by placing the bar close to the average period of beginning sexual maturity, or approximately at the ten or ten-and-one-half-inch length.

FRANCIS H. HERRICK.
WESTERN RESERVE UNIVERSITY,
February 12, 1906.

SCIENTIFIC BOOKS.

Congress of Arts and Science, Universal Exposition, St. Louis, 1904. Edited by HOWARD J. ROGERS, A.M., LL.D., Director of Congresses. Vol. I., Philosophy and Mathematics. Boston and New York, Houghton, Mifflin and Co. 1905. Pp. ix + 626.

On account of its comprehensiveness of plan, the large attendance of foreign scholars of the first eminence, and the picturesqueness (in several senses) of its attendant circumstances, the Congress of Arts and Science of the St. Louis Exposition was doubtless the most memorable and impressive scientific gathering ever held in America—as it was certainly the most creditable and original thing connected with the exposition. The more permanently valuable of its results will come less from the preservation of the papers read than from the stimulating influence of the actual assembling of so many great specialists for the comparison of methods and conclusions; from the informal discussions of workers in kindred fields, over restaurant tables or in the barracks where so much learning was housed in the midst of amateur soldiers, flying-machines and blanket-Indians; from the closer acquaintance brought about between scholars of a dozen different nations; and from the manner in which the congress brought home to the consciousness of a part of the world not hitherto adequately awake to such ideas the dignity of productive research, its central place amongst the functions of universities, and the primacy of its office in relation to all the work of modern civilization and to the increase of all forms of human power and wealth. For all this American men of science are in no small measure under obligations to all concerned in the organization and management of the congress—especially to the officials of the exposition, to the exposition's committee on congresses, to the boards responsible for the determination of the plan and scope of the congress, and to the foreign scholars who entered into the plan, often at considerable sacrifice of personal comfort and convenience. Much mention of personalities would be invidious; but it appears that the most distinctive features of this congress are to be credited to Mr. F. J. V. Skiff, director of exhibits, who insisted 'to the executive committee of the exposition that the congress work stand for something more than an unrelated series of independent gatherings,' and induced the committee to appropriate a sum sufficient to make practicable a project so extensive; to the late Mr. F. W. Holls, who suggested the idea of selecting and remunerating the speakers; and to Professor Münsterberg, whose imagination conceived the detailed plan finally adopted, and whose energy provided much of the driving power that made it possible to carry the plan through.

The present volume, the first of eight, contains a large amount of prefatory matter: a history of the congress by the editor of the series, Dr. H. J. Rogers; a paper on 'The Scientific Plan of the Congress' by Professor Münsterberg; and the eloquent opening address of the president, Dr. Simon Newcomb, on 'The Evolution of the Scientific Investigator.' Then follow the proceedings of 'Division A' of the congress—sixteen papers in philosophy and eight in mathematics—covering the field of what is called 'Normative Science.'

Münsterberg's classification of the sciences for the purposes of the congress has already been pretty widely criticized. No imaginable scheme of arrangement could fail to have its own special disadvantages. But there undeniably seems to be a supererogatory amount of perversity, and a needless sacrifice of practical convenience and naturalness of connection, in an arrangement which, *e. g.*, widely separates esthetics from psychology, theoretical from experimental physics, the philosophy from the history of religion, while bringing an edifying but rather preachy exposition of

Carlyle's 'Gospel of Work' into close proximity with a disquisition on 'The Theory of Invariants of Quadratic Differential Quantics.' Moreover, the scheme, with its uniform recurrence of 'divisions,' 'departments' and 'sections,' has an undue *a priori* rigidity, and does not properly take account of the actual contemporary interlacings of the problems of different sciences. The congress would probably have been more fruitful if the metaphor chosen to express its purpose had been, not the unification, but the cross-fertilization, of the sciences. In that case, perhaps, a greater proportion of the participants would have been at pains to make themselves intelligible and directly serviceable to men in other though not alien specialties; and we might have had a useful series of indications of just the light that workers in each field most need to have thrown upon their problems by workers in other fields. As it is, the 'unity of knowledge' sometimes shows only in a pretty abstract sense; and now and then the 'unification of the sciences' seems to owe more to the bookbinder than to the philosopher.

