost 2.09 per cent, that weighed daily 2.39 per cent of weight, both above the average.

The brain weighed daily gained much on the first day, reached a maximum on the fourth day, declined slowly to seventh, rose after change of solution during two days, fell gradually to the end of the first month, then, after a change of solution, rose one day and has been slowly losing since.

TEN PER CENT FORMALIN.

End of first week: Weight of brains in 3 c. c. to the gram solution had risen in average 15 per cent, or nearly one-seventh of the original. Variation: From 112.84 (original weight, 97.5 grams) to 116.87 per cent (original weight, 80 grams)=4.03 per cent. The two heaviest brains (112 and 110.5 grams) gained, respectively, 14.73 and 15.38 per cent, the two lightest (96.5 and 80 grams) 15.54 and 16.87 per cent. The brain in the 6 c. c. to the gram solution (125 grams original weight) gained but 14 per cent of weight, that weighed daily (102 grams original weight) 16.17 per cent.

End of first month: The weight of one of the nine specimens in 3 c. c. to the gram solution has very slightly (+0.45 per cent) increased, that of the other eight slightly to moderately (−1.07 to −3.29 per cent) decreased. Variation: From 110.31 to 115.63 per cent=5.32 per cent. The changes did not quite harmonize with those of the first

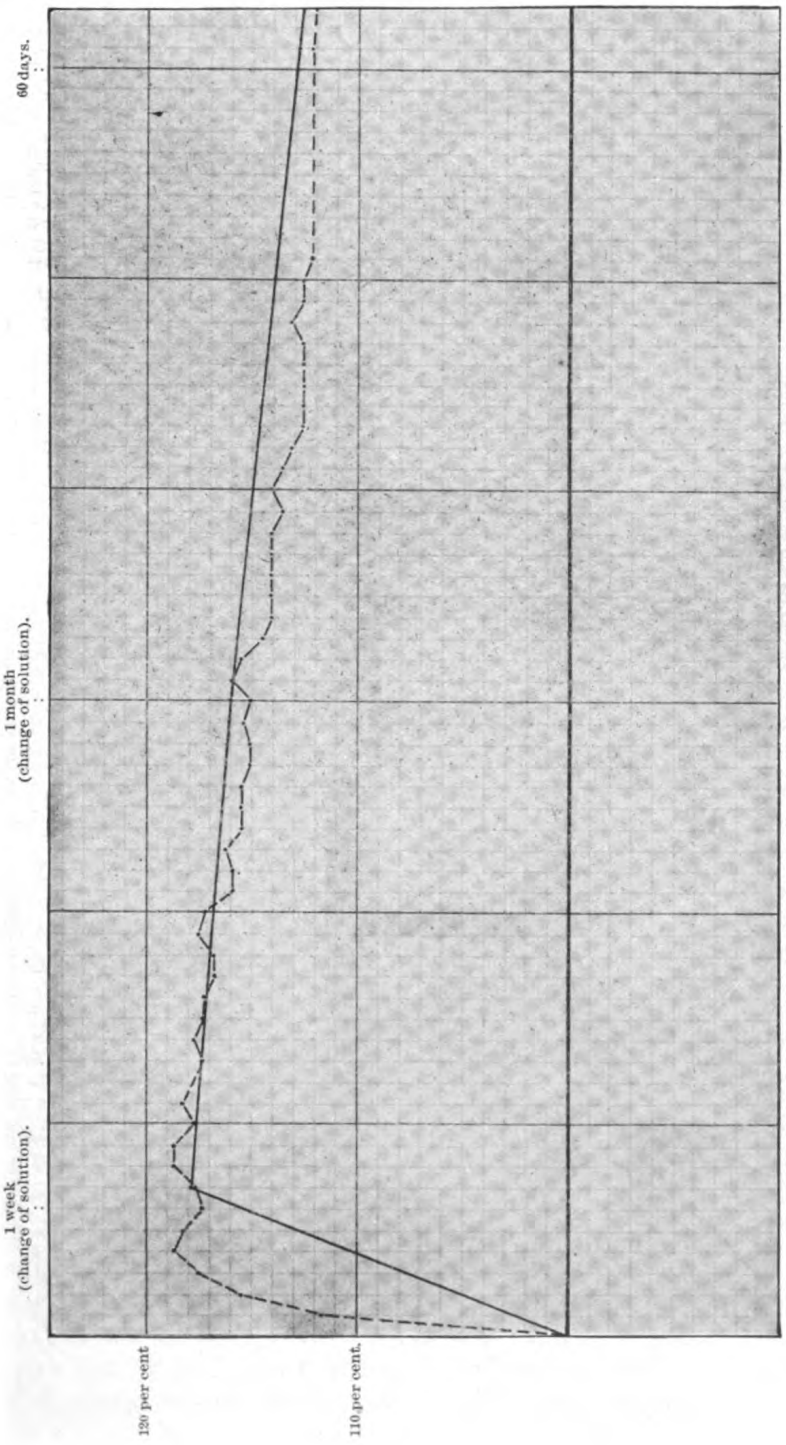



FIG. 13.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 5 PER CENT FORMALIN SOLUTION.


FIG. 14.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 10 PER CENT FORMALIN SOLUTION.

week nor were they proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost 1.05 per cent in weight, that weighed daily 3.38 per cent.

Changes in the brain weighed every day: Considerable rise the first twenty-four hours, continuation of rise until the sixth day, then slow decline; a moderate rise of two days' duration after the first and of one day after the second change of solution.

### FIFTEEN PER CENT FORMALIN.

End of first week: Weight of specimens in 3 c. c. to the gram solution had risen in average nearly 13 per cent, or one-eighth of the original. Variation: From 107.61 (original weight, 98.5 grams) to 116.48 per cent (original weight, 91 grams)=8.87 per cent. The two heaviest brains (119 and 111.8 grams) gained, respectively, 12.1 and 13.5 per cent, the two lightest ones (94 and 91 grams) 11.7 and 16.4 per cent. The brain in the 6 c. c. to the gram liquid (original weight, 97 grams) gained but 9.08 per cent, less than any of the above with one exception, that weighed daily (original weight, 105.5 grams) gained but 8.53 per cent.

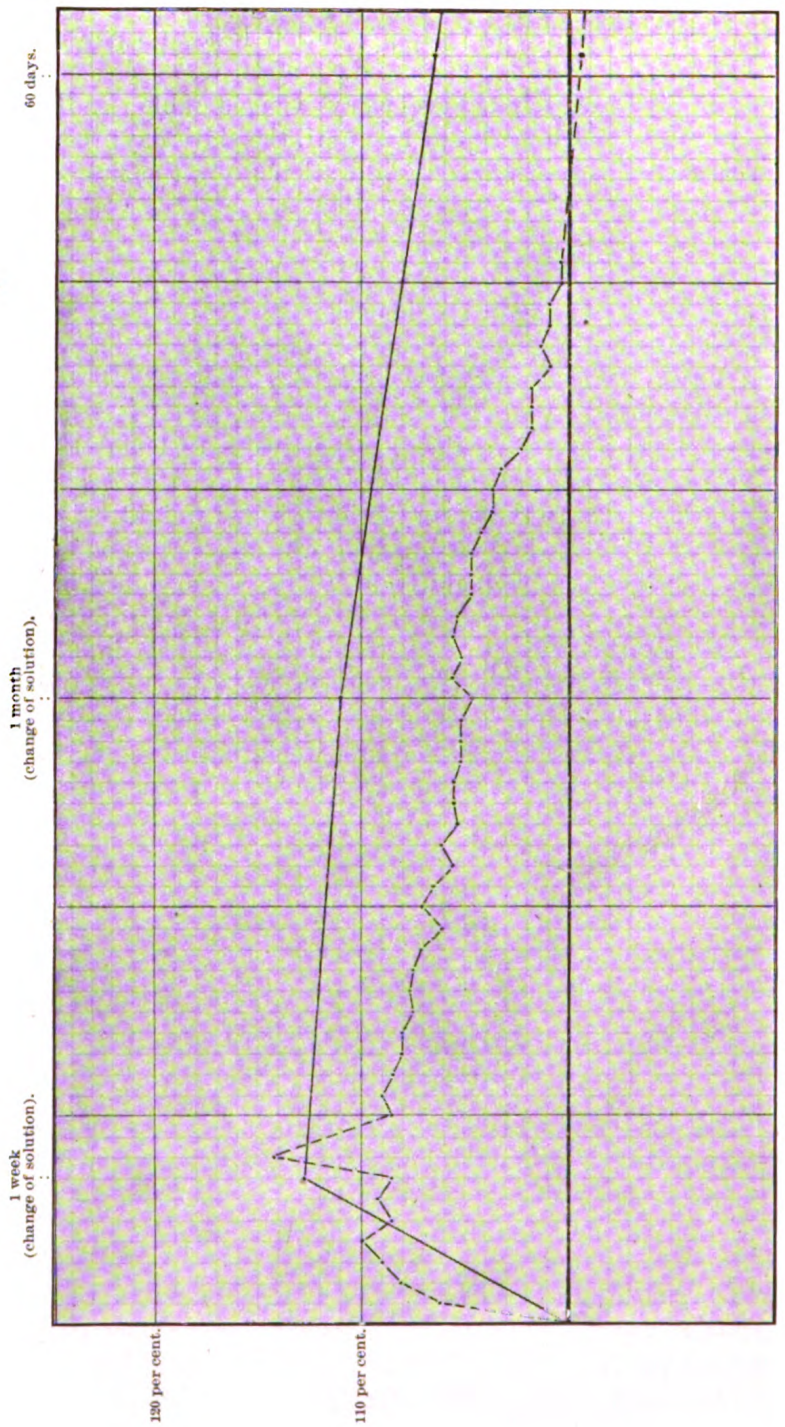
End of first month: Weight of all the nine specimens in 3 c. c. to the gram solution has diminished (−0.88 to 2.31 per cent). Variation: From 105.58 to 115.38 per cent=9.8 per cent. The changes are fairly harmonious with those of the first week, but are not proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost 5.95 per cent, much more than any of the above, that weighed daily 3.49 per cent, also more than any of those in similar quantity of solution but weighed less frequently.

Changes in the brain weighed daily: A moderate rise in weight during the first twenty-four hours, maximum of rise on fourth day, then slow, continuing loss; one day's rise after each change of solution.

### SATURATED SOLUTION OF SODIUM CHLORIDE, WITH 5 PER CENT FORMALIN.

End of first week: Weight of brains in the 3 c. c. to the gram solution had diminished in average by 7 per cent, or one-fourteenth of the original. Variation: From 90.33 (original weight, 95.2 grams) to 95.19 per cent (original weight, 104 grams)=4.86 per cent. The two heaviest brains (107.7 and 105 grams) lost, respectively, 6.6 and 5.72 per cent; the two lightest (89.7 and 84.5 grams) 5.8 and 5.9 per cent. The specimen in the 6 c. c. to the gram solution (original weight, 95.5 grams) lost 6.8 per cent, that weighed every day 7.9 per cent.

End of first month: Weight of all nine brains in the 3 c. c. to the gram solution decreased (−3.15 to 5.23 per cent). Variation: From 85.61 to 91.82 per cent=6.2 per cent. The decrease was quite alike in most of the nine specimens and harmonized somewhat with that of




——— Average of 9 sheep brains, weighed at periods indicated by dots. — — — — — — 1 sheep brain, weighed daily.

FIG. 15.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 15 PER CENT FORMALIN SOLUTION.

the first week, but was not proportionate to the original weight. The brain in the 6 c. c. to the gram solution fell to 90.05 per cent of original weight; after which it diminished until it became relatively the lightest of all; that weighed every day was damaged and discarded at first change.

1,030 SPECIFIC GRAVITY SODIUM CHLORIDE SOLUTION WITH 5 PER CENT FORMALIN.

End of first week: Two of the nine brains in the 3 c. c. to the gram solution showed a slight increase, seven a slight decrease, in weight. Variation: From 93.86 (original weight, 106 grams) to 104.2 per cent (original weight, 107 grams)=10.34 per cent. The two heaviest brains (112 and 107 grams) gained, respectively, 2.68 and 4.2 per cent, the two lightest (95 and 94 grams) lost 1.58 and 3.73 per cent in weight. The brain in the 6 c. c. to the gram solution (original weight, 105 grams) lost 5.72 per cent, more than any of the above but one, and that weighed every day (original weight, 103 grams), lost 2.92 per cent in weight.

End of first month: All the brains in the 3 c. c. to the gram solution lost slightly in weight after the end of the first week (−1.3 to −3.72 per cent), but two are still slightly heavier than originally. Variation: From 92.45 to 102.33 per cent=9.88 per cent. The changes were not wholly harmonious with those during the first week, or proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost more than any but two of the above (2.02 per cent) and is now relatively the lightest; that weighed every day lost 3 per cent and is now also among the relatively lightest specimens.

Changes in the brain weighed daily: The first day a very slight loss of weight, which continued slowly till the first change (the first day after which there was an insignificant gain) and then up to the one month change (which produced no result). After the thirty-fifth day there were two weeks of stability, with a slight loss following.

1,015 SPECIFIC GRAVITY SODIUM CHLORIDE SOLUTION WITH 5 PER CENT FORMALIN.

End of first week: Weight of brains in 3 c. c. to the gram solution had risen in average a little less than 2 per cent, or a little less than one-fiftieth of the original. Variation: From 101.29 (original weight, 116 grams) to 102.45 per cent (original weight, 102 grams)=1.2 per cent. The brain in 6 c. c. to the gram solution, (123 grams original weight) rose 2.03 per cent; that weighed daily (11.4 grams original weight) 1.31 per cent.

End of first month: Weight of both specimens in 3 c. c. to the gram solution has diminished (−1.43 per cent and −1.7 per cent). Variation=1.41 per cent. The specimen in 6 c.c. to the gram solution

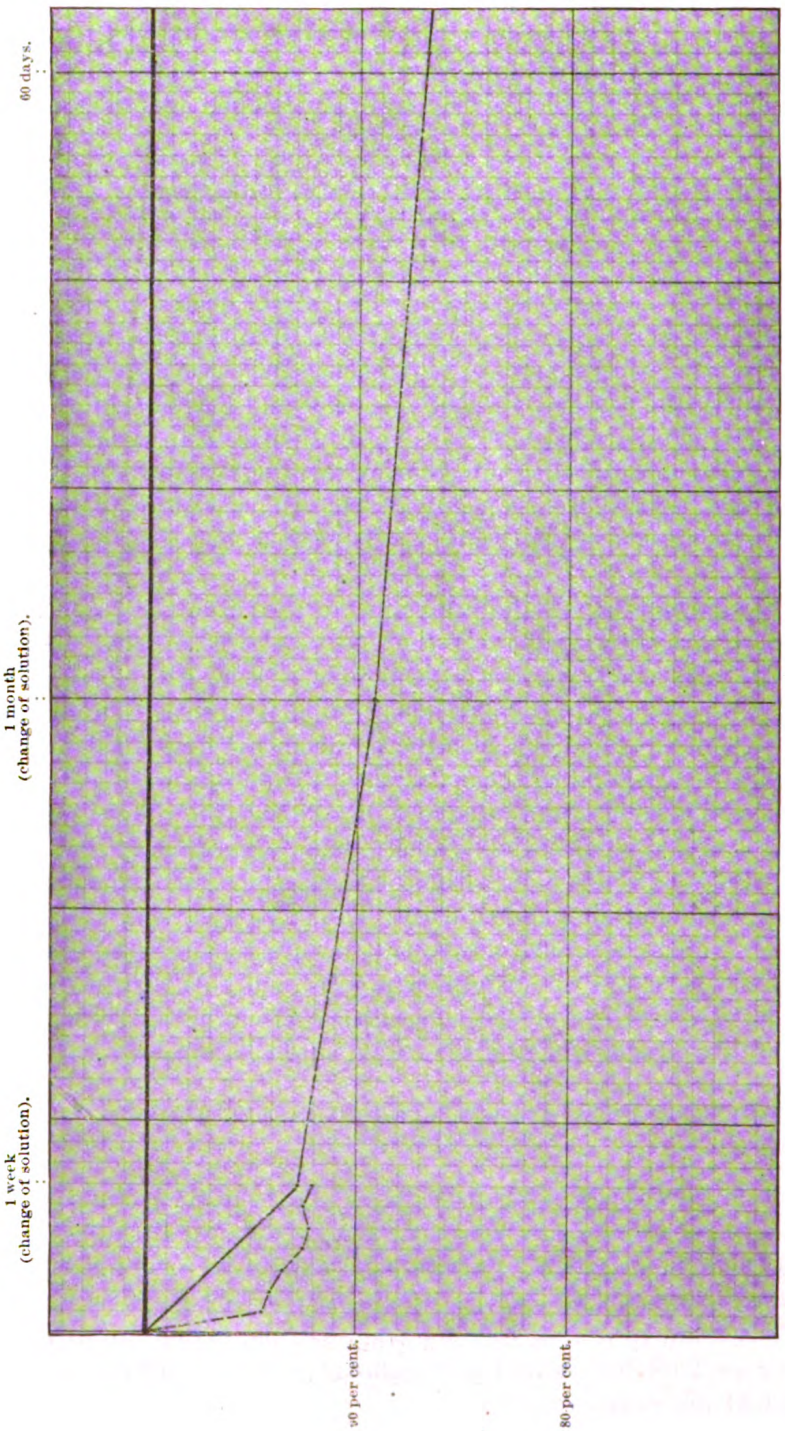
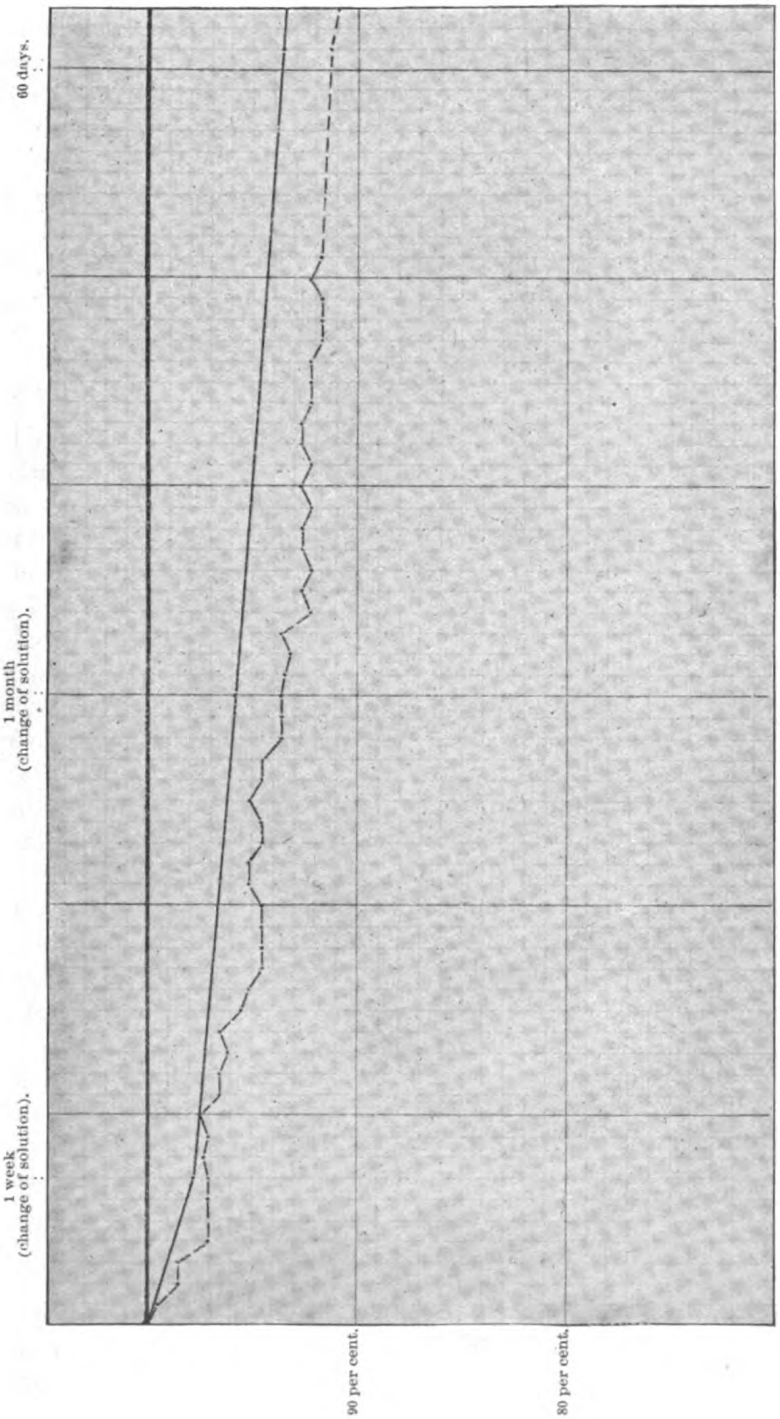



FIG. 16.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SATURATED SOLUTION OF SODIUM CHLORIDE WITH 5 PER CENT FORMALIN.




