by due process of law into all the facts of the case, I would just point out that there would have been no further inquiry than actually took place in this man's case, supposing he had been indicted and brought before the High Court, because insanity would have been pleaded in bar of trial, and he would have been forthwith committed to Perth, the facts relating to his state of mind only being brought before the Court.

Dr. URQUHART—What is the difference from a pecuniary point of view?

Dr. CARSWELL—The difference is simply that the Parish keeps the patient instead of the Crown.

Dr. URQUHART—Precisely. Is not that a feature which requires watching?

On Mental Fatigue and Recovery. By W. H. R. RIVERS, M.D., M.R.C.P.*

I propose, in this paper, to give a brief account of an investigation carried out in Professor Kraepelin's laboratory at Heidelberg, and undertaken with the view of gaining some first-hand knowledge of the methods I brought before the notice of the Association last July.

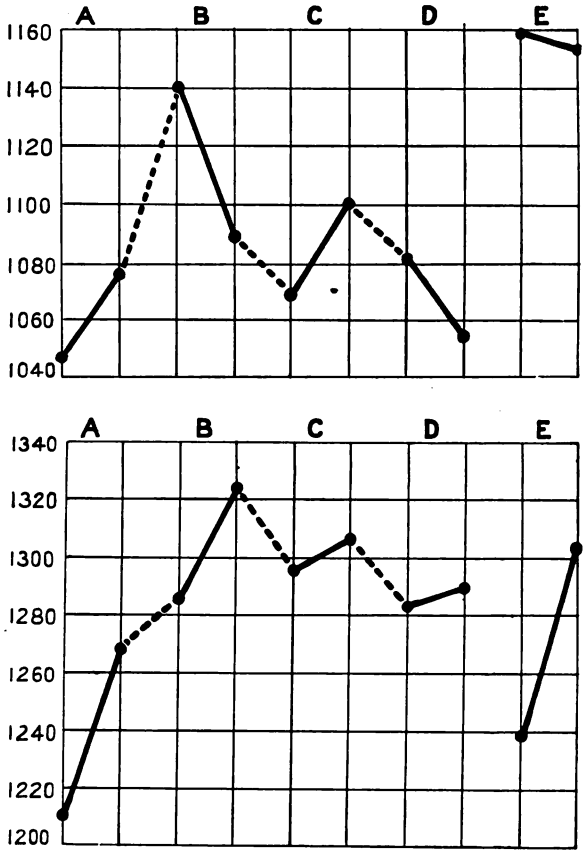
The problem investigated was comparatively simple; it was to ascertain the duration of the pause necessary for recovery from the effects of the fatigue induced by half an hour's mental work. The work done was addition. In this method rows of figures are printed in books, and opposite each pair of figures is written as quickly as possible the result of their addition; when the result is in two figures, only the second is written. At the end of each five minutes a clock sounds, and a mark is made so that at the end of a period of work, the number of additions done in each five minutes can be determined.

Two series of experiments were carried out, each lasting six days. In each, the period of work was half an hour. On the first, third and fifth days (long days) of each series, four periods of work were done, separated from each other by periods of rest; in the first series this period of rest was of half an hour's duration; in the second series the pause lasted one hour. On the second, fourth, and last days (short days) of each series only one half hour's work was done. The two series resembled each other in every respect except that in the first the period of rest after each half hour's work was also half an hour, while in the second it was one hour. The general results are shown in the accompanying charts, when each round mark indicates the number of

* Read at the Cambridge Meeting of the Medico-Psychological Association, 20th February, 1896. A detailed account of the investigation will appear in Kraepelin's *Psychologische Arbeiten*.

https://doi.org/10.1192/bjp.42.178.525 Published online by Cambridge University Press

additions performed in each quarter hour. Consequently the course of the continuous lines joining the marks indicates increase or decrease in the amount of work done. The dotted lines correspond to the pauses. The letters A, B, C, D indicate the four periods of the long days, while E



indicates the work of the short days. In each case the figures give the mean of those of three days.

Before comparing the charts I may mention that all conditions were kept as equal as possible in the two series. To avoid the influence of hunger, a certain quantity of milk was taken at the end of each period of work. No alcohol was taken during the whole investigation; tea and coffee

https://doi.org/10.1192/bjp.42.178.525 Published online by Cambridge University Press

only after the work of the day was over. The rest taken during the pauses was as complete as possible.

