mal relations of the testis to the scrotum; a scrotal testis is normal, an extra-scrotal testis degenerate. Here, then, is a partial answer to the question of why an active epithelium in an intramuscular, subcutaneous or intraperitoneal rat testis graft never possesses spermatozoa. Furthermore, if such a relationship between a normal germinal epithelium and the scrotum holds, it would be expected that a testis grafted onto the walls of the scrotum would develop a normal epithelium.

RAT TESTIS GRAFTS IN THE SCROTUM

In making grafts of testis onto the walls of the scrotal sac one must employ relatively small amounts of tissues in order to permit of vascularization, and preferably testis tissue before the establishment of the germinal epithelium. Testes were taken from just born rats (two to ten days old) and the entire testis grafted onto the walls of the scrotal sac of a sixty-day-old castrated male. Such grafts recovered from the scrotum six months after the transplantation have been found to contain some tubules that were entirely normal and possessing spermatozoa. Most of the tubules were degenerate; many contained an actively proliferating epithelium. To my knowledge this is the only case on record where spermatozoa have been differentiated from a mammalian testis graft.

It is not surprising that all tubules do not contain spermatozoa. Interruption of blood supply is quickly fatal to the germinal epithelium and it must be remembered that the normal testis is vascularized by the internal spermatic as well as by the artery of the vas deferens. The graft is deprived of both these arterial supplies and must depend for its blood supply upon the small vessels of the scrotal sac wall. The limitations of a graft in such a position as this depends upon the amount of blood supply that can be brought to it.

These results confirm our supposition that a normal germinal epithelium and the differentiation of spermatozoa are dependent upon some influence derived from the position of the testis in the scrotum. The factors involved are not fully known but I am inclined to the suggestion of Crew[9] that body temperature may be the responsible agent. The scrotum may act as a local regulator of the temperature of these parts. Details of this work will be presented more fully at a later date.

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[9] F. A. E. Crew, *Jour. Anat.* (Lond.), Vol. 56, p. 98, suggests on hypothetical grounds that the aspermatic condition of imperfectly descended testes may depend upon a temperature gradient locally controlled by the scrotum.

ADDENDUM

Since the above account was written experiments, designed to test the hypothesis that germinal epithelium degeneration in undescended and artificial cryptorchid testes is due to a different temperature relationship established and probably locally controlled by the scrotal sac, have been brought to a close. The writer, in cooperation with Mr. Robert Oslund, using the sheep as the experimental animal attempted to insulate the scrotum from loss of heat by secure wrappings. After a period of eighty days the testes were found to be entirely devoid of spermatozoa. The majority of the seminiferous tubules were decidedly degenerate and presented similar conditions to many of the artificial cryptorchid testes; control testes were in full gametogenic activity.

N. Fukui has shown that local application of heat to the scrotum produces germinal epithelium destruction and the writer has been able to confirm these findings. It thus appears very probable that increased temperature is the operating factor in the degeneration of the epithelium, but it is well recognized that this may not be the only factor.

THE AMERICAN CHEMICAL SOCIETY

SECTION OF CHEMICAL EDUCATION

Edgar F. Smith, *chairman*
Neil E. Gordon, *secretary*

How shall we feed our children? MARIE DYE. The problem of correct food for children may be roughly considered in two parts: first the quantitative, dealing with the amount of food required and second the qualitative, showing the kinds of food. Research in calorimetry has given the basis for the former and enables us to calculate the amount of food required by children of various ages. The qualitative aspect of the food problem necessitates the study of food composition and the research with animals. Fats and carbohydrates are useful chiefly as fuel foods, while proteins, certain inorganic elements and vitamines are needed for growth and maintenance. The amount of protein, calcium, phosphorus, etc., required is determined through balance experiments. It is then a simple matter, when the chemical composition of food is known, to select the kind and quantity to fit the needs of the child. The animal work on vitamines has shown their importance, and our experiments during the war proved that this information may be applied to children. Thus the knowledge of the chemical composition of food and the quantitative needs of the individual give a reliable basis for the selection of food for children.

Some problems in chemical education which are vital to the development of the chemistry in this country: NEIL E. GORDON. Reasons are given for the importance of the twelve following problems in chemical education in the development of the chemistry of this country: (1) Chemical training in the high school; (2) correlation of high school and college chemistry; (3) chemical train-

ing in college; (4) methods and devices used in the presentation of chemistry; (5) correlation problems; (6) standardization problems; (7) chemical education of the layman; (8) chemical education of the industrial man; (9) educating the chemist in the industry; (10) chemical education as a profession; (11) a national organization of chemical education; (12) a journal on chemical education.