——— Average of 9 sheep brains, weighed at periods indicated by dots. — — — — — — — — 1 sheep brain, weighed daily.

FIG. 17.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 1,030 SPECIFIC GRAVITY FORMALIN SALT SOLUTION.

(original weight, 123 grams) lost 2.39 per cent in weight, more than either of the above; while that weighed daily (original weight, 114 grams) lost even more, or exactly 3.03 per cent.

The brain weighed daily fell very slightly in weight during the first day, rose slightly during the next two days (reaching maximum the third day), remained stationary the fourth day and then began to lose. It rose the first day after a change of solution, remained one day stationary, and then lost slightly, gained again a little, and then continued to lose to the end of the first month. No rise followed the one month change, the specimen remaining stationary in weight for one day, and then went on losing.

SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

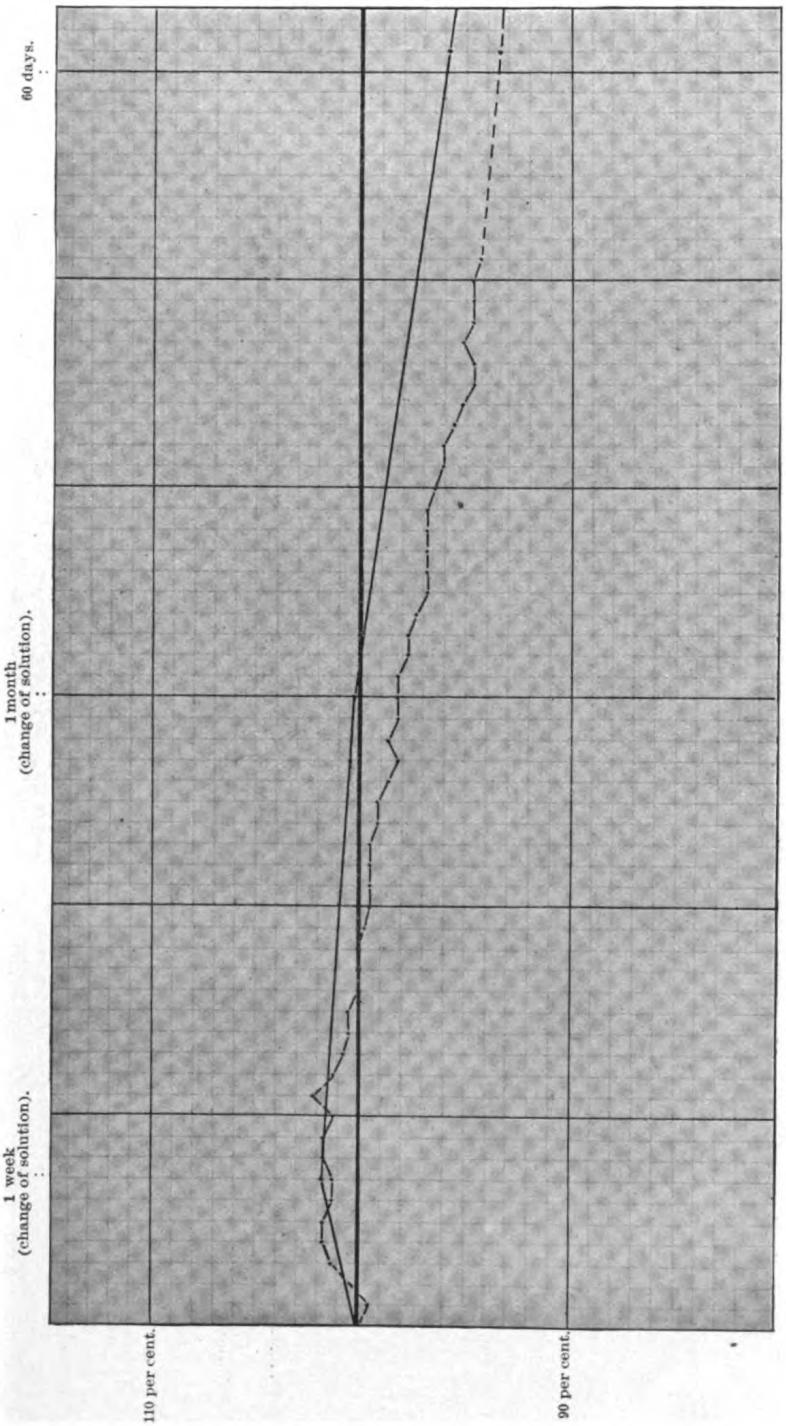
End of first week: Weight of brains in 3 c. c. to the gram solution had fallen in average nearly 23 per cent, or nearly one-fourth of the original. Variation: From 74.27 (original weight 103 grams) to 81.74 per cent (original weight 115 grams) =7.47 per cent. The two heaviest brains (115 and 109.7 grams) lost, respectively, 18.26 and 23.25 per cent in weight, the two lightest ones (92 and 88 grams) 21.74 and 23.87 per cent. The brain in the 6 c. c. to the gram solution (original weight 125.2 grams), the largest specimen in the series, lost but 17.74 per cent, hence less than any other; that weighed every day (original weight 101 grams) lost 25.75 per cent, which is more than any of the remaining nine in same solution.

End of one month: All of the brains in the 3 c. c. to the gram liquid had suffered noticeably further loss, and that from 4.86 to 9.04 per cent. Variation: From 64.08 to 74.45 per cent =10.37 per cent. The changes were not harmonious with those of the first week nor proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution, though large, lost considerable (10.68 per cent); and that weighed every day became relatively lightest but one of all those in the 3 c. c. to the gram solution.

The brain weighed every day showed a great loss during the first twenty-four hours, lost slowly and steadily for eighteen days, remained nearly stationary during next thirty days, and then lost slightly again. The day after each change of solution an insignificant rise took place.

ONE-THIRD SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

End of first week: Four of the nine brains in the 3 c. c. to the gram solution showed a very slight increase (+0.42 to +0.90 per cent), five a slight decrease (−1.43 to −2.59 per cent). Variation: From 97.41 (original weight 116 grams) to 100.9 per cent (original weight 110 grams) =3.49 per cent. The two heaviest brains (120 and 116.5 grams) showed, respectively, 100.42 and 97.85 per cent; the two lightest ones




Average of 2 sheep brains, weighed at periods indicated by dots. — — — — — — — 1 sheep brain, weighed daily.

FIG. 18.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 1,015 SPECIFIC GRAVITY SALT FORMALIN SOLUTION.

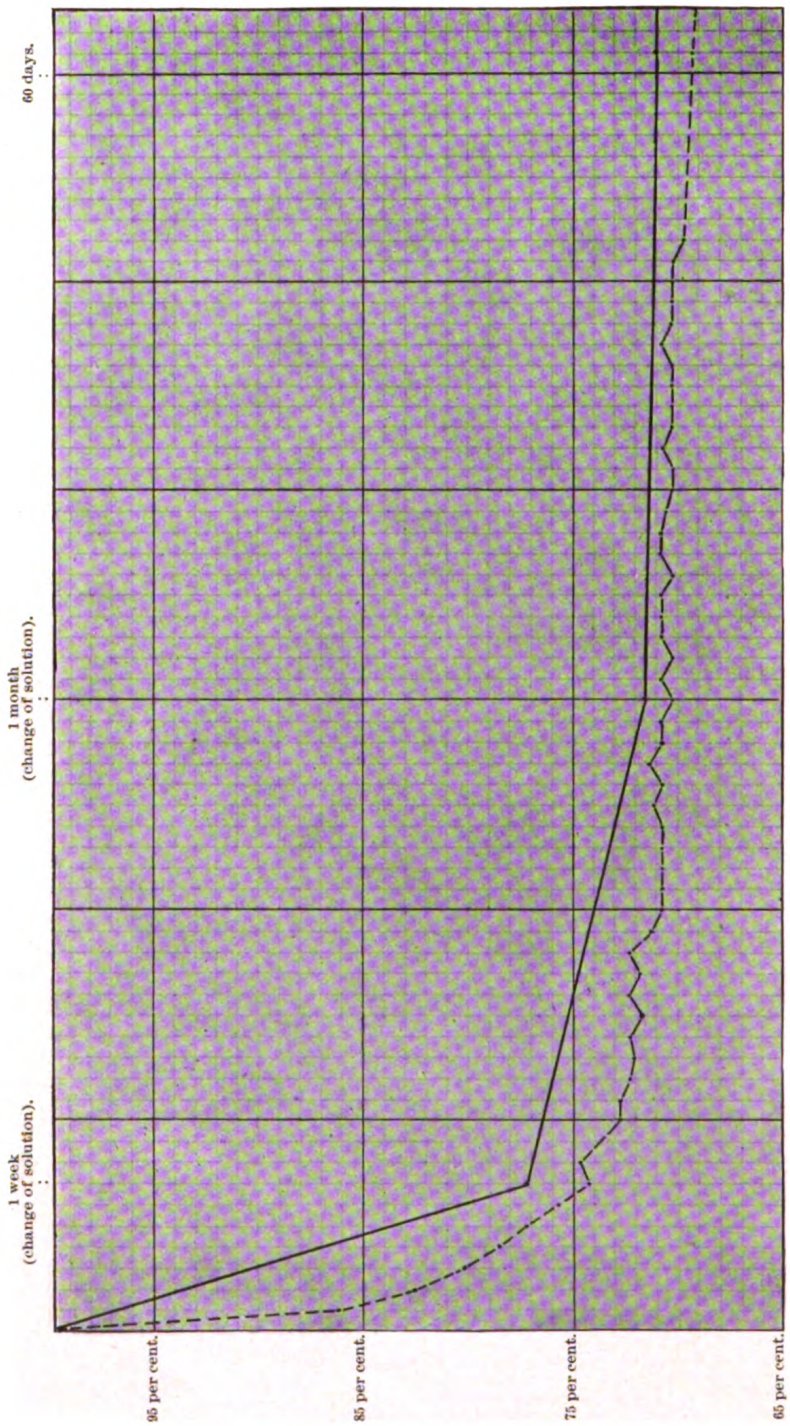



FIG. 19.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SATURATED SOLUTION OF ALUM WITH 5 PER CENT OF FORMALIN.

(103 and 97 grams), 98.54 and 100.51 per cent of their original weight. (There is no relation apparent at this stage between the changes and weight of the specimens, but ultimately the originally heaviest brain showed, with one exception only, the least loss, the lightest brain the greatest loss. The specimen in the 6 c. c. to the gram solution (original weight 122 grams) lost 2.05 per cent, with two slight exceptions, more than any of the above; that weighed daily (original weight 108 grams) losing 4.17 per cent, or more than any other specimen in the whole series.

End of first month: The weight of the specimens in 3 c. c. to the gram solution had diminished from 4.15 to 11.27 per cent (the heaviest brain losing least, the lightest most). Variation: From 89.17 to 96.25 per cent =7.08 per cent. The changes were not harmonious with those of the first week nor proportionate to the original weight of the brains. The specimen in the 6 c. c. to the gram solution lost 5.44 per cent more than the majority of the above, that weighed daily 11:11 per cent more than any but one in the whole series.

Changes in the brain weighed every day: A slight increase in weight the first twenty-four hours, followed by gradual, steady decrease, apparently not affected by either of the changes of solution.

### ONE-FIFTH SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

End of first week: Weight of one of the nine brains in the 3 c. c. to the gram solution had very slightly decreased, of one it was the same as original, and it had slightly increased (0.43 to 3.12 per cent) with the seven remaining. Variation: From 99.09 (original weight 109.5 grams) to 103.12 per cent (original weight 96 grams) =4.03 per cent. The two heaviest brains (116 and 115 grams) had gained in weight, respectively, 0.43 and 0.87 per cent, the two lightest (99 and 96 grams) 3.03 and 3.12 per cent. The brain in the 6 c. c. to the gram solution (original weight 126 grams) had lost 1.59 per cent, or more than any of the above, while that weighed daily (original weight 100.2 grams) gained 1.99 per cent.

End of first month: All of the nine brains of the first group had lost in weight (7.35 to 12.83 per cent). Variation: From 87.56 to 95.45 per cent =7.89 per cent. The changes, while not differing greatly, were not harmonious with those of the first week nor proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost in weight 7.66 per cent, that weighed daily 9.76 per cent, or more than any other in the whole series.

Changes in the brain weighed daily: A moderate increase, reaching maximum on the third day, and then a slow continuous loss, not affected by the changes of solution.

