4.—Any bleeding, however trivial, occurring after the change of life means almost invariably cancer, and cancer which is then curable. If neglected till pain occurs, it means cancer which is almost always incurable.

5.—Any irregular bleeding occurring at the change of life should invariably be submitted to a doctor's investigation. It is not the natural method of the onset of the change of life, and in a large number of cases means commencing cancer.

6.—Any wart or sore occurring spontaneously on the lower lip in a man over 45 years of age is almost certainly cancer. If removed at once the cure is certain, if neglected the result is inevitably fatal.

7.—Any sore or swelling occurring on the tongue or inside of the mouth in a man after 45 years of age should be submitted to investigation without a moment's delay, and the decision at once arrived at by an expert microscopical examination whether it is cancer or not. A very large proportion of such sores or swellings occurring at this time of life are cancer, and if neglected for only a few weeks the result is almost inevitably fatal. If removed at once the prospect of cure is good.

8.—Any bleeding occurring from the bowel after 45 years of age, commonly supposed by the public to be "piles," should be submitted to investigation at once. A large proportion of such cases are cancer, which at this stage is perfectly curable.

9.—When warts, moles, or other growths on the skin are exposed to constant irritation they should be immediately removed. A large number of them, if neglected, terminate in cancer.

10.—Avoid irritation of the tongue and cheeks by broken jagged teeth, and of the lower lip by clay pipes. Many of these irritations, if neglected, terminate in cancer.

11.—Although there is no evidence that cancer is communicable under ordinary circumstances it is desirable that rooms occupied by a person suffering from cancer should be cleaned and disinfected from time to time.

A. MEARNS FRASER, M.D.,

Health Department, Medical Officer of Health.
Town Hall, Portsmouth.

APPOINTMENTS.

DR. JOHN ALLEN has been appointed clinical tuberculosis officer and assistant medical officer of health of Bury.

DR. FREDERICK J. C. BLACKMORE has been appointed chief medical officer to the Woolwich Tuberculosis Dispensary.

DR. C. G. H. CAMPBELL has been appointed a junior assistant medical officer in the infectious hospitals service of the Metropolitan Asylums Board.

DR. G. DAVIDSON has been appointed a junior assistant medical officer in the infectious hospitals service of the Metropolitan Asylums Board.

DR. A. HOGG has been appointed medical officer of health of Monk Bretton U.D.

DR. J. DICKINSON LEIGH has been appointed an assistant tuberculosis officer to the Durham C.C.

DR. R. T. MEADOWS has been appointed medical officer of health to the Saltash Town Council.

DR. PEEK, of Regent's Park, London, has been appointed assistant school medical officer to the Flintshire Education Committee.

DR. S. S. RENDALL has been appointed medical officer of health to the Boston R.D.C.

DR. ROBERT E. ROBERTS, Cwmfelinfach, has been appointed medical officer of health of Mynyddislwyn U.D.

DR. H. C. SNELL, of Sheffield, has been appointed school medical officer for Retford.

DR. EDWARD F. STEPHENSON, medical officer of Dunmore, Co. Waterford, has been appointed a medical inspector under the Irish Local Government Board.

DR. E. F. SYRETT has been appointed medical officer of health of the Borough of Harwich.

DR. RALPH P. WILLIAMS, school medical officer for Sheffield, has been appointed senior assistant medical officer to the Board of Education.

RECENT STATISTICAL WORK ON THE CANCER PROBLEM.

By MAJOR GREENWOOD, JUN., M.R.C.S., L.R.C.P.

AN experienced city man once told me that chess had ruined many a promising clerk; there is a fascination exercised by its initially simple and ultimately complex technique which lures the beginner on until he wakes from dreams of Morphy and Lasker to the reality of a lost situation. Much the same may be said of cancer research. Great are the prizes to be claimed by him who discovers the "cause" of cancer and its "cure," while data for a solution seem abundant. We have statistics of every description, records of autopsies, reports of operations, medical opinions and theories in profusion. Surely with so much grist, the statistical mill must grind out something of value! This is the thought which has inspired many who are endowed with enthusiasm, leisure, some familiarity with arithmetic and a hearsay knowledge of the clinical Proteus we name cancer.

