ty Press, 1972) the tortuous path to a second edition of the magnum opus.

Nor will it seem strange to the even greater number of people who know of Newton's mysterious "breakdown" in 1693. The papers in volume 7 shed no light on what happened in that "black year," but they do make clear that it had no lasting effect on his powers of thought. As Whiteside puts it,

> In Newton's scientific papers and correspondence of the early 1690's we may trace a slow but accelerating decrease in his elasticity to absorb fresh findings and his hitherto matchless capacity to attack novel problems and evolve new techniques of solution. . . . But this is the inevitable relentless attrition of old age, not the sudden and permanent debility of a mental storm or physical breakdown in health in the summer of that year [p. xxiii].

Three topics dominated Newton's mathematical work in the early 1690's. First, spurred by Gregory's plagiarism and by John Wallis's request for something on the subject to include in his *Algebra* (1693), Newton worked out a draft and final revision of his *De quadratura curvarum* (not published until 1704, as an appendix to the *Opticks*). To a limited theorem communicated to Leibniz in 1676 and to earlier work on the quadrature of curves given by trinomial equations, Newton now added general methods for moving from fluxional expressions to their fluents, both directly and via infinite series, and for applying fluxions to curvilinear motion and central forces. To the revise he also added for the first time his "pricked," or dot, notation for fluxions. During the later priority dispute with Leibniz, however, he ignored this notational evidence of the time at which his treatise had taken shape, placing in the mid-'70's what had seen light only in the early '90's.

As early as 1691 Newton had intended to make his *Quadrature of Curves* the second half of a bipartite treatise on the "Geometry of the Ancients and of Quadrature." Part 2 of the present volume contains the several versions of the first half. In them Newton attempted a reconstruction of the geometrical analysis of the Greeks, for which, following tradition, he took book VII of Pappus of Alexandria's *Mathematical Collection* as the starting point, dubbing it the "treasury of analysis" (*penus analytica*). The result is striking for two reasons: first, in his reconstruction of Euclid's *Porisms* Newton showed himself the equal of any of the creators of projective geometry in the 17th century; second, despite his talents and his professed preference for classical, "pure" geometry, his discussion begins with references to equations and ends with the algebraic quadrature of curves. In short, Newton wrestled briefly with past canons and then abandoned the struggle. One may question whether he had any feeling of defeat:

> As he slips into this accustomed role of modern innovator once more one can sense Newton's relief at relinquishing the frock of classical expositor and interpreter, relentlessly stressing—and overstressing—the superiority of the ancient polished syntheses over the cruder 'algebraic' resolutions of more recent Cartesian geometry [pp. 193–194].

Here, in particular, the original papers will surely help to undo misunderstanding occasioned by the myth-makers among Newton's followers who made of him the century's greatest analyst *malgré lui*.

Few works demonstrate Newton's powers as an algebraic analyst so forcefully as the *Enumeratio linearum tertii ordinis*, his all-but-complete classification of cubic curves that was also published as an appendix to the *Opticks* in 1704 and that here forms the core of part 3. In the *Enumeration*, the culmination of some 30 years' work, complete mastery of Cartesian methods combined with innovative use of projective techniques to produce the first modern analytical study of curves for their own sake. Yet the work was largely ignored by Newton's contemporaries, and no one until James Stirling in 1717 appears to have understood it. The reasons for its neglect make it a fitting conclusion to the works in this volume. For, as one considers them not for their mathematical content but for their place in history, they engender sadness and a sense of poignancy. Knowing what was being published at the time by Leibniz, the Bernoullis, l'Hôpital, Varignon, and others less luminous, one sees time and events overtaking Newton. A look back at volume 3 of the *Papers* proves revealing. The magisterial *Method of Series and Fluxions* (1671–73) placed its author alone at the edge of contemporary mathematical advance. Had it been published, it would have obviated almost all the research going on elsewhere and drawn most of the community into its ban. But it was not published, and others got along on their own. Having learned on their own, they missed the *Quadrature of Curves* even less. Whiteside writes of the latter,

> We will not pretend that the onward advance of mathematical discovery was more than temporarily slowed by this failure on Newton's part to communicate the totality of the notational and technical novelties of his treatise to his contemporaries. Within a few years (and sometimes in but months) all came to be independently rediscovered and quickly absorbed into the scientific mainstream [p. 17].

