coming impervious during use, a granular material was obtained by powdering plaster figures, igniting and passing through a 2 mm. sieve. The substance was air-dried and ordinary ether used. Anhydrous ether apparently did not affect the results, though these were lowered by a previous drying of the food stuff. The extracts, though pure, were not constant in weight. Spanish earth was found to yield satisfactory results after the following procedure. The fine powder was mixed with water, sufficient sulphuric acid added to remove the carbonates, and the whole evaporated to dryness and ignited. The mineral was then powdered and passed through a 2 mm. sieve. A cotton plug is inserted in the end of the extraction tube, and upon this a layer of 3-4 cm. of Spanish earth, after which a mixture of the earth and fodder and then another plug. 12-15 grammes of the earth were used for 5 grammes of the fodder. With ordinary fodders the results were the same whether hydrous or anhydrous ether was employed, but with foods rich in fat lower results by a few tenths were obtained with the anhydrous. A previous drying of the substance, when Spanish earth is used, gives low results, probably due to the retention of that portion of the fat which may have been changed by the action of the heat.

SYNTHESIS OF PURPUREO-AND LUTEO-CHROMIUM CHLORIDES.

Professor Christensen, of Copenhagen, has produced by direct synthesis the so-called purpureo-and luteo-chromium chlorides, $Cr\,Cl_3\,5\,NH_3$ and $Cr\,Cl_3\,6\,NH_3$. A small quantity of violet chromium chloride, dried at 100°, *is placed in a beaker and immersed in a freezing mixture of solid carbon dioxide and ether. Liquid ammonia (NH_3) is slowly added. At this temperature no reaction takes place, but upon removing from the freezing mixture and warming to —38.5°, the boiling point of ammonia, a sudden reaction sets in, converting the chloride into a red mass, consisting largely of the purpureo-chloride. The excess of NH_3 is eliminated as gas. The product is washed with cold water and hydrochloric acid, finally dissolved in water and the solution dropped into concentrated hydrochloric, in which the purpureo-chloride is insoluble, when the red crystals of the pure salt are thrown down. The first aqueous washings are yellow and yield a yellow crystalline precipitate of luteo-nitrate upon the addition of concentrated nitric acid. The reaction takes place between very narrow limits—immediately above and below the boiling point of ammonia —38.5°.

DETERMINATION OF GERMANIUM.

Quantitative estimations of the rare metals being unknown to text-books on chemistry, the methods adopted by experienced analysts have a decided instructive value. The following is the procedure in an analysis of the new mineral canfieldite as given by Mr. S. L. Penfield in the *Am. Jour. of Science.* A preliminary qualitative examination was made showing the mineral to be essentially a sulpho salt of germanium and silver. The silver and sulphur were determined as usual. For the germanium, 2 grammes are oxidized with nitric acid, a little sulphuric being added and the excess of nitric removed by evaporation to dryness. The residue is dissolved in water, which has been rendered slightly acid, if necessary, and the silver precipitated with ammonium thiocyanate, filtered and the filtrate containing the germanium collected. The solution is evaporated to dryness in a platinum dish without danger, no acid being present to form with the germanium a volatile compound. The excess of sulphuric acid is driven off by heat, and the ammonium thiocyanate is destroyed by the nitric acid present. The residue is covered with a little strong ammonia (NH_4OH) into which sulphuretted hydrogen is conducted, thus dissolving the germanium oxide and leaving all heavy metals, except those which form sulpho salts soluble in ammonium sulphide, undissolved. The filtrate from this solution is collected in a platinum crucible and evaporated on a water bath, the residue oxidized by concentrated nitric, and the excess of the latter removed by a second evaporation. The mass in the crucible is now gently ignited and weighed, the germanium being determined as the oxide, GeO_2. There is no loss of weight on subsequent heating to a red heat.