It is to be feared that the outcome of their labours is not always satisfactory. Thus, *The Times* in a recent article directed public attention to Mr. C. E. Green's book, *The Cancer Problem*, in language which might lead its readers to attribute importance to Mr. Green's theory that the products of coal combustion are a factor in determining the geographical incidence of cancer. It is sufficient to remark that Mr. Green's statistical method is a comparison of the proportions of cancer deaths to deaths from all causes in various districts, that the effects of varying age and sex constitutions are not noticed, and that figures based upon large cities such as Glasgow, and sparsely populated rural districts, such as the Shetland Islands, are compared in the same table. This is still a free country, and Mr. Green has a perfect right to publish any statistical results he pleases, however inadequate one may think them, but whether a leading journal should, without the least attempt at critical analysis, give these notions a wide currency, is a more disputable point. In the same article, *The Times* refers to another recent statistical paper more deserving serious notice; this is Professor Karl Pearson's analysis of some data collected by the late Dr. T. L. Webb.* Dr. Webb's data consisted of a record of deaths from

**Biometrika*, Vol. viii., 430 and ix., 28.

cancer occurring in various houses in the registration sub-district of Madeley (Shropshire), between 1837 and 1910. The numbers of houses with 0, 1, 2, 3, etc., deaths being given in the data, Professor Pearson calculated the distribution to be expected as a matter of chance and found that the frequency of multiple cases was excessive, the probability being very small that such a state of affairs could have arisen as the result of random sampling. Professor Pearson then enumerated the following possible explanations (1) The houses with multiple cases might be larger and contain more inmates than the others; (2) a tendency to cancer might be hereditary; (3) the occupations of the inhabitants of the house with multiple cases might be those specially associated with cancer; (4) something in the environment of the houses, perhaps the presence of an organism, might explain the result.

The data enabled Professor Pearson to negative (2) and (3) as possible explanations and there was no evidence in favour of (1). His provisional conclusion was that Dr. Webb's data established a *prima facie* case in favour of "cancer houses," and that further data should be collected. Any utterance of Professor Karl Pearson relating to the science of which he is so great a master must be received with respect, but it seems possible to indicate other factors which need elucidation before we can accept the theory of "cancer houses." In the first place, I do not see how Professor Pearson was able to eliminate the possible effect of varying age distribution. To illustrate the point by an imaginary case, suppose that in a given village a certain cottage is habitually tenanted by elderly persons, used for example as an alms-house; it would not be very surprising if in fifty years many tenants died of cancer. An extreme case of this kind would of course be noted in the data, but a tendency might escape unremarked, and one can easily imagine that particular houses or cottages present superior attractions for tenants of a certain age, that, perhaps, the landlord may be unwilling to let them to persons "with encumbrances." In other words, it seems essential to be sure that the age constitutions of the occupants throughout the series of years under notice were comparable in the different houses. Although from a remark at the beginning of his paper it is clear that Professor Pearson had by no means lost sight of the age difficulty, I cannot satisfy myself that he has overcome it. The second criticism

which might be passed upon Dr. Webb's data is that to combine records of cancer sixty years ago with those of our own time is dangerous in view of the probably increasing inaccuracy of the data as we approach the earlier limit. This question of the accuracy of cancer statistics, first seriously raised by Newsholme and King in 1893, has been further considered by Dr. Stevenson in the Registrar-General's Annual Report for 1911, and formed the topic of a paper by Mrs. Frances Wood and the present writer, which was read at the March Meeting of the Epidemiological Section of the Royal Society of Medicine. The strongest evidence, from the statistical standpoint, that facilities for making a diagnosis play a great part in determining the recorded rate of cancer mortality has been:—(1) The greater rapidity of increase in the rates of mortality for inaccessible organs; (2) the tendency of the male rate to overtake the female rate of mortality; (3) the exceptional position of London with respect to cancer mortality among males as compared with other registration areas.

The conclusions at which we arrived were that the general increase in cancer mortality could hardly be entirely attributed to improved facilities for effecting a diagnosis, but that probably discussion of the subject would only be fruitful if comparisons were confined to special sites. One speaker in the subsequent discussion violently impugned the methods of analysis we had adopted, and the validity of his objections must be determined after reference to the paper and our reply; what is of more immediate importance is the series of reasons adduced by other speakers for thinking that accuracy of diagnosis or at least of certification has improved. Among other circumstances may be noted better education of the laity in the symptoms of malignant disease, especially in the case of females, a larger proportion of institutional deaths (in London) and a more general dissemination of pathological knowledge among practitioners. It is, I think, plain that the problem of the increase of cancer is not a simple one, and that serial statistics need to be interpreted with caution.