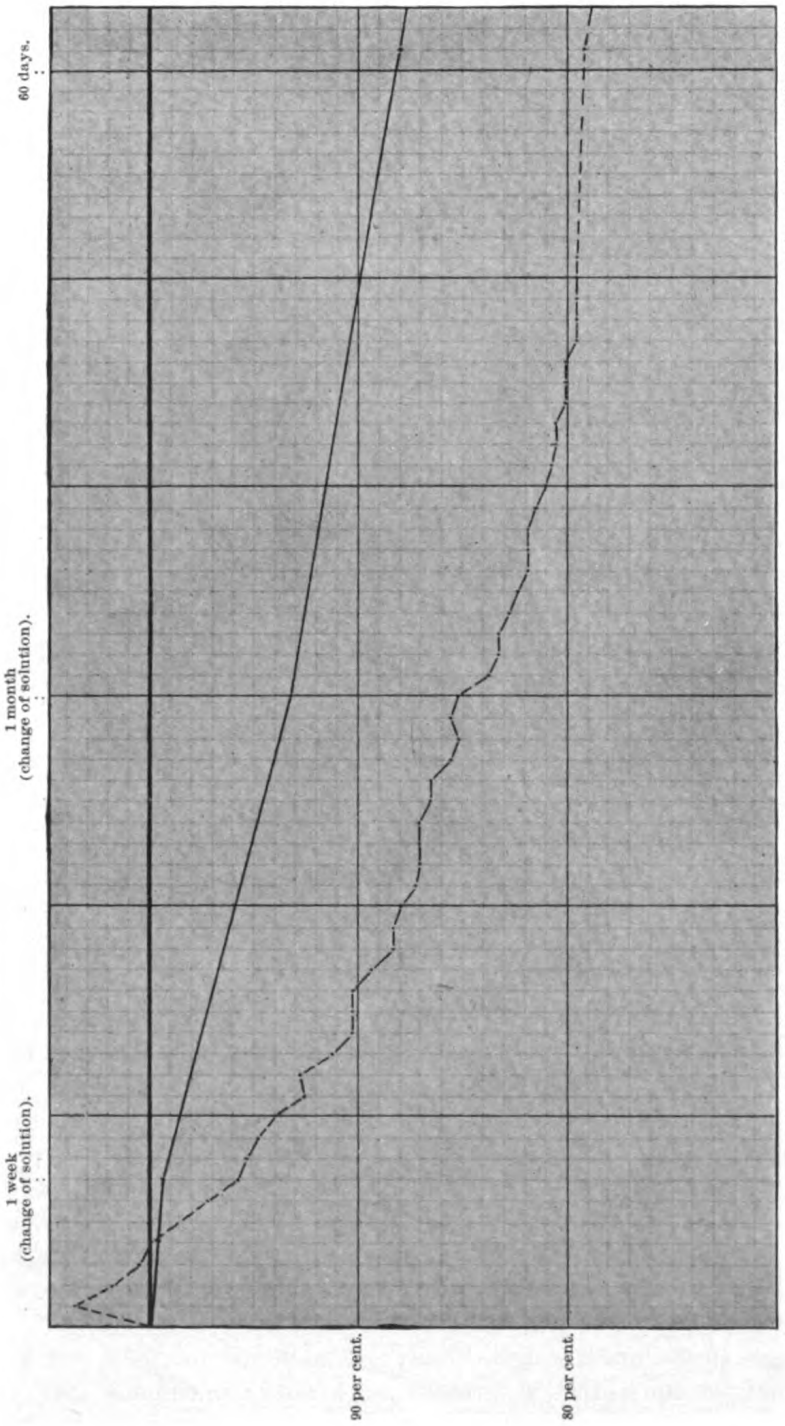
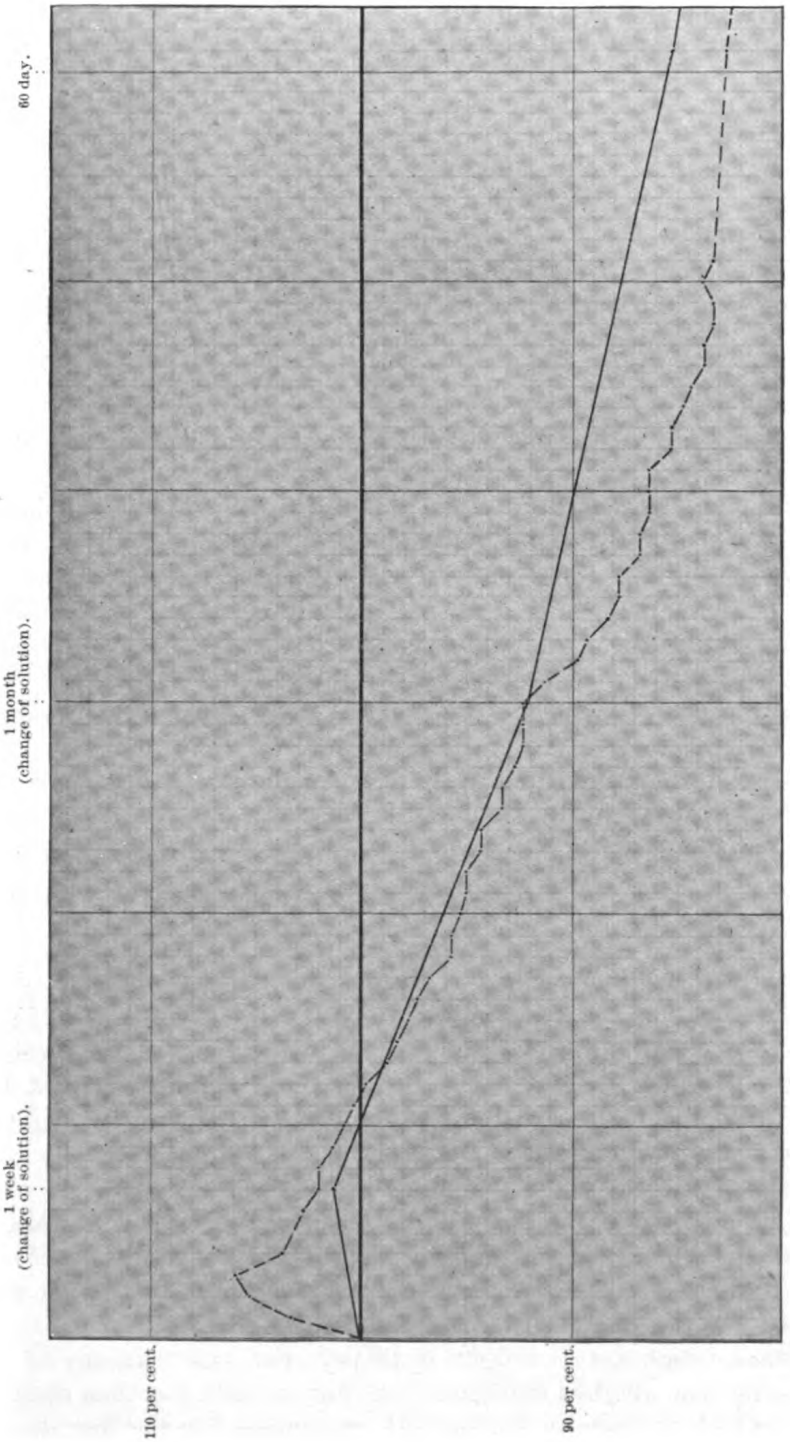



FIG. 20.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH 5 PER CENT OF FORMALIN.




——— Average of 9 sheep brains, weighed at periods indicated by dots. — — — — — — 1 sheep brain, weighed daily.

FIG. 21.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-FIFTH SATURATED SOLUTION OF ALUM WITH 5 PER CENT OF FORMALIN.

ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE TO 1,030 SPECIFIC GRAVITY, AND 10 PER CENT FORMALIN.

End of first week: The brains in the group of nine in the 3 c.c. to the gram solution all lost moderately in weight (−2.99 to −9.74 per cent). Variation: From 90.26 (original weight 113 grams) to 97.01 per cent (original weight 100.5 grams) =6.75 per cent. The two heaviest brains (115.2 and 113 grams) lost in weight, respectively, 7.99 and 9.74 per cent, the two lightest (100.5 and 95.5 grams) 2.99 and 5.24 per cent. Ultimately, however, the heaviest brain shows the least loss, while that of the lightest specimen is among the greatest losses. The specimen in the 6 c. c. to the gram solution (original weight 115.5 grams) lost 6.06 per cent; that weighed daily, however (original weight 105 grams), 10.95 per cent, or more than any other in the series.

End of the first month: The brains in the 3 c. c. to the gram solution all show a further marked loss of weight (−6.6 to −13.81 per cent); the heaviest brain had lost the least, the lightest the most. Variation: From 78.70 to 85.94 per cent =7.24 per cent. Changes were not harmonious with those of the first week, and were more in a reverse than a direct proportion to the original weight of the specimens. The brain in the 6 c. c. to the gram solution lost 11.52 per cent, that weighed daily 11.76 per cent.

Changes in the brain weighed daily: A moderate loss the first and second day and gradual loss, unaffected by the changes of solution, thence onward.

ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE TO 1,030 SPECIFIC GRAVITY, AND 5 PER CENT FORMALIN.

End of first week: Weight of brains in the 3 c. c. to the gram solution had risen slightly (+0.44 to +4.08 per cent). Variation: From 100.44 (original weight 114 grams) to 104.08 per cent (original weight 98 grams) =3.64 per cent. The two heaviest brains (123 and 114 grams) had gained, respectively, 4.06 and 0.44 per cent, the two lightest (98 and 97.5 grams) 4.08 and 3.58 per cent. The brain in the 6 c. c. to the gram solution lost 1.66 per cent, that weighed daily 4.63 per cent.

End of first month: Weight of all brains had notably diminished (−13.67 to −21.12 per cent in the group of nine). Variation: From 81.72 to 89.84 per cent =8.12 per cent. The changes were not proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost in weight 10.13 per cent, less than any of the above, and that weighed daily 9.22 per cent, or still less than the preceding, which compensated with both specimens for the loss during the first week.

Changes in the brain weighed daily: A slow loss from the first day onward, accelerated slightly the day after each change of solution.

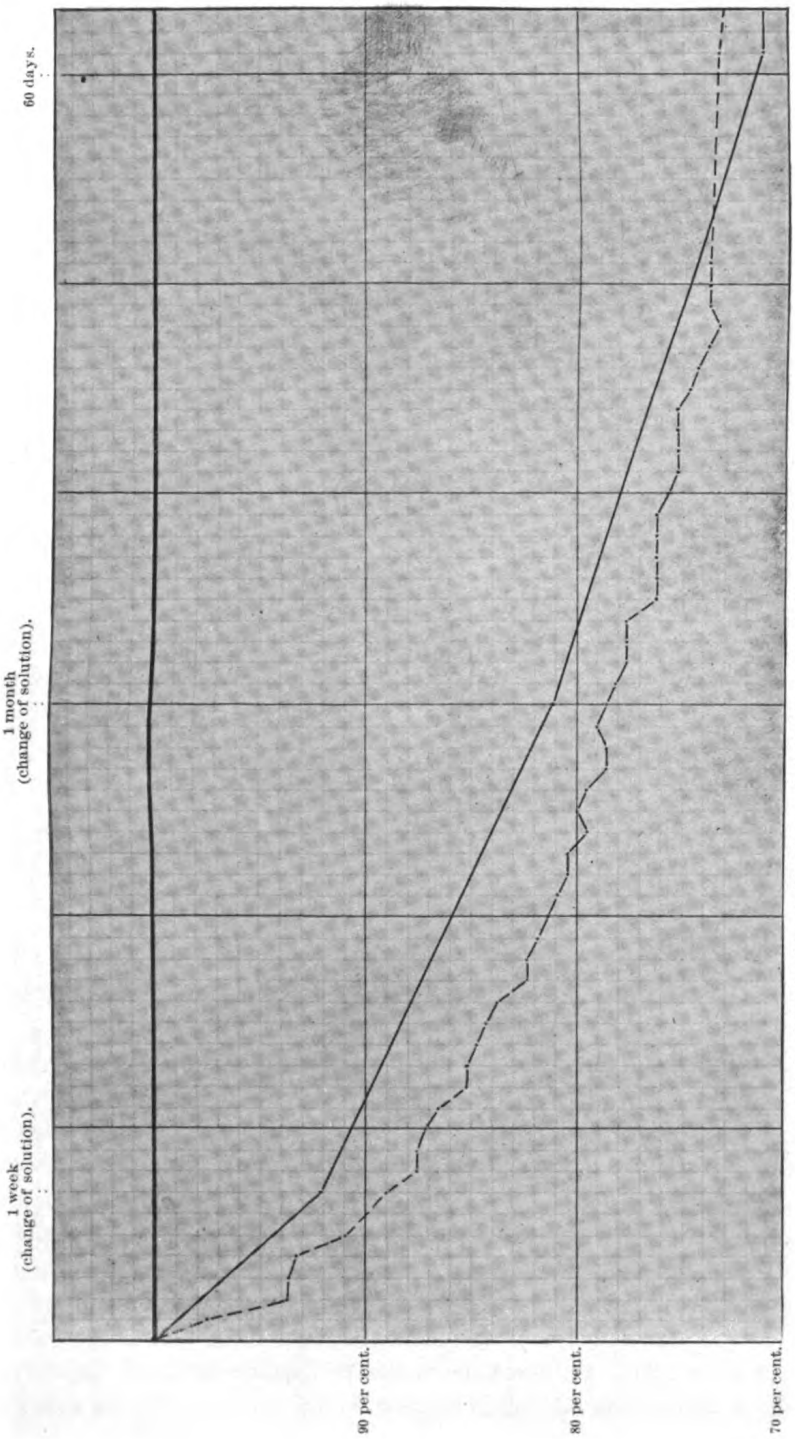



FIG. 22.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE TO 1,030 SPECIFIC GRAVITY, AND 10 PER CENT FORMALIN.


FIG. 23.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE TO 1,030 SPECIFIC GRAVITY, AND 5 PER CENT FORMALIN.

EIGHTY PARTS OF 95 PER CENT ALCOHOL AND 20 PARTS 5 PER CENT SOLUTION OF FORMALIN.

(Alcohol, 80; water, 19; formalin, 1.)

End of first week: All the brains in the 3 c. c. to the gram solution had lost in weight; the average loss was 11.5 per cent, or one-ninth of the original. Variation: From 85.27 (original weight 112 grams) to 91.45 per cent (original weight 117 grams). The heaviest brain lost least. The specimen in the 6 c. c. to the gram solution (original weight 106 grams) lost more than any of the above (15.1 per cent), that weighed daily (original weight 109 grams) lost 11.47 per cent.

End of one month: The solution was not changed at the end of the first week nor at the end of the first month, except with the specimen weighed daily. No especial difference appeared in the results. All the brains in the 3 c. c. to the gram solution lost slightly in weight after the end of the first week (−0.77 to −2.09 per cent). Variation: From 83.48 to 89.31 per cent =5.83 per cent. The changes were not harmonious with those of the first week nor proportionate to the weight of the brains. The specimen in the 6 c. c. to the gram solution lost 1.66 per cent, that weighed daily 1.56 per cent.

Changes in the brain weighed daily: A moderate loss in weight occurred during each of the first five days, after which there was a slow, continuous loss up to the end of the month and beyond. Neither the first nor the second change of solution produced any effect.

SIXTY-FIVE PARTS 95 PER CENT ALCOHOL AND 35 PARTS 3 PER CENT FORMALIN.

(Alcohol, 65; water, 34; formalin, 1.)

End of first week: Weight of brains in 3 c. c. to the gram solution had fallen in average nearly 4 per cent. The lighter brain lost somewhat more than the heavier one. The specimen in the 6 c. c. to the gram solution lost much more than either of the above; that weighed daily lost slightly more than either of the other two in similar quantity of the preservative.

End of first month: Weight of the two brains in 3 c. c. to the gram solution had diminished but slightly, that of the specimen in 6 c. c. to the gram solution distinctly more, while that of the brain weighed daily was equal.

Changes in the brain weighed daily: The first day a slight (1.56 per cent) rise, then a gradual loss; an insignificant rise the first and third days after the first change of solution, then stability, with slight ups and downs. No rise or fall in weight after the one-month's change of the preservative.

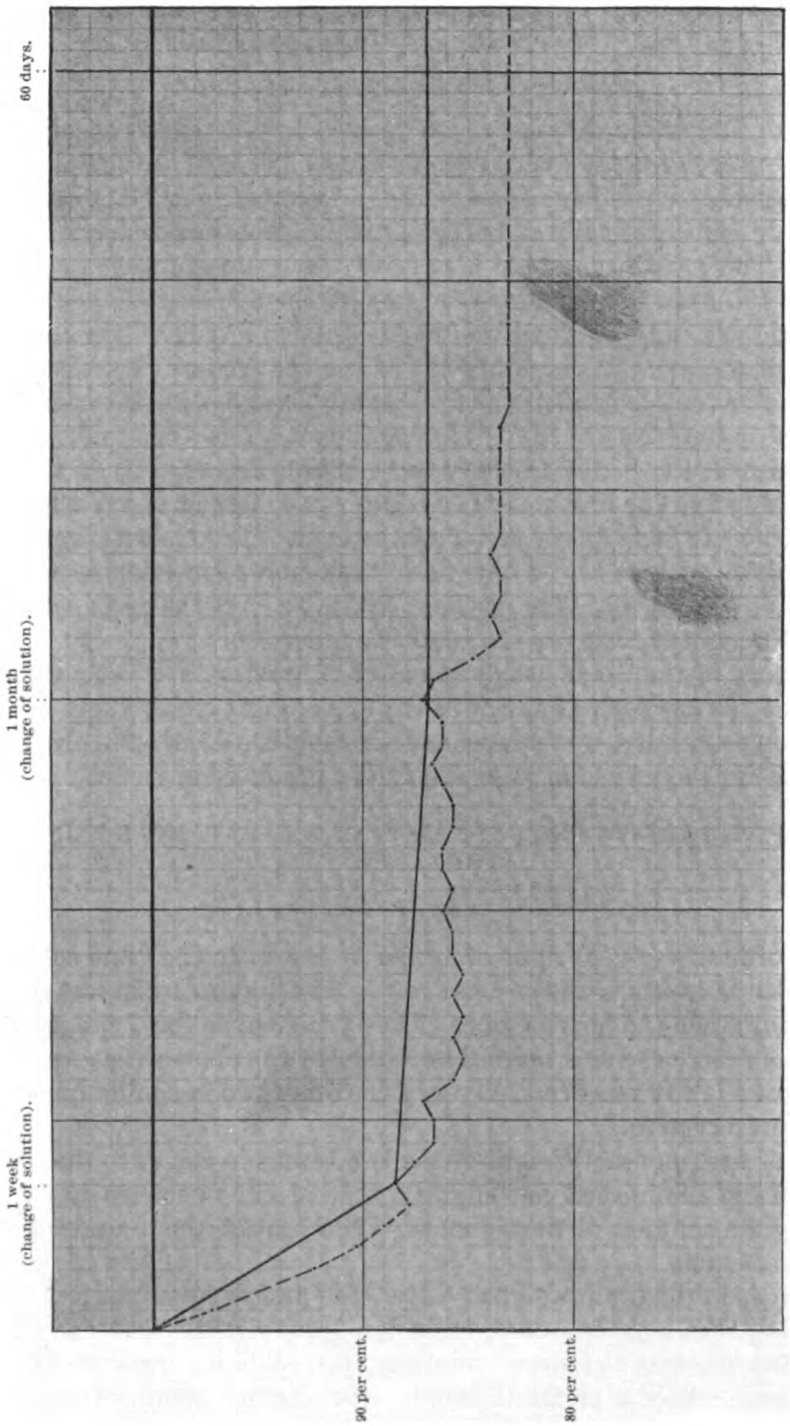



FIG. 24.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SOLUTION OF 80 PARTS OF 95 PER CENT ALCOHOL AND 20 PARTS 5 PER CENT FORMALIN.


——— Average of 2 sheep brains, weighed at periods indicated by dots. — — — — — — 1 sheep brain, weighed daily.

FIG. 25.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SOLUTION OF 65 PARTS 95 PER CENT ALCOHOL AND 35 PARTS 3 PER CENT FORMALIN.


FIG. 26.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SODIUM ACETATE, SODIUM CHLORIDE, ALCOHOL, AND FORMALIN SOLUTION.

SODIUM ACETATE (FUSED), 130 GRAMS; SODIUM CHLORIDE, 110 GRAMS; FORMALIN, 20 C. C.; 95 PER CENT, ALCOHOL, 460 C. C.; WATER, 540 C. C.

(100 c. c. = sodium acetate, 13; sodium chloride, 11; alcohol, 46; water, 54; formalin, 2.)

End of first week: Weight of brains in the 3 c. c. to the gram solution had diminished in average by 14 per cent, or one-seventh of the original. Variation: From 84.54 (original weight 103.5 grams) to 86.89 per cent (original weight 103 grams) =2.35 per cent. The two heaviest brains (118.2 and 115.2 grams) lost in weight, respectively, 13.28 and 14.07 per cent, the two lightest ones (101 and 82 grams) 14.36 and 14.64 per cent. The specimen in the 6 c. c. to the gram solution (original weight 110 grams) lost 15 per cent, that weighed every day (original weight 100.8 grams) 14.69 per cent, becoming each relatively lighter than any but one of the above.

