and givens. Yet experimental botanists have come up with some generalizations about plant development over the years, and Wardlaw has reviewed these and mulled them over in the light of his own understanding; he has given us an entertaining, if not especially incisive, view of plant morphogenesis.

Not all will appreciate his style. Consider the apologia with which he begins his book:

> Alas! Like the stern, gloomy Scot that I am, deeply indoctrinated from long time past with the knowledge that things will be worse before they are better, that laughter in the morning means tears at sunset, and other quite unnecessarily sadistic saws, not always as wise as they sound, I fear that I have already preached at inordinate length on morphogenesis in plants as a great edifying and unifying theme. My trouble is that I don't know when to stop: I have still something more to say! But, pray, do not take the present modest offerings too much to heart: just enjoy them, even if only by disagreeing with my concepts and arguments. As for my choice of literary presentation, the subtle reasons will emerge in due course.

He frequently includes ponderous clichés which none but the irrational would need to see in print:

> The search for general truths, which can accommodate seemingly conflicting facts, i.e. laws of science *in biology*, must be maintained as a great central aim. Mutual tolerance and respect should be exercised, and an open mind maintained, during difficult, controversial periods of new ideas and new discoveries. No precious discovery in botany should, through automatic opposition, lack of appreciation, prejudice, or cliquism, be allowed to pass without being accorded discriminating attention.

He is also somewhat addicted to "cute" talk:

> That is not all: there is cogent evidence that histones are also synthesized in the nucleolus. What a busy biochemical market-place that little blob in the nucleus has become!

These eccentricities of style, together with the liberal use of question marks, parenthetic phrases, and exclamation points, tend to distract the reader from the major message, but to the extent that the major message involves the personality, prejudices, and interpretations of the author, the style is, in fact, the message itself.

The brute fact is that in the study of differentiation we are hopefully barely starting to emerge from the dark ages. We know most of what happens at the gross level, but at the fine structural level, and especially at the level of chronicling the new macromolecules that appear in order, much remains to be discovered. We know how to interfere with and change the rate of normal processes and to simulate developmental changes by tricks involving physics and chemistry. Yet of ultimate mechanisms we know only a little, despite the confident dogmatism of some molecularists. What Wardlaw is doing, after a lifetime of research and contemplation in the field, is simply to mirror our own current frustrations in a reasonably entertaining way, and against a historical backdrop.

There are five essays in the book: "On writing botanical essays," "Aspects of cellular differentiation in plants," "Reconciliations among apex lovers," "Enigmas of epigenesis," and "Organization, disorganization and neo-organization." These essays have in common only a concern with plant morphogenesis. They are frequently repetitive but paradoxically rather unconnected. They may be read with no more expectation of continuity than, for example, successive short stories in a collection by Maugham.

My main rewards in reading this book, aside from its entertainment value, which is not inconsiderable, were certain new generalizations such as the following: "The phloem typically differentiates in that region of the incipient vascular tissue which is closest to the region of most rapid growth." This helps one understand why the lower or abaxial side of the primordium produces phloem, whereas xylem differentiates on the upper, more slowly growing adaxial side. This simple generalization, if true, also helps us understand why in experiments with excised callus tissue high sugar concentrations result in the induction of phloem, whereas low sugar concentrations result in the induction of xylem. As Wardlaw says in a footnote: "Having now (?) seen the light, I am surprised it has not been seen by others long ere this!" Another reward from the reading of the book is the renewed realization that many of the recent statements on plant morphogenesis framed in the language of modern molecular biology are really derivatives of previous statements by predecessors such as Vöchting, Driesch, and, more recently, S. J. Holmes.

Read this book, then, not so much to learn a field as to sample the man and his times, and to gain some perspective for the new experiments and reports descending on us in a flood. As Wardlaw reminds us, the mysteries of plant morphogenesis are bound to be around for many years to amaze us, entertain us, and engage our passions, energies, and intelligence.

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Cortical Signals

Average Evoked Potentials. Methods, Results, and Evaluations. A conference, San Francisco, Sept. 1968. EMANUEL DONCHIN and DONALD B. LINDSLEY, Eds. National Aeronautics and Space Administration, Washington, D.C., 1969 (available from the Superintendent of Documents, Washington, D.C.). xviii, 402 pp., illus. Paper, $2. NASA SP-191.

Sensory stimuli evoke cortical potentials in the spontaneous electroencephalogram (EEG). When recorded from the scalp, these potentials are not directly detectable. They are extracted from the EEG by signal-averaging techniques. Other events may also provide the time references for averaging.

The conference recorded in this volume was devoted to current problems in conducting AEP (average evoked potential) studies and to reporting experimental results. Donald Lindsley, a pioneer in EEG research, sounds a note of warning in the introductory chapter, observing that the slenderness of our knowledge, despite many years of EEG research, about "the source, nature, and regulation of alpha and other spontaneous rhythms" should give AEP researchers pause. While both the EEG and the AEP are believed to derive from synchronized depolarizing and hyperpolarizing postsynaptic potentials of neuronal populations, the AEP probably reflects the functioning of smaller, more discrete neuronal groups time-related to a reference event. Herbert Vaughn in his chapter "The relationship of brain activity to scalp recordings of event related potentials" cogently points out that "although averaging was introduced primarily as a means of enhancing the signal-to-noise ratio, the technique has broader implications for the treatment of neuroelectric data: the analysis of electrical activity occurring between stimulus and response can provide clues concerning the timing and anatomical location of physiological events which have direct psychological correlates." Perhaps AEP research will

even resolve some unanswered questions about the EEG.

