BY the will of Mrs. Katie M. A. Grimmons, of Somerville, Massachusetts, provision is made for the creation of a $150,000 trust fund, the income to be used for scholarships to be given to students at Massachusetts Institute of Technology.

JULIUS ROSENWALD, of Chicago, has given $250,000 toward the endowment fund of the American University of Beirut, Syria.

THE contest in the courts of the will of the late W. J. McDonald, of Paris, Texas, who left in 1926 almost his entire estate to found an astronomical observatory in connection with the University of Texas, has been settled by a compromise. In place of the $1,200,000 originally bequeathed, a little less than $900,000 is secured to the observatory by the compromise. The Board of Regents of the university has full power to use this fund at once or later to advance astronomical knowledge in any way that they may deem wise. It being known that Mr. McDonald at times contemplated the accumulation of the fund over a number of years before the actual establishment of the observatory, the regents will proceed with plans very slowly and in accordance with advice from leading astronomers.

THE University of Chicago announces the appointment of Dr. Russell M. Wilder, of the Mayo Clinic, Rochester, Minnesota, as professor and chairman of the department of medicine, to succeed, as chairman, Dr. Franklin C. McLean, whose appointment as director of university clinics was recently announced.

THE Vanderbilt University School of Medicine, Nashville, Tennessee, announces the appointment of Dr. William Groce Harrison, of Birmingham, Alabama, as lecturer in the history of medicine. Dr. Harrison will begin his work in September.

DR. JOHN ARTHUR THOMSON, regius professor of natural history at the University of Aberdeen, will join the staff of the University of California at Los Angeles next year as visiting professor of biology.

DISCUSSION AND CORRESPONDENCE

IS LIFE QUANTITY?

IT is, answers Mrs. Augusta Gaskell. Her answer is based on atomic physics, although she is not an experimental physicist. She is, however, a broad and careful reader in that field. This is attested both by her book, "What is Life?" and by the distinguished physicist, K. T. Compton, who introduces her.

Nor is she an experimental biologist although likewise an extensive reader in parts of that field. Furthermore, her answer has a tentative backing from this side also by the distinguished biologist, Raymond Pearl.

Surely then her answer deserves serious consideration, for she and her introducers, like everybody else, recognize it to be an answer to a question than which no other concerns human kind more deeply.

That which entitles this answer above the hundreds of others the question has received to the attention of scientists is the claim by the author and her technical sponsors that here at last is an answer susceptible of being tested by laboratory experiments.

I venture the opinion that not only can this new answer not be really tested, thus, but that were it objectively true no answer to any scientific question could be so tested.

This sweeping rejection of the hypothesis that life is quantity is based on the recognition that the assumption that quantity *alone* can constitute and can explain any natural phenomenon is an assumption which would place that phenomenon outside the realm of human knowledge.

All natural knowledge whether gained inside or outside of the laboratory necessarily involves observation. This is granted as an idea and adhered to in practice by experimentalists without exception.

Likewise it is both ideationally and practically granted that at least three parts of the human organism are directly and indispensably involved in experimental work. These are hands, eyes and brain.

From these facts it certainly follows, though apparently obscurely for many workers, that all human knowledge is directly and inseparably tied to two classes of psychobiological phenomena. These are sense perception and ideation.

But now comes a proposition which though demonstrably true, I believe, is far from generally granted or recognized as possibly true. It is that quantity and quality are so linked together and interpenetrated in the make-up of natural bodies, and consequently in our knowledge of them, that neither can be conceived (except in pure fancy) to exist apart from the other.

The cosmic order, ourselves and everything else being included, is such as to compel our recognition sooner or later that quality and quantity form a continuum similar, so far as inseparableness is concerned, to the space-time continuum of Einsteinean relativity.

The road of justification for this statement is long, steep and stony, but yet "passable though dangerous" as highway signs often read.

It is blazed, inadequately, in "The Organismal Conception"[1] and can not be traveled at all here. One

[1] Ritter and Bailey, Univ. of Calif. Publ. Zool., Vol. 31, No. 14, pp. 307–358, 1928.

point may, however, be appropriately referred to, dealing as this note does with a theory grown from the rich soil of atomic physics. No working physicist ever, so far as I know, thinks for a moment of his science as able to get along without human eyes and human hands.

