A REVIEW OF ANALYSIS OF KARYOGRAPHS OF THE HUMAN CELL IN MITOSIS

D. E. BARTON*
UNIVERSITY COLLEGE, LONDON
F. N. DAVID**
UNIVERSITY COLLEGE, LONDON
and
UNIVERSITY OF CALIFORNIA, BERKELEY
EVELYN FIX**
UNIVERSITY OF CALIFORNIA, BERKELEY
and MAXINE MERRINGTON
UNIVERSITY COLLEGE, LONDON

1. Introduction

Since the publication of the first clear human karyograph by Tjio and Levan [13], much research, both theoretical and experimental, investigating the behavior of the chromosomes in the human cell during mitosis, has been carried out. Encouraged by L. S. Penrose and using karyographs made by him and by scientists working under him at the Galton Laboratory and, more recently, at the Kennedy-Galton Centre for Mental Retardation Research, Harperbury, we have carried out an intensive statistical study of the positions of the chromosomes as indicated by their centromeres. A typical karyograph is illustrated in figure 1.

It is the purpose of this present paper to present this study as a connected whole—it has previously been reported piecemeal as results were obtained—and to give such further work as has been done. Further, since such tests as we have devised may all be considered as variants of randomization tests in the plane, we advance here a way in which the randomization set might be weighted (or distorted), which leads to an approximate power function for the tests.

The experimental difficulties in the production and labeling of the karyograph are considerable. We may note that owing to the method of preparation used it appeared probable that any pattern in the chromosome centromeres would be largely destroyed and we ourselves were told at the beginning of our investigation that we might expect a completely random arrangement. We showed that

* Now at the Institute of Computer Sciences and Queen Mary College, University of London.
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