Concerning the propriety of grouping philosophy and mathematics together as 'normative sciences' much might be said; but the arrangement at all events serves to bring into clearer relief one of the real tendencies of the moment: the disposition to merge logic, metaphysics and mathematics together in a more fundamental science, a morphology of the primary formal concepts, which shall yield a new logic of relations. To-day—in the opinion of an influential group of thinkers, both philosophers and mathematicians—as at the beginning of the seventeenth century, philosophy is to be revivified by a transfusion of blood with mathematics; and mathematics is to be made more simple, more clear and more fruitful than ever before. As the subject is a favorite one with Professor Royce, he naturally improved the occasion, in his general address on the field of the whole 'division,' to insist upon the epoch-making significance of this new mathematical logic, and especially of the work of Kempe (which later is again set forth by Bôcher). It is an evidence of the strength of this tendency that the names of certain protagonists of the movement, Dedekind, Weierstrass, Cantor, Peirce, Peano, recur throughout the volume with greater apparent frequency than the name of Kant. It is of interest also to note that, partly because of this and partly because of other tendencies of contemporary thought, Leibniz, 'the first and greatest of German philosophers'—as he is called in Professor A. E. Taylor's very interesting paper—is enjoying a notable revival, much at Kant's expense. The signs of this appear alike in the papers of Royce, Taylor and Howison. This inclination to go 'back of Kant'—whose reputation has long been chiefly an obstruction to the progress of logic and metaphysics—is, so far as it goes, an encouraging symptom. There are those, however—and the present reviewer is among them—who find in much of the new mathematics only a straining of the concepts of ordinal arrangement and of correspondence into logical functions for which they are not fitted; who do not make out how, after all, the concepts of quantity and number can be reduced to anything else; who suspect the antinomies to be one of Kant's really sound contributions to logic; and who, in any case, can not share Royce's confidence in the direct serviceableness of the new logic of relations in the more concrete branches of philosophy. These, however, are too large matters to be argued out here. In emphasizing the tendency in question, the present volume at any rate gives a true picture of one striking feature of the contemporary situation. But another not less conspicuous tendency of the period—that known as pragmatism—is hardly so well represented. But for two or three brief references by writers unfriendly to the doctrine, no reader of this collection of papers would guess that pragmatism is the theme which, above all, fills our philosophical journals with controversy.

Of the two general papers in philosophy, Professor Howison's, on 'Fundamental Concepts and Methods' is only a torso. The comprehensive survey promised in the introduction does not appear; the part printed consists

chiefly in a fresh exposition of the author's own well-known system of pluralistic idealism —an exposition more technical and at points more thorough than any of the earlier ones. In view of Professor Howison's association, a generation ago, with the St. Louis group of philosophers, who did so much to introduce the German philosophical tradition into America, a certain historic appropriateness attaches to his place on this occasion as the first of the special representatives of philosophy and as the spokesman of a new argument which seeks to utilize the Kantian and the Hegelian logic to reestablish the Leibnitzian monadology. The other 'departmental' paper —one of the longest in the volume—by Professor Ladd, on the development of philosophy in the past century, is disappointing. The theme was a most alluring one; nothing could be more interesting than a review of the genesis and gradual growth and ramification of the several new fundamental concepts and presuppositions which were chiefly the discoveries of nineteenth-century thought—the idea of evolution, in its several phases, the invention of the philosophy of history and of the historical and genetic fashion of dealing with all problems, the manifold applications of the idea of relativity, the vicissitudes of the eighteenth century's favorite 'principle of contradiction' in subsequent logic and metaphysics, etc. But Ladd's treatment is pretty conventional, and, but for a few inconclusive generalities about the relations of philosophy and the sciences, consists largely in a dry catalogue of philosophers and their tendencies. Nor is the catalogue entirely accurate. It is, *e. g.*, misleading to speak of Reinhold as "rejecting Kant's arbitrary and self-contradictory 'thing-in-itself.'" Though the *Ding-an-sich* has a rather odd status in that system, it is nearer the truth to say with Falckenberg that Reinhold 'changed the thing-in-itself from a problematical negative, merely limiting concept, into a positive element of doctrine.' The summary in which F. Schlegel is disposed of is true only of his first period. Such figures as Lamennais, J. de Maistre—the great representative of the extreme reaction against the spirit of the Aufklärung—and Dühring, go unmentioned, while room is found for such names as Whedon, Hazard, Day and Tappan. The portrayal of the contemporary situation in philosophy is indefinite and inadequate.