Not many words occur oftener or in more crucial connections in many technical treatises than *observer*. Yet the fact that this term implies a whole raft of objects—bones, muscles, nerves, sense organs, glands, blood vessels, and so on, all so united and interrelated as to become a *sine qua non* of the observations and concepts which are the sum and substance of the discussions—these indubitable facts seem to be quite ignored so far as the discussions themselves are concerned.

Typically, it almost seems, "the observer" is reduced to a mathematical point much as stars and other heavenly bodies are for quantitative treatments of them.

It is, I think, fortunate that we are given this book on the ancient question, "What is Life?" at this particular time and in this particular form. It is fortunate because the discussion shows more unmistakably than anything I have seen that the issue raised by the book goes to the heart of one of the profoundest problems mankind has ever grappled with.

That issue is the universal struggle between the naturalistic and the supernaturalistic ways of observing and thinking about the world in which we live.

A special merit of the discussion is its appropriateness as a stimulus to discriminating sharply between these two ways of observing and thinking. Just so far as the proper balance is held between quantity and quality in the knowledge processes are these naturalistic. Indeed such balance is exactly a basic constituent of what "the natural" really is. Per contra just so far as there is departure from such balance does super- or extra-naturalism prevail. From this it follows that supernaturalism takes on almost as many and varied forms as does naturalism.

A reference that is peculiarly revealing in this connection is given by Mrs. Gaskell.[2] She quotes from R. A. Millikan:

> Indeed, from my point of view of that ancient philosopher, the problem of all natural philosophy is to drive out qualitative conceptions and to replace them by quantitative relations. And this point of view has been emphasized by the far-seeing throughout all the history of physics clear down to the present.

The ancient philosopher alluded to was Pythagoras. That both Professor Millikan and Mrs. Gaskell should fail to perceive that to "drive out qualitative conceptions" from "all natural philosophy" would be to drive sense data out of natural philosophy and so relieve students from the necessity of making observations, is perhaps not surprising, for the point involves complex and recondite knowledge in the realm of psychobiology.

But it does seem a bit strange that painstaking students having acquaintance enough with the history of science to refer to Pythagoras at all should not take cognizance of the direction in which this reference faces them. No adequate history of philosophy fails to tell in considerable fulness the story of the "Pythagorean mysteries" as these flourished during several centuries of classical antiquity. The pairs of opposites, odd and even, and male and female, for example, corresponding in number to the sacred ten, show what wonders can be accomplished on Pythagorean principles. And the neo-Pythagoreanism of still later times shows still greater possibilities in this direction.

Nor do these stories fail to make clear that these old confusing and corroding futilities (as we now see them) arose primarily from this very effort to "drive qualitative conceptions" from the world; or at least to reduce them to the rank of mere copies or imitations of pure number. Much to the point for this new (supposedly) hypothesis of the nature of life are a couple of sentences in Windelband's discussion of ideas about the microcosm and the macrocosm that had vogue during the Renaissance:

> The book of Nature is written in numbers; the harmony of things is that of the number-system. All is arranged by God according to measure and number; *all life is an unfolding of mathematical relations.*[3]

My italicizing of the last phrase is probably superfluous for calling attention to its relevancy to the hypothesis under examination.

Mrs. Gaskell is sufficiently explicit in crucial places to leave no room for doubt about the essence of her theory. A new and unique kind of unit is assumed to arise from a "unique manner of combination of ultimate units" already known, namely, electrons and protons. This new kind of unit, or system, is the "Z System." What constitutes the newness of this system is its possession of "unique qualities." Now notice: "The degree to which these unique qualities are present, of course, is determined quantitatively."[4]

The reasoning that would justify this conclusion (supposing justification possible) is disposed of by that mischief-making little phrase "of course." What the logical leap here really covers can not be even

[2] "What is Life?" p. 32.

[3] "A History of Philosophy" (Eng. by J. H. Tufts), 2d ed., p. 372.

[4] "What is Life?" p. 134.

pointed toward in this note. But if my view about the quantity-quality continuum is correct, that of itself disposes of the conclusion.