Chemical education via radio: D. H. KILLEFFER. This paper deals with the broadcasting of popular talks on the subject of chemistry via the radio telephone. The discussion is based on the writer's experience in broadcasting ten talks on a variety of chemical topics from the Westinghouse station in New York. The method of arranging for the series is described, the subject-matter treated and the points to be borne in mind by those who prepare such talks are mentioned. Three points in delivering a talk to a radiophone are brought out: First, the subject must be interesting and must be interestingly treated, for radio audiences "walk out" easily and quickly if their interest is not sustained; second, each talk of a series must be complete in itself on account of the fact that the audience is extremely impatient with things it does not understand and it is very easy for one or more talks of a series to be missed; and third, the delivery of the speaker should be clear, deliberate and without raising the voice above the ordinary tone.

Chemistry and civilization: D. L. RANDALL. This is designed to be a popular illustrated lecture in which the writer undertakes to show to what extent the development of civilization has depended on the work of the chemist. He has made possible the development of great cities and modern methods of industry by preparing iron and steel in abundance. The work of the metallographer is pointed out. The development of the electrical industry has been materially assisted by the discovery of the chemical battery and the electrolytic refining of copper. The cement industry is a chemical industry. The manifold uses to which sulfur and salt are put are given, also the products obtained from coal and coal tar. The hand of the chemist is seen in the production of fertilizers, the preparation of new foods, the study of nutrition, the preparation of medicines and the purification of water. Finally, the chemist has improved the quality of merchandise by his methods of testing, has had a share in introducing the laboratory method into educational work and has used his efforts to have the public attack all problems in a scientific manner.

The training of chemistry teachers: B. S. HOPKINS. A good teacher is the most important factor in any chemical course of study. Many superior teachers are succeeding wonderfully well in spite of dingy laboratories, meagre equipment, mediocre textbooks or inadequate libraries. There is a heavy annual demand for teachers of chemistry who know both method and subject-matter. Graduates of colleges or universities may know chemistry, but as a rule they have had no training in teaching the subject; graduates of normal schools are well trained in methods of teaching, but all too frequently they do not know chemistry. The American Chemical Society has appointed a committee to consider methods for improving the teaching of chemistry in the high schools of the country. Even if it were possible for this committee to present a perfect outline for a course in chemistry, little improvement can be expected unless the higher institutions of learning are willing to take up the task of supplying well-trained teachers of chemistry.

Making high school chemistry worth while: C. E. OSBORNE. The reconstruction period following the world war has had its influence on educational work. Curriculum reconstruction is much discussed. To retain its place in the high school course, chemistry must show itself worthy. The subject "Making High School Chemistry Worth While" is, therefore, timely. Any achievement, mental or material, involves certain factors. Art demands an artist, a vision, a plan, paints and brushes and canvas; the picture is the vision become a reality. To make high school chemistry worth while demands a teacher, a definite purpose, a plan of work, materials with which to work, and material to be fashioned—the boy or girl in the sensitive, impressional formative period. The ultimate product should approach the highest type of American manhood and womanhood. This paper will briefly discuss each of the above factors.

Qualitative analysis without hydrogen sulfide: R. D. MULLINIX. G. Almkvist has proposed a method without the use of H_2S, but uses Na_2S followed by H_2SO_4. (*Zeit. anor. Chem.*, 103, 221–242 (1918)). A number of similar methods have been proposed. I have used for the past two years a method in which, after the removal of the silver group by HCl, a mixture of NaOH, Na_2CO_3 and bromine water precipitates a group of hydroxides and carbonates, which are then further separated by HNO_3 followed by NH_4OH, $(NH_4)_2CO_3$, etc. The As, Sb, Sn, Pb trace, Zn, Al and Cr are in the filtrate. This is divided by HCl followed by NH_4OH and zinc tested for in the presence of chromate and arsenate by the potassium ferrocyanide method worked out last year. The method will detect "traces" with as much certainty as will the sulfide method. Organic matter, phosphates, etc., can be handled. There are certain advantages in the use of the method, among these being: (1) The usual trouble with colloidal suspension, especially sulfur, is avoided; (2) the analysis can be performed without the use of the hood. Work is being done at the present time to determine the minimum concentration of each ion that can be detected.

A method for determining the formula for carbon dioxide (an experiment for elementary students): W. L. EVANS, J. B. PETERSON, H. B. HASS and G. P. HOFF. This experiment consists of two parts: (a) Determining the quantitative composition of carbon dioxide by passing oxygen over a weighed amount of dry activated charcoal contained in a porcelain boat. The boat is placed in a small combustion tube and is carefully heated while oxygen is being passed over its contents. The carbon dioxide, thus formed, is collected in a small U tube filled with soda lime and previously weighed; (b) the weight of one liter of carbon dioxide is determined by passing a known volume of the gas (made in the usual laboratory manner) into a soda lime tube as described above.

