in a more intensive study of some cases of abnormal discharge which have been reported by Buller.

In connexion with the basidiospore discharge Dr. Ingold describes his observations, accompanied by excellent drawings, on the liberation of the basidiospores of Puccinia and also of the so-called "shadow yeast" *Bullera alba*, which from the nature of its spore formation must be included among the Basidiomycetes. In the Bryophyta he describes in detail the scattering of the spores from the open capsule of *Cephalozia bicuspidata* by the spring mechanism of the elaters released by water-rupture. This latter process is also dealt with in considering the spore discharge of the ferns and of Selaginella.

In concluding a final chapter given up to a general consideration of spore discharge in Cryptogams, the author makes a plea for the experimental study of this process in the ordinary botany courses at the universities. The realization of this very reasonable hope will be greatly facilitated by the publication of the book under review, which not only describes clearly the many fascinating methods of spore discharge and dispersal found in cryptogamic land plants, but also contains a large number of excellent illustrations, most of which have been specially drawn to explain the various mechanisms of dispersal. The historical introduction and the bibliography will be of great value to students of this very interesting subject.

DETERMINANTAL LOCI

The Geometry of Determinantal Loci
By Prof. T. G. Room. Pp. xxviii + 483. (Cambridge: At the University Press, 1938.) 42*s*. net.

PROF. T. G. ROOM uses the symbol $(|p,q|_r,[n])$ to denote the locus, in projection space $[n]$ of n dimensions, whose equations are given by the vanishing of the determinants of order $r+1$ of a matrix (x_{ij}), of p rows and q columns, whose elements are linear functions of the (general homogeneous) co-ordinates in $[n]$. This he calls a determinantal locus; particular determinantal loci are the conic in [2] and the quadric surface, cubic curve and cubic surface in [3], with respective symbols $(|2,2|_1,[2])$, $(|2,2|_1,[3])$, $(|2,3|_1,[3])$ and $(|3,3|_2,[3])$. $(|p,q|_r,[n])$ may be *projectively generated* as the locus of the meets of the $\infty^{r(p-r)}$ sets of corresponding $[n-p+r]$'s of q projectively related $[n-p]$-stars, and, since $(|p,q|_r,[n])$ is the same as $(|q,p|_r,[n])$, there is a conjugate projective generation obtained by interchanging p and q. Thus the cubic curve in [3] may be regarded either as the locus of the meets of corresponding planes of three related pencils or as the locus of the meets of corresponding lines of two related point-stars. If p and q are equal, the two conjugate generations are of the same kind.

Prof. Room's book, in which he uses both synthetic and algebraic methods, is divided into three main sections. Part 1 deals with the general $(|p,q|_r,[n])$ and Part 2 with the loci obtained by specializing the matrix (x_{ij}), with particular consideration of the cases in which this matrix is symmetric or skew-symmetric. Part 3 is an exhaustive and fascinating account of the different types of determinantal quartic primal and associated loci in [4].

The general theorems proved in the first two parts are of a formidable nature, but they are freely illustrated by examples in which the algebraic quantities are given particular numerical values. The author recognizes that it is generally the special cases which are of the greatest interest, and, while sympathizing with his evident desire to keep the book to reasonable proportions, we should have liked to see him develop some of them further.

In the generation of the cubic surface in [3] by three related point-stars, there are six sets of three corresponding planes which meet in a line instead of a point. These six lines and six others, which arise from the conjugate generation and are paired with these, form a *double-six* of lines, with the property that no two lines of the same set of six intersect and each line of one set meets all but one of the lines of the other. The remaining fifteen lines of the cubic surface arise naturally, though not so simply as this, from the projective generation. In chapters iv and xiii, Prof. Room describes many new such configurations of linear spaces with remarkable intersection properties.

The class of determinantal loci is very extensive. It includes, for example, all plane algebraic curves, and, in fact, as the author claims, almost all loci of whose projective properties anything is known are either determinantal loci or closely connected with them. The great diversity of the problems solved and the naturalness with which they fall into the author's scheme fully justify that claim. The book consists very largely of original researches, and among these the chapters on the representation of spaces by points and the chapter and appendix on the freedom of loci are particularly interesting.

The index and table of contents are admirably complete and the author suggests a useful course of selective reading. D. W. B.