is paralleled by the use of somewhat analogous formulas in finding the sum of a geometric series and in solving problems in arithmetical series in the Ahmes papyrus[2] which antedates by one hundred or more years the recently famous King Tut-ankh-amen.

Another problem in the Moscow papyrus is concerned with determining the "sides of a quadrilateral, when the relation of the sides and the area of the quadrilateral are known." This problem is almost equally important, as it indicates clearly the Egyptian inspiration of a whole series of problems found in Euclid's Data. The problems in question are concerned with the determination of the sides of a rectangle when the area and some other relationship of the sides are given.[3]

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ZIRCONIUM FRACTIONS

A COMMUNICATION by Professor Kurt A. Grönvall in *Svensk Kem. Tids.* for April may be of interest to some of your readers. Professor Grönvall has been reading some back numbers of his *Zeit. für Kristallographie* and came across references to zirconium fractions which led their observers to all the thrills of discoverers of new elements. These supposedly new elements were observed before Nils Bohr came upon the scene with a new fangled tool and could not therefore be clinched as was hafnium. The elements from zirconium are: ostranium discovered by Breithaupt of Freiburg in 1825, noranium by Svanberg of Uppsala, discovered in 1845, and jargonium by the first petrographer, H. C. Sorby, from zirconium collected in Ceylon, 1869. Now comes hafnium with its several discoverers. Professor Grönvall asks us, "Is hafnium a new element?"

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APRIL 22, 1923

2 Karpinski, "Algebraical developments among the Egyptians and Babylonians," *Amer. Math. Mo.*, Vol. 24, 1917, pp. 257-265.

3 Problems 85-90 in Simson's edition of Euclid's Data; in Opera Omnia ed. Heiberg and Menge, Vol. 6, Prop. 84-86, pp. 165-173.

QUOTATIONS

FEDERATIONS OF SCIENTIFIC MEN

THE reluctance to discuss the monetary value of their services is a tradition which dies hard among the brain-workers in this country and abroad, and is in large measure responsible for the unenviable position of many salaried workers during and since the war. In the legal and medical professions, which occupy a legalized privileged position and are further safeguarded by the needs and the attitude of the community, professional unity is possible and demands for improved conditions of service and better remuneration for these classes are generally successful. The success of medical men in this country in particular has given an impetus to other professional workers towards combination, and various organizations now exist having for their avowed object the improvement of the economic position of the professional classes. In France, after approaching first the Confédération Générale du Travail, and later the General Association of Employees—both organizations of manual workers—the brain-workers have decided to form their own independent Confédération des Travailleurs Intellectuels. It is already in a position to exert considerable influence in the chamber of deputies and the senate, and its success has provoked the creation of similar bodies in several other European countries. In this country there is an organization, the National Federation of Professional, Technical, Administrative and Supervisory Workers, founded in 1920, having similar aims. Hitherto it has not been able to obtain the support of the medical, legal, engineering, teaching or scientific associations. These may join the federation later, but, in the first instance, they will probably find it better to form their own federation. The time is certainly opportune for a movement to be made in this direction.—*Nature*.

THE INTERNATIONAL WORK OF SCIENTIFIC SYNTHESIS[1]

THE current development of science is so varied and so extensive that even the expert is

1 A review of the international journal, *Scientia*.

finding difficulty in keeping in touch with the detailed acquisitions not merely in his own field but often also in those divisions of it to which his own labors are devoted. This has become so pronounced that one sometimes hears the fear expressed that the body of science is in danger of falling apart into chaos from its mere bigness and diversity. It is often true that experts in the same field can not understand the details of each other's work well enough to judge its value with any confidence; and the different sciences have adopted each a jargon peculiar to itself so that workers from different fields find that they speak so little the same language that they can sometimes scarcely understand each other at all.

And yet there is a deep-seated conviction that all valid sciences must be parts of one whole, one Science, which subsumes all of them under its universal extent. If such a general science exists effectively, in the sense of a body of truth which is accessible to all intellectually minded people with a desire to understand it, it must be possible to gather the essentials of this science into an organized whole whose connections are not very complicated. This science must be organized along rather simple lines and its main truths must be capable of being brought into connection under a few general headings of a comprehensive character.

