conifer forests, the vegetation of coastal southeastern America, or regional monographic synthesis will need. It is one thing to comment on what the authors might have done for the Pine Barrens; it is another to do it if the necessary research has not yet been done, as appears to be the case here. The volume implicitly identifies the unique opportunities that remain for work on the Pine Barrens of New Jersey.

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Developmental Biology

Determinants of Spatial Organization. Papers from a symposium, Madison, Wis., June 1978. STEPHEN SUBTELNY and IRWIN R. KONIGSBERG, Eds. Academic Press, New York, 1979, xxiv, 334 pp., illus. $24.

This volume is the proceedings of a symposium that focused on cytoplasmic localization of determinative factors in early embryonic development, maternal-effect mutants of development, and pattern formation and regulation in later stages of development. The book has a good balance between data and theory and covers a spectrum of topics of sufficient maturity and relatedness to be coherent. The contributions are in general well conceived and clearly presented. Too few concentrate on each of the three major topics to provide a truly thorough picture of the current state of each, but sufficient material on each topic is presented to make this a useful volume.

A scholarly review by Frankel is pivotal. Frankel discusses pattern regulation in *Tetrahymena* and demonstrates convincingly that both global long-range ordering and short-range inductive phenomena can be found in single-cell ciliates and directly parallel pattern regulation in multicellular developmental fields. Thus similar principles of pattern regulation may apply to the single-cell egg. Wolk describes the phenomenology and cellular physiology underlying heterocyst pattern formation in filamentous blue-green algae such as *Anabaena*. Campbell has recently succeeded with hydra in forming clones of organisms comprised solely of epithelial cells. Such epithelial hydra undergo essentially normal growth, budding, and pattern regulation after surgical intervention, a finding that suggests to Campbell that pattern control rests primarily in epithelial cells and may often be regulated by mechanical attributes rather than chemical gradients. Lawrence and Morata provide a brief description of the effects of homoeotic mutants in *Drosophila* in relation to the compartmental hypothesis.

Bryant reviews the data on the imaginal disks of *Drosophila* that support the hypothesis that positional information is supplied by an identical polar coordinate system in each disk. This model has been used with considerable success in interpreting pattern regulation in insects and secondary developmental fields in amphibians, but it has not been applied to primary positional information in the egg itself. The alternative hypothesis, that positional information in the *Drosophila* egg is supplied by monotonic gradients in a Cartesian coordinate system, is discussed by Nüsslein-Volhard using evidence from the maternal mutants *bicaudal* and *dorsal*. In *bicaudal*, most embryos are normal, that is, have a mirror-symmetric double abdomen. Nüsslein-Volhard suggests that a normal anterior-posterior monotonic gradient has a second stable symmetrical shape with two peaks. Kalthoff has induced a similar double abdomen in *Smittia* by ultraviolet irradiation of the anterior egg pole and suggests in his paper an independent anterior-posterior decision process and a metamerization process.

Thoughtful papers by Dohmen and Verdonk, Whittaker, Freeman, Quantrano *et al.*, Hirsh, and Mahowald *et al.* discuss the localization of cytoplasmic or cortical determinants in eggs and how the determinants might arise. Dohmen and Verdonk describe dorsal determinants in molluscan eggs. Whittaker reviews the evidence for determinants in ascidian eggs, in particular experiments in which early cleavage planes are altered, leading specific blastomeres to incorporate cytoplasm usually segregated elsewhere. Freeman describes data showing that various determinants are progressively localized during the early cleavage divisions of *Cerebratulus* eggs rather than being definitively prelocalized by fertilization. Quantrano and colleagues discuss axis fixation in *Fucus* in terms of electrical potential gradients or contractile mechanisms to move macromolecular determinants. Hirsh has collected temperature-sensitive maternal mutants of *Caenorhabditis elegans* that disrupt the geometry of early cleavage but has not yet found evidence that resulting cell linkages are altered. A paper by Mahowald and colleagues summarizes the efforts to find the molecular basis of localized pole cell determinants in *Drosophila*.

Among the most provocative papers is that by Brothers, who has analyzed the recessive maternal-effect *o* mutant of axolotl. Female homozygotes produce eggs that block during gastrulation. Exposure of mutant o^- nuclei to wild-type egg cytoplasm or nucleoplasm corrects the defect. Such o^- nuclei can sustain normal development in back transplantations to enucleate mutant o^- eggs for over 30 divisions. Brothers's results establish that o^- nuclei can be rescued to a stably heritable o^+ state despite repeated exposure to o^- cytoplasm. The analysis of cytoplasmic determinants has generally assumed that nuclei remain fully responsive to cytoplasmic factors. In many species, nuclei do remain totipotent after transplantation to enucleate eggs. However, totipotency may require features of early cleavage divisions. Progressive determination may be associated with the assumption of progressively more stable nuclear states that, once established, are resistant to signals for a wide variety of alternative developmental pathways. Such phenomena would be of deep interest in their own right and would complicate the analysis of localized determinants.

The volume is well produced, with extensive references for each paper and a clear subject index. Despite the limitations of the symposium format, this is a sound and useful book.

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Books Received

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Air Pollution Chemistry. J. D. Butler. Academic Press, New York, 1979. viii, 408 pp., illus. $52.50.

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The Biological Basis of Schizophrenia. Gwynneth Hemmings and W. A. Hemmings, Eds. University Park Press, Baltimore, 1979. xii, 272 pp., illus. $29.50.

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A Complex Variable Approach to the Analy-

(Continued on page 521)