Eight of the most important papers—those of A. E. Taylor (metaphysics), Hammond (logic), Woodbridge (logic), Ostwald (theory of science), Erdmann (validity of the causal law), M. Bôcher (mathematics) and Boltzmann (applied mathematics)—though scattered through different sections, form a connected group dealing with essentially the same topic—logic or epistemology. It is a pity that the program did not explicitly provide in advance for a single many-sided discussion of the logical foundations of the sciences, by the representatives of a number of distinct disciplines; here is a case where the mechanical uniformity of the scheme of the congress defeated its own purpose. But even as it is, these papers, read together, present an instructively diversified array of reasoning upon the same set of problems—the relation of logic to psychology, to metaphysics, to mathematics, the connection of the formal and the empirical elements in knowledge, the existence of intuitive or necessary truths, the ultimate criterion of validity in inference, the relation of the judgment to the 'transcendent object.' The result seems to show a general need of a better digestion of the work of the epistemological century—the eighteenth. For much that is ostensibly novel in the views presented seems due less to a real transcending of earlier positions than to a forgetting or an imperfect consideration of them. The question of the existence of 'necessary' truths and their relation to experience (a question, surely, that is capable of clear logical determination) still evokes a sharp conflict of opinions. Taylor declares that recent mathematical logic has only the more clearly shown the reality of self-evident principles and their primacy in knowledge, though it has also shown them to be reducible to a small number. Erdmann, in a similar spirit, observes that 'the assertion of modern scientific empiricism . . . that there is no

such thing as necessity of thought, goes altogether too far.' Bôcher takes a middle position, apparently holding to the validity of the criterion of mental necessity or ultimate self-evidence, as such, but doubting whether we can at any given time be sure that we can apply that principle to any specified proposition:

> We must remember, when we are tempted to put implicit confidence in certain fundamental logical principles, that . . . no very great weight can be attached to the mere fact that these principles appeal to us as obviously true; for other modes of reasoning which are now universally recognized as faulty have appealed in just this way to the greatest minds of the past.

Ostwald, speaking of the conclusion that if B follows A and C follows B in any well-ordered series, then C comes after A, says:

> The correctness and validity of this proposition seems to us beyond all doubt. But this is only a result of the fact that we are able to demonstrate it very easily in countless single cases, and have so demonstrated it. . . . To call such a proposition, however, a necessity of thinking does not appear to me correct. . . . To base the proof for the correctness of a proposition upon the impossibility of thinking its opposite is an impossible undertaking, because every kind of nonsense can be thought.

And Boltzmann deprecates an 'immoderate trust in the so-called laws of thought':

> Our problem cannot be to quote [*sic* the translator] facts before the judgment seat of our laws of thought, but to fit our mental representations to the facts.

Yet, somewhat oddly, Boltzmann is (in the same paragraph) sure that

> in facts there can be no contradictions. As soon as contradictions seems unavoidable we must test, extend and modify that which we call laws of thought, but which are [*sic*] only inherited, customary representations, preserved for æons for the description of practical needs.

As the requirement of non-contradiction is itself commonly understood to be nothing but the most fundamental of the laws of thought, the paragraph seems to show that contradictions are at any rate possible in the reasonings of a great physicist—when he turns aside into epistemology. The whole discussion of the question shows an undue amount of mental confusion and divergence of view, which it ought to be possible to get rid of, if philosophers and men of science would generally agree to study the history of philosophy understandingly and then 'get together' for an open-minded, patient, Socratic examination of their own meanings and of one another's views.