End of first month: The solution had been changed, both at the end of the first week and at the end of the first month, only with the specimen weighed daily, without, however, any material difference resulting. Of the nine brains in the 3 c. c. to the gram solution eight had, since the end of the first week, slightly increased in weight, while in one the weight was the same. The gain ranges from 0.51 to 1.15 per cent. Variation: From 85.51 to 87.38 per cent =1.87 per cent. The changes were quite alike. The specimen in the 6 c. c. to the gram solution gained 0.45 per cent in weight, that weighed daily 2 per cent, or more than any other in the whole series.

Changes in the brain weighed daily: A pronounced loss during the first twenty-four hours, the next day a smaller loss, then three days of stability, and then a slight loss again. After first change a slight rise during the first twenty-four hours and lasting to next day, then a slight loss lasting four days and then slow rising. No marked effect of the second change of solution.

## SUMMARY.

A glance at the foregoing data and at those of Part I of this paper shows that, with the same preservatives, the results were in substance much alike, but that in the first series there was a much greater variation in results.

The simple formalin solutions all show, with all brains, the same type of effects, consisting of a sharp initial rise in the weight of the specimens, reaching a maximum within less than a week, with a subsequent gradual, long-continued loss. The rise, very clearly shown by the tests on sheep brains, is related in an inverse ratio to the strength of the formalin in the solution. The proportion of loss is much alike and is apparently independent of the formalin percentage, which makes it probable that it consists of simple solution by the water of the preservatives.

The addition of common salt to formalin solutions acts very much like larger proportions of formalin alone. The initial rise is shortened and reduced; in stronger concentrations it is replaced in twenty-four hours by loss; but the subsequent loss in weight proceeds much like that in simple formalin solutions.[a]

Additions of alum to formalin solutions cause, though the specific gravities of the resulting liquids are less, a greater loss in brain weight than the liquids with similar additions of common salt. The weaker solutions caused a smaller initial (one week) but a greater subsequent loss than the concentrated one.[b]

The mixtures of alum, common salt, and formalin are characterized by the great loss which they produce in the weight of the specimens after the first week. There is no advantage whatever in these solutions.

The three mixtures of alcohol with formalin all show an initial loss in the weight of the specimens, but subsequently there is a relatively great stability. Several of the groups (particularly with Stroud's liquid) show actually a little gain following the initial loss. As the proportion of the formalin in any of the solutions is quite insignificant (1 per cent), these effects must be referred nearly wholly to the alcohol and water in the solutions, with the action of which, so far as our knowledge goes, they agree.[c]

Individual variation was present with all the liquids used, most in the 15 per cent formalin and the 1,030 specific gravity common salt solution with 5 per cent formalin, least in the 65 parts of alcohol with 35 parts of 3 per cent formalin (two specimens only) and in the sodium acetate-sodium-chloride-alcohol-formalin mixture. In a large majority of the preservatives the variation was greater at the end of the first month than at the end of the first week; after that it still increased with some solutions, while with others it grew less.

The most potent discernible cause of this individual variation was, as in the cases dealt with in the first part of this paper, the difference in size of the specimens. Another ascertainable cause, but operative to a less extent, was the relative quantity of the preservatives. Even with the sheep brains alone the large ones suffered in the same relative quantity of preservative less change, particularly less ultimate loss, than the small ones; and a double quantity of the liquid, even though most brains chosen for the experiment were large ones, resulted, in the majority of instances, in a loss of weight markedly greater than the average in the smaller proportion of the solution. The variations which remain unaccounted for are of obscure and probably complex

[a] A greater whiteness of the specimens was again noticeable.

[b] All the specimens showed very good hardening. The diminution in size in those in the concentrated solution was very noticeable.

[c] See Donaldson, Jour. Morphol., 1894, p. 149.

nature; fortunately they are not, at least in normal animal brains, very serious.

The effect of daily weighing the brain was, almost generally, greater than the average loss of weight.

The changing of solution after one week and one month had in a few instances no appreciable effect, but mostly there was a consequent temporary (one to two days) rise in weight which acted as a retarder of the continuing loss.

As to the practical results of these experiments on the value of various brain preservatives for macroscopical purposes, it is plain that neither any of the simple formalin solutions nor any of those to which common salt or alum had been added, is satisfactory. The changes in these liquids are considerable and their continuation prolonged, while there are no compensatory advantages. No good purpose would be served by using any of these mixtures, with one possible exception, in the future; the exception concerns the addition of alum to the solution used for brains of fœtuses or the very young, for the purposes of increasing the hardening.

On the other hand, the results obtained with the alcohol and formalin mixtures are most encouraging. These liquids have produced but moderate initial changes (much of which can be done away with by proper modifications of the solutions), followed by the all important feature of subsequent stability. The permanence of this stability has not received as yet a sufficient test of time, but Donaldson's prolonged observations with other alcohol mixtures render it highly probable. The brain is not affected perceptibly by the necessary changes of solution. At all events, it is with this class of preservatives that further experiments are most justifiable.

The addition of the salts in Stroud's liquid gives no superiority over the simple alcohol-formalin solutions. The greater specific gravity of the mixture would commend it on account of the slightly greater prevention of deformation in the specimens, but the somewhat greater initial loss in weight and the subsequent continuous gain are disadvantageous. If equally good results, so far as weight and size of the specimens are concerned, can be obtained with simple mixtures, these should be preferred. Conservation of the form of a specimen in any preservative is largely a matter of proper care.

As a result of the data obtained by the experiments reported upon in this paper, the tentative regulations below outlined concerning brain preservation have been made in the laboratory of physical anthropology of the U. S. National Museum. They can, it is hoped, be pursued with daily and longer periodical weighings of the specimens, and with whatever modifications may become indicated in the liquids, until a substantiated and as simple as possible method of brain preservation has been determined. It would be very desirable if a concurrent

microscopical investigation could be made in some other laboratory, more suited for that purpose, as to the relative value of the various preservatives for the purposes of histology and pathology.

## PRESENT REGULATIONS CONCERNING BRAIN PRESERVATION IN THE LABORATORY OF PHYSICAL ANTHROPOLOGY, UNITED STATES NATIONAL MUSEUM.

Remove the brain as fresh as possible and with the least injury, without the dura; weigh at once; measure the proper solution into a jar of suitable size; place sufficient absorbent cotton on the bottom to protect the specimen from deformation by pressure; in larger specimens introduce a little cotton between the cerebrum and cerebellum, and lay the brain in, base downward. If necessary, support the hemispheres in proper position by additional cotton; close jar as nearly air-tight as possible and place on a shelf out of direct light of the sun; weigh, after the regular drainage, on the eighth day and change solution. Weigh again on the thirty-first day, at the end of three months after reception, and every three months (as long as the experiments last).

*Solutions and proportions.*

| | Distilled water. | 95 per cent alcohol. | Formalin. |
|---|---|---|---|
| | *Parts.* | *Parts.* | *Parts.* |
| Brains up to 50 grams in weight | 45 | 52 | 3 |
| Brains 51 to 150 grams in weight | 40 | 57 | 3 |
| Brains 151 to 300 grams in weight | 35 | 62 | 3 |
| Brains 301 to 900 grams in weight | 30 | 67 | 3 |
| Brains above 900 grams in weight | 25 | 75 | 3 |

Quantity of liquid: All specimens above 30 grams in weight, use 4 c. c. to the gram; brains 15–29 grams, use 6 c. c. to the gram; brains less than 15 grams use 75 c. c. per each specimen.[a]

For brains of fœtuses and the very young use one-half saturated solution of alum in place of water and 10 per cent formalin. Where there is danger of an injury to the brain during weighing, on account of its softness, weigh it indirectly; approximate the quantity of the solution to the calculated weight of the brain; weigh jar and all before and after introduction of the specimen, and subtract, bringing afterwards the liquid to exact proportion.

[a] Larger quantity of liquid made necessary by the size of the smallest convenient jar.

ABSTRACT.

| Preservative. | 3 c. c. per gram (weight at periods indicated below). | | | | | | |
|---|---|---|---|---|---|---|---|
| | Number of brains. | Average per cent of original weight at the end of 1 week. | Per cent variation. | Average per cent of original weight at the end of 1 month. | Per cent variation. | Average per cent of original weight at the end of 2 months. | Per cent variation. |
| 3 per cent formalin | 9 | 121.4 | 5.4 | 121.3 | 6.8 | 118.2 | 5.7 |
| 5 per cent formalin | 9 | 117.9 | 3.9 | 116.0 | 5.8 | 112.8 | 5.3 |
| 10 per cent formalin | 9 | 115.0 | 4.0 | 113.1 | 5.3 | 110.3 | 4.0 |
| 15 per cent formalin | 9 | 112.8 | 8.9 | 111.0 | 9.8 | 106.6 | 10.5 |
| Saturated solution of common salt with 5 per cent formalin | 9 | 92.9 | 4.9 | 89.3 | 6.2 | 86.8 | 6.5 |
| 1,030 sp. gr. common salt solution with 5 per cent formalin | 9 | 97.9 | 10.3 | 95.9 | 9.9 | 93.6 | 10.8 |
| 1,015 sp. gr. common salt solution with 5 per cent formalin | 2 | 101.9 | (1.2) | 100.3 | (1.4) | 95.9 | (1.3) |
| Saturated solution of alum with 5 per cent formalin | 9 | 77.2 | 7.5 | 71.5 | 10.4 | 71.0 | 3.7 |
| One-third saturated solution of alum with 5 per cent formalin | 9 | 99.4 | 3.5 | 93.2 | 7.1 | 88.0 | 10.1 |
| One-fifth saturated solution of alum with 5 per cent formalin | 9 | 101.2 | 4.0 | 92.1 | 7.9 | 85.2 | 6.6 |
| One-third saturated solution of alum with common salt to 1,030 sp. gr. and 10 per cent formalin | 9 | 92.1 | 6.7 | 81.1 | 7.2 | 71.2 | 11.4 |
| One-third saturated solution of alum with common salt to 1,030 sp. gr. and 5 per cent formalin | 9 | 102.4 | 3.6 | 85.6 | 8.1 | 76.3 | 8.9 |
| 80 parts of alcohol and 20 parts of 5 per cent formalin | 3 | 88.5 | 6.2 | 86.9 | 5.8 | 87.0 | 7.1 |
| 65 parts of alcohol and 35 parts of 3 per cent formalin | 2 | 96.3 | (1.1) | 95.8 | (1.2) | 96.0 | (1.7) |
| Sodium acetate, sodium chloride, formalin, and alcohol solution | 9 | 85.9 | 2.3 | 86.5 | 1.9 | 86.4 | 1.9 |

| Preservative. | 6 c. c. per gram (weight at periods indicated below). | | | | 3 c. c. per gram (weighed every day). | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of brains. | Per cent of original weight at the end of— | | | Number of brains. | Per cent of original weight at the end of— | | |
| | | 1 week. | 1 month. | 2 months | | 1 week. | 1 month. | 2 months |
| 3 per cent formalin | 1 | 118.9 | 116.9 | 113.9 | 1 | 117.6 | 115.2 | 113.2 |
| 5 per cent formalin | 1 | 118.9 | 116.4 | 111.4 | 1 | 117.8 | 115.0 | 112.2 |
| 10 per cent formalin | 1 | 114.0 | 112.8 | 108.4 | 1 | 116.2 | 112.2 | 110.3 |
| 15 per cent formalin | 1 | 109.1 | 102.6 | 96.9 | 1 | 108.5 | 104.7 | 99.5 |
| Saturated solution of common salt with 5 per cent formalin | 1 | 93.2 | 90.0 | 81.7 | 1 | 92.1 | ..... | ..... |
| 1,030 sp. gr. common salt solution with 5 per cent formalin | 1 | 94.3 | 92.4 | 89.0 | 1 | 97.1 | 94.2 | 91.2 |
| 1,015 sp. gr. common salt solution with 5 per cent formalin | 1 | 102.0 | 99.6 | 95.1 | 1 | 101.3 | 98.25 | 93.4 |
| Saturated solution of alum with 5 per cent formalin | 1 | 82.3 | 73.5 | 71.5 | 1 | 74.2 | 70.3 | 69.3 |
| One-third saturated solution of alum with 5 per cent formalin | 1 | 97.9 | 92.6 | 88.9 | 1 | 95.8 | 85.2 | 79.2 |
| One-fifth saturated solution of alum with 5 per cent formalin | 1 | 98.4 | 90.9 | 84.1 | 1 | 102.0 | 92.3 | 81.3 |
| One-third saturated solution of alum with common salt to 1,030 sp. gr. and 10 per cent formalin | 1 | 93.9 | 88.1 | 74.0 | 1 | 89.0 | 78.6 | 73.3 |
| One-third saturated solution of alum with common salt to 1,030 sp. gr. and 5 per cent formalin | 1 | 98.3 | 88.4 | 84.2 | 1 | 95.4 | 86.6 | 81.0 |
| 80 parts of alcohol and 20 parts of 5 per cent formalin | 1 | 84.9 | 83.5 | 82.0 | 1 | 88.5 | 87.1 | 83.0 |
| 65 parts of alcohol and 35 parts of 3 per cent formalin | 1 | 90.2 | 87.9 | 88.4 | 1 | 95.3 | 95.3 | 95.3 |
| Sodium acetate, sodium chloride, formalin, and alcohol solution | 1 | 85.0 | 85.4 | 85.4 | 1 | 85.3 | 87.3 | ..... |

## CHANGES IN INDIVIDUAL SHEEP BRAINS.

*Preservative: 3 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 2... | June 6 | 110.5 | 131.0 | 118.55 | 129.5 | 117.19 | −1.15 | Aug. 6 | 127.0 | 114.93 |
| 3... | ....do... | 98.0 | 119.2 | 121.63 | 119.3 | 121.94 | + .08 | ....do... | 116.0 | 118.36 |
| 4... | ....do... | 102.0 | 126.0 | 123.53 | 126.5 | 124.02 | + .39 | ....do... | 123.0 | 120.59 |
| 5... | ....do... | 100.2 | 119.5 | 119.26 | 119.0 | 118.76 | − .42 | ....do... | 115.5 | 115.26 |
| 6... | ....do... | 117.5 | 141.0 | 120.00 | 141.5 | 120.42 | + .35 | ....do... | 138.5 | 117.87 |
| 7... | ....do... | 94.0 | 113.0 | 120.21 | 113.5 | 120.74 | + .44 | ....do... | 110.5 | 117.55 |
| 8... | ....do... | 93.2 | 113.8 | 122.13 | 114.0 | 122.32 | + .17 | ....do... | 110.0 | 118.02 |
| 9... | ....do... | 102.5 | 127.0 | 123.92 | 126.0 | 122.92 | − .78 | ....do... | 123.5 | 120.48 |
| 10[a] | ....do... | 100.5 | 119.5 | 118.90 | 117.5 | 118.00 | −1.67 | ....do... | 114.5 | 113.93 |
| 11.. | ....do... | 95.5 | 118.0 | 123.56 | 118.0 | 123.56 | ..... | ....do... | 115.0 | 120.42 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 7, 1905. Original weight, 102 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First..... | 114.5 | 112.25 | +12.25 | Twenty-ninth... | 118.0 | 115.68 | ± 0.00 |
| Second..... | 118.5 | 116.17 | + 3.92 | Thirtieth[a]..... | 117.5 | 115.19 | − .49 |
| Third..... | 120.0 | 117.64 | + 1.47 | Thirty-first..... | 120.0 | 117.64 | + 2.45 |
| Fourth..... | 120.5 | 118.13 | + .49 | Thirty-second... | 120.5 | 118.13 | + .49 |
| Fifth..... | 120.5 | 118.13 | ± .00 | Thirty-third..... | 120.0 | 117.64 | − .49 |
| Sixth..... | 120.0 | 117.64 | − .49 | Thirty-fourth.... | 119.5 | 117.15 | − .49 |
| Seventh[a]..... | 120.0 | 117.64 | ± .00 | Thirty-fifth..... | 119.5 | 117.15 | ± .00 |
| Eighth..... | 123.2 | 120.59 | + 2.95 | Thirty-sixth..... | 119.5 | 117.15 | ± .00 |
| Ninth..... | 124.0 | 121.56 | + .97 | Thirty-seventh.. | 119.0 | 116.67 | − .48 |
| Tenth..... | 124.0 | 121.56 | ± .00 | Thirty-eighth... | 118.5 | 116.17 | − .50 |
| Twelfth..... | 123.0 | 120.58 | − .98 | Thirty-ninth.... | 119.0 | 116.67 | + .50 |
| Thirteenth..... | 122.5 | 120.09 | − .49 | Fortieth..... | 118.0 | 115.68 | − .99 |
| Fourteenth..... | 122.0 | 119.61 | − .48 | Forty-first..... | 118.0 | 115.68 | ± .00 |
| Fifteenth..... | 121.5 | 119.11 | − .50 | Forty-second.... | 117.5 | 115.19 | − .49 |
| Sixteenth..... | 121.5 | 119.11 | ± .00 | Forty-third..... | 117.5 | 115.19 | ± .00 |
| Seventeenth.... | 121.0 | 118.62 | − .49 | Forty-fourth..... | 117.0 | 114.70 | − .49 |
| Eighteenth..... | 120.5 | 118.13 | − .49 | Forty-fifth..... | 116.5 | 114.21 | − .49 |
| Nineteenth..... | 120.5 | 118.13 | ± .00 | Forty-sixth..... | 116.5 | 114.21 | ± .00 |
| Twentieth..... | 120.0 | 117.64 | − .49 | Forty-seventh... | 116.5 | 114.21 | ± .00 |
| Twenty-first.... | 119.5 | 117.15 | − .49 | Forty-eighth.... | 116.0 | 113.72 | − .49 |
| Twenty-second.. | 118.5 | 116.17 | − .98 | Forty-ninth..... | 116.5 | 114.21 | + .49 |
| Twenty-third... | 119.0 | 116.67 | + .50 | Fiftieth..... | 116.0 | 113.72 | − .49 |
| Twenty-fourth.. | 119.0 | 116.67 | ± .00 | Fifty-first..... | 116.0 | 113.72 | ± .00 |
| Twenty-fifth.... | 118.5 | 116.17 | − .50 | Fifty-eighth..... | 115.5 | 113.23 | − .49 |
| Twenty-sixth... | 118.0 | 115.68 | − .49 | Sixty-fifth..... | 113.5 | 111.22 | − 2.01 |
| Twenty-seventh | 118.0 | 115.68 | ± .00 | Seventy-second.. | 112.5 | 110.29 | − .93 |
| Twenty-eighth.. | 118.0 | 115.68 | ± .00 | | | | |

[a] Change of solution.