The AEP recorded from the scalp is a complex wave, probably the result of a distinct number of spatially independent components of different latencies, whose amplitude depends on the position of the recording electrodes. This partly accounts for the variability in evoked responses recorded under seemingly identical conditions. Assigning and assessing the sources of this variability are discussed by Emanuel Donchin, the organizer of the conference. In his chapter "Data analysis techniques," he stresses the contribution that multivariate statistical analysis and the general purpose computer can make in AEP studies.

Jerome Cohen's chapter, "Very slow brain potentials relating to expectancy: The CNV," reviews research on this new phenomenon, first reported in 1964, which requires averaging in order to be detected.

Other research topics covered in the book are: "Cross modality comparisons of average evoked potentials," by W. R. Goff *et al.*; "Specification of psychological variables in an AEP experiment," by Samuel Sutton; and "Diagnostic uses of the AEP," by Enoch Calloway. The discussion that followed the presentation of each paper at the conference is included.

Although much of the material has been published in other sources, this volume is useful as an excellent, easy-to-read overview, with a comprehensive bibliography. It should appeal to psychologists, neurophysiologists, clinicians, biomathematicians, system engineers, and other researchers concerned with the AEP or EEG.

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Air-Sampling Methodology

The Analysis of Air Pollutants. W. LEITHE. Translated from the German edition (Stuttgart, 1968) by R. Kondor. Ann Arbor-Humphrey, Ann Arbor, Mich., 1970. x, 304 pp., illus. $18.75.

There is a widespread demand for a reordering of national priorities in favor of tackling the problems of the human environment. However, for purposes of simplification the various types of pollution have been compartmentalized although the human environment is a single, interrelated system.

Air pollution is one of the important compartments of the environmental problem. Authoritative analytical books are needed in this field. The present volume is one of the first of many that will be appearing to fill this need.

The first few chapters consider the background of the problem. The definition of terms, meteorological effects, and the hygiene of air pollution are briefly discussed.

Air sampling for the gaseous components of the atmosphere is discussed in 12 pages. Considering the limitations imposed by the size of the book the subject is well handled. The main deficiency is the absence of discussion of methods and equipment for the collection of airborne particles that are to be analyzed for the chemical components. Since the components of the air that cause the most misery to human beings are in the particulates, it would be a good idea to include much of the work on particulate analysis available in the literature in the next edition of this book. However, a section is presented in a later part of the book on dust and its collection for the purposes of gravimetry, microscopy, or counting.

A well-balanced presentation is given of a wide range of pertinent topics, among them photometric analytical methods, gas detection devices, automatic devices, gas chromatography, mass spectrometry, odor analysis, and radioactive substances. Of these topics, continuously operating automatic devices and gas chromatographic methods are the most thoroughly discussed.

Analytical methods are given for the standard air pollutants that are present in the atmosphere in fairly large amounts. In most cases for each pollutant the physiological and toxicological properties, the available methods, and some working procedures are presented. Pollutants thus surveyed include hydrogen sulfide, the sulfur oxides, ammonia, hydrazine, nitrogen oxides, carbon oxides, halogens, arsenic, lead, mercury, aldehydes, aliphatic chlorinated hydrocarbons, monocylic and polynuclear arenes, phenols, benzo(a)pyrene, and others.

A few minor errors are present. For example, on page 135, lines 23 and 24, "fluorescein" and "fluorescin" should be interchanged in the first part of the sentence, and on page 234 the determination of acetone is said to involve colorimetry when actually titrimetry is used. Another point worth considering is the absence from the book of any discussion of the chromotropic acid method for formaldehyde. Simpler, faster methods are available for the determination of the polynuclear arenes than what is described. Much more selective methods are available for the determination of benzo(a)pyrene. In the method described benzo(k)fluoranthene would be a serious interference.

A table in the appendix on the conversion of aerotoxicant concentrations from ppm to mg/m^3 and vice versa is a worthwhile portion of the book. Another table worth including in a future edition of the book would be one showing the range in concentration of urban air pollutants and the highest values that have been obtained.

I was favorably impressed with this book. I think it should be on the shelves of all people interested in the technical aspects of air pollution.

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High-Frequency Sound

Physical Ultrasonics. ROBERT T. BEYER and STEPHEN V. LETCHER. Academic Press, New York, 1969. x, 382 pp., illus. $18.50. Pure and Applied Physics, vol. 32.

Physical Principles of Ultrasonic Diagnosis. P. N. T. WELLS. Academic Press, New York, 1969. viii, 284 pp., illus. $12.50. Medical Physics, vol. 1.

Physical Ultrasonics is a veritable handbook of all the important interactions of matter and ultrasonic energy, especially as used to delineate the properties of matter. It is intended for the graduate and the advanced student, as well as for the worker in the field. *Physical Principles of Ultrasonic Diagnosis* pays due attention to the physical and engineering aspects of ultrasound but is intended chiefly for the medical specialist who would like to (indeed who should) know more about the tools he is using.

For its intended audience *Physical Ultrasonics* provides a ready reference to theory, description of experiments, and comparison of measurements and predictions. A good working knowledge of thermodynamics is required to derive maximum benefit from the book.

The introductory material includes a clear exposition of Eulerian and Lagrangian formulations, in which the