On the relation of logic to psychology, Taylor, Hammond and Woodbridge substantially agree in—I can not but think—misapprehending the matter. All three, while recognizing obvious points of contact, insist that (in Hammond's phrase) 'the essence of the logical problem is not touched by psychology, and should not be mixed up with it,' since psychology merely *describes* judgment and other mental processes, while logic inquires concerning *truth* in judgments. 'The psychological laws of the formation of concepts and beliefs are exemplified equally in the discovery and propagation of truth and of error,' says Taylor. But surely the only verifiable test of an absolutely true judgment (if there be such a thing) is the subjective fact that I can neither believe nor conceive its opposite; or of a probable judgment, that I find no adequate consideration which impels me to believe its opposite. At any given moment of inquiry, verifiable truth can, for anybody, only mean unescapable belief; probability can only mean belief conformable to preponderating, experience-engendered mental ease and habit. And the determination of the general sort of mental content in the presence of which such necessities of conception or deeply-rooted preferences of belief arise is certainly nothing but a question of introspective psychology. A normative principle can only be a way of stating a peculiar kind of descriptive fact, *viz.*, a necessary (and supposably universal) judgment-reaction exhibited by the mind in the presence of certain carefully analyzed meanings or ideational content. This was not unfamiliar to Locke or to Hume or to the Leibnitzians; but it seems of late to be too little considered. So, again, Woodbridge's vigorous and well-written argu-

ment for the realistic implications intrinsic in the judgment as such seems, after all, curiously like a mere relapse into a pre-Cartesian, even a pre-Protagorean, dogmatism. Doubtless a cognitive process purports to be 'connected with something other than itself,' and the truths which thought thinks are meant to be 'true, not about thought, but about things.' But it is also a peculiarity of the mind that it has the power of self-consciousness, and so is capable of doubting its own success in achieving this 'transcendent reference.' Such a self-conscious 'going-behind' the immediate content of consciousness, such a distinguishing of the thought-process from its potential object, necessarily supervenes in the history of philosophy and in any thoroughgoing reflection by the individual; and for any modern logician or metaphysician this reflective situation is already presupposed. The implications of the proposition that man is a self-conscious animal, Woodbridge hardly seems to have sufficiently considered.

At a moment when a renascence of realism is in fashion among metaphysicians—Dr. W. P. Montague even contending, in one of the shorter papers here printed, for the physical reality of the secondary qualities—it is interesting to turn to Poincaré's remarkable essay on the present condition of theoretical physics. He exhibits—in a fashion that will seem paradoxical enough to physicists of an older school—all the working principles which physics has long employed, as now subsisting in a very problematical and parlous state, and the concepts of matter and energy as surviving only in a singularly eviscerated form. The uncertainty and provisionality which are thus revealed in the theoretical foundations of the most fundamental of the physical sciences, by one who is perhaps its most eminent living representative, make this paper a noteworthy document in the history of science.

Erdmann's new rehabilitation of the concept of necessary causality appears in a rather bafflingly unidiomatic translation; but so far as one can follow the argument, it does not seem likely to render obsolete Ostwald's remark in the immediately preceding paper, that "all attempts to prove the general validity of the law of causality have failed, and there has remained only the indication that without this law we should feel an unbearable uncertainty in reference to the world." Erdmann's reasoning, however, is (though distantly related to the argument of Kant's 'Second Analogy of Experience'), original and *gedankenreich*, and it would be profitable to attempt an analytical discussion of it; but the paper is the longest of the series, and a commensurate treatment of it here is forbidden by considerations of space. Like considerations make it necessary to mention a number of the more specialized papers only by title: those of Ormond on 'Present Problems of Metaphysics'; of Pfleiderer and Troeltsch on the 'Philosophy of Religion'; of Sorley and Hensel on 'Ethics'; of H. R. Marshall and Dessoir on 'Esthetics'; of Pierpont on the 'History of Mathematics in the Nineteenth Century'; of Picard and Maschke on 'Algebra and Analysis'; of Darboux and Kasner on 'Geometry.' As has been sufficiently shown, the volume covers a very wide and very mixed field. The selection of these last-named papers for so brief mention is not due to any lack of interest and value on the part of most of them; it is rather due, partly to the limits of the province of this journal, and partly to the limitations of the present reviewer. Those who attended the sessions of the congress will remember that a number of the 'ten-minute papers' were by no means the least profitable part of the proceedings. Of these a few in philosophy, but none in mathematics, are printed—in each case in abridged form. The volume is not free from bad misprints; and most of the translations from French and German (that of Dessoir's paper, by Miss E. D. Puffer, is one exception) seem to be hasty renderings into that unknown tongue which only translators employ.

ARTHUR O. LOVEJOY.

The Eolithic Problem—Evidences of a Rude Industry Antedating the Paleolithic. By GEORGE GRANT MACCURDY.[1]

[1] *American Anthropologist*, N. S., Vol. 7, pp. 425–479, with five half tone plates reproduced