Fi

Proc

*Preservative: 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 12.. | June 6 | 117.0 | 138.5 | 118.37 | 140.0 | 119.66 | +1.08 | Aug. 6 | 135.5 | 115.81 |
| 13.. | June 7 | 114.0 | 133.5 | 117.10 | 130.8 | 114.73 | −2.02 | Aug. 7 | 126.0 | 110.53 |
| 14.. | ....do ... | 101.6 | 118.5 | 116.63 | 115.7 | 113.87 | −2.36 | ....do ... | 112.5 | 110.72 |
| 16.. | ....do ... | 98.5 | 116.0 | 117.76 | 113.7 | 115.43 | −1.98 | ....do ... | 111.0 | 112.69 |
| 17.. | ....do ... | 99.5 | 117.0 | 117.58 | 114.2 | 114.77 | −2.39 | ....do ... | 111.5 | 112.06 |
| 18.. | ....do ... | 99.0 | 118.8 | 120.00 | 116.6 | 117.78 | −1.85 | ....do ... | 113.5 | 114.65 |
| 19.. | ....do ... | 95.5 | 114.0 | 119.37 | 112.0 | 117.28 | −1.75 | ....do ... | 109.0 | 114.13 |
| 20.. | ....do ... | 99.0 | 116.8 | 117.98 | 114.0 | 115.15 | −2.39 | ....do ... | 111.0 | 112.12 |
| 21.. | ....do ... | 119.7 | 139.0 | 116.12 | 137.8 | 115.12 | − .86 | ....do ... | 134.5 | 112.37 |
| 22[a] | ....do ... | 100.5 | 119.5 | 118.90 | 117.0 | 116.42 | −2.09 | ....do ... | 112.0 | 111.44 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 6, 1905. Original weight, 106.5 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 119.0 | 111.73 | +11.73 | Twenty-ninth | 122.9 | 115.40 | +0.38 |
| Second | 123.0 | 115.49 | + 3.76 | Thirtieth[a] | 122.5 | 115.02 | − .38 |
| Third | 125.2 | 117.55 | + 2.06 | Thirty-first | 123.5 | 115.96 | + .94 |
| Fourth | 126.5 | 118.77 | + 1.22 | Thirty-second | 123.0 | 115.49 | − .47 |
| Fifth | 126.0 | 118.31 | − .46 | Thirty-third | 122.0 | 114.55 | − .94 |
| Sixth | 125.0 | 117.37 | − .94 | Thirty-fourth | 121.5 | 114.08 | − .47 |
| Seventh[a] | 125.5 | 117.84 | + .47 | Thirty-fifth | 121.5 | 114.08 | ± .00 |
| Eighth | 126.5 | 118.77 | + .93 | Thirty-sixth | 121.5 | 114.08 | ± .00 |
| Ninth | 126.5 | 118.77 | ± .00 | Thirty-seventh | 121.5 | 114.08 | ± .00 |
| Tenth | 125.5 | 117.84 | − .93 | Thirty-eighth | 121.5 | 114.08 | ± .00 |
| Eleventh | 126.0 | 118.31 | + .47 | Thirty-ninth | 121.0 | 113.61 | − .47 |
| Thirteenth | 125.0 | 117.37 | − .94 | Fortieth | 121.5 | 114.08 | + .47 |
| Fourteenth | 125.5 | 117.84 | + .47 | Forty-first | 121.0 | 113.61 | − .47 |
| Fifteenth | 125.0 | 117.37 | − .47 | Forty-second | 120.5 | 113.14 | − .47 |
| Sixteenth | 124.8 | 117.18 | − .19 | Forty-third | 120.0 | 112.67 | − .47 |
| Seventeenth | 124.5 | 116.90 | − .28 | Forty-fourth | 120.0 | 112.67 | ± .00 |
| Eighteenth | 124.5 | 116.90 | ± .00 | Forty-fifth | 120.0 | 112.67 | ± .00 |
| Nineteenth | 125.2 | 117.56 | + .66 | Forty-sixth | 120.0 | 112.67 | ± .00 |
| Twentieth | 125.0 | 117.37 | − .19 | Forty-seventh | 120.0 | 112.67 | ± .00 |
| Twenty-first | 123.5 | 115.96 | − 1.41 | Forty-eighth | 120.5 | 113.14 | + .47 |
| Twenty-second | 123.5 | 115.96 | ± .00 | Forty-ninth | 120.0 | 112.67 | − .47 |
| Twenty-third | 123.8 | 116.24 | + .28 | Fiftieth | 120.0 | 112.67 | ± .00 |
| Twenty-fourth | 123.0 | 115.49 | − .75 | Fifty-first | 119.5 | 112.21 | − .46 |
| Twenty-fifth | 123.0 | 115.49 | ± .00 | Fifty-eighth | 119.5 | 112.21 | ± .00 |
| Twenty-sixth | 123.0 | 115.49 | ± .00 | Sixty-fifth | 119.0 | 111.73 | − .48 |
| Twenty-seventh | 122.5 | 115.02 | − .47 | Seventy-second | 117.0 | 109.86 | −1.87 |
| Twenty-eighth | 122.5 | 115.02 | ± .00 | | | | |

[a] Change of solution.

*Preservative: 10 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 24.. | June 7 | 110.5 | 127.5 | 115.38 | 125.5 | 113.57 | −1.56 | Aug. 7 | 123.0 | 111.31 |
| 25.. | ....do... | 97.0 | 109.5 | 112.88 | 107.0 | 110.31 | −2.28 | ....do... | 105.0 | 108.25 |
| 26.. | ....do... | 97.5 | 110.0 | 112.84 | 110.5 | 113.33 | + .45 | ....do... | 108.0 | 110.77 |
| 27.. | ....do... | 97.0 | 112.2 | 115.67 | 108.5 | 111.85 | −3.29 | ....do... | 106.5 | 109.79 |
| 28.. | June 8 | 96.5 | 111.5 | 115.54 | 109.5 | 113.47 | −1.79 | Aug. 8 | 106.0 | 109.84 |
| 29.. | ....do... | 112.0 | 128.5 | 114.73 | 126.5 | 112.95 | −1.56 | ....do... | 123.0 | 109.82 |
| 30.. | ....do... | 102.0 | 117.5 | 115.19 | 114.5 | 112.25 | −2.55 | ....do... | 111.5 | 109.31 |
| 31.. | ....do... | 110.5 | 128.5 | 116.29 | 127.0 | 114.93 | −1.17 | ....do... | 124.0 | 112.21 |
| 32.. | ....do... | 80.0 | 93.5 | 116.87 | 92.5 | 115.63 | −1.07 | ....do... | 89.0 | 111.25 |
| 33 [a] | ....do... | 125.0 | 142.5 | 114.00 | 141.0 | 112.80 | −1.05 | ....do... | 135.5 | 108.40 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 8, 1905. Original weight, 102 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 113.5 | 111.27 | +11.27 | Twenty-ninth | 114.7 | 112.47 | −0.08 |
| Second | 116.0 | 113.72 | + 2.45 | Thirtieth [a] | 114.5 | 112.25 | − .22 |
| Third | 118.0 | 115.68 | + 1.96 | Thirty-first | 116.0 | 113.72 | +1.47 |
| Fourth | 118.0 | 115.68 | ± .00 | Thirty-second | 116.0 | 113.72 | ± .00 |
| Fifth | 118.5 | 116.17 | + .49 | Thirty-third | 116.0 | 113.72 | ± .00 |
| Sixth | 119.0 | 116.67 | ± .00 | Thirty-fourth | 115.5 | 113.23 | − .49 |
| Seventh [a] | 118.5 | 116.17 | − .49 | Thirty-fifth | 116.0 | 113.72 | + .49 |
| Eighth | 119.8 | 117.45 | + 1.28 | Thirty-sixth | 115.5 | 113.23 | − .49 |
| Ninth | 120.5 | 118.13 | + .68 | Thirty-seventh | 115.5 | 113.23 | ± .00 |
| Tenth | 120.0 | 117.64 | − .49 | Thirty-eighth | 115.0 | 112.74 | − .49 |
| Twelfth | 119.2 | 116.86 | − .78 | Thirty-ninth | 115.0 | 112.74 | ± .00 |
| Thirteenth | 119.0 | 116.67 | − .19 | Fortieth | 114.5 | 112.25 | − .49 |
| Fourteenth | 118.5 | 116.17 | − .50 | Forty-first | 114.0 | 111.76 | − .49 |
| Fifteenth | 117.5 | 115.19 | − .98 | Forty-second | 114.0 | 111.76 | ± .00 |
| Sixteenth | 117.5 | 115.19 | ± .00 | Forty-third | 113.5 | 111.27 | − .49 |
| Seventeenth | 117.5 | 115.19 | ± .00 | Forty-fourth | 113.5 | 111.27 | ± .00 |
| Eighteenth | 117.5 | 115.19 | ± .00 | Forty-fifth | 113.0 | 110.78 | − .49 |
| Nineteenth | 117.0 | 114.71 | − .48 | Forty-sixth | 113.5 | 111.27 | + .49 |
| Twentieth | 116.5 | 114.21 | − .50 | Forty-seventh | 113.0 | 110.78 | − .49 |
| Twenty-first | 116.5 | 114.21 | ± .00 | Forty-eighth | 113.0 | 110.78 | ± .00 |
| Twenty-second | 116.0 | 113.72 | − .49 | Forty-ninth | 113.0 | 110.78 | ± .00 |
| Twenty-third | 115.5 | 113.23 | − .49 | Fiftieth | 112.5 | 110.29 | − .49 |
| Twenty-fourth | 115.0 | 112.74 | − .49 | Fifty-first | 113.0 | 110.78 | + .49 |
| Twenty-fifth | 115.7 | 113.43 | + .69 | Sixtieth | 112.5 | 110.29 | − .49 |
| Twenty-sixth | 115.0 | 112.74 | − .69 | Sixty-seventh | 111.0 | 108.82 | −1.47 |
| Twenty-seventh | 115.0 | 112.74 | ± .00 | Seventy-fourth | 109.5 | 107.35 | −1.47 |
| Twenty-eighth | 114.8 | 112.55 | − .19 | | | | |

[a] Change of solution.

*Preservative: 15 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 34.. | June 8 | 107.0 | 121.0 | 113.08 | 118.2 | 110.47 | −2.31 | Aug. 8 | 114.0 | 106.54 |
| 35.. | ....do... | 111.0 | 126.0 | 113.51 | 123.5 | 111.26 | −1.98 | ....do... | 120.0 | 108.11 |
| 36.. | ....do... | 91.0 | 106.0 | 116.48 | 105.0 | 115.38 | − .94 | ....do... | 101.0 | 110.99 |
| 37.. | ....do... | 94.0 | 105.0 | 111.70 | 103.5 | 110.11 | −1.43 | ....do... | 100.0 | 106.38 |
| 38.. | ....do... | 106.0 | 122.0 | 115.09 | 120.4 | 113.58 | −1.31 | ....do... | 117.0 | 110.38 |
| 39.. | ....do... | 111.8 | 129.2 | 115.56 | 127.0 | 113.59 | −1.70 | ....do... | 122.5 | 109.57 |
| 40.. | ....do... | 119.0 | 133.4 | 112.10 | 130.5 | 109.66 | −2.17 | ....do... | 126.5 | 106.30 |
| 42.. | June 9 | 103.0 | 113.5 | 110.19 | 112.5 | 109.22 | − .88 | Aug. 9 | 103.5 | 100.48 |
| 43.. | ....do... | 98.5 | 106.0 | 107.61 | 104.0 | 105.58 | −1.88 | ....do... | 99.5 | 101.01 |
| 44[a] | ....do... | 97.0 | 105.8 | 109.08 | 99.5 | 102.58 | −5.95 | ....do... | 94.0 | 96.91 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 9, 1905. Original weight, 105.5 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 112.0 | 106.16 | +6.16 | Twenty-ninth | 111.0 | 105.21 | ±0.00 |
| Second | 114.0 | 108.05 | +1.89 | Thirtieth[a] | 110.5 | 104.74 | − .47 |
| Third | 115.0 | 109.00 | + .95 | Thirty-first | 111.5 | 105.68 | + .94 |
| Fourth | 116.0 | 109.95 | + .95 | Thirty-second | 111.0 | 105.21 | − .47 |
| Fifth | 114.5 | 108.53 | −1.42 | Thirty-third | 111.5 | 105.68 | + .47 |
| Sixth | 115.2 | 109.19 | + .66 | Thirty-fourth | 111.2 | 105.40 | − .28 |
| Seventh[a] | 114.5 | 108.53 | − .66 | Thirty-fifth | 110.5 | 104.74 | − .66 |
| Eighth | 115.5 | 109.48 | + .95 | Thirty-sixth | 110.5 | 104.74 | ± .00 |
| Tenth | 114.5 | 108.53 | − .95 | Thirty-seventh | 110.5 | 104.74 | ± .00 |
| Eleventh | 115.0 | 109.00 | + .47 | Thirty-eighth | 110.0 | 104.26 | − .48 |
| Twelfth | 114.5 | 108.53 | − .47 | Thirty-ninth | 109.5 | 103.79 | − .47 |
| Thirteenth | 114.0 | 108.05 | − .48 | Fortieth | 109.5 | 103.79 | ± .00 |
| Fourteenth | 114.0 | 108.05 | ± .00 | Forty-first | 109.0 | 103.31 | − .48 |
| Fifteenth | 113.5 | 107.58 | − .47 | Forty-second | 108.0 | 102.37 | − .94 |
| Sixteenth | 113.7 | 107.77 | + .19 | Forty-third | 107.5 | 101.90 | − .47 |
| Seventeenth | 113.5 | 107.58 | − .19 | Forty-fourth | 107.5 | 101.90 | ± .00 |
| Eighteenth | 113.0 | 107.11 | − .47 | Forty-fifth | 107.5 | 101.90 | ± .00 |
| Nineteenth | 112.0 | 106.16 | − .95 | Forty-sixth | 106.5 | 100.95 | − .95 |
| Twentieth | 113.0 | 107.11 | + .95 | Forty-seventh | 107.0 | 101.42 | + .47 |
| Twenty-first | 112.5 | 106.63 | − .48 | Forty-eighth | 106.5 | 100.95 | − .47 |
| Twenty-second | 111.5 | 105.68 | − .95 | Forty-ninth | 106.5 | 100.95 | ± .00 |
| Twenty-third | 112.0 | 106.16 | + .48 | Fiftieth | 106.0 | 100.47 | − .48 |
| Twenty-fourth | 111.2 | 105.40 | − .76 | Fifty-first | 106.0 | 100.47 | ± .00 |
| Twenty-fifth | 111.5 | 105.68 | + .28 | Fifty-ninth | 105.0 | 99.52 | − .95 |
| Twenty-sixth | 111.5 | 105.68 | ± .00 | Sixty-sixth | 104.0 | 98.58 | − .94 |
| Twenty-seventh | 111.0 | 105.21 | − .47 | Seventy-third | 103.5 | 98.10 | − .48 |
| Twenty-eighth | 111.0 | 105.21 | ± .00 | | | | |

[a] Change of solution.

*Preservative: Saturated solution of salt, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 56.. | June 9 | 95.2 | 86.0 | 90.33 | 81.5 | 85.61 | −5.23 | Aug. 9 | 80.5 | 84.56 |
| 57.. | ....do... | 105.0 | 99.0 | 94.28 | 95.5 | 90.95 | −3.54 | ....do... | 92.5 | 88.09 |
| 58.. | ....do... | 107.7 | 100.5 | 93.31 | 96.5 | 89.78 | −3.98 | ....do... | 95.0 | 88.21 |
| 59.. | ....do... | 103.0 | 94.2 | 91.45 | 90.5 | 87.86 | 3.93 | ....do... | 89.5 | 86.89 |
| 60.. | ....do... | 102.0 | 93.5 | 91.66 | 89.5 | 87.74 | −4.28 | ....do... | 88.5 | 86.76 |
| 61.. | June 10 | 102.5 | 93.5 | 91.22 | 90.0 | 87.80 | −3.74 | Aug. 10 | 84.5 | 82.44 |
| 62.. | ....do... | 104.0 | 99.0 | 95.19 | 95.5 | 91.82 | −3.54 | ....do... | 92.5 | 88.94 |
| 64.. | ....do... | 89.7 | 84.5 | 94.20 | 81.5 | 90.86 | −3.55 | ....do... | 78.5 | 87.51 |
| 65.. | ....do... | 84.5 | 79.5 | 94.08 | 77.0 | 91.12 | −3.15 | ....do... | 74.0 | 87.57 |
| 66[a] | ....do... | 95.5 | 89.0 | 93.19 | 86.0 | 90.05 | −3.37 | ....do... | 78.0 | 81.67 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 10, 1905. Original weight, 101 grams.]

| Number. | Date weighed. | Absolute weight. | Per cent of original weight. | Number. | Date weighed. | Absolute weight. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|
| | | *Grams.* | | | | *Grams.* | |
| 63.. | June 11, 1905 | 95.5 | 94.55 | 63. | June 15, 1905 | 93.2 | 92.27 |
| | June 12, 1905 | 95.0 | 94.05 | | June 16, 1905 | 93.5 | 92.57 |
| | June 13, 1905 | 94.5 | 93.56 | | June 17, 1905 | 93.0 | 92.08 |
| | June 14, 1905 | 93.5 | 92.57 | | | | |