A method for determining the weight of one liter of steam (an experiment for elementary students): W. L. EVANS, C. S. PEASE and C. D. BLAND. This experiment consists of two parts: (a) Filling a liter flask, previously heated to 106°–110°, with steam; (b) passing the steam thus contained into a calcium chloride tube previously weighed. A current of dry air is used to sweep the steam from the liter flask. All these steps should be carried out while the flask is immersed in a calcium chloride bath contained in an ordinary galvanized iron bucket.

Some helps in elementary qualitative analysis: JESSE E. DAY. The following laboratory helps were used in the course in general chemistry for engineering students at the University of Wisconsin: (1) Copious and gelatinous precipitates were filtered by suction; the suction apparatus was constructed from two 250 cc wide mouth bottles and an ordinary funnel; (2) blue-prints showing the wash-flask, H_2S precipitation flask and suction outfit, with detailed angles and dimensions, were hung in the laboratory; the result was more uniform and presentable apparatus; (3) each student was supplied with a set of mimeographed skeleton equations covering the metals and arranged with reference to the reagents; the student was required to regroup these according to the metals and also complete them; (4) the sodium thiosulfate method for the separation of copper and cadmium was used with excellent success; (5) a modified automatically closing individual hydrogen sulfide cut-off has been developed at the University of Wisconsin; (6) a modified general chemistry record card has been designed.

Some illustrations of molecular and atomic magnitudes for undergraduate classes: JAMES KENDALL.

A neglected professorial duty: PAUL M. GIESY. Chemistry teachers should remember that chemistry is usually a means of livelihood as well as a science. Students contemplating chemistry as a profession are entitled to complete information as to probable remuneration, working conditions, opportunities for advancement and other economic considerations. Few students realize that research on a subject of their own choice is a luxury attainable only by those who have independent incomes, or who are willing to give up the prospects of a family, at least for many years. The present tendency for heads of university laboratories to require younger members of their staffs to work on problems in which the heads are interested further restricts the chance to work on one's own problems.

Chemical spelling: C. A. JACOBSON. Chemical spelling has attracted considerable attention since first reported about a year ago. The second annual contest at the West Virginia University was held last May, and the results of the two contests held would doubtless warrant a brief report at the A. C. S. meeting in Milwaukee. The method of conducting the contest and of selecting the contestants from the preliminary matches have been improved upon. The winner in the final contest is now chosen on a percentage basis. Different means of arousing interest in the contest have been tried. At least one other university has tried chemical spelling with good results. The subject has been discussed in SCIENCE and the news edition of the *Jour. Ind. and Eng. Chem.*

The response of high school pupils to chemical education: HERBERT R. SMITH. Chemical knowledge has contributed enormously to human progress. It can contribute much more when the population as a whole has a better understanding of things chemical. The logical time for such education is in youth, while the pupil is most impressionable and has his lifetime yet ahead. But chemistry as well as other subjects will not attract modern pupils if taught by antique methods. The subjects of the high school must compete with the modern world of amusements for the pupil's time. Chemistry can compete successfully only when it is *taught in terms of its service to mankind.* But not many high school teachers are doing this now. They lack knowledge and contact with the service side of chemistry. Interest and enthusiasm for chemistry can not grow only in the atmosphere of academic teaching. They must take root in the rich soil of accomplishment to hold the pupil's attention to study. The research and industrial groups of the American Chemical Society are now working with this knowledge which can be so valuable to high school teachers. Can the society bring about a *rapprochement* of these groups so that not only they but the public also may profit?

A quantitative analysis of aims in teaching high school chemistry: JACOB CORNOG and J. C. COLBERT. Data collected from 187 high schools in all parts of this country indicate that (1) text-books used are about 80 per cent. descriptive, final examination questions are 60 per cent. descriptive, while stress indicated by teachers' opinions is about 50 per cent. descriptive matter; (2) in many instances considerable inconsistency of aim exists between what teachers say they stress in instruction and what they ask in final examinations; (3) harmony of objective between different schools is lacking; (4) equation writing and chemical arithmetic receive much unity of stress; (5) geographical location of schools reveals no general modification of foregoing observations.

Quantitative analysis of aims in teaching freshmen chemistry: JACOB CORNOG and J. C. COLBERT. Data, concerning aims in teaching freshmen chemistry, collected from 27 American colleges and universities indicate that (1) College texts are about 70 per cent. descriptive matter, final examination questions are about 40 per cent. descriptive, while stress indicated by teachers' opinions is about 30 per cent. descriptive; (2) in many individual instances considerable inconsistency exists between what teachers say they stress in instruction and what they ask in final examinations; (3) harmony of objective between different institutions, while not perfect, is very fair; (4) equation writing and chemical arithmetic receive much unity of stress; (5) among teachers a widespread feeling exists that college courses are too full and that results lack thoroughness; (6) recent advances are slow in finding place in curricula; (7) contrasted with high school chemistry, except in content of texts, college chemistry is preponderantly theoretical, while high school chemistry is correspondingly descriptive.

NEIL E. GORDON,
Secretary