This difficulty of interpretation leads me to refer to some other recent work on cancer statistics. In 1909, Dr. Maynard, of Pretoria, published an interesting study of the correlation between cancer and diabetes * death-rates, using American data.

* *Biometrika*, vii, 278.

He found that the death-rates from these two diseases were highly correlated, and inferred that some physiological or pathological link connected them, as, for instance, that the increasing wear and tear of life might be given effect to in an increase of both diseases. Professor Karl Pearson and Dr. Alice Lee re-investigated the subject * with the object of determining whether Dr. Maynard's result could be attributed to any subtle fallacy of method, and confirmed his conclusion. At the request of Mr. Jessup, Mrs. Frances Wood and I have recently† returned to the subject. Professor Pearson having failed to detect any methodological error in Dr. Maynard's analysis, it was not to be expected that we should discover one and, in fact, we did not do so. We did, however, find that no correlation of the same order as that noted by Dr. Maynard in the case of American statistics was deducible from either Swiss or Italian data, and that the English figures led to conflicting results, some groupings of the data yielding high correlations between the two rates, while other, as we think, more satisfactory arrangements gave low values.

The one weakness of the American statistics which we were able to demonstrate was the extraordinary racial heterogeneity of the American cities studied by Maynard. Since it is possible that the differences in recorded incidence of cancer in different countries may in some measure reflect differences of real incidence, this fact makes the interpretation of Dr. Maynard's results more difficult, although we only reach this explanation, if it may so be termed, by a process of exclusion. Lastly, although Dr. Bashford's recent criticism of the American statistics‡ has been hotly resented, a perusal of the rejoinder to his article will fail to satisfy all readers that his strictures were unwarranted. I think a study of this set of papers will convince anyone who needs convincing that the difficulties of statistical work in connection with cancer are very great and that solid results can only be achieved by means of co-operative investigation. Turning to another aspect of recent statistical work, mention may be made of the alleged differences of class incidence. On the strength of Dr. David Heron's study published in 1907** it has been asserted that cancer, unlike tuberculosis, is a disease which tends to attack the wealthier

classes with a relatively greater frequency than the inhabitants of poor districts.

In my opinion, Dr. Heron's conclusion principally rests upon a failure to allow for differences of age constitution in the communities with which he dealt, and there is no real evidence of any differential class incidence of the disease. I have little doubt, however, that my opinion on this point will be attributed to ignorance of the methods adopted by "trained statisticians," and can only advise the reader to study Dr. Heron's original paper and a forthcoming article by Dr. Mohan Lal and Mr. J. W. Brown, which will appear in the *Journal of Hygiene*. If one attempts to sum up the present position of statistical research into the problems of cancer, I think the following conclusions may be drawn. Work in which "Cancer" *sans phrase* appears as one of the variables is always difficult and sometimes impossible to interpret. Some writers have perpetrated blunders which can be easily detected, others, while employing methods practically beyond reproach, have not overcome the inherent difficulties of the data at their disposal, and none have succeeded in making important additions to our positive knowledge of the disease. On the other hand, the statistical comparison of site rates and the detailed analysis that such a presentation of the material renders possible, have already provided us with valuable suggestions. For a lucid account of some of these, the reader should consult Dr. E. F. Bashford's remarks contributed to the discussion at the Epidemiological Section of the Royal Society of Medicine in March last. The moral is that pointed by so many chapters in the history of science. It is said that he who would enter the Kingdom of Heaven must become as a little child, and he who would subdue the difficulties of the cancer problem must abandon the idea of a frontal attack upon the statistics, they must be mastered in detail. To the public an answer to the question—Is cancer on the increase? seems an easy matter, and it is necessary that the medical profession should disabuse the public of this notion as speedily as possible.

VENTILATION OF CHAPELS.—Dr. G. G. Lloyd, medical officer of the Newcastle Emlyn Rural District Council, in his annual report draws attention to the overcrowding and defective ventilation of public buildings, especially chapels. These, he says, are never ventilated during the week days and seldom on Sundays. He advised those in charge to set an example in this respect by insisting upon having their buildings properly ventilated.

* *Journ. Roy. Stat. Soc.*, lxxiii, 534.

† *Journ. Hygiene*, xiv, 83.

‡ *Lancet*, 1914, I, p. 379.

** *Relation of Fertility to Social Status* (Dulau & Co.), p. 12.