SCIENTIFIC BOOKS

The Mysterious Universe. By SIR JAMES JEANS. ix + 154 pp. Cambridge University Press, 1930. 3*s* 6d.

To those who have read Sir James Jeans's "Universe Around Us," his latest volume, "The Mysterious Universe," will prove an appropriate supplement. As the earlier volume was largely descriptive and astronomically informative, the latest book from his pen is largely philosophical and is a fitting interpreter to the facts presented in the earlier publication.

As explained in the foreword, the book is an amplification of the subject-matter presented in the Rede Lecture, delivered at the University of Cambridge in October, 1930.

In the opening chapter on "The Dying Sun," the author gives us a picture of a decadent future with all the pessimism of classical thermodynamics.

With a brisk transition, however, the reader meets in chapter two the "New World of Modern Physics." Here the revolutionary changes in fundamental concepts considered inviolate a generation ago give a far different picture of the universe than the mechanical conception of the engineer scientists of the Kelvin and Maxwell era.

In kinetoscopic fashion, he traces the metamorphosis of the radiation concepts from the undulatory theory of Huygens and Thomas Young, through the quantum theory of Planck to Schroedinger's wave-mechanics and Heisenberg's principle of indeterminism.

A chapter on relativity follows, with remarks on the astronomical consequences of the Einstein and DeSitter conception of space and time. The non-astronomical reader may be somewhat confused in the discussion of the "reddening of stars," where change in the wave-lengths of the spectral lines involved, due to various causes, is the real issue.

In chapter three, Jeans describes the significance of modern physical theories and stellar evolution leading to the startling concepts of the annihilation of matter through radiation. The possible significance of cosmic rays in this connection, and the hypothesis of Millikan that interstellar space sees the recreation of matter through absorption of cosmic radiation is discussed quite uncolored by the author's own views, although he thinks the probabilities are against such an hypothesis.

Chapter four, on "Relativity and the Ether," recounts the observational evidence at the basis of the theories of relativity. It is, perhaps, not surprising that Jeans makes no mention of the results of D. C. Miller in repeating the Michelson and Morley experiment, but one is a bit surprised to infer from the reading that the experiment was first carried on by Michelson and Morley at the University of Chicago instead of at the laboratory of the Case School in Cleveland, at which Miller's subsequent repetitions were performed.

From relativity the author progresses "Into Deep Waters," the title of chapter five. Here he pursues a philosophical and mathematical inquiry bordering on metaphysics. One sees in this volume a philosophy convening toward much the same end as has marked the recent writings of Eddington. Perhaps the most significant statement of Jeans's evaluation of the trend of modern physical science is to be found in the final paragraphs of the volume.

> To-day there is a wide measure of agreement, approaching almost to unanimity, that the stream of knowledge is heading towards a non-mechanical reality; the universe begins to look more like a great thought than like a great machine. . . . And with this reflection before us, we may well conclude by adding, what might well have been interlined into every paragraph, that everything that has been said, and every conclusion that has been tentatively put forward, is quite frankly speculative and uncertain. We have tried to discuss whether present-day science has anything to say on certain difficult questions, which are, perhaps, set for ever beyond the reach of human understanding. We can not claim to have discerned more than a very faint glimmer of light at the best; perhaps it was wholly illusory, for certainly we had to strain our eyes very hard to see anything at all. So that our main contention can hardly be that the science of to-day has a pronouncement to make, perhaps it ought rather to be that science should leave off making pronouncements: the river of knowledge has too often turned back on itself.

HARLAN T. STETSON
THE PERKINS OBSERVATORY

Artificial Sunlight. By M. LUCKIESH. 254 pp. Illustrated. D. Van Nostrand Company, Inc., New York.

THIS book, like most of this author's works, carries forward a definite theme supported by concise and digested data to a seemingly indisputable conclusion, and this makes the book useful to those interested in illumination and health. Likewise, the book is characteristic in that the author's naturalistic philosophy is a premise and a safeguard in the development.

Perhaps this thread may be epitomized by saying that, since the human race has been able to survive and thrive through countless generations with sunlight, sunlight therefore must have in it the necessary elements of radiation to support well-being and efficiency. Just as, although nature originally provided hair on the body and perspiration as protection from cold and heat, man by scientific means and otherwise learned to use clothing, shelter and artificial heating to supplement what nature provided, so, while nature has been very successful, a scientific analysis should enable us to increase the efficiency of society by artificial sunlight. This phase of the presentation should make the book interesting reading to the philosopher, the student of nature and all those who have not a deadened intellectual curiosity.

The opening sentences are most illuminating. "Nature is beneficent—life-giving—but also ruthlessly destructive. Its eternal shower of blessings has not effaced or even dimmed the edict that only the fit shall survive." In the first chaper on "A New Era of Lighting" is shown how man's striving to supply the elements of sunlight in his machine age living has resulted in the development of lamps that supply the requisite character of illumination and the needed ultra-violet light.

In the chapter on the sun's beneficence is given not only an array of historic facts and modern scientific data supporting the theses that sunlight, generally speaking, supports good health, but the argument is made more impressive by a chart showing the relation between the death-rate in the different months of the year and the hours of sunshine corresponding thereto. The chapter on solar radiation is essentially a digest of some of the leading workers in this field. On the basis of these data he concludes that artificial sunlight must be developed more or less independently of natural sunlight, but he does not imply that all the elements known to be useful should not be preserved.

Dr. Luckiesh has supplied the underlying data for designing lighting installations, of artificial sunlight with the various sources and filters available. Although considerable work remains to be done in conserving the requisite ultra-violet component, nevertheless the practical application is already within engineering reach.

Beginning with the fifth chapter, the book consists very largely of the author's data. It is very interesting to note that the carrying out of the problem requires the development of paints for ceilings so that indirect lighting can be used, but where this is not feasible it is always possible to resort to special fixtures, of which many have been designed and several have been built.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW MICRO-MANIPULATOR

Is there a worker with a micro-manipulator who does not wish that his instrument possessed more than merely smooth and exact control in three dimensions; whose impatience has not suggested improvements to facilitate his operations? Suggestions gathered from various laboratories go far to define the ideal manipulator, which should conceivably have the following characteristics:

1. Simple and quick gross adjustments to the microscope, giving a wide range of orientation.

2. Means for immediate return of the point to its operating position after withdrawal of the micro-manipulator for the setting or changing of the moist chamber, etc.

3. Grouped controlling handles which permit instant selection and actuation by the fingers of one hand without distraction of attention.

4. Coordination of the motion of each controlling handle with the resultant motion of the operating point, producing, as observed under the microscope, "natural" or expected movement.

5. Complete bilateral symmetry in double instruments through a right- and left-hand arrangement of controls.

6. Identical direction of the motion of each pair of corresponding controls in double instruments to secure identical movements of the respective operating points.

7. Compactness and directness of action, even in combination with a micro-injector, which will permit inclination of the manipulator to an acute angle with the optical axis of the microscope for operations on tissues and organs *in situ* in living animals.

8. Rugged and wearproof moving and bearing parts, so that proper use will not limit the life of the instrument.

An original solution of the mechanical problems involved in micro-operations is offered in the design of a micro-manipulator by the writer, here first publicly described. The special features of this design are covered in applications for patents now pending.

A diagrammatic general view of a double manipulator in relation to a microscope is shown in Fig. 1.