*Preservative: 1,030 sp. gr. salt solution, with 5 per cent formalin.*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 100. | June 13 | 112.0 | 115.0 | 102.68 | 113.5 | 101.34 | −1.30 | Aug 13 | 111.0 | 99.11 |
| 101. | ....do... | 101.0 | 97.5 | 96.53 | 96.0 | 95.05 | −1.54 | ....do... | 93.5 | 92.57 |
| 102. | ....do... | 107.0 | 111.5 | 104.20 | 109.5 | 102.33 | −1.79 | ....do... | 107.5 | 100.47 |
| 103. | ....do... | 97.0 | 93.0 | 95.87 | 91.5 | 94.33 | −1.61 | ....do... | 89.0 | 91.75 |
| 104. | ....do... | 94.0 | 90.5 | 96.27 | 89.0 | 94.68 | −1.66 | ....do... | 88.0 | 93.62 |
| 105. | ....do... | 106.0 | 99.5 | 93.86 | 98.0 | 92.45 | −1.51 | ....do... | 96.5 | 91.04 |
| 106. | ....do... | 105.5 | 101.5 | 96.21 | 99.5 | 94.31 | −1.97 | ....do... | 96.0 | 91.00 |
| 108. | ....do... | 95.0 | 93.5 | 98.42 | 91.0 | 95.79 | −2.67 | ....do... | 88.5 | 93.16 |
| 109. | ....do... | 97.0 | 94.0 | 96.91 | 90.5 | 93.29 | −3.72 | ....do... | 87.0 | 89.69 |
| 110[a] | ....do... | 105.0 | 99.0 | 94.28 | 97.0 | 92.38 | −2.02 | ....do... | 93.5 | 89.05 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 13, 1905. Original weight, 103 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 102.5 | 99.51 | −0.49 | Twenty-eighth | 96.5 | 93.69 | −0.97 |
| Second | 101.5 | 98.54 | − .97 | Twenty-ninth | 96.5 | 93.69 | ± .00 |
| Third | 101.5 | 98.54 | ± .00 | Thirtieth[a] | 96.5 | 93.69 | + .00 |
| Fourth | 100.0 | 97.08 | −1.46 | Thirty-first | 96.3 | 93.49 | − .20 |
| Sixth | 100.0 | 97.08 | ± .00 | Thirty-second | 96.0 | 93.20 | − .29 |
| Seventh[a] | 100.0 | 97.08 | ± .00 | Thirty-third | 96.5 | 93.69 | + .49 |
| Eighth | 100.20 | 97.28 | + .20 | Thirty-fourth | 95.0 | 92.23 | − .46 |
| Ninth | 100.0 | 97.08 | − .20 | Thirty-fifth | 95.5 | 92.72 | + .49 |
| Tenth | 100.5 | 97.57 | + .49 | Thirty-sixth | 95.0 | 92.23 | − .49 |
| Eleventh | 99.5 | 96.60 | − .97 | Thirty-seventh | 95.5 | 92.72 | + .49 |
| Twelfth | 99.5 | 96.60 | ± .00 | Thirty-eighth | 95.5 | 92.72 | ± .00 |
| Thirteenth | 99.0 | 96.11 | − .49 | Thirty-ninth | 95.0 | 92.23 | − .49 |
| Fourteenth | 99.5 | 96.60 | + .49 | Fortieth | 95.5 | 92.72 | + .49 |
| Fifteenth | 98.5 | 95.63 | − .97 | Forty-first | 95.0 | 92.23 | − .49 |
| Sixteenth | 98.0 | 95.14 | − .49 | Forty-second | 95.5 | 92.72 | + .49 |
| Seventeenth | 97.5 | 94.66 | − .48 | Forty-third | 95.5 | 92.72 | ± .00 |
| Eighteenth | 97.5 | 94.66 | ± .00 | Forty-fourth | 95.0 | 92.23 | − .49 |
| Nineteenth | 97.5 | 94.66 | ± .00 | Forty-fifth | 95.0 | 92.23 | + .00 |
| Twentieth | 97.5 | 94.66 | ± .00 | Forty-sixth | 95.0 | 92.23 | ± .00 |
| Twenty-first | 98.0 | 95.14 | + .48 | Forty-seventh | 94.5 | 91.75 | − .48 |
| Twenty-second | 98.0 | 95.14 | ± .00 | Forty-eighth | 94.5 | 91.75 | ± .00 |
| Twenty-third | 97.5 | 94.66 | − .48 | Forty-ninth | 94.5 | 91.75 | ± .00 |
| Twenty-fourth | 97.5 | 94.66 | ± .00 | Fiftieth | 95.0 | 92.23 | + .48 |
| Twenty-fifth | 98.0 | 95.14 | + .48 | Fifty-first | 94.5 | 91.75 | − .48 |
| Twenty-sixth | 97.5 | 94.66 | − .48 | Sixty-first | 94.0 | 91.24 | − .51 |
| Twenty-seventh | 97.5 | 94.66 | ± .00 | Sixty-eighth | 92.5 | 89.81 | −1.43 |

[a] Change of solution.

*Preservative: 1,015 sp. gr. salt solution with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 131. | June 16 | 102.0 | 104.5 | 102.45 | 103.0 | 100.98 | −1.43 | Aug. 16 | 98.5 | 96.57 |
| 132. | ....do ... | 116.0 | 117.5 | 101.29 | 115.5 | 99.57 | −1.70 | ....do ... | 110.5 | 95.26 |
| 134[a] | ....do ... | 123.0 | 125.5 | 102.03 | 122.5 | 99.60 | −2.39 | ....do ... | 117.0 | 95.12 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 16, 1905. Original weight, 114 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 113.5 | 99.56 | −0.44 | Twenty-eighth | 112.5 | 98.68 | +0.43 |
| Third | 115.5 | 101.31 | +1.75 | Twenty-ninth | 112.0 | 98.25 | − .43 |
| Fourth | 116.0 | 101.75 | + .44 | Thirtieth[a] | 112.0 | 98.25 | ± .00 |
| Fifth | 116.0 | 101 75 | ± .00 | Thirty-first | 112.0 | 98.25 | ± .00 |
| Sixth | 115.5 | 101.31 | − .44 | Thirty-second | 111.5 | 97.81 | − .44 |
| Seventh[a] | 115.5 | 101.31 | ± .00 | Thirty-third | 111.5 | 97.81 | ± .00 |
| Eighth | 116.0 | 101.75 | + .44 | Thirty-fourth | 111.0 | 97.37 | − .44 |
| Ninth | 116.0 | 101.75 | ± .00 | Thirty-fifth | 110.5 | 96.93 | − .44 |
| Tenth | 115.5 | 101.31 | − .44 | Thirty-sixth | 110.5 | 96.93 | ± .00 |
| Eleventh | 116.5 | 102.19 | + .88 | Thirty-seventh | 110.5 | 96.93 | ± .00 |
| Twelfth | 115.5 | 101.31 | − .88 | Thirty-eighth | 110.5 | 96.93 | ± .00 |
| Thirteenth | 114.8 | 100.70 | − .61 | Thirty-ninth | 110.5 | 96.93 | ± .00 |
| Fourteenth | 114.5 | 100.44 | − .26 | Fortieth | 110.0 | 96.49 | − .44 |
| Fifteenth | 114.5 | 100.44 | ± .00 | Forty-first | 109.5 | 96.05 | − .44 |
| Sixteenth | 114.0 | 100.00 | − .44 | Forty-second | 109.5 | 96.05 | ± .00 |
| Seventeenth | 114.0 | 100.00 | ± .00 | Forty-third | 109.0 | 95.61 | − .44 |
| Eighteenth | 114.0 | 100.00 | ± .00 | Forty-fourth | 108.5 | 95.17 | − .44 |
| Nineteenth | 113.8 | 99.82 | − .18 | Forty-fifth | 108.0 | 94.73 | − .44 |
| Twentieth | 113.5 | 99.56 | − .26 | Forty-sixth | 108.0 | 94.73 | ± .00 |
| Twenty-first | 113.5 | 99.56 | ± .00 | Forty-seventh | 108.5 | 95.17 | + .44 |
| Twenty-second | 113.5 | 99.56 | ± .00 | Forty-eighth | 108.0 | 94.73 | − .44 |
| Twenty-third | 113.5 | 99.56 | ± .00 | Forty-ninth | 108.0 | 94.73 | ± .00 |
| Twenty-fourth | 113.0 | 99.12 | − .44 | Fiftieth | 108.0 | 94.73 | ± .00 |
| Twenty-fifth | 113.0 | 99.12 | ± .00 | Fifty-first | 107.5 | 94.29 | − .44 |
| Twenty-sixth | 112.5 | 98.68 | − .44 | Sixty-first | 106.5 | 93.42 | − .87 |
| Twenty-seventh | 112.0 | 98.25 | − .43 | Sixty-eighth | 106.0 | 92.98 | − .44 |

[a] Change of solution.

*Preservative: Saturated solution of alum, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 45.. | June 9 | 109.5 | 84.5 | 77.17 | 79.5 | 72.60 | − 5.92 | Aug. 9 | 78.0 | 71.23 |
| 46.. | ....do... | 103.0 | 76.5 | 74.27 | 72.5 | 70.39 | − 5.23 | ....do... | 71.0 | 68.93 |
| 47.. | ....do... | 102.5 | 78.0 | 76.09 | 73.0 | 71.22 | − 6.41 | ....do... | 71.5 | 69.75 |
| 48.. | ....do... | 92.0 | 72.0 | 78.26 | 68.5 | 74.45 | − 4.86 | ....do... | 66.0 | 71.74 |
| 50.. | ....do... | 100.5 | 78.0 | 77.61 | 73.0 | 72.63 | − 6.41 | ....do... | 71.5 | 71.14 |
| 51.. | ....do... | 100.8 | 77.0 | 76.38 | 72.5 | 71.92 | − 5.84 | ....do... | 71.5 | 70.93 |
| 52.. | ....do... | 109.7 | 84.2 | 76.75 | 79.3 | 72.29 | − 5.82 | ....do... | 78.5 | 71.56 |
| 53.. | ....do... | 88.0 | 67.0 | 76.13 | 63.5 | 72.16 | − 5.22 | ....do... | 63.0 | 71.59 |
| 54.. | ....do... | 115.0 | 94.0 | 81.74 | 85.5 | 74.35 | − 9.04 | ....do... | 83.5 | 72.61 |
| 55[a] | ....do... | 125.2 | 103.0 | 82.26 | 92.0 | 73.48 | −10.68 | ....do... | 89.5 | 71.48 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 9, 1905. Original weight, 101 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 87.0 | 86.14 | −13.86 | Twenty-ninth | 71.5 | 70.79 | ±0.00 |
| Second | 83.5 | 82.67 | − 3.47 | Thirtieth[a] | 71.0 | 70.29 | − .50 |
| Third | 81.0 | 80.19 | − 2.48 | Thirty-first | 71.5 | 70.79 | + .50 |
| Fourth | 79.3 | 78.51 | − 1.68 | Thirty-second | 71.0 | 70.29 | − .50 |
| Fifth | 78.0 | 77.22 | − 1.29 | Thirty-third | 71.5 | 70.79 | + .50 |
| Sixth | 76.5 | 75.74 | − 1.48 | Thirty-fourth | 71.5 | 70.79 | ± .00 |
| Seventh[a] | 75.0 | 74.25 | − 1.49 | Thirty-fifth | 71.5 | 70.79 | ± .00 |
| Eighth | 75.5 | 74.75 | + .50 | Thirty-sixth | 71.0 | 70.29 | − .50 |
| Tenth | 73.5 | 72.77 | − 1.98 | Thirty-seventh | 71.5 | 70.79 | + .50 |
| Eleventh | 73.5 | 72.77 | .00 | Thirty-eighth | 71.5 | 70.79 | ± .00 |
| Twelfth | 73.0 | 72.27 | − .50 | Thirty-ninth | 71.3 | 70.59 | − .20 |
| Thirteenth | 72.8 | 72.08 | − .19 | Fortieth | 71.0 | 70.29 | − .30 |
| Fourteenth | 73.0 | 72.27 | + .19 | Forty-first | 71.0 | 70.29 | ± .00 |
| Fifteenth | 72.5 | 71.78 | − .49 | Forty-second | 71.5 | 70.79 | + .50 |
| Sixteenth | 73.0 | 72.27 | + .49 | Forty-third | 71.0 | 70.29 | − .50 |
| Seventeenth | 72.5 | 71.78 | − .49 | Forty-fourth | 71.0 | 70.29 | ± .00 |
| Eighteenth | 73.0 | 72.27 | + .49 | Forty-fifth | 71.0 | 70.29 | ± .00 |
| Nineteenth | 72.0 | 71.28 | − .99 | Forty-sixth | 71.0 | 70.29 | ± .00 |
| Twentieth | 71.5 | 70.79 | − .49 | Forty-seventh | 71.5 | 70.79 | + .50 |
| Twenty-first | 71.5 | 70.79 | ± .00 | Forty-eighth | 71.0 | 70.29 | − .50 |
| Twenty-second | 71.5 | 70.79 | ± .00 | Forty-ninth | 71.0 | 70.29 | ± .00 |
| Twenty-third | 71.7 | 70.99 | + .20 | Fiftieth | 71.0 | 70.29 | ± .00 |
| Twenty-fourth | 71.5 | 70.79 | − .20 | Fifty-first | 70.5 | 69.80 | − .49 |
| Twenty-fifth | 71.8 | 71.09 | + .30 | Sixty-first | 70.0 | 69.31 | − .49 |
| Twenth-sixth | 71.5 | 70.79 | − .30 | Sixty-eighth | 69.5 | 68.81 | − .50 |
| Twenty-seventh | 72.0 | 71.28 | + .49 | Seventy-fifth | 69.5 | 68.81 | ± .00 |
| Twenty-eighth | 71.5 | 70.79 | − .49 | | | | |

[a] Change of solution.

*Preservative: One-third saturated solution of alum, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. Date. | Weight of brain. | Per cent of original weight. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 89 | June 12 | 106.0 | 106.5 | 100.47 | 96.5 | 91.04 | − 9.39 | Aug. 12 | 90.5 | 85.38 |
| 90 | ....do.... | 97.0 | 97.5 | 100.51 | 86.5 | 89.17 | 11.27 | ....do.... | 79.0 | 81.44 |
| 91 | June 13 | 116.5 | 114.0 | 97.85 | 107.0 | 91.84 | 6.14 | Aug. 13 | 101.0 | 86.69 |
| 92 | ....do.... | 105.5 | 104.0 | 98.57 | 99.3 | 94.12 | 4.52 | ....do.... | 95.0 | 90.05 |
| 94 | ....do.... | 116.0 | 113.0 | 97.41 | 106.5 | 91.81 | 5.75 | ....do.... | 100.0 | 86.21 |
| 95 | ....do.... | 120.0 | 120.5 | 100.42 | 115.5 | 96.25 | 4.15 | ....do.... | 109.0 | 90.83 |
| 96 | ....do.... | 113.0 | 112.5 | 99.55 | 107.0 | 94.69 | 4.89 | ....do.... | 103.5 | 91.59 |
| 97 | ....do.... | 110.0 | 111.0 | 100.90 | 105.8 | 96.18 | 4.68 | ....do.... | 99.5 | 90.45 |
| 98 | ....do.... | 103.0 | 101.5 | 98.54 | 96.5 | 93.69 | 4.92 | ....do.... | 92.0 | 89.32 |
| 99 | ....do.... | 122.0 | 119.5 | 97.95 | 113.0 | 92.62 | 5.44 | ....do.... | 108.5 | 88.93 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 13, 1905. Original weight, 108 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 112.0 | 103.70 | 3.70 | Twenty-eighth | 92.0 | 85.19 | − 0.46 |
| Second | 110.0 | 101.85 | −1.85 | Twenty-ninth | 92.5 | 85.65 | + .46 |
| Third | 108.5 | 100.46 | 1.39 | Thirtieth[a] | 92.0 | 85.19 | − .46 |
| Fourth | 108.0 | 100.00 | − .46 | Thirty-first | 90.5 | 83.79 | −1.40 |
| Sixth | 105.0 | 97.22 | 2.78 | Thirty-second | 90.0 | 83.33 | − .46 |
| Seventh[a] | 103.5 | 95.83 | 1.39 | Thirty-third | 90.0 | 83.33 | ± .00 |
| Eighth | 103.0 | 95.37 | − .46 | Thirty-fourth | 89.5 | 82.87 | − .46 |
| Ninth | 102.5 | 94.91 | − .46 | Thirty-fifth | 89.0 | 82.41 | − .46 |
| Tenth | 101.5 | 93.98 | − .93 | Thirty-sixth | 88.5 | 81.94 | − .47 |
| Eleventh | 100.0 | 92.59 | −1.39 | Thirty-seventh | 88.5 | 81.94 | ± .00 |
| Twelfth | 100.2 | 92.78 | + .19 | Thirty-eighth | 88.5 | 81.94 | ± .00 |
| Thirteenth | 98.5 | 91.20 | −1.58 | Thirty-ninth | 88.0 | 81.48 | − .46 |
| Fourteenth | 97.5 | 90.28 | − .92 | Fortieth | 87.5 | 81.02 | − .46 |
| Fifteenth | 97.5 | 90.28 | ± .00 | Forty-first | 87.3 | 80.83 | − .19 |
| Sixteenth | 97.5 | 90.28 | ± .00 | Forty-second | 87.0 | 80.55 | − .28 |
| Seventeenth | 96.6 | 89.44 | − .84 | Forty-third | 87.0 | 80.55 | ± .00 |
| Eighteenth | 95.5 | 88.42 | −1.02 | Forty-fourth | 86.5 | 80.09 | − .46 |
| Nineteenth | 95.5 | 88.42 | ± .00 | Forty-fifth | 86.5 | 80.09 | ± .00 |
| Twentieth | 95.0 | 87.96 | − .46 | Forty-sixth | 86.5 | 80.09 | ± .00 |
| Twenty-first | 94.2 | 87.22 | − .74 | Forty-seventh | 86.0 | 79.63 | − .46 |
| Twenty-second | 94.0 | 87.01 | − .18 | Forty-eighth | 86.0 | 79.63 | ± .00 |
| Twenty-third | 94.0 | 87.04 | + .00 | Forty-ninth | 86.0 | 79.63 | ± .00 |
| Twenty-fourth | 94.0 | 87.04 | + .00 | Fiftieth | 86.0 | 79.63 | ± .00 |
| Twenty-fifth | 93.5 | 86.57 | − .47 | Fifty-first | 86.0 | 79.63 | ± .00 |
| Twenty-sixth | 93.5 | 86.57 | + .00 | Sixty-first | 85.5 | 79.17 | − .46 |
| Twenty-seventh | 92.5 | 85.65 | − .92 | Sixty-eighth | 84.0 | 77.78 | −1.39 |

[a] Change of solution.

