reviewed *The Physiology of Thirst and Sodium Appetite* by James Fitzsimons from Cambridge University (*Science* **208**, 711; 1980).

This latest response from Oxford in the race for dominance of the water intake field is a fast-moving, sometimes too brief but nonetheless highly readable account of our present knowledge of thirst. It is not as erudite as the volume by Fitzsimons — it is less than half the size for one thing — but it is a book that one could recommend to students of physiological psychology and researchers newly attracted to the field. It covers a comprehensive list of topics and as an introductory text it is excellent. What it lacks for the researcher actively involved in these studies is the depth of sources and an accounting of all available information. For example, the authors avoid covering the brain angiotensin system in detail by dismissing it as being controversial. Perhaps that attitude is the better part of valour, but in consequence much recent data are overlooked.

Since most of the interest in the subject can be attributed to the discovery that injections of angiotensin II stimulate thirst, it is appropriate that Barbara Rolls is the senior author of this text. It was she, with Fitzsimons, who first showed that effect of angiotensin II intravenously and shortly afterwards intracranially. Edmund Rolls adds his unique expertise in the understanding of central mechanisms of thirst in primates. It is a winning combination for a work that will appeal to those interested in the physiology of motivation.

The book is profusely illustrated with clear pictures, almost one to a page. The material presented is a readable summary of the progress that has been made in the study of thirst and particularly since the discovery of the effects of angiotensin II in 1969. It is apparent, however, that the race is not over because the control of drinking under normal physiological conditions has not yet been established; the authors say that involvement of angiotensin in thirst may only be in emergencies. As a review of the field, the book enables one to see that advances have been made with relatively simple techniques. The flow of experiments presently is towards more precise localization of receptors and more accurate descriptions of the brain pathways involved. In that respect, thirst research is not yet far from the starting line.

The book does show that there is sufficient data for a course in thirst and for an active field of research. There is certainly room for the two volumes on water intake without causing hypervolumia and, as far as competition between the two books goes, the winner seems to be Cambridge since its University Press is the publisher of both. □

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Genes through the looking glass

P.H. Williams

Gene Function: E. coli *and Its Heritable Elements.* By Robert E. Glass. Pp.487. Hbk ISBN 0-7099-0081-3; pbk ISBN 0-7099-0082-1. (Croom Helm/University of California Press: 1982.) Hbk £19.95, $45.60; pbk £9.95, $22.80.

WHEN, several years ago, I embarked upon post-graduate research in microbial genetics, the pre-eminent textbook of the field was *The Genetics of Bacteria and their Viruses* by William Hayes. To a newcomer like myself, Hayes was indispensable, offering all there was to know about molecular genetics in an authoritative, well-referenced, easily readable package. It was with great regret that I watched that book drift slowly, but inevitably, out of date.

Gene Function by Robert Glass is, to use Hayes's description of his own work, "a rather advanced text book". It covers much the same ground as Hayes, and is aimed at the same type of audience, namely at advanced undergraduates, and at researchers in the field at every level. Only a few authors since Hayes have successfully abridged the monumental mass of *Escherichia coli* research into a single informative but highly readable volume. In my opinion Robert Glass has made a creditable attempt.

Gene Function, however, is not merely Hayes updated. Over and above the incorporation of the wealth of knowledge accumulated over a decade and a half, Glass's book has an entirely different viewpoint which reflects the backgrounds and attitudes of those who have more recently entered and contributed to the field. Hayes began his book with an introduction to genetic principles, and then developed the theme of bacteria and bacteriophage as genetic systems. Glass, on the other hand, writes as a biochemist, beginning with an overview of the structure and biological role of nucleic acids at the molecular level (or rather a preview, since these are covered in detail later), before outlining elements of microbial physiology and metabolism essential to a full comprehension of experimental methods.

In the preface to his book the author thanks a colleague for "a 'sensible' title". It is a little surprising that a volume devoted exclusively to one organism should presume to claim for itself the title *Gene Function.* However, this book is about genes and the way they function in that particularly convenient little bag known as *E. coli* — simple genes, perhaps; organized and regulated differently from those of eukaryotes, certainly; but the strong implication is that knowledge of the molecular wonderland of *E. coli* genes will form a firm basis for the study of genes in any other organism. Nonetheless, the title still worries me a little.

Gene Function is well researched, adequately referenced and nicely balanced in terms of breadth of material and depth of detail. In general it is clearly written, although extensive cross-referencing tends to destroy the reader's train of thought at times. The frequent use of footnotes and parentheses in the text irritated me somewhat, and I confess that I found the index almost impossible to use. However, these are quite minor quibbles, and, except for the last point, did not seriously detract from my enjoyment of the book. *Gene Function* may not, perhaps, be as fondly remembered 15 years hence as Hayes's book is now, but there is no doubt that it is an important and useful addition to the book-shelves of today's molecular geneticists. I hope it can be regularly updated without losing any of the evident enthusiasm of its author. □

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Space-time through time

Paul Davies

The Science of Space-Time. By Derek J. Raine and Michael Heller. Pp.255. ISBN 0-912918-12-8. (Pachart Publishing, Tucson, Arizona: 1981.) $24.

IT IS curious the way that certain ideas and concepts in science exercise a wide and seemingly disproportionate fascination. These include the measurement paradoxes of quantum theory, and the origin of time's mysterious "arrow". Another is Mach's principle. Scientists return to it again and again. Now, for the first time, a comprehensive treatment of Mach's principle is available in a book that can be profitably read by those with only a basic knowledge of space-time physics.

The basic idea of Mach's principle is that the property of inertia in a material body has its origin in cosmology. A rotating planet, for example, feels centrifugal stresses and bulges at the equator. But visually the Earth's rotation is deduced by "watching the stars go round". So, are these two radically different phenomena — the experience of centrifugal bulging and the whirling of the stars — in some way connected? Are rotations (and other types of accelerated motions) purely relative to the background framework of far-flung galaxies?

Einstein at first thought so, and Mach's work deeply influenced his development of the theory of relativity. In 1916, on Mach's