

of sections changes in all the constituents of the cerebral cortex can be fully described.*

Description of Drawings illustrating these Changes.

FIG. 1 represents the appearance of a normal cell. The nucleus (*N*) stains lighter than the cell body. *NO* is the nucleolus with a clear endonucleolus. The ovoid bodies (*OB*) are stained deeply.

FIG. 2 represents an early stage of degeneration. The nucleus is enlarged and granular, while one of the processes shows the breaking down of the ovoid bodies into intermediate granules before becoming fatty.

FIGS. 3 and 4 represent later stages with the appearance of fat (*F*) and the different staining of granules (*G*) and intermediate granules (*IG*). The nucleus is scarcely distinguishable.

FIG. 5 represents a later stage still. The cell has burst, and nothing remains but the processes and *débris*.

The Specific Gravity of the Insane Brain.† By FRANCIS O. SIMPSON, L.R.C.P.Lond., M.R.C.S.Eng.; Senior Assistant Medical Officer, Govan District Lunatic Asylum, Hawkhead.

THIS paper is only intended to be a preliminary note upon the specific gravity of the brain in the insane, and contains the results of experiments upon thirty cases conducted at the West Riding Asylum, Wakefield, during the early part of this year. Over 1400 investigations have been made upon these brains, and as the inclusion of data from different parts of the country might cause scientific inaccuracies, it has been thought advisable to publish the present results separately, prior to the initiation of a further series of experiments.

The most important work upon the subject undertaken in this country was performed by Sankey between the years 1846 and 1852, the material used being obtained from the London Fever Hospital. The paper in question appeared in the *British and Foreign Medico-Chirurgical Review* of 1853, vol. xi; it is of a most exhaustive nature, and is accompanied by numerous valuable tables.

The present series of investigation were conducted upon

* Since writing this paper I have had my attention directed to a method by Dr. Robert S. Cook, in which osmic acid was used as a fixative, and have repeated my experiments with osmic acid, which has failed as before to produce a good Nissl preparation.

† Prepared for the Annual Meeting of the Medico-Psychological Association, Edinburgh, 1898.

fourteen male and sixteen female brains, the same regions being examined in every instance, viz.:

1. The middle of the second frontal convolutions.
2. The middle of the ascending parietal convolutions.
3. The middle of the second occipital convolutions.
4. The middle of the hippocampal convolutions.

The grey and the white matter of each region have been tested from either hemisphere, and every experiment has been performed in triplicate, the greatest precautions being observed in ensuring the accurate separation of the cerebral components.

The average time after death at which the investigations were conducted was thirty-five hours, and the average age at death of the patients was fifty-five years for both sexes, the females averaging fifty-eight years, and the males six years less.

Clinically the cases might be relegated to the following categories, viz.:

1. Five cases of general paralysis.
2. Five cases of senile dementia.
3. Four cases of organic dementia.
4. Five cases of secondary and one of primary dementia.
5. Five cases of epileptic dementia, and one of epileptic imbecility.
6. Three cases of simple imbecility.
7. One case of chronic melancholia (omitted).

The method employed in these experiments has been as follows:—Large pieces of the encephalon were excised from the regions to be tested before the removal of the pia, and set aside until the conclusion of the macroscopical examination. It is necessary for this purpose to use a very sharp knife, the back of which should be as thin as possible; and a straight sharp-pointed bistoury can be conveniently adapted to these requirements by suitable grinding. Subsequently minute fragments (2 × 1 cm., or even smaller) may be detached from the larger portions of cerebral tissue by the use of a Liebreich's or Critchett's cataract knife, or a cataract spoon with sharpened edges, thus avoiding as far as possible undue compression of the brain matter.

The fluid used has been a saturated solution of magnesium sulphate, to which a small quantity of pure carbolic acid was added. The presence of the phenol renders the solution of greater stability, and prevents the growth of fungus in the fluid, thus obviating the necessity for its frequent renewal.

A separate test-glass was reserved for each unit, and the contents were adjusted each morning, care being taken to ensure their precise accuracy: by this is meant that in the glass labelled 1039, for example, the bulb 1038 should be *exactly* at the surface of the fluid, and that marked 1040 just touching the bottom of the tube.

All Forms of Insanity.

Examining the totals from all regions of the brain, we find that the average specific gravity of the grey matter of the insane brain is 1037, and of the white matter 1041. In Sankey's paper the grey matter was stated to be 1034, and the white matter the same as in the present series, so that the insane cortex is of higher specific gravity than that of the non-insane at the same age.

Next, regarding the sexes, we discover that in the insane the specific gravity of the white matter is the same for each, whilst that of the grey matter is 1039 in males and only 1032 in females. Comparing these figures with Sankey's results, we again observe that the specific gravity of the white matter is the same amongst the sane as in our present cases; whilst, regarding the grey substance, the specific gravity is higher in the male insane and lower amongst female lunatics than amongst the general members of the community.