*Preservative: One-fifth saturated solution of alum, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 111. | June 13 | 99.0 | 102.0 | 103.03 | 94.5 | 95.45 | − 7.35 | Aug. 13 | 82.0 | 82.82 |
| 113. | June 16 | 108.5 | 109.5 | 100.92 | 100.5 | 92.62 | − 8.22 | Aug. 16 | 92.5 | 85.25 |
| 114. | ....do ... | 108.0 | 111.0 | 102.78 | 101.5 | 93.98 | − 8.56 | ....do ... | 95.5 | 88.42 |
| 115. | ....do ... | 96.0 | 99.0 | 103.12 | 90.5 | 94.27 | − 8.58 | ....do ... | 83.0 | 86.46 |
| 116. | ....do ... | 116.0 | 116.5 | 100.43 | 106.5 | 91.81 | − 8.58 | ....do ... | 99.0 | 85.34 |
| 117. | ....do ... | 108.5 | 108.5 | 100.00 | 99.0 | 91.24 | − 8.75 | ....do ... | 94.5 | 87.09 |
| 118. | ....do ... | 115.0 | 116.0 | 100.87 | 105.5 | 91.74 | − 9.05 | ....do ... | 98.5 | 85.65 |
| 119. | ....do ... | 109.5 | 108.5 | 99.09 | 98.5 | 89.95 | − 9.21 | ....do ... | 92.5 | 84.47 |
| 120. | ....do ... | 112.5 | 113.0 | 100.44 | 98.5 | 87.56 | −12.83 | ....do ... | 92.0 | 81.77 |
| 121[a] | ....do ... | 126.0 | 124.0 | 98.41 | 114.5 | 90.88 | − 7.66 | ....do ... | 106.0 | 84.13 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 13, 1905. Original weight, 100.2 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 103.5 | 103.29 | +3.29 | Twenty-eighth | 92.5 | 92.31 | −0.50 |
| Second | 105.5 | 105.28 | +1.99 | Twenty-ninth | 92.5 | 92.31 | ± .00 |
| Third | 106.5 | 105.97 | + .69 | Thirtieth[a] | 92.5 | 92.31 | ± .00 |
| Fourth | 104.3 | 103.78 | −2.19 | Thirty-first | 91.5 | 91.31 | −1.00 |
| Sixth | 103.2 | 102.78 | −1.00 | Thirty-second | 90.0 | 89.82 | −1.49 |
| Seventh[a] | 102.5 | 101.99 | − .79 | Thirty-third | 89.5 | 89.31 | − .51 |
| Eighth | 102.5 | 101.99 | ± .00 | Thirty-fourth | 88.5 | 88.32 | − .99 |
| Ninth | 101.5 | 101.29 | − .70 | Thirty-fifth | 88.0 | 87.82 | − .50 |
| Tenth | 101.0 | 100.79 | − .50 | Thirty-sixth | 88.0 | 87.82 | ± .00 |
| Eleventh | 100.5 | 100.29 | − .50 | Thirty-seventh | 87.0 | 86.82 | −1.00 |
| Twelfth | 100.0 | 99.80 | − .49 | Thirty-eighth | 87.0 | 86.82 | ± .00 |
| Thirteenth | 99.0 | 98.80 | −1.00 | Thirty-ninth | 86.5 | 86.32 | − .50 |
| Fourteenth | 98.5 | 98.30 | − .50 | Fortieth | 86.5 | 86.32 | ± .00 |
| Fifteenth | 98.0 | 97.80 | − .50 | Forty-first | 86.5 | 86.32 | ± .00 |
| Sixteenth | 97.5 | 97.31 | − .49 | Forty-second | 85.5 | 85.32 | −1.00 |
| Seventeenth | 97.0 | 96.81 | − .50 | Forty-third | 85.5 | 85.32 | ± .00 |
| Eighteenth | 96.0 | 95.81 | −1.00 | Forty-fourth | 85.0 | 84.83 | − .49 |
| Nineteenth | 96.0 | 95.81 | ± .00 | Forty-fifth | 84.5 | 84.33 | − .50 |
| Twentieth | 95.5 | 95.31 | − .50 | Forty-sixth | 84.0 | 83.83 | + .50 |
| Twenty-first | 95.2 | 95.01 | − .30 | Forty-seventh | 84.0 | 83.83 | ± .00 |
| Twenty-second | 95.2 | 95.01 | ± .00 | Forty-eighth | 83.5 | 83.33 | − .50 |
| Twenty-third | 94.5 | 94.31 | − .70 | Forty-ninth | 83.5 | 83.33 | ± .00 |
| Twenty-fourth | 94.5 | 94.31 | ± .00 | Fiftieth | 84.0 | 83.83 | + .50 |
| Twenty-fifth | 93.5 | 93.31 | −1.00 | Fifty-first | 83.5 | 83.83 | − .50 |
| Twenty-sixth | 93.5 | 93.31 | ± .00 | Sixty-first | 83.0 | 82.83 | −1.00 |
| Twenty-seventh | 93.0 | 92.81 | − .50 | Sixty-eighth | 81.5 | 81.33 | −1.50 |

[a] Change of solution.

*Preservative: One-third saturated solution of alum, sodium chloride up to 1,030 sp. gr., with 10 per cent formalin.*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 78.. | June 12 | 108.0 | 98.0 | 90.74 | 85.0 | 78.70 | −13.26 | Aug. 12 | 77.5 | 71.76 |
| 79.. | ....do ... | 115.2 | 106.0 | 92.01 | 99.0 | 85.94 | − 6.60 | ....do ... | 94.5 | 82.03 |
| 80.. | ....do ... | 108.0 | 99.0 | 91.66 | 86.5 | 80.09 | −12.62 | ....do ... | 78.0 | 72.22 |
| 81.. | ....do ... | 111.5 | 102.0 | 91.48 | 91.5 | 82.06 | −10.29 | ....do ... | 81.5 | 73.09 |
| 82.. | ....do ... | 104.0 | 94.5 | 90.86 | 83.0 | 79.81 | −12.17 | ....do ... | 73.5 | 70.67 |
| 83.. | ....do ... | 101.0 | 91.5 | 90.59 | 79.5 | 78.71 | −13.11 | ....do ... | 71.5 | 70.79 |
| 84.. | ....do ... | 113.0 | 102.0 | 90.26 | 89.0 | 78.76 | −12.74 | ....do ... | 80.5 | 71.24 |
| 86.. | ....do ... | 95.5 | 90.5 | 94.76 | 78.0 | 81.67 | −13.81 | ....do ... | 69.5 | 72.77 |
| 87.. | ....do ... | 100.5 | 97.5 | 97.01 | 85.0 | 84.57 | −12.82 | .... do ... | 76.5 | 76.12 |
| 88[a]. | ....do ... | 115.5 | 108.5 | 93.94 | 96.0 | 83.12 | −11.52 | ....do ... | 85.5 | 74.03 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 12, 1905. Original weight, 105 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 102.5 | 97.62 | − 2.38 | Twenty-ninth | 83.0 | 79.05 | +0.47 |
| Second | 98.5 | 93.81 | −3.81 | Thirtieth[a] | 82.5 | 78.57 | − .48 |
| Third | 98.4 | 93.71 | − .10 | Thirty-first | 82.0 | 78.09 | − .48 |
| Fourth | 98.0 | 93.33 | − .38 | Thirty-second | 81.5 | 77.62 | − .48 |
| Fifth | 95.5 | 90.95 | −2.38 | Thirty-third | 81.5 | 77.62 | ± .00 |
| Seventh[a] | 93.5 | 89.05 | −1.90 | Thirty-fourth | 81.5 | 77.62 | ± .00 |
| Eighth | 92.0 | 87.62 | −1.43 | Thirty-fifth | 80.0 | 76.19 | −1.43 |
| Ninth | 92.0 | 87.62 | ± .00 | Thirty-sixth | 80.0 | 76.19 | ± .00 |
| Tenth | 91.5 | 87.11 | − .48 | Thirty-seventh | 80.0 | 76.19 | ± .00 |
| Eleventh | 91.0 | 86.67 | − .47 | Thirty-eighth | 80.0 | 76.19 | ± .00 |
| Twelfth | 89.5 | 85.23 | −1.44 | Thirty-ninth | 80.0 | 76.19 | ± .00 |
| Thirteenth | 89.5 | 85.23 | ± .00 | Fortieth | 79.5 | 75.71 | − .48 |
| Fourteenth | 89.0 | 84.76 | − .47 | Forty-first | 79.0 | 75.23 | − .48 |
| Fifteenth | 88.5 | 84.28 | − .48 | Forty-second | 79.0 | 75.23 | ± .00 |
| Sixteenth | 88.0 | 83.81 | − .47 | Forty-third | 79.0 | 75.23 | ± .00 |
| Seventeenth | 86.5 | 82.38 | −1.43 | Forty-fourth | 79.0 | 75.23 | ± .00 |
| Eighteenth | 86.5 | 82.38 | ± .00 | Forty-fifth | 78.5 | 74.76 | − .47 |
| Nineteenth | 86.0 | 81.90 | − .48 | Forty-sixth | 78.0 | 74.28 | − .48 |
| Twentieth | 85.5 | 81.43 | − .47 | Forty-seventh | 77.5 | 73.81 | − .47 |
| Twenty-first | 85.0 | 80.95 | − .48 | Forty-eighth | 77.0 | 73.33 | − .48 |
| Twenty-second | 84.5 | 80.47 | − .48 | Forty-ninth | 77.5 | 73.81 | + .48 |
| Twenty-third | 84.5 | 80.47 | ± .00 | Fiftieth | 77.5 | 73.81 | ± .00 |
| Twenty-fourth | 83.5 | 79.52 | − .95 | Fifty-first | 77.5 | 73.81 | ± .00 |
| Twenty-fifth | 84.0 | 80.00 | + .48 | Sixty-first | 77.0 | 73.33 | − .48 |
| Twenty-sixth | 83.5 | 79.52 | − .48 | Sixty-seventh | 76.0 | 72.38 | − .95 |
| Twenty-seventh | 82.5 | 78.57 | − .95 | Seventy-fourth | 76.0 | 72.38 | ± .00 |
| Twenty-eighth | 82.5 | 78.57 | ± .00 | | | | |

[a] Change of solution.

*Preservative: One-third saturated solution of alum, with salt up to 1,030 sp. gr.; 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 67.. | June 10 | 123.0 | 128.0 | 104.06 | 110.5 | 89.84 | −13.67 | Aug. 10 | 94.0 | 76.42 |
| 68.. | June 12 | 114.0 | 114.5 | 100.44 | 95.0 | 83.33 | −17.03 | Aug. 12 | 87.0 | 76.31 |
| 69 | ....do... | 104.5 | 107.0 | 102.37 | 88.5 | 84.69 | −17.29 | ....do... | 78.0 | 74.64 |
| 70.. | ....do... | 99.8 | 101.5 | 101.70 | 84.0 | 84.16 | −17.24 | ....do... | 75.5 | 75.65 |
| 71.. | ....do... | 104.5 | 107.0 | 102.37 | 84.4 | 81.72 | −21.12 | ....do... | 76.0 | 72.73 |
| 72.. | ....do... | 109.5 | 110.5 | 100.91 | 92.0 | 84.02 | −16.74 | ....do... | 82.0 | 74.88 |
| 73.. | ....do... | 97.5 | 101.0 | 103.58 | 83.0 | 85.13 | −17.82 | ....do... | 76.0 | 77.95 |
| 74.. | ....do... | 110.8 | 113.5 | 102.43 | 97.5 | 87.99 | −14.09 | ....do... | 90.5 | 81.68 |
| 76.. | ....do... | 98.0 | 102.0 | 104.08 | 87.5 | 89.28 | −14.21 | ....do... | 75.0 | 76.53 |
| 77[a] | ....do... | 120.5 | 118.5 | 98.34 | 106.5 | 88.38 | −10.13 | ....do... | 101.5 | 84.23 |

[a] At 6 c. c. per gram.

[Brain weighed daily. Received June 12, 1905. Original weight, 108 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 107.0 | 99.08 | −0.92 | Twenty-ninth | 93.0 | 86.11 | ±0.00 |
| Second | 106.0 | 98.15 | − .93 | Thirtieth[a] | 93.5 | 86.57 | + .46 |
| Third | 105.5 | 97.68 | − .47 | Thirty-first | 91.5 | 84.72 | −1.85 |
| Fourth | 105.0 | 97.22 | − .46 | Thirty-second | 91.0 | 84.26 | − .46 |
| Fifth | 105.5 | 97.68 | + .46 | Thirty-third | 90.5 | 83.79 | − .47 |
| Seventh[a] | 103.0 | 95.37 | −2.31 | Thirty-fourth | 90.5 | 83.79 | ± .00 |
| Eighth | 102.7 | 95.09 | − .28 | Thirty-fifth | 89.5 | 82.87 | − .92 |
| Ninth | 100.5 | 93.05 | −2.04 | Thirty-sixth | 89.5 | 82.87 | ± .00 |
| Tenth | 100.5 | 93.05 | ± .00 | Thirty-seventh | 89.5 | 82.87 | ± .00 |
| Eleventh | 100.5 | 93.05 | ± .00 | Thirty-eighth | 89.0 | 82.41 | − .46 |
| Twelfth | 100.0 | 92.59 | − .46 | Thirty-ninth | 88.5 | 81.94 | − .47 |
| Thirteenth | 99.0 | 91.67 | − .92 | Fortieth | 89.0 | 82.41 | + .47 |
| Fourteenth | 98.5 | 91.20 | − .47 | Forty-first | 89.0 | 82.41 | ± .00 |
| Fifteenth | 97.0 | 89.81 | −1.39 | Forty-second | 89.5 | 82.87 | + .46 |
| Sixteenth | 96.8 | 89.63 | − .18 | Forty-third | 89.0 | 82.41 | − .46 |
| Seventeenth | 95.5 | 88.42 | −1.21 | Forty-fourth | 89.0 | 82.41 | ± .00 |
| Eighteenth | 96.0 | 88.89 | + .47 | Forty-fifth | 87.5 | 81.02 | −1.39 |
| Nineteenth | 96.5 | 89.35 | + .46 | Forty-sixth | 88.0 | 81.48 | + .46 |
| Twentieth | 95.8 | 88.70 | − .65 | Forty-seventh | 87.5 | 81.02 | − .46 |
| Twenty-first | 95.5 | 88.42 | − .28 | Forty-eighth | 88.0 | 81.48 | + .46 |
| Twenty-second | 95.0 | 87.96 | − .46 | Forty-ninth | 87.5 | 81.02 | − .46 |
| Twenty-third | 95.0 | 87.96 | ± .00 | Fiftieth | 87.5 | 81.02 | ± .00 |
| Twenty-fourth | 94.5 | 87.50 | − .46 | Fifty-first | 88.0 | 81.48 | + .46 |
| Twenty-fifth | 94.3 | 87.31 | − .19 | Sixty-first | 87.5 | 81.02 | − .46 |
| Twenty-sixth | 94.0 | 87.03 | − .28 | Sixty-seventh | 86.5 | 80.09 | − .93 |
| Twenty-seventh | 93.0 | 86.11 | − .92 | Seventy-fourth | 86.0 | 79.63 | − .46 |
| Twenty-eighth | 93.0 | 86.11 | ± .00 | | | | |

[a] Change of solution.

*Preservative: Eighty parts of 95 per cent alcohol and 20 parts of 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 123 | June 16 | 102.0 | [a]90.5 | 88.72 | [a]89.8 | 88.04 | 0.77 | Aug. 16 | 90.5 | 88.72 |
| 124 | ....do.... | 117.0 | [a]107.0 | 91.45 | [a]104.5 | 89.31 | - 2.34 | ....do.... | 105.0 | 89.74 |
| 126 | ....do.... | 112.0 | [a]95.5 | 85.27 | [a]93.5 | 83.48 | - 2.09 | ....do.... | 92.5 | 82.59 |
| 125[b] | ....do.... | 106.0 | [a]90.0 | 84.90 | [a]88.5 | 83.49 | - 1.66 | ....do.... | 87.0 | 82.07 |

[a] Solution not changed. [b] At 6 c. c. per gram.

[Brain weighed daily. Received June 16, 1905. Original weight, 109 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 106.0 | 97.25 | −2.75 | Twenty-eighth | 94.0 | 86.24 | - 0.45 |
| Third | 100.6 | 92.29 | - 1.96 | Twenty-ninth | 94.0 | 86.24 | + .00 |
| Fourth | 98.5 | 90.36 | −1.93 | Thirtieth[a] | 95.0 | 87.15 | + .91 |
| Fifth | 97.0 | 88.99 | - 1.37 | Thirty-first | 94.5 | 86.69 | - .46 |
| Sixth | 95.8 | 87.89 | - 1.10 | Thirty-second | 92.5 | 84.86 | - 1.83 |
| Seventh[a] | 96.5 | 88.53 | + .64 | Thirty-third | 91.0 | 83.48 | - 1.38 |
| Eighth | 95.5 | 87.61 | - .92 | Thirty-fourth | 91.5 | 83.94 | + .46 |
| Ninth | 94.5 | 86.69 | .92 | Thirty-fifth | 91.0 | 83.48 | - .46 |
| Tenth | 94.5 | 86.69 | + .00 | Thirty-six | 91.0 | 83.48 | + .00 |
| Eleventh | 95.0 | 87.15 | + .46 | Thirty-seventh | 91.5 | 83.94 | + .46 |
| Twelfth | 93.5 | 85.78 | 1.37 | Thirty-eighth | 91.0 | 83.48 | - .46 |
| Thirteenth | 93.0 | 85.32 | - .46 | Thirty-ninth | 91.0 | 83.48 | ∓ .00 |
| Fourteenth | 93.5 | 85.78 | + .46 | Fortieth | 91.0 | 83.48 | + .00 |
| Fifteenth | 93.0 | 85.32 | - .46 | Forty-first | 91.0 | 83.48 | + .00 |
| Sixteenth | 93.5 | 85.78 | + .46 | Forty-second | 91.0 | 83.48 | + .00 |
| Seventeenth | 93.0 | 85.32 | - .46 | Forty-third | 91.0 | 83.48 | + .00 |
| Eighteenth | 93.5 | 85.78 | + .46 | Forty-fourth | 90.5 | 83.03 | - .45 |
| Nineteenth | 93.5 | 85.78 | + .00 | Forty-fifth | 90.5 | 83.03 | + .00 |
| Twentieth | 94.0 | 86.24 | + .46 | Forty-sixth | 90.5 | 83.03 | + .00 |
| Twenty-first | 93.5 | 85.78 | - .46 | Forty-seventh | 90.5 | 83.03 | + .00 |
| Twenty-second | 94.0 | 86.24 | + .46 | Forty-eighth | 90.5 | 83.03 | + .00 |
| Twenty-third | 94.0 | 86.24 | + .00 | Forty-ninth | 90.5 | 83.03 | + .00 |
| Twenty-fourth | 93.5 | 85.78 | - .46 | Fiftieth | 90.5 | 83.03 | + .00 |
| Twenty-fifth | 93.5 | 85.78 | + .00 | Fifty-first | 90.5 | 83.03 | + .00 |
| Twenty-sixth | 94.0 | 86.24 | + .46 | Sixty-first | 90.5 | 83.03 | + .00 |
| Twenty-seventh | 94.5 | 86.69 | + .45 | Sixty-fifth | 90.5 | 83.03 | + .00 |

[a] Change of solution.

