

velocity they would be expected to penetrate into the actual atomic structure, and indeed, in the skillful hands of Davisson and Kunzman they have presented us with the most striking and direct evidence we have for the nuclear theory of the structure of the atom. Low velocity electrons will undoubtedly tell us something about the mass structure, though as yet the conclusions are indefinite. Since the outer atomic levels are, without doubt, seriously altered in the mass (otherwise atomic optical properties would show themselves) it is improbable that the atomic ionization and resonance potentials will be observed in connection with low velocity bombardment—though there might well be, in some cases, observable effects due to analogous quantum changes, which might be expected to be more pronounced in those metals where the outer electron levels are the least disturbed by agglomeration.

Mention of the subjects of this address would, I suspect, bring to most of us first a thought of the wide variety and complexity of the experimental and theoretical methods involved and then a feeling of the apparent disconnection between them, as if each group of workers were so intensely interested in cultivating their own field that they paid but scant attention to what was being done in others. Even an incomplete account such as the present may be of value in showing that while the complexity is real the impression of disconnection is largely superficial, and in pointing out some of the cross-relations which are developing between the various methods of attacking the fundamental problem of the constitution of solids. If in this presentation I have appeared to overemphasize the failures of our theories and the defects of our experimental knowledge, you must accept this as in part a matter of temperament. The pessimist dwells on successes to keep his courage up—the optimist enjoys facing things as they are. On the other hand, it is the failures and the inconsistencies of our interpretations which point the way to new knowledge, and it is in one very real sense true that a theory is valuable inversely in proportion to its apparent completeness and rationality. I have no regrets, therefore, in commending to you the subjects of this afternoon's discussion as ones in which there is great room for improvement.

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THE ORGANIZATION OF SCIENTIFIC MEN

IN discussing altruism and the struggle for existence¹ David Starr Jordan has urged that those who band together win. Those who can stand shoulder to

shoulder loyally have the promise of the future. Those who can not hold together find every man's hand raised against them.

Some contemporary developments are eloquent that the traditional policy of individualism which animates so many intellectual workers is harmful to the best interest of the workers, their work and of society, and that it must ultimately be abandoned and replaced by a policy of cooperation. There is scarcely justification for an absorption in one's specialty which leaves no time for consideration of the welfare of one's family and fellow workers.

We believe that certain organizations already in the field are doing valuable work in this direction, though most of them are handicapped by limitations greatly reducing their effectiveness. To mention a few only: The social and scientific activities of the American Association for the Advancement of Science are considerable, but its contribution on the economic side is very small; the scientific-technical branch of the Washington, D. C., local of the National Federation of Federal Employees did a valuable piece of work in behalf of the reclassification of the civil employees of the government, but has now become inactive, and is, of course, limited to employees of the United States government; in their own spheres of activity such organizations as the American Medical Association and the American Association of Engineers have accomplished much, but their contributions have been very largely to the welfare of the more or less homogeneous groups which they represent; more important, perhaps, than any of these (at least for university men) is the American Association of University Professors, which, however, is limited to certain grades of university men, and which has not been nearly so effective as it might be with a larger membership and more adequate dues.

It seems clear that a professional organization more inclusive than any of these is needed, embracing workers in *universities, academies, museums, private scientific and intellectual foundations*, and in the *service of state and federal governments*, to insure the social and economic welfare of the intellectual worker and to increase the value of his contribution to society. Business interests and labor have long had their organizations, through at least some of which they secure effective cooperation. Even the long-suffering farmer is taking some elementary lessons in the fine art of mutual endeavor. Why should the intellectual worker lag so far behind? In some of the countries of the old world, perhaps as a result of an almost insupportable economic pressure, there are signs of an awakening. A writer in a recent number of the *British Medical Journal*² reports that there are, in

¹ "Footnotes to Evolution," 1913, p. 28.

² Quoted in *SCIENCE*, May 18, 1923.

Europe, no less than nine national confederations of intellectual workers, though none as yet in England or the United States. The present precarious status of academic freedom and the wholly inadequate economic basis on which intellectual and research work rests in this country and elsewhere enforces the need of some such agency. Such an organization should be supported by adequate dues and should, from the first, adhere to a consistent policy of advancement of scientific workers and their work and defense of intellectual interests wherever they might be attacked. There is great need for the stimulation of a better appreciation, on the part of the public, of the important rôle in our modern life played by the intellectual worker. The important results of his work should be given more adequate publicity. As Gregory³ says, "The time has come for a crusade which will plant the flag of scientific truth in a bold position in every province of the modern world." Among the legitimate objects of such an organization as that proposed are to be numbered the following:

- (1) Strive for academic freedom.
- (2) Endeavor to secure better pay for intellectual workers.
- (3) Adopt and maintain codes of ethics for intellectual workers.
- (4) Educate the public as to what is going on among intellectual workers, and emphasize the value of the work of the expert.
- (5) Educate the expert in the basic principles of the sociology, economics, world history and practical politics which underlie the present social structure, to the end that he may better protect his own economic interests and take a more intelligent part in community councils.
- (6) Study the special economic problems of the intellectual worker, such, for example, as supply and demand of intellectual workers, wages and cost of living, employment methods and policies in different institutions.
- (7) Insist on higher standards of preparation for intellectual workers, with emphasis on a broad curriculum to increase their all-round efficiency.
- (8) Maintain an employment service for this group of workers; help young intellectual workers get started.
- (9) Secure the passage of desirable legislation, such as registration laws, protective alike of the intellectual worker and the public.
- (10) Cooperate with other organizations of similar objects; advocate the formation of an American Confederation of Intellectual Workers, to be composed of all organizations of adequately trained brain workers striving for the social and economic advancement of their members, and so for a more adequate research product, and a more worthy contribution to human advancement.

We believe it will be generally conceded that the old system puts the emphasis too much on each man for himself alone and for his work alone. The newer

plan, while not lessening, in any degree, the obligation to cultivate his specialty to the utmost, adds an obligation to help his fellows. In order to be successful, an organization of the type proposed must be based on a real friendship and mutual loyalty on the part of intellectual workers. No mere machinery of organization can take the place of sympathy and mutual interest.

The intellectual worker has made immeasurable contributions to the welfare of mankind, both spiritually and physically, and not a few men he has made immensely rich. While the dollar is an inadequate yard stick by which to assess the value of his product, it is one of a very practical character, and it is only just to insist that from the billions of dollars representing the values resulting from his research enough should be returned to make his continuing contribution efficient. The opinion of the business man who regards the intellectual worker with mild toleration, not to say contempt, on the ground that he is an economic imbecile lacking the sense to make a decent living for his family, is, after all, pretty well founded. The merchant does not stop to consider that the successful operation of his business depends on the previous painstaking work of a long line of brain workers. The lack of consideration of the scientific workers on the part of the public will continue just so long as it is accepted by such workers.

We are of the opinion that the intellectual workers should get their heads together; that such topics as academic freedom and the economic status of brain workers should be increasingly discussed wherever scientific men gather; that interested individuals in the various institutions of the country should take it upon themselves to bring together within their own sphere a group of sympathetic and interested individuals; and that, at the earliest practicable opportunity, a thoroughgoing organization for the social and economic advancement of intellectual workers (in university, museum, academy, private scientific and intellectual foundations and the scientific-technical service of state and federal government) be set up, either by the expansion of some association already in existence, or the formation, from the ground up, of a new and more inclusive agency for the purpose suggested. Ultimately, this might well be followed by the union of this organization and others with similar objects into a single large unit for the better service of intellectual workers and the public.

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³ SCIENCE, Nov. 11, 1921, p. 449.