The normal course of a curve of work is a rise at first, due chiefly to practice and partly to the factor termed by Kraepelin "Anregung." This is followed sooner or later by a fall due to fatigue. On comparing the charts of the two series, it will be seen that this fall in the third and fourth periods is much greater in the first series than in the second. Secondly, if the factor of fatigue has been eliminated as much as possible from a curve of work, the curve of work of the following day should begin at a lower level owing to loss of the effects of practice during twenty-four hours, and in the second series this is seen to be the case; the work of the short days falls below in amount the end performance of the preceding long days. In the first series on the other hand, the condition is very different; the work of the short days is much above the level of the end performances of the previous days, and it may be inferred that but for the great influence of fatigue in the latter periods of the long days, the end of the curve D would have been above the level of E. A third point of difference is seen on comparing the amount of work done in the two halves of each period. In the second series in each case more work was done in the second than in the first quarter hour of each period; the line in each case rises; in the first series, on the other hand, the line shows a marked descent in the second and fourth periods, and the rise in the third period was due to a disturbing factor noted at the time which led to a great diminution in the amount of work done in the first half on one day On two out of the three days of which it gives the mean result, the course of the line was descending.

These three differences all point in the same direction; and they show the much greater influence of fatigue in the first series and lead to the conclusion that half an hour's complete rest is wholly insufficient to neutralise the fatigue induced by an equal period of mental work. Even with a rest of one hour, the effects of fatigue were not completely eliminated.

The charts show the quantity of work done in the two series, and I also investigated the quality of the work. The number of mistakes made was extremely small; in the first series ·085 per cent., in the second series ·104 per cent. The number of corrections was larger, *i.e.*, cases in which mistakes made had been immediately corrected; the

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numbers were ·92 per cent., and ·98 per cent., for the two series. The number of mistakes was too small to allow any conclusions to be drawn, but it may be noted that the second series showed a slightly greater percentage of both mistakes and corrections, and this may be connected with the much greater rapidity with which the process of addition was carried on in the second series. As regards quantity of work this investigation gives a very definite result. This result is however derived from observations on one individual only, and does not justify generalisation on the ratio of the periods of mental fatigue and recovery. I bring it before the Association chiefly as a concrete example of one of Professor Kraepelin's methods.

After some inquiries in regard to the interpretation of the diagrams, Dr. MERCIER said—We must agree that the base of all science is measurement, and in that regard the observations of Dr. Rivers are of the very highest importance, though I should be afraid they are open to considerable fallacies which would vitiate their value to a very considerable extent. The work is measured, as I understand it, by the addition of pairs of figures. Two figures are added, then another two, and so on, and the numbers of pairs of figures which have been added are taken as representative of the work done during a certain period of time. The method seems, on the face of it, to be a fair one, but as a matter of fact and experience it is a very much easier thing to add together certain pairs of figures than certain other pairs. For my own part 7 and 3 make a couple which in common addition I always treat as one figure, they are so easily added together, whereas 8 and 3 I have to pause over. It is a much longer process to add 8 and 3 than 7 and 3. In the same way 5 and 6 always take me considerably longer than would 8 and 4, and so on, and I suppose we all have idiosyncrasies of this kind which would render it harder for us to add together certain pairs of figures than other pairs, so the actual amount of work done in a given time is not strictly represented by the number of couples of figures added together. Supposing a difficult couple were to occur very frequently in one series, the work done in adding that series together would be considerably greater than if that difficult couple occurred more seldom and easier couples more frequently. So although it is a test, probably as good as can be taken, yet it is by no means a certain and absolute test of the amount of work done in a given time. I am not prepared to suggest a better, and I welcome very heartily any method which can be devised for applying the science of numbers to our mental processes, but I am afraid it is open to that fallacy, and it may be to other fallacies which I won't take up the time of the meeting by mentioning, which may possibly vitiate the results. It is particularly desirable that work of this kind should be undertaken, but at the same time I fear the results will not be commensurate with the amount of labour involved in obtaining them.

Dr. WIGLESWORTH—I quite agree with Dr. Mercier as regards measurements, and that these results are very much to be welcomed, but I do not think they have so far given us any information we did not possess before. It is extremely interesting to have knowledge confirmed in this highly scientific manner; at the same time we were already acquainted with the fact that when we commence mental work the commencement is never so good as the secondary period, *i.e.*, in the second half hour our mental activities are very much keener than they were when we first sat down. I don't know whether Dr. Rivers has any explanation to offer of that. I think it is largely due to the vascular supply, the brain attracting to itself a larger amount of blood as the work is proceeded with.

Dr. BOWER—I take it that measurements of the mental abilities of individuals are not confined to adding up figures. There are other methods, as, for instance, by

https://doi.org/10.1192/bjp.42.178.525 Published online by Cambridge University Press

committing to memory certain words; and individuals would vary in the ability displayed in their various methods. For example, in committing words to memory, I am certain I should be a long way behind a great many others, and possibly in adding figures I should be considerably ahead. I think there was one point with regard to which Dr. Rivers' measurements did give some new information, viz., that half an hour of rest is not enough to counteract the result of half an hour's work.

Dr. RAYNER—The suggestion which has already been made that the work would have been done better if the vascular supply had been thoroughly established, is one which strikes one forcibly, and the question is whether that may not be the reason why, with a short period of rest, there is no falling off of work, whereas in the longer period there is; the vascular supply having fallen to its low level in the longer period of rest, and not in the shorter period. One would like to know whether Dr. Rivers has made any observation with regard to the external temperature of the head during his observations. One knows in active mental work, especially such work as that of adding up figures, the temperature of the brain externally rises rapidly, and of course it falls more or less rapidly. I should think it would be of interest to observe whether the rate of falling bears any relation to the rate of loss of power of work in the five or fifteen minutes' period.