Taking each region of the brain separately, we discover that, when regarding all forms of insanity together, there is a close resemblance between the specific gravity of the two hemispheres of the brain in every part examined, whilst the greatest differences between the white and grey matter exist in the motor region, and such variations are precisely similar on the two sides in the case of the frontal and occipital lobes. The grey and white matter of the cornu Ammonis show exactly the same specific gravity in both hemispheres.

Considering the sexes separately, we notice that in the males the specific gravity is precisely identical in the two hemispheres both for the white and grey matter of each region. The greatest difference between the grey and white substance in men occurs in the frontal regions, the least in the occipital convolutions, whilst in the cornu Ammonis the white matter of each hemisphere has a somewhat lower specific gravity than the grey substance.

Amongst the females, on the other hand, the only region in which grey and white matter show the same specific gravity in both hemispheres is the ascending parietal convolution. The

differences between the specific gravity of the grey and the white substance are practically the same in both frontal and occipital regions, but these differences are much greater in the right hemisphere than they are in the left. The specific gravity of grey and white matter in the hippocampal region of the females is almost identical in both hemispheres.

1. *General Paralysis.*

Considering the various clinical classes of insanity as separate entities, and starting with progressive paralysis, we find the specific gravity of the grey matter to be 1040 and of the white substance 1042; or, in other words, it is higher in general paralysis, taking the brain as a whole, than in any other form of insanity examined; and, comparing the above figures with Sankey's results at the same age, we observe that in paralytic dementia the specific gravity of the grey substance is much higher and that of the white matter somewhat lower than amongst the sane. The average age at which these cases were examined was thirty-five years.

The specific gravity of the grey matter alone is also considerably higher in this affection than in any other of the clinical subdivisions investigated in this paper.

The specific gravity of the white substance is not so high in general paralysis as in secondary dementia, but higher than in the other clinical classes of which we have examples, and there is less difference between the specific gravity of the grey and white matter in paralytics than in any other form of insanity under consideration excepting organic dementia.

In the further examination of the paralytic demented brains regionally we notice a considerable similarity between the specific gravity of the grey matter in the two hemispheres, but the white matter is much higher in the right hemisphere than it is in the left.

The specific gravity of the grey matter is a trifle higher in the motor region than in the frontal and occipital lobes; in these two latter situations it is precisely identical in each hemisphere.

The greatest difference between the specific gravity of the grey and of the white matter in general paralysis occurs in the occipital regions, and the least variation is present in the frontal lobes.

The grey matter of the hippocampal regions is of somewhat higher specific gravity in both hemispheres than the white.

2. *Senile Dementia.*

The next clinical form of insanity for consideration is senile dementia, and the average age at death in the present series of cases was seventy-five years.

The average specific gravity of the grey matter is 1037, and of the white matter 1041, the corresponding figures in Sankey's tables being 1032 for the grey and 1041 for the white substance. It should also be noticed that in seniles the specific gravity of both grey and white substance is exactly the same as the average specific gravity for all forms of insanity (*vide antea*).

Examining the various regions of the senile brains separately, we find that the specific gravity of the grey matter is lowest in the frontal lobes and highest in the occipital regions; whilst the greatest difference between the specific gravity of the grey and white substance is likewise observable in the frontal gyri and the least variation in the occipital convolutions.

The white substance in this class is of a lower specific gravity in the occipital convolutions than elsewhere, being the same in the frontal and motor regions of both hemispheres.

The specific gravity of the cornu Ammonis is precisely the same in each hemisphere, both as regards the white and the grey matter.

3. *Organic Dementia.*

The next clinical subdivision in our list is organic dementia, the age at death in these cases being sixty-one years, and the specific gravity of the grey matter 1037, whilst that of the white matter is 1038.

Sankey's results at the same age showed a specific gravity of 1034 for the grey matter, and 1041 for the white substance. Thus it will be seen that, in dements of this class, the grey matter is of average specific gravity for the insane, but the white substance lower in this respect than in any other of the clinical classes; also that there is less difference between the specific gravity of grey and white matter in this than in any other form of insanity.

Next, considering this division regionally, we find that the specific gravity of the grey matter is higher in the occipital lobes of both hemispheres than elsewhere; also that the white matter shows the lowest specific gravity in this locality, which is likewise noticeable for showing the least difference between the specific gravity of the grey and of the white substance.

When considering the cornu Ammonis we observe that the specific gravity is identical in the two hemispheres both for the grey and the white matter, whilst these figures are also the lowest observed in any of the clinical forms of insanity.

4. *Simple Dementia.*

Simple dementia forms the next of our clinical classes, and the age at death in this class averaged forty-nine years, whilst the cerebral specific gravity is 1038 for the grey, and 1043 in the case of the white matter; that is to say, that whilst the specific gravity of the cortex is about average in this form of insanity, the white matter is higher than in any other subdivision.