To accomplish this synthesizing of exact truth requires a great international work of scientific synthesis—a work in which different peoples and different sciences are brought together in a large constructive effort. It is not desirable, and it would be impossible, to bring the necessary group of people together in a definite organization and to carry out this work by means of a concentrated effort under the direction and inspiration of a central organization. This is not the way in which the task is to be accomplished. What is needed for the purpose in mind is a world's arena for the highest philosophic and scientific analysis and discussion among the greatest living thinkers, among those who are now advancing the separate sciences and at the same time are looking for those connections which bind all science into a great and fundamental unity.

A unique journal for serving these purposes now exists in *Scientia,* an international review of scientific synthesis published at Milan, Italy.[2] This journal has an interesting feature which makes all of its articles accessible to those who read the French language. If an author writes for it in a language other than French his article is published both in its original language and in a French translation. This journal serves as a great international encyclopedia of current philosophic synthesis of scientific truth. It is doing a great international work which would be left undone if it did not render this service. It is much more than a storehouse for such articles as are submitted to it. It organizes the preparation of important series of papers by the experts of all countries, the papers in a particular series all dealing with the various aspects of some important subject.

At the present time, for instance, a series of articles on relativity is being prepared by experts from all over the world; and these will be published in due course. Each writer, even on this difficult and abstruse subject, is required to express himself in the language which is current among educated men and women everywhere. He is denied the use of the technical language which the experts employ in communication with each other. That technical language has its use. But what is expressed in it is inaccessible to those who are not experts. What *Scientia* demands is the exposition of the important ideas of relativity in a language which is free from technical expressions so that the articles may be accessible to thinkers in every field of thought. A similar demand is made with respect to all the articles which are to be published in *Scientia.* The editors can hardly claim that they have succeeded in holding every contributor to the ideal which they have set; but their success has been sufficiently great to make of *Scientia* a forum for the philosophic discussion of scientific questions in such a form as to elicit the interest of all people who believe in the broad philosophic synthesis of science.

A great purpose has inspired both those who

[2] *Scientia,* edited by Eugenio Rignano and published at Via A. Bertani, 14, Milan, Italy. American subscribers can conveniently purchase it through Messrs. Williams & Wilkins, Mount Royal and Guilford Avenues, Baltimore, Maryland, at ten dollars per year (twelve issues).

initiated the publication of *Scientia* and those who have continued its work. They have desired to place at the disposal of every cultivated person an instrument of scientific synthesis which might facilitate that work of coordination and systematization of knowledge rendered necessary by the growing need of rapid summaries and careful accounts of central ideas suitable to enable one quickly to orient himself with respect to the most vital scientific ideas of the day. In serving this purpose the editors have realized that it is necessary to give rigorously exact information concerning new researches and the hypotheses which are elaborated or proposed by various workers for extending the bounds of human knowledge; and they have spared no pains to procure accounts of these by the experts best fitted to give them—accounts which move not in technical terms but in the language of all cultivated people. The new ideas and discoveries are thus being rendered accessible to all persons, with the hope that science may live more as a unit both among scientific workers generally and also in the minds of all cultivated persons who are interested in the work of science. *Scientia* is seeking to bring the great guiding ideas of science out of the scientific preserves of individuals and of small groups and to help make it possible for all to enjoy the intellectual advantages of scientific thought and discovery. If the world of thought tends to become little to any one through an over-emphasis of his specialty, *Scientia* is effectively urging him to come out into a broader field of scientific thought. Let him still pursue his narrow specialty with all vigor and ardor, if he will; but let him at the same time see it as a small part of a fascinating whole and let him understand that the connections of his specialty with this whole are more important in their human values than the details of his work are in themselves.

Through the pages of this unique journal the leading thinkers of Europe and America are contributing towards a realization of this inspiring ideal. Independence of judgment, clearness of form, absence of all prejudice, liberty of criticism characterize their contributions. The continued success of this effective organ of international culture is a matter of importance to the development and unification of science. It aims at reaching a systematic and synthetic order of truth suitable to give a general view of the physical and human world within the limits of the most rigorous scientific knowledge. In carrying out this plan it has organized cooperation in the preparation of articles on the causes of the great war, on the international questions growing out of it, on social questions, on the problem of vitalism and mechanism in biology, on the now famous theory of relativity, on the contributions of the various peoples to the development of the several branches of human knowledge, and on other questions of deep interest in the current thought of the world.