The PRESIDENT—I think, gentlemen, that it is much easier for us, knowing so little about this question, to see the great difficulties in regard to arriving at any conclusion of a practical sort. Perhaps it is right we should do so, because when entering upon any great field of investigation which requires most complete accuracy to substantiate the results upon which to build the ultimate fabric, we have to deal with factors that we are not completely and thoroughly acquainted with. No doubt each one of us knows the kind of work which he affects, and any one of us in this room might easily begin a comparison in his own mind by asking himself with what amount of spontaneous energy he is able to sit down to a rubber of whist, or with what amount of spontaneous energy he is able to sit down to write out his case book. I think that in a test of this kind, if a sufficient number of individuals could be got to compare their individual experiences, that ultimately some conclusions might be arrived at, first of all at the length of the period of what is called "anregung" here, and, on the other hand, the duration of the period of depression, where the work has an element of boredom in it. Again, one individual could take to himself and compare in his own mind the results with regard to this question of practice and of fatigue and recovery from fatigue from a succession of winning or losing rubbers at whist. It is a very simple comparison, involving an element of excitement, and each one of us might be able to compare what period it took us to recover from the fatigue involved, not only where the rubbers were successful, but where the rubbers were unsuccessful. It is very difficult to get at the kinds of work that are interesting to individuals, and being able to institute that comparison is the only possible method to ensure accuracy of results. I think that the question of what I might call the spontaneous energy of individuals is of great moment, but that is a long way ahead of those more simple introductory methods such as Dr. Rivers has submitted to us to-day. With regard to this, at any rate it is quite evident that results of a practical sort can be arrived at. Whether they may be beneficially applicable is another matter, but no doubt Dr. Rivers can tell us his own variation as regards the capacities he has on one day for doing certain work, and the amount of fatigue he has had to recover from before he is able to come up to his normal standard. There is no doubt that whatever difficulties there may be in the wide and extensive application of work of this sort its immediate interest is very great, and that with a sufficient number of investigators carrying out work on the same lines in the end the science may be so applied as to be valuable and beneficial to us in our dealings with the results of mental fatigue or with the results of diseases arising from mental fatigue. I think we must be extremely grateful to Dr. Rivers for having brought forward his experiments and results on a most important line of inquiry.

Dr. RIVERS, in reply, said—I am familiar with Dr. Mercier's observation that

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some additions are easier than others, but Prof. Kraepelin's addition books are so arranged that this cannot appreciably affect the result. In my own case, the difficult numbers are those which make 13 or 15, but I found that this difference disappeared to a great extent in the course of the investigation. Dr. Wiglesworth made a point with which I must disagree. He said there was nothing in this we did not know before. As a matter of fact, there was something in it which Prof. Kraepelin, with his large experience of mental work, did not know before, and that was that half hour periods of rest are not sufficient, far from sufficient, to get rid of the effects of half hour periods of work. I brought my experiences forward this evening chiefly as an example of work done by these methods. That work, standing alone, is, I acknowledge, of very little use, but taken in conjunction with all the other work which is being done by Professor Kraepelin and by his school it may be of greater value. As regards a physiological explanation of "anregung," I may mention that Kraepelin finds it to be a factor also in muscular work. As regards the question of external temperature, so far as I know, no observations have been made in connection with this special kind of work. I do not know whether Mosso has made such observations. At present it seems to me that what is really the greatest difficulty with regard to these methods is the question of *interest*. These methods of mental work are not interesting, and the interest one can get up in them cannot be very great. Whether one is entitled to draw conclusions from these uninteresting methods of work to work which is interesting is a question of the greatest importance. I hope it may be possible to carry out some kind of experimental investigation of this question of interest.

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*Remarks on the Nursing Staff in Asylums.** By P. W. MacDonald, M.D., Dorset County Asylum.

The subject matter of this paper can hardly fail to be of special interest at the present time, when so much attention is being given to, and so much done for, the nursing staff of every asylum.

It therefore needs no apology from me to ask for your consideration and friendly discussion of this question, for we must all recognise that whatever success may attend our efforts, we are largely indebted to the nursing staff.

That there is a wide divergence of opinion as to how we can best secure and retain the services of an efficient staff I am well aware, and perhaps it was this fact more than any other that induced me to bring the subject before you to-day.

At a meeting of the Association held at Oxford in February, 1894, an able paper was contributed by Dr. Menzies† on "The Future Supply and Status of the Nursing Staff." From time to time opinions are ventilated in the pages of medical journals, and paraphrased in the daily

* Read at the meeting of the S.W. Division of the Medico-Psychological Association, 14th April, 1896.

† *Journal of Mental Science* for July, 1894.

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