The figures at the corresponding age in the non-insane were 1035 for the grey matter and 1041 for the white, establishing clearly the fact that the specific gravity of the brain is higher in simple dementias than in the general public.

Concerning the grey matter of the various regions examined in this class, the specific gravity is noticed to be highest in the occipital and hippocampal gyri, and equal in these situations for both hemispheres. The specific gravity of the grey matter is at its lowest in the frontal regions in this clinical division.

The greatest difference between the specific gravity of the grey and of the white matter, taking the brain as a whole, is noticed in simple dementia, and the white substance shows the greatest irregularity of all the clinical classes in this form. It is rather higher in the right hemisphere than in the left for every region examined.

The cornua Ammonis show greater variations between the specific gravity of their grey and white matter than the same regions do in any other form of insanity, and that of the right hemisphere is higher than that of the left for both the cerebral constituents.

5. *Epileptic Insanity.*

The epilepsies constitute our next clinical category, and the age at death in these patients was fifty-four years, the specific gravity of the brain as a whole being 1038 for the grey substance and 1042 for the white,—slightly higher in each instance than the average for all forms of insanity.

Comparing these figures with those of the non-insane at a similar period of life, that is to say 1031 for the grey matter and 1041 for the white, we observe that although the specific

gravity of the white substance of the brain is but little higher in epileptic insanity than in the non-insane, that of the grey matter is much in excess of the corresponding figures for the sane taken at the same period of life.

Next, taking this sub-class regionally, we notice that the specific gravity of the grey matter is highest in the cornu Ammonis and equal in this locality of either hemisphere, whilst its next highest place is in the occipital gyri.

The specific gravity of the epileptic cortex is at its lowest in the frontal convolutions, and varies but little in any region from its fellow of the opposite side.

The specific gravity of the white substance is somewhat higher in the occipital lobes than elsewhere, and is at its minimum in the hippocampal regions. In epileptic insanity the specific gravity of the white substance is rather higher in the right than in the left half of the brain.

The cornu Ammonis in this form of insanity shows an almost equable specific gravity for the two hemispheres, the white matter of this region being of a higher average specific gravity than the grey substance.

6. *Simple Imbecility.*

The last clinical subdivision which claims our attention is that of the simple imbecilities, the age at death being thirty-four years in these cases, and the average cerebral specific gravity 1037 for the cortex and 1040 for the white matter. In other words, the cortex is of average specific gravity in this subdivision as compared with all forms of insanity, and the white substance is decreased.

The corresponding figures in the sane are 1034 for the grey substance and 1041 for the white, so that the cortex of imbeciles is of a much higher specific gravity and the white matter of a slightly lower specific gravity than obtains in the corresponding regions of those who are not naturally deficient.

The specific gravity of the grey matter is higher in the cornu Ammonis than elsewhere, and next highest in the motor region, whilst it is lowest in the frontal convolutions of this class. In the case of all localities but the motor area the specific gravity of the grey matter in imbeciles is identical in the two hemispheres.

The specific gravity of the white substance is highest in the frontal lobes and lowest in the hippocampal regions of

this class. It is also rather higher in the left hemisphere of the brain than on the right side.

The specific gravity of the cornu Ammonis of imbeciles is higher, on the whole, in the left hemisphere, this being due to a decrease in the consistence of the white matter of the right side only. The grey matter of these regions is precisely identical in the two hemispheres.

In conclusion it is to be regretted that no data are to hand concerning the cerebral specific gravity of the acute and chronic psychoses, but further investigations into this subject will be undertaken at the earliest possible opportunity.

*Sewage Disposal at Hawkhead Asylum.** By W. R. WATSON,
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THE bacterial disposal of sewage has been so widely discussed during the past year or two, that possibly some apology is due to the Association for the introduction of a subject that has ceased to be novel. So far as Hawkhead Asylum is concerned the subject is still in the experimental stage, and the brief outline of the experiment contained in the following communication is the outcome of a correspondence with some of my friends who suggested that the question is not without interest to asylum superintendents.

When the building of Hawkhead Asylum was under the consideration of the Govan District Lunacy Board the disposal of the sewage necessarily received attention. Various plans were in turn suggested and rejected. The asylum grounds having about a thousand yards of river frontage, obviously the simplest way would have been to run the raw sewage directly into the river Cart, already a foul sewage-laden stream. This plan, at present largely followed by private proprietors and public bodies, received no countenance from the Board. Irrigation, so efficient and economical at Cane Hill Asylum and elsewhere, is not available, owing to the character of the soil. Precipitation by chemicals has the enormous disadvantage of having to deal with the sludge, which, after all the expense and trouble, is of little or no agricultural value. For a time a method was followed of

* Read at the Annual Meeting of the Medico-Psychological Association, Edinburgh, 1898.