The sum and substance of my criticism is that Mrs. Gaskell's argument is a garment beautifully woven and patterned from ultra-modern materials (atomic physics) and draped upon a manikin of supernaturalism that is at least as old as the Pythagorean mysteries. Nor is there difficulty about so classifying this manikin as to bring out its kinship with others much more recent and, to biologists, much more familiar than its Pythagorean prototype. It will suffice to mention the Pangens of Darwin and the Determinants of Weismann. For these, each in its day, illumined the whole biological sky from horizon to zenith. Any biologist of forty years' standing will be able to enlarge the class to his heart's content.

Or if one's predilections whet his curiosity more toward the physical than the biological descendants of the Pythagorean system and precursors of Gaskellean system, the monads of Leibnitz modernized from those of Bruno should satisfy that curiosity. In fact the peculiar interiorness, so to speak, of Mrs. Gaskell's new unit is strangely reminiscent of Leibnitz's monad as a "purely internal principle." Mrs. Gaskell tells us, it should be noted, that the only space available for the new unit is "intraatomic space."[5]

There are two possibilities of real benefit from studying the ancestral line of units of this kind. One is in the chance afforded for seeing the particular ways in which the principle of quality-quantity can be violated. The other is in illustrations they furnish of the statement previously made that the super- or extra-natural can manifest itself in almost as great variety as the natural.

As I see the new theory it is only one more illustration of the self-defeat to which the imperialistic claims of atomism are bound to lead if pushed into the realm of mental life. And perhaps in this as in so many other situations self-defeat is the most effective kind of defeat and hence in a sense the surest promoter of truth.

Should the book before us contribute even in this negative way to the deliverance of mankind from bondage to all forms of supernaturalism, it would have rendered a great service. For all aspects of man's spiritual life—those to which are due his science, his philosophy, his ethics, his art, his religion, and all the rest—are subject in greater or lesser measure to this bondage.

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UNIVERSITY OF CALIFORNIA,
March 7, 1929.

[5] p. 128.

HERMAPHRODITISM IN ARBACIA

HERMAPHRODITIC sea-urchins are rare. One has been reported from Africa; two from Europe. That is all, or at any rate all I have been able to find in a hasty search of the literature.

Viguier in 1900[1] makes brief mention of a hermaphroditic specimen of *Sphærechinus granularis* collected at Algiers. He gives no details. Herlant, 1918,[2] describes a *Paracentrotus lividus* from Villefranche with three large testes, one atrophied testis and one mixed gonad. Drzewina and Bohn, 1924,[3] report a *Strongylocentrotus* (=*Paracentrotus*) *lividus* with four ovaries and one testis. This was taken at Roscoff. In all three of the above cases, self-fertilization was possible; and in the last two, normal larvae were obtained.

In spite of the many thousands of *Arbacia* used at Woods Hole, there is apparently no record of hermaphroditism in this form. On June 25, 1928, at Woods Hole, I found an *Arbacia punctulata* with four typically red ovaries and one ovotestis. The ovotestis consisted of a red ovarian portion with normal ova, and a yellow testicular portion with normal spermatozoa. On finding this hermaphroditic sea-urchin, I was reminded of an earlier discovery of the same sort. In the summer of 1915, while working at Woods Hole, I came across a specimen of *Arbacia* with two testes, two ovaries and one ovotestis. The ovaries and testes were alternately placed, that is to say, neither the two ovaries nor the two testes were adjacent to each other. In this case, as in the one previously mentioned, the eggs and sperm were normal and gave rise to normal larvae following self-fertilization.

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MICROPHOTOGRAPH OR PHOTOMICROGRAPH?

AFTER observing for several times in close succession what seems to me to be inconsistent use of these terms, I am moved to register my views on the subject. A microphotograph is logically, and by derivation, "a microscopic photograph of a macroscopic object" (Century dictionary). The man who claims to have originated the term meant it to be used in this sense only. A photomicrograph is "a macro-

[1] Viguier, 1900, *Compt. Rend.*, Acad. Sci. Paris, 131: 63.

[2] Herlant, 1918, "Notes et Revue," *Arch. de Zool. exp. et gen.*, 57: 28.

[3] Drzewina and Bohn, 1924, *Compt. Rend.*, Acad. Sci. Paris, 178: 663.