By these means *Scientia* has become suitable to serve as a valuable instrument for the cultural development of all those who love knowledge. Specialists may find in it an incentive to look beyond their own gardens of thought, to enlarge their intellectual horizons and to increase their joy in truth. People of culture have through it a unique opportunity to become acquainted with many trends of current thought and to obtain a panoramic view of the intellectual world. Perhaps there is no other single journal in the world which so effectively brings to its readers a knowledge of the present currents in the intellectual life of mankind. Now in its seventeenth year, *Scientia* seems to have received a new impulse from the novelty and importance of the problems which have been pressing upon men in the recent eventful years. It is achieving with increased success its object of reacting against the excesses of specialism and of breaking down the partitions which have separated one from another the diverse branches of science and those who cultivate them.

Such is the work for which *Scientia* stands and such is the ideal which it holds up before all scientific workers.

This ideal, as supported by *Scientia* and various other agencies throughout the world as well as by a considerable number of individual thinkers, may yet inspire a greater work than any which can be accomplished by the more or less fragmentary articles of a periodical. It will do much to furnish the material to some great thinker who will give his life to a fresh synthesis of truth and it will hold up his hands in the arduous undertaking. The materials for such a comprehensive synthesis should be gath-

ered and put into order in such a form that an original thinker who would encompass all of them would find it possible to do so in a lifetime and still have left that energy which is necessary to fuse and unite the whole material in the fire of his intellect and mould it into a great (even though tentative) synthesis of scientific truth.

Such a work can not be done once for all. Science continues to grow and novel thoughts arise occasionally in its progress. These will ever require new syntheses if they are to be comprehended properly. No such work of philosophic interpretation can ever be final, for science itself can never reach a final and completed stage. Each generation or century will need to do it again; but this lack of finality does not make the work of any the less importance.

It is important that the great scientific ideas of each generation should come out of their technical dress and be set forth in a literary form which makes them pleasingly accessible to all cultivated persons with a tendency to philosophic interpretation. To this double work of the synthesis of truth and the putting of it into an accessible form the editors of *Scientia* have committed that journal, and it is going forward with increasing success towards the realization of this high aim.

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SPECIAL ARTICLES

PARAMAGNETISM AND THE THEORY OF QUANTA

THE last issue of the *Journal de Physique* contains an interesting and meritorious review by B. Cabrera of the extensive work done by different observers on the magnetism of salts of metals of the iron group. A conspicuous part of this work is due to Professor Cabrera himself and to his pupils and was heretofore outside the reach of most of the scientific readers, because it was published in Spanish journals.

I wish to draw the attention of the physicists engaged in magnetic research to an interpretation of which the material presented by Professor Cabrera is susceptible, and which seems to me to be a strong support of the quantum theory of magnetism. It is well known that the theory of electrons gives a simple relation between the magnetic moment of an atom m and its chief moment of momentum G

$$(1) \qquad m = \frac{e}{2\mu} G$$

e/μ being the ratio of the charge of an electron to its mass. On the other hand, the theory of quanta admits only certain discreet values of the moment of momentum G, *to wit*, whole multiples of the value $h/2\pi$, where h denotes Planck's universal constant of action. The result is that the magnetic moment of an atom (or ion) is also a whole multiple of an elementary value

$$m_0 = \frac{eh}{4\pi\mu}$$

so that

$$(2) \qquad m = j\, m_0$$

where m_0 is called the "Bohr-Magneton" and the integer j (in *Sommerfeld's* terminology) the "internal quantic number" of the atom.

The conception that the atomic magnetic moment is a multiple of a "magneton" was originally introduced empirically by *P. Weiss*. However, the empirical "Weiss-Magneton"

Ion	m in W.-M.	j	m' in W.-M.	m' in M_0	$\gamma \cdot 10^4$ calc.	$\gamma \cdot 10^4$ obs.
Cr^{+++}	19.0	3	15.2	3.04	4.8	5.0
Cr^{++}	24.0	4	20.2	4.04	7.7	7.9
Mn^{++}	29.0	5	25.2	5.04	11.3	11.6
Fe^{+++}	28.9		25.1	5.02		11.5
Fe^{++}	26.0-29.0	4	22-24.4	4.4-4.9	7.7	9.3-11.6
		5	22.6-25.2	4.5-5.04	11.3	
Co^{++}	24.0	4	20.2	4.04	7.7	7.9
Ni^{++} saturated	16.0	3	12.9	2.6	4.8	3.5
Ni^{++} unsaturated	13.0	2	9.5	1.9	2.5	2.3
Cu^{++}	9.1	1	5.26	1.05	1.9	1.1
Cu^{+}	0	0	0	0	0	0