Another scheme by which all of the determinations are made in one sample is briefly as follows: Solution in nitric; precipitation of the silver by means of hydrochloric; precipitation of the sulphur with barium nitrate; removal of the excess of chlorine and barium, in one operation, with silver nitrate and sulphuric acid; removal of the silver by means of ammonium thiocyanate; and the final determination of the germanium as above.

*Throughout these articles temperatures will be given in Centigrade unless otherwise stated.

THE WORLD'S CONGRESS AUXILIARY OF THE COLUMBIAN EXPOSITION.

BY GEO. H. JOHNSON, SC. D., ST. LOUIS, MO.

ONE of the greatest attractions of the Columbian Exposition is outside of the exposition. In the World's Congresses we have an exhibit of the world's intellectual progress and present condition such as has never been attempted before. For the first systematic attempt to make such a comprehensive exhibit of the world's thought by spoken language only the congresses have been very successful. During the whole of the six months that the fair is open the Memorial Art Palace, foot of Adams Street, Chicago, is the place of assembly for those who are prominent in any branch of theoretical and practical learning. At the fair we see the magnificent work of great masters. At the Art Palace we see the great masters themselves. As the creator is greater than his work, as thought is greater than action, so are the world's congresses greater than the fair.

It has been said that President Bonney, since the first day of May, has done nothing but open congresses; and indeed, that is quite sufficient to keep him busy, since several congresses meet each week, and each one is opened by Mr. Bonney with felicitous remarks appropriate to the subject.

Little effort, apparently, has been made here to show the intimate relations which exist between different departments of science and art. To attend one congress and then another exhibits as complete a change as to pass from Machinery Hall to the Fine Arts Building. Since the congresses are designedly meetings for specialists, it is to be expected that very few can take a prominent part in more than one congress. But the wisdom of such a complete separation between dependent and cognate subjects as some of the programs show, is open to question. For example, the Congress on Higher Education did not consider University Extension because the latter subject was considered exclusively in its own congress. The engineering educators could not attend any of the meetings of the civil, mechanical, naval, mining, metallurgical, or military engineers without leaving their own meeting, since all these and others were in session simultaneously.

Perhaps the greatest need of coöperation between closely related specialists was shown in the congresses on experimental and rational psychology. These meetings were held simultaneously in opposite halls of the institute, and each succeeded remarkably well in ignoring the work of their opposite brethren. Indeed, it might have been inferred from some of the remarks that what is experimental is not rational, and what is rational will not bear the test of experiment. A professor in one famous

university, in summing up his criticism on experimental psychology, said that the new results of that science, for example, Weber's law, were not strictly true; and their true and valuable results had been set forth centuries before in rational psychology. In the other congress, shortly after, I heard the representative of another great university say that a single study in experimental psychology, carefully worked out, was of more value than all the works on rational psychology which had ever been written. A friendly rivalry between the advocates of different methods is probably stimulating and favorable to the development of science; but the depreciating of all methods except one's own, and the rejection or neglect of results obtained by other methods, is certainly detrimental to the specialist himself, and it lessens the reliability of his work. A conference between all those interested in psychology would have been very desirable.

There were some surprises at these congresses for which the programs could not prepare us. At the Congress on Rational Psychology, over which the venerable ex-President McCosh presided, some *irrational* speakers persisted in making themselves prominent when the subjects were open for discussion. On the other hand, at the Conference on Aerial Navigation, where some people went expecting to see the "cranks," there was nothing but plain statements of observations made, experiments tried, results achieved and theorems proved. At no other congress, perhaps, was there such a pressure of really valuable and original matter. The three days set apart for the conference, with doubt as to whether so much time would be needed for the discussion of such an embryonic art, proved to be quite insufficient; and even a fourth day did not give time for the reading of several valuable memoirs offered by practical and scientific men who are devoting much of their time to arts aerial without hope of any immediate financial return.

The Congress on Woman Suffrage was notable for the large number of men present who seemed to enthusiastically support the claims of their sisters. The Congress on Jurisprudence and Law Reform, where the most serious debates might have been expected, was characterized by the amusing stories and reminiscences of venerable judges.

