

# SCIENCE

VOL. 94

FRIDAY, OCTOBER 24, 1941

No. 2443

<i>The Cosmical Abundance of the Elements:</i> DR. HENRY NORRIS RUSSELL .....	375	<i>Special Articles:</i> <i>The Size of Streptococcus Bacteriophages as Determined by X-Ray Inactivation:</i> DR. FRANK M. EXNER and DR. S. E. LURIA. <i>The Detection of Poliomyelitis Virus in Flies:</i> DR. J. R. PAUL and OTHERS. <i>The Localization of the Nicotine Synthetic Mechanism in the Tobacco Plant:</i> DR. RAY F. DAWSON .....	394
<i>Obituary:</i> <i>Hugh McCormick Smith:</i> DR. LEONARD P. SCHULTZ. <i>Recent Deaths</i> .....	381	<i>Scientific Apparatus and Laboratory Methods:</i> <i>A New Type of Micro-Respirometer:</i> PROFESSOR ALBERT TYLER and WILLIAM E. BERG. <i>A Qualitative Test for Bile in the Urine:</i> DR. FRANK T. MAHER .....	397
<i>Scientific Events:</i> <i>Results of the Eclipse Expedition of 1940; The Engineers' Defense Board; The "B-Complex" Award of Mead Johnson and Company; The 1941 Rumford Award of the American Academy of Arts and Sciences; Dr. Jessup Succeeds Dr. Keppel as President of the Carnegie Corporation</i> .....	382	<i>Science News</i> .....	8
<i>Scientific Notes and News</i> .....	385		
<i>Discussion:</i> <i>Colleges and the Changing High Schools:</i> DR. M. H. TRYTTEN. <i>P-Aminobenzoic Acid, an Essential Metabolite for Autotrophic Organisms:</i> DR. STEN WIEDLING. <i>Culex Quinquefasciatus, a New Vector of Plasmodium Gallinaceum:</i> DR. LUIS VARGAS and PROFESSOR ENRIQUE BELTRÁN. <i>Polished Arcas on Granitic Porphyries of the Hueco and Cornudas Mountains of Texas and New Mexico:</i> WALTER B. LANG .....	387		
<i>Quotations:</i> <i>Mr. Keppel's Achievement</i> .....	391		
<i>Scientific Books:</i> <i>Elementary Biological Texts:</i> PROFESSOR C. E. MCCLUNG. <i>Acoustics:</i> DR. W. F. G. SWANN. <i>The Glass Electrode:</i> DR. W. C. STADIE .....	391		

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKEEN CATTELL and published every Friday by

## THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.  
New York City: Grand Central Terminal  
Annual Subscription, \$6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

## THE COSMICAL ABUNDANCE OF THE ELEMENTS<sup>1</sup>

By Dr. HENRY NORRIS RUSSELL

PRINCETON UNIVERSITY OBSERVATORY

EIGHTY-EIGHT chemical elements are known—not counting two whose isolation is still a matter of controversy, nor unstable isotopes of short life, produced artificially). For all these, methods of isolation and of qualitative and quantitative analysis have been developed in chemical and physical laboratories, so that it is only a matter of hard work for the analyst, presented with a sample of matter of any sort, to determine its composition with accuracy. The simplest definition of composition alone concerns us here—the relative abundance of the elements in our specimen. We may measure this by weight or by the numbers of atoms of different kinds. The chemist is

likely to do the first, the astrophysicist the second. As one of the latter, it is not my place to-day to do more than mention the many methods by which the chemist separates the various elements, and avoids loss of them in the process. Suffice it to say that the separation is sometimes easy, sometimes very difficult (as for the rare earths). The best available tests are much more sensitive for some elements than for others, and it is peculiarly hard to detect the latter when they are present in but small proportion, say less than one ten-thousandth of the whole mass.

The physicist can at times come in to ease the situation. Radio-active tests are available for but a small number of the elements, but can detect these in excessively small amounts.

<sup>1</sup> An address delivered at the symposium, September 26, 1941, in connection with the Fiftieth Anniversary Celebration of the University of Chicago.