*Preservative: Sixty-five parts of 95 per cent alcohol and 35 parts of 3 per cent formalin.*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | | *Grams.* | |
| 128. | June 16 | 93.5 | [a]89.5 | 95.72 | [a]89.0 | 95.18 | −0.50 | Aug. 16 | 89.0 | 95.18 |
| 129. | ....do... | 95.5 | [a]92.5 | 96.86 | [a]92.0 | 96.34 | −0.54 | ....do... | 92.5 | 96.86 |
| 130[b] | ....do... | 112.0 | [a]101.0 | 90.18 | [a]98.5 | 87.95 | −2.47 | ....do... | 99.0 | 88.39 |

[a] Solution not changed. [b] At 6 c. c. per gram.

[Brain weighed daily. Received June 16, 1905. Original weight, 96 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 97.5 | 101.56 | +1.56 | Twenty-eighth | 91.5 | 95.31 | ±0.00 |
| Third | 94.0 | 97.91 | −3.65 | Twenty-ninth | 91.5 | 95.31 | ± .00 |
| Fourth | 92.5 | 96.35 | −1.56 | Thirtieth | 92.0 | 95.83 | ± .52 |
| Fifth | 92.5 | 96.35 | ± .00 | Thirty-first[a] | 91.5 | 95.31 | − .52 |
| Sixth | 92.0 | 95.83 | − .52 | Thirty-second | 91.5 | 95.31 | ± .00 |
| Seventh | 91.5 | 95.31 | − .52 | Thirty-third | 91.5 | 95.31 | ± .00 |
| Eighth[a] | 91.5 | 95.31 | ± .00 | Thirty-fourth | 91.0 | 94.79 | − .52 |
| Ninth | 91.7 | 95.52 | + .21 | Thirty-fifth | 91.5 | 95.31 | + .52 |
| Tenth | 91.5 | 95.31 | − .21 | Thirty-sixth | 91.5 | 95.31 | ± .00 |
| Eleventh | 92.0 | 95.83 | + .52 | Thirty-seventh | 91.5 | 95.31 | ± .00 |
| Twelfth | 91.5 | 95.31 | − .52 | Thirty-eighth | 91.0 | 94.79 | − .52 |
| Thirteenth | 91.0 | 94.79 | − .52 | Thirty-ninth | 91.0 | 94.79 | ± .00 |
| Fourteenth | 91.5 | 95.31 | + .52 | Fortieth | 91.5 | 95.31 | + .52 |
| Fifteenth | 91.0 | 94.79 | − .52 | Forty-first | 91.0 | 94.79 | − .52 |
| Sixteenth | 91.0 | 94.79 | ± .00 | Forty-second | 91.0 | 94.79 | ± .00 |
| Seventeenth | 91.5 | 95.31 | + .52 | Forty-third | 91.0 | 94.79 | ± .00 |
| Eighteenth | 91.0 | 94.79 | − .52 | Forty-fourth | 91.0 | 94.79 | ± .00 |
| Nineteenth | 91.5 | 95.31 | + .52 | Forty-fifth | 91.5 | 95.31 | + .52 |
| Twentieth | 91.5 | 95.31 | ± .00 | Forty-sixth | 91.5 | 95.31 | ± .00 |
| Twenty-first | 91.5 | 95.31 | ± .00 | Forty-seventh | 91.0 | 94.79 | − .52 |
| Twenty-second | 91.5 | 95.31 | ± .00 | Forty-eighth | 91.0 | 94.79 | ± .00 |
| Twenty-third | 91.8 | 95.63 | + .32 | Forty-ninth | 91.0 | 94.79 | ± .00 |
| Twenty-fourth | 91.0 | 94.79 | − .84 | Fiftieth | 91.0 | 94.79 | ± .00 |
| Twenty-fifth | 91.5 | 95.31 | + .52 | Fifty-first | 91.0 | 94.79 | ± .00 |
| Twenty-sixth | 91.5 | 95.31 | ± .00 | Sixty-first | 91.5 | 95.31 | + .52 |
| Twenty-seventh | 91.5 | 95.31 | ± .00 | Sixty-seventh | 91.0 | 94.79 | − .52 |

[a] Change of solution.

*Sodium acetate (fused) 130 grams; sodium chloride, 110 grams; formalin, 20 c. c.; 95 per cent alcohol, 460 c. c.; water, 540 c. c. (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Date. | Weight of brain. | Per cent of original weight. |
| | 1905. | *Grams.* | *Grams.* | | *Grams.* | | | 1905. | *Grams.* | |
| 135. | June 27 | 118.2 | [a]102.5 | 86.72 | [a]102.5 | 86.72 | +0.00 | Aug. 27 | 102.5 | 86.72 |
| 136. | ...do... | 114.0 | [a]98.5 | 86.40 | [a]99.0 | 86.84 | + .51 | ....do... | 98.5 | 86.40 |
| 137. | ....do... | 101.0 | [a]86.5 | 85.64 | [a]87.5 | 86.63 | +1.15 | ....do... | 87.0 | 86.13 |
| 139. | ....do... | 114.5 | [a]98.5 | 86.02 | [a]99.5 | 86.90 | +1.01 | ....do... | 99.5 | 86.90 |
| 140. | ....do... | 115.2 | [a]99.0 | 85.93 | [a]99.5 | 86.37 | + .51 | ....do... | 99.0 | 85.93 |
| 141. | ....do... | 105.7 | [a]90.5 | 85.62 | [a]91.0 | 86.09 | + .55 | ....do... | 91.5 | 86.56 |
| 142. | ....do... | 82.0 | [a]70.0 | 85.36 | [a]70.5 | 85.97 | + .71 | ....do... | 70.5 | 85.97 |
| 143. | ....do... | 103.5 | [a]87.5 | 84.54 | [a]88.5 | 85.51 | +1.14 | ....do... | 88.5 | 85.51 |
| 144. | ....do... | 103.0 | [a]89.5 | 86.89 | [a]90.0 | 87.38 | + .56 | ....do... | 90.0 | 87.38 |
| 145[b] | ....do... | 110.0 | 93.5 | 85.00 | 94.0 | 85.45 | + .53 | ....do... | 94.0 | 85.45 |

[a] Solution not changed.

[b] At 6 c. c. per gram.

[Brain weighed daily. Received June 27, 1905. Original weight, 100.8 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|---|---|---|---|---|---|---|---|
| | *Grams.* | | | | *Grams.* | | |
| First | 90.5 | 89.78 | −10.22 | Twenty-seventh | 88.0 | 87.30 | +0.49 |
| Second | 87.5 | 86.81 | − 2.97 | Twenty-eighth | 88.0 | 87.30 | ∓ .00 |
| Third | 86.5 | 85.81 | − 1.00 | Twenty-ninth | 88.5 | 87.79 | + .49 |
| Fourth | 86.5 | 85.81 | ∓ .00 | Thirtieth[a] | 88.0 | 87.30 | − .49 |
| Fifth | 86.5 | 85.81 | ∓ .00 | Thirty-first | 88.0 | 87.30 | ∓ .00 |
| Sixth | 85.5 | 84.82 | − .99 | Thirty-second | 87.5 | 86.81 | − .49 |
| Seventh[a] | 86.0 | 85.31 | + .49 | Thirty-third | 87.5 | 86.81 | ∓ .00 |
| Eighth | 86.5 | 85.81 | + .50 | Thirty-fourth | 87.5 | 86.81 | ∓ .00 |
| Ninth | 86.5 | 85.81 | ∓ .00 | Thirty-fifth | 87.0 | 86.31 | − .50 |
| Tenth | 87.0 | 86.31 | + .50 | Thirty-sixth | 87.0 | 86.31 | ∓ .00 |
| Eleventh | 87.0 | 86.31 | ∓ .00 | Thirty-seventh | 87.5 | 86.81 | + .50 |
| Twelfth | 87.0 | 86.31 | ∓ .00 | Thirty-eighth | 87.5 | 86.81 | ∓ .00 |
| Thirteenth | 87.0 | 86.31 | ∓ .00 | Thirty-ninth | 87.5 | 86.81 | ∓ .00 |
| Fourteenth | 86.5 | 85.81 | + .50 | Fortieth | 87.5 | 86.81 | ∓ .00 |
| Fifteenth | 86.5 | 85.81 | ∓ .00 | Forty-first | 87.5 | 86.81 | ∓ .00 |
| Sixteenth | 87.0 | 86.31 | − .50 | Forty-second | 87.5 | 86.81 | ∓ .00 |
| Seventeenth | 87.0 | 86.31 | ∓ .00 | Forty-third | 87.5 | 86.81 | ∓ .00 |
| Eighteenth | 87.0 | 86.31 | ∓ .00 | Forty-fourth | 87.5 | 86.81 | ∓ .00 |
| Nineteenth | 87.5 | 86.81 | + .50 | Forty-fifth | 87.0 | 86.31 | − .50 |
| Twentieth | 87.0 | 86.31 | − .50 | Forty-sixth | 87.5 | 86.31 | + .50 |
| Twenty-first | 87.5 | 86.81 | + .50 | Forty-seventh | 87.5 | 86.81 | ∓ .00 |
| Twenty-second | 87.5 | 86.81 | ∓ .00 | Forty-eighth | 87.5 | 86.81 | ∓ .00 |
| Twenty-third | 87.3 | 86.61 | − .20 | Forty-ninth | 87.5 | 86.81 | ∓ .00 |
| Twenty-fourth | 87.5 | 86.81 | + .20 | Fiftieth | 88.0 | 87.30 | + .49 |
| Twenty-fifth | 87.0 | 86.31 | − .50 | Fifty-seventh | 88.0 | 87.30 | ∓ .00 |
| Twenty-sixth | 87.5 | 86.81 | + .50 | Sixty-fourth | 88.5 | 87.80 | + .50 |

[a] Change of solution.

## BIBLIOGRAPHY.


v. BARDELEBEN, K., and U. HOLZIN (OPPERMANN). Ein neues Mittel zur Conservirung von organischen Substancen, etc.: Verh. Ges. deutsch. Nat. und Aerzte, 68 Vers., II, Pt. 2, 1897, p. 490. Frankfurt a. M.

BERGONZOLI, G. La formalina quale mezzo di conservazione e di indurimento dei preparati anatomici: Boll. scient., XVI, 1894, pp. 18–21. Pavia.

———. Ancora sulla formalina: Boll. scientif., XVII, 1895, pp. 26–29.

BLUM, F. Der Formaldehyd als Härtungsmittel: Zeitschr. f. wissensch. Microscopie, X, 1893, pp. 314–315. Braunschweig.

———. Notiz über die Anwendung des Formaldehyds (Formol) als Härtungs- und Conservirungsmittel: Anat. Anz., IX, 1894, No. 7.

———. Ueber Formaldehyd: München. Med. Wochenschr., 1894, No. 24 (with a review of the use of the chemical).

———. Ueber Wesen und Wert der Formolhärtung: Anat. Anz., XI, 1896, pp. 718–727.

BORN, G. Demonstration einer Anzahl in Formaldehyd (Formol) gehärteter menschlicher Gehirne: Jahresber. Schlesische Gesell. f. vaterländische Kultur, Med. Sek., 2. März 1894, pp. 42–43.

CHENCINSKI, C. J. O sokhranenii mozga i drugikh anatomicheskikh preparatov v rastvorakh formalina. (On the preservation of the brain and other anatomical specimens in solutions of formalin): Yuzhnorussk. med. gaz., Odessa, V, 1896, pp. 49–51.

———. Ueber die Härtung des Gehirns in Formalinlösungen: Centralbl. f. allg. Pathol. u. pathol. Anat., VII, 1896, pp. 429-430. Jena.

DEXLER, H. Zur Präparationstechnik der Organe des Centralnervensystems: Zeitschr. f. Thiermed., V, 1901, pp. 361–387.

DIEDERICHS, K. Formol Konservirung: Zeischr. f. angew. Mikroskopie, VII, 1902, pp. 146–149.

DONALDSON, H. H. Preliminary Observations on some Changes Caused in the Nervous Tissues by Reagents commonly Employed to Harden them: Jour. Morphol., IX, 1894, pp. 123–166. Boston.

ECCLES, W. MCADAM. Formic-Aldehyde as a Rapid Hardening Reagent for Animal Tissue: Brit. Med. Jour., I, 1894, p. 1124.

EISLER. Demonstration macroscopischer Präparate von in Formol gehärteten menschlichen Gehirnen: Verhandl. d. Anat. Ges., X. Vers., Berlin, Jena, 1896, pp. 181–183.

FISH, P. A. Formalin for the Preservation of Brains: Jour. of Neurol., V, 1895, pp. 126–128.

———. The Use of Formalin in Neurology: Proc. Amer. Mic. Soc., XVII, 1895.

FLATAU. Referred to in Dexler; original not found.

FREEBORN, G. C. A Résumé of the Uses of Formalin: New York Med. Jour., LXIII, 1896, pp. 770–775; also Proc. New York Path. Soc. (1896), 1897, pp. 29–43.

FÜLLEBORN. Ueber Formalinconservirung: Zool. Anz., XXIV, 1901, pp. 42–46.

GEIDENREIKH, L. L. O nailuchshei zhidkosti dlya sokhraneniya anatomicheskikh preparatov (Best fluid for preserving anatomical specimens): Russk. Vrach, St. Petersb., II, 1903, pp. 602–605.

GEROTA, D. Ueber die Anwendung des Formols in der topographischen Anatomie: Anat. Anz., XI, 1896, pp. 417–420.

HEWSON, A. Descriptions of a Method for Preparing Brains used in Class Demonstrations: Amer. Jour. of Anat., III, 1904, pp. xi–xii (Proc. Amer. Assoc. Anat.).

JELGERSMA, G. D. Fixirung des Centralnervensystems in Formol: Psychiatr. e. Neurol. Bladen, 1898, No. 1, p. 84.

KEITH, A. Organs from Dissecting Room Subjects which had been Preserved with Formaldehyd: Trans. Anat. Soc. Great Brit. and Ire., Jour. Anat. and Physiol., XXX (N. S., X), 1896, pp. xi, xii.

KRAUSS, W. C. Formalin as a Hardening Agent for Nerve Tissues: Mod. Med. and Bacter. Rev., V, 1896, pp. 59–60. Battle Creek, Mich.

LANZILLOTTI-BUONSANTI, A. Nuovo processo di conservazione dei centri nervosi: Monit. Zool. Ital., V, 1894, p. 273.

MARCUS, H. Die Verwendung der Weigert-Palschen Färbungsmethode für in Formol gehärtetes Centralnervensystem: Neurol. Central., XIV, 1895, p. 4.

MARIE, R. Formal comme réactif fixateur et durcissant des centres nerveux: Bull. Soc. anat., LXIX, 1894, pp. 992–993. Paris.

MELNIKOFF-RASVÉDENKOFF N. Eine neue Conservirungsmethode anatomischer Präparate: Beitr. pathol. Anat. allg. Pathol., XXI, 1897, pp. 172–199.

———. Ueber die Herstellung anatomischer Präparate nach der Formalin-Alcohol-Glycerin-essigsaurem Salz Methode: Centralbl. allg. Pathol. und path. Anat., VIII,1897, pp. 121–128.

MONTI, A. Sulla conservazion di preparati anatomici per museo. Rendic. 1st. Lomb., Ser. 2, V, 1898, p. 837; also in Gaz. med. lomb., Milano, LVII, 1898, pp. 247–249.

ONUF (ONUFROWITZ), B. A Method of Securing Fixation and Hardening of the Central Nervous System before the Autopsy: Med. Rec., LXVI, 1904, pp.52–54.

OSIPOW. Ueber die Bedeutung der Formol-Müller'schen Flüssigkeit für die Härtung und Färbung des Centralnervensystems: Neurologische Bote, V, 1897, Pt. 3.

PARKER, G. H., and FLOYD, R. The Preservation of Mammalian Brains by Means of Formal and Alcohol: Anat. Anz., XI, 1896, pp. 156–158; idem., pp. 567–568.

PFISTER, H. Zur Härtung des Centralnervensystems in situ: Neurol. Centralbl., XVII, No. 14, pp. 643–644.

RENÉ, M. Note sur l'emploi de l'aldéhyde formique ou formol comme réactif fixateur et durissant des centres nerveux: Bull. Soc. Anatom., LXIX, 1894, pp. 992–993. Paris.

RETZIUS, G. Om hjernors härdning medels formalin: Förh. Svens. Läk. Sallsk. Sammank., Stockholm, pp. 81–83, 1895.

SAINTON, P., and KATTWINKEL, W. Ueber die Conservirung des Centralnervensystems durch Formol in situ: Deutsch. Arch. f. klin. Med., LX, 1897–1898, pp. 548–553.

SHAVLOVSKI, I. E. Ob uplotnyayushtshem i konserviruyushtshem dieistvii formaldehyda (On the Solidifying and Preservative Action of Formaldehyde): Trudi V. Syezda Obsh. russk. vrach. v pamyat Pirogova, I, 1894, pp. 124–126. St. Petersburg.

STROUD, B. B. On Brain Preservation: Proc. Assoc. Amer. Anat., IX, 1897, pp. 30–32.

TELLYESNITZKI, K. Ueber die Fixirungs-(Hartungs)-Flüssigkeiten: Arch. f. microsc. Anat., LII, 1898, p. 202.

WEIGERT, C. Technicalische Ergebnisse der Anatomie und Entwickelungsgeschichte, III, p. 1.

——— Capitel "Methode" in Beiträge z. normalen menschlichen Neuroglia: Abhandl. d. Senckenberg. Naturf. Gesellsch., Frankfurt a. M., 1895.

WILDER, B. G. Brain: Methods of Removing, Preserving, Dissecting, and Drawing: Refer. Handb. Med. Sciences, New ed., II, 1901, pp. 369–389.