The Congress on Social Settlements was a very earnest conference between ardent young college graduates, who constitute most of these settlements, and philanthropists and socialists.

The number of eminent visitors from abroad who have participated in most of these congresses has been sufficient to make the term "International" no misnomer. So many valuable papers have been read at these meetings, and the average excellence has been so high, that it is very desirable that the proceedings of all the congresses, including the discussion of papers, should be published in uniform style, fully indexed, and offered for sale at a price to secure a large circulation. An effort is to be made to have such an edition published and widely distributed by our government. The whole work would be a kind of thesaurus of practical knowledge. The theorists and visionaries have contributed their part to each subject, but generally it has been only a subordinate part; and the proceedings as a whole have been characterized by great practical wisdom.

The World's Congresses have been a kind of university for which the fair has served as museums, laboratories and recreation grounds. The congresses, although they have the mottoes, "Not things, but men," "Not matter, but mind," are officially designated as "auxiliary" to the exposition; I am inclined, however, to consider the exposition as auxiliary to the congresses.

A NEW FACTOR IN FRUIT GROWING.

BY B. T. GALLOWAY, WASHINGTON, D. C.

During the past three years the Division of Vegetable Pathology in the U. S. Department of Agriculture has been engaged in the study of twig or fire blight of the pear and apple. In the course of these investigations, which were for the most part carried on by Mr. M. B. Waite, an assistant in the Division, an attempt was made to obtain some definite information in regard to the relation of insects to the disease in question. As a result of this work it was shown that the organism causing blight was disseminated by insects during their visits to the blossoms. The blossoms, it was found, were readily infected by the pear blight germs brought to them by insects, the result being the death of the flower and frequently the twig or branch supporting the latter. This discovery raised the question of the necessity of insect visits to the flowers of pears and other fruits affected by blight. It was thought that if by some practical means insects could be excluded from the flowers without interfering with the fruitfulness of the trees, one form of blight at least might be prevented.

In order to obtain some information in regard to the effect on fruitfulness of excluding insects a series of experiments were made at Brockport, New York, in the spring of 1891. The results of these trials were somewhat startling, as it seemed to indicate a fact hitherto overlooked by scientific and practical men, viz., that many of our well-known varieties of pears will not set fruit unless their flowers receive pollen from other varieties. In other woods, the visits of insects, by means of which cross-fertilization is effected, is necessary to insure proper setting of the fruit.

To obtain further information on this subject more extended experiments were made on this subject in 1892 and 1893. This work was carried on in Virginia, New York, and New Jersey, the results in every case confirming those obtained in 1891. The facts obtained by these investigations seemed sufficient to warrant the important conclusion that most of our common varieties of pears and apples are unable to fertilize themselves. This law can hardly be called new, for Knight, Darwin and others have touched the same point in a broader and more general way. Strange to say, however, no one, up to the present time, seems to have applied the conceptions of Darwin and others on this subject to some of our common fruits, although it has long been recognized that orchards of pears, apples, plums, etc., fail to bear fruit regularly, even under the most favorable conditions.

In the light of our present knowledge it is known that unfruitfulness, in many cases, is due to the fact that large blocks of single varieties have been planted. In such cases there is not sufficient foreign pollen to effect fertilization, consequently the trees bloom profusely but no fruit sets. The new factor, therefore, which confronts the grower of pears and apples is to select his varieties and plant them in such a way as to insure cross-fertilization. Of course, in doing this it will be necessary to observe a number of important points, the details of which need not be given here. Suffice it to say that the time of flowering of the various varieties must be kept in mind in selecting those designed for pollinating. Then again, the question of the potency of the pollen with respect to the variety it is intended to grow must of necessity be considered, and, finally, it will be important to know what proportion of pollinating trees to trees it is desired to fruit should be planted.