Thus, from the early 1690's on, the new methods bore the name "differential calculus," were expressed in Leibniz's symbols, and included Johann Bernoulli's techniques of integration, more powerful than Newton's. By the time Newton's *Quadrature* did appear in 1704, it was redundant rather than novel. As if in epitaph, Whiteside says of it,

> What is not communicated at its due time to one's fellow men is effectively stillborn [p. 20].

Perhaps Newton knew this and knew himself as well. Whiteside puzzles over why Newton left Cambridge.

> Watching over the minting of a nation's coin, catching a few counterfeiters, increasing an already respectably sized personal fortune, being a political figure, even dictating to one's fellow scientists: it should all seem a crass and empty ambition once you have written a *Principia*. . . . But it did not to Newton [p. xxix].

Perhaps here too Newton knew better than we.

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Wood Production

Tree Physiology and Yield Improvement. Papers from a meeting, Edinburgh, July 1975. M. G. R. CANNELL and F. T. LAST, Eds. Academic Press, New York, 1976. xviii, 568 pp., illus. $32.75.

This book is the proceedings of a conference held under the auspices of the International Union of Forest Research Organizations, a large, worldwide organization whose concerns range from the biology of trees to forest policy. The purpose of the conference was to stimulate communication between academically oriented physiologists and foresters concerned with wood production. The book contains 30 chapters grouped under six headings. An introductory chapter by A. H. Bunting is followed by six chapters on photosynthetic efficiency. These review instrumentation, field measurements, and computer modeling, discussing ways to find the desirable attributes and to provide criteria for mass selection. The second and largest part of the book is devoted to shoot and cambial growth. It includes two chapters that discuss productivity and its relation to the shape of tree crowns and forest canopies. Tree shape is the product of meristematic activity in different parts of the tree. These meristems, the shoot apices and the cambium, operate under complex hormonal control that is regulated by internal hormonal correlations modified by environmental factors. In the third part of the book, three chapters discuss water stress, one of the factors limiting tree growth most severely. Drought-resistant trees either avoid drought (by such means as suppressing water loss or developing deep root systems) or tolerate desiccation. Trees can be selected according to criteria indicating drought avoidance. Another possibility is to breed trees with leaves that tolerate lower water potential while maintaining a high net carbon dioxide assimilation. Two other chapters deal with root respiration (the effect of waterlogged soils). Frost-hardiness is the topic of the fourth part of the book. The survival of trees in cold climates depends on their frost-hardiness, but the underlying physiological mechanisms and their relation to dormancy are still poorly understood. Wild trees are adapted to their native climates, but the periodicity of dormancy and frost-hardiness are important factors when trees are transplanted to another region. Selection for hardiness is time-consuming, but a good correlation has been found between hardiness and electrical impedance ratios, measured at kilohertz and megahertz frequencies, in the upper part of the stem. Two chapters on mineral nutrition make up the fifth part of the book. The final four chapters discuss various aspects of tree genetics, competition, productivity, and wood quality. A discussion section at the end of the book not only summarizes each of the previous parts, but also contains recommendations for the immediate application of past research and for desirable future research. It is a welcome addition for the busy reader who just has time to browse.

Tree physiology is not a crowded field of scientific endeavor. The present volume is a good representation of present-day activities, one that should be accessible both to researchers and to students. Applied biological research is more difficult to carry out with fully grown trees than with agricultural plants, not only because of trees' size, but also because it takes much longer to study successions of generations in trees. Foresters usually do not have as much control over weeds as agriculturists do, and their use of fertilizers is much more restricted. Yet, in the long run, humanity will probably be dependent on improved forest production.

