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PROCEEDINGS

of

1st IBM MEDICAL SYMPOSIUM
June 15-17, 1959
Poughkeepsie, New York

and

2nd IBM MEDICAL SYMPOSIUM
September 28-30, 1960
Endicott, New York

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PREFACE

We are happy to present here the Proceedings of IBM's two Medical Symposia, the first of which was held in Poughkeepsie in June 1959, and the second in Endicott in September 1960. We hope that combining the papers from these two meetings into one volume will be a matter of convenience for the reader and that the papers themselves will provide valuable information.

We regret that it has been necessary to omit papers by Drs. Hearon and Sweeney because these speakers were not able to supply us with edited texts. The material presented by Mr. Gordon Hedrick was intentionally omitted, since it was a review of material which is covered in more detail in our regular Company literature and available through any of our Branch Offices. Also, Dr. Rikli's Summary for the first Symposium was in the nature of a general discussion involving many members of the Symposium, and it was not practical to try to put this material in written form.

Richard Taylor, Symposium Chairman
and Manager of Medical Liaison

Thomas J. Watson Research Center
Yorktown Heights, New York

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IBM'S PROGRAM FOR MEDICAL DATA PROCESSING

Dr. D. L. Thomsen, Jr.
International Business Machines Corporation

By way of introduction I would like to emphasize IBM's interest in the life sciences. We feel very definitely that there is much promise here for future applications particularly in data processing and computing. We base this largely on two premises; one is the tremendous interest in the entire field of medical records. This encompasses much of what we think of today as clinical data processing and also many features of the field of information retrieval.

I would also like to add to this a second consideration on which we are basing the future in this area; that is the noteworthy effort which has primarily been mathematically-oriented over shall we say roughly the last five or six years. For example, there have been many talented mathematicians interested in the applications of stochastic processes to the biological sciences. Now we have seen applications in data processing developed with much less scientific foundation and go on to become extremely useful to many fields of engineering and business. And so in our appreciation of the potential that Electronic Data Processing can aid medical research and also the enormous day to day processing of medical records, we hope to reach a fuller understanding in these few days with you as to the future of these applications.

I'm going to enumerate within IBM the various efforts which we hope will be of interest to you and which may become points of mutual discussion during this week. In Research, as Mr. Taylor mentioned, we have first of all the interest in medical equipment. This has been a continuing effort, and even though our concern this week is more with Data Processing applications, I do want to say a few words about it. We have for some time been studying the special needs of the medical profession as they have been related to IBM's own particular fields of competence. This particular department in IBM Research

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THE APPLICATION OF COMPUTERS TO CLINICAL MEDICAL DATA
(including machine demonstration)

Dr. T. Tanimoto and Mr. R. G. Loomis
International Business Machines Corp.
(Talk presented by Mr. R. G. Loomis)

A frequent problem in activity involving large quantities of data is a means of deriving a systematic classification that will permit greater ease in handling and thinking about the data and accomplishing some desired objectives. In some instances, a useful classification is obvious from a mere visual inspection of the data or an easily-obtained graphical arrangement of it. However, when this is not the case, a detailed analysis of the data is usually involved, and this normally requires a large number of calculations and logical comparisons. If the data are completely quantitative in nature, then such methods of mathematical statistics as multiple regression are frequently employed with favorable results. However, in the fields of medicine, botany, the social sciences and information retrieval, data of a qualitative nature are often encountered. It was precisely this fact that led Dr. David Rogers, an economic botanist on the staff of the New York Botanical Gardens, to initiate a series of discussions with Dr. Taffee T. Tanimoto, an IBM mathematician, on the classification problems experienced by the researcher in systematic botany. Dr. Tanimoto recognized that the problem of classifying qualitative information was a significant one in many diverse disciplines and undertook to develop a mathematical method which would attempt to measure the similarity of such data and which would be capable of general application. As Dick Taylor mentioned, Dr. Tanimoto is unable to be present today and since I have been in the fortunate position of assisting him in this project, my remarks are intended to accurately and clearly reflect his views on the philosophy underlying his approach to this task as well as the mathematical and intuitive interpretations of the method which this philosophy led him to develop.

The subsequent presentation by Dr. Davis, of Mt. Sinai Hospital, will be concerned with one particular use to which this program has been put in the field of hematology. Dr. Davis will also comment on the potential usefulness of this method to the medical profession.

A basic belief which guided the work on this project was that in this area of investigation no method of analysis could be considered a complete

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ANALYSIS OF GENETIC LINKAGE IN MAN WITH ASSISTANCE OF DIGITAL COMPUTER

Victor A. McKusick
and
Samuel A. Talbot

In this presentation we will try to make clear (1) our objective in studying genetic linkage, (2) why the objective seems worthwhile and (3) why the digital computer is almost essential to the analysis. We will also review the program.

The developments in genetics in the last one hundred years, since Mendel "started the ball rolling" - at least those essential to this exposition - can be discussed under six headings:

1. The genetic information is contained in the chromosomes which exist in the nuclei of all cells of the body, in pairs, one from the mother, one from the father. Man has 23 pairs of chromosomes in each cell.

2. Each of the paired homologous chromosomes contains multiple genes in linear arrangement, so that for the gene at a given locus there is a partner on the other chromosome.

3. The genes paired at a given locus may be identical (the homozygous state) in their function or they may be different (the heterozygous state). If different, one gene, or better the trait it determines, may be dominant, that is, it has the upper hand in expression of the gene locus, the partner being termed recessive. A dominant trait in one heterozygous parent with the other parent homozygous for the recessive passes to half the offspring. In the case of some gene pairs there is no dominant-recessive relationship but rather each gene has its effect. An example is the several blood group systems. The gene A on one chromosome and the gene B at the same locus on the paired chromosome results in blood type AB. Another important detail is the fact that there are in a population multiple genes which can substitute at a given locus; these are called multiple alleles. Again the ABO blood group system is an example. The two genes at the ABO blood group locus may be A and B, A and A, B and B, B and O, O and O, and so on. In fact, there are two A types, A_1 and A_2, so that the total number of different gene pairs, genotypes as it is called, which can occur from combination of A_1, A_2, B, and O, is 16.

2nd IBM Medical Symposium September 28-30, 1960

WELCOMING ADDRESS

Dr. Emanuel R. Piore
Vice President
International Business Machines Corporation

Dr. Piore was unable to attend the Symposium to deliver this address. His prepared remarks, we believe, will be of interest to the members of the Symposium and they are included in these Proceedings for this reason. - R. Taylor