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Herpetology

Morphology and Biology of Reptiles. Papers from a symposium, London, Sept. 1975. A. D'A. BELLAIRS and C. BARRY COX, Eds. Published for the Linnean Society of London by Academic Press, New York, 1976. xii, 290 pp., illus. $31.75. Linnean Society Symposium Series, No. 3.

Herpetology has remained a single coherent discipline, Bellairs and Cox write, because its practitioners attempt to cross the boundaries between different aspects of their subject. This book tests this idea, for in it diversity is maximized and cohesion is nearly nonexistent. Some chapters will be of interest only to the most narrow specialist. Others are written for the general reader and contain either analytical reviews or new syntheses. Those calling themselves herpetologists will want the book in their libraries, for it is like a thick issue of a journal aimed at them. The quality of certain articles is sufficiently high that the book should be of considerable value to general vertebrate paleontologists and functional morphologists as well.

E. C. Olson's lead chapter dealing with the exploitation of land by early tetrapods is one of the most general in the book, providing perspective on subjects ranging from phylogeny to ecology and physiology. Other chapters, such as those by Gasc on mechanical analysis of snake vertebrae and Saint Girons on comparative histology of parts of anguimorph lizards, are more narrowly focused.

The most successful chapter is a long, highly analytical, and incisive review by Charig of the controversy surrounding dinosaur relationships and the suggestion by Bakker and Galton that dinosaurs and birds together constitute a new vertebrate class, the Dinosauria. All major aspects of the controversy are considered. Points made by others are reexamined, and new data and interpretations are presented. Charig argues that the major conclusions drawn by Bakker and Galton are unwarranted.

The book is heavily morphological in orientation. Two chapters on thermal biology (by Avery and Spellerberg) seem like appendages, quite detached from potentially related chapters, notably de Ricqlès's review of his work on bone histology of fossil and living forms. Useful new information is offered by Robinson on acrodont teeth of *Sphenodon* and *Uromastyx* (they are really very different), Gans on uropeltid snakes (a bizarrely specialized, burrowing group), Russell on the feet of geckos, and Underwood on boid snake structure and relationships (two families are recognized; McDowell's recent work appeared too late to be adequately considered in detail). The turtlelike exoskeleton of placodonts is described by Westphal and compared with the epithecal armor of dermochelids. A speculative article by Swain considers the possibility that the evolution of the angiosperms was accompanied by the production of antiherbivore chemicals such as tannins and alkaloids. Swain argues that Mesozoic reptiles were less able to detect the presence of alkaloids than mammals and that they built up sufficient loads of these toxins to lead to eggshell thinning. Thus we are treated to yet another somewhat plausible explanation for Cretaceous extinctions.

We need books like this to demonstrate that even though a synthesis of reptilian biology may not be possible, general knowledge of the group is still an attainable goal.

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Cell Biology

Reproduction of Eukaryotic Cells. DAVID M. PRESCOTT. Academic Press, New York, 1976. x, 178 pp., illus. $14.50.

Prescott's book is intended to "organize in a single source the principal facts and observations on the cell life cycle and reproduction of eukaryotic cells in an effort to increase our overall understanding of how these cells reproduce themselves and how this reproduction is regulated." The work reviewed in the book is primarily that done since 1971, the publication date of J. M. Mitchson's *Biology of the Cell Cycle* (Cambridge University Press), to which the present volume is to be a complement. The author's emphasis is appropriate and timely: regulation and control at the genetic and molecular levels have become focal points of current work and thought in cell biology and are likely to remain so for some time.

Despite some overemphases (on synchronization methodology and on variability of G_1, for example) and some omissions, inadequate treatments, and inaccuracies (concerning chromosome movement, cytokinesis, and chromosome puffing, for example), the volume provides the reader with a good perspective of a wide range of current experiments and of the specific contexts in which they are done, and thus serves a useful pur-