PROCEEDINGS

of the

PENNSYLVANIA ACADEMY OF SCIENCE

VOLUME XVI

1942

Including

AUTHOR AND SUBJECT INDEX

VOLUMES I TO XV

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1942 - 1943

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CONTENTS

Page

Minutes of the 1941 Summer Meeting 7
Minutes of the Eighteenth Annual Meeting 9
Minutes of the Ninth Annual Convention of the Pennsylvania Junior Academy of Science 17
Size-regulation in Rodent Incisors, by Marcus H. Green 20
Tuberculin Testing of College Students, by Clarence A. Horne 22
A list of Spiders Collected in Western Pennsylvania, by Lee C. Truman 25
The Influence of Zinc on Gonadotropic Extracts, by J. H. Leathem and E. J. Mills, Jr. 28
Results of Ten Years' Bat Marking in Pennsylvania, by Charles E. Mohr 32
Probable Parasitic Stalked Bodies in Adult Lepidoptera, by Joseph L. Williams 37
The Effect of a Detergent in the Soilless Production of Sweet Potato Slips, by L. Marshall 39
Tergitol Lowers the Bacterial Count in Hydroponic Cultures, by L. Marshall 40
Some Advantages of the Sweet Potato in Experimentation, by L. Marshall 42
Essential Courses in Biology for the Preparation of Qualified High School Science Teachers, by Robert T. Hance 44
Freeing Frozen Glass Stoppers and Syringes, by Robert T. Hance 46
Sawfly Infestation in Pennsylvania, by Homer C. Will 47
Nervous Habits and Morale, by Albert Leroy Billig 51
The Relationship between Circulation in the Gray Matter of Cat Cerebrum and Specialization of Function, by Bernice Wenzel 54
Some Nature Notes, by Thomas H. Knepp 56
A Quantitative Study of Some Mammalian Testes, by Thomas H. Knepp 57
Two New Subspecies of Cercyonis Alope, by F. H. Chermock and R. L. Chermock 58
Notes on Collecting Argynnis Diana, by Ralph L. Chermock 59
A New Modification of Iron Alum Haematoxylin as a Cytoplasmic Stain, by Ralph L. Chermock 61
On the Inexistability of H_40++, by E. A. Vuilleumier 63
Some Experiences with a National Defense Course in Chemistry, by George W. Bennett 64
Pennsylvania Geological Survey and National Defense, by R. W. Stone 67

CONTENTS

	Page
The Brush Creek Limestone of Western Pennsylvania, by David M. Seaman	72
Manganese Mineralization in Pennsylvania[1], by Richard M. Foose	76
Dr. Antoine F. Saugrain, Pennsylvania's Earliest Mineralogist, by Wayne F. O'Neill	81
A Simple Device for Measuring the Coefficient of Restitution of Small Spheres, by Wellington A. Parlin	83
A New A. C. pH Electrometer, by H. C. O'Brien	88
Bottled Speed, by R. T. Hance and H. C. O'Brien	91
Between the Acts, by W. A. Royston, Jr.	93
Black-out and Camouflage, by Louis G. Royston	96
The Romance of Asphalt, by W. A. Royston, Jr.	98
An Asymmetrical Union of Thyroid and Thymus in the Cat, by P. L. Crummy, C. Griffith, and J. Ayres	102
An Easily Constructed and Adjustable Dissection Table, by Pressley L. Crummy	104
The Increasing Importance of Genetics in the Pre-Medical Curriculum, by Pressley L. Crummy	106
Production of Mother Sporocysts in Notocotylus Urbanensis, by E. C. Herber and H. C. Spencer	109
Authors Index, Volumes I to XV, by Ralph W. Stone	111
Subject Index, Volumes I to XV, by Ralph W. Stone	117

PENNSYLVANIA ACADEMY OF SCIENCE

MINUTES OF THE 1941 SUMMER MEETING

BEDFORD, BEDFORD COUNTY

AUGUST 8 AND 9, 1941

A trip to the Reynoldsdale Fish Hatchery started from the Fort Bedford Inn at 3 p. m., the party numbering 35 persons.

The dinner, at the Bedford Inn, was served to 65 persons. The evening meeting was opened by President E. A. Vuilleumier who introduced Mr. Harry Lundy of the Turnpike Commission. His talk on the historical background of the Turnpike was followed by the showing of a sound motion picture on the construction of the Superhighway and a short Kodachrome film featuring autumn coloration along the Turnpike.

Dr. O. E. Jennings proposed that the Academy "memorialize" the Pennsylvania Turnpike Commission to restrict the plantings along the Turnpike to native species, and to develop wild flower preserves on some of the larger available tracts. Dr. T. D. Cope's motion that the executive committee be designated to communicate with the Commission in this regard was seconded and passed. Subsequently the representatives of the Pennsylvania Turnpike Commission reported that they are fully in harmony with the proposals suggested.

Dr. E. M. Gress called attention to the slow growth rate of native trees and shrubs and warned against expecting results too quickly.

Dr. Edgar T. Wherry spoke of the need of protecting rare species and called attention to some of the interesting shale barren flora in southern Bedford County and offered to lead a botanical foray to this section.

Dr. R. W. Stone reported that a guide book to the geology of the Turnpike was ready to go to press, and expressed the hope that roadside planting would not obscure the more interesting exposures mentioned in the guidebook. Mr. Ralph Stewart, landscape architect for the Commission, outlined some of the plans and methods in use and said that a demonstration would be made on the field trip, Saturday.

Mr. Harry Lins, Bedford attorney who conducted the trip to the fish hatchery in the absence of the Superintendent, spoke of the appreciation of the community for its selection as the site for the Summer meeting, called the attention of the Academy to numerous

local historical and natural features including Wonderland Caverns at Mann's Choice.

Mr. Thomas H. Knepp, local chairman, announced that a tour of the Superhighway would start from the Inn at 9:30 a. m., Saturday.

Dr. T. D. Cope, urged that the Academy encourage the good work of its members by calling it to the attention of the various committees, giving as an example Mr. Knepp's fine record in Bedford, a fact that he had caused to be known among a number of Bedford residents.

Twenty-eight persons, travelling with an official escort drove 40 miles over the Superhighway to Tuscarora Tunnel making stops to observe rock strata exposed in the tremendous cut at Clear Ridge cut, and to witness modern planting methods by which a mixture of seed, fertilizer, and moistened soil was blown onto steep road cuts where erosion threatened to be serious.

At Tuscarora Tunnel rock fills and dumps made in 1883-84 were visited and the forest growth that has occurred since then was pointed out by Mr. Stewart and Mr. McGovern.

Returning, about half of the party left the Turnpike at Breezewood to make a botanical foray around Everett under the leadership of Drs. Wherry and Jennings and Mr. Knepp. The rest of the party returned to Bedford and disbanded.

C. E. MOHR, Sec. Pro-tem.

MINUTES OF THE EIGHTEENTH ANNUAL MEETING
EDINBORO, PENNSYLVANIA
APRIL 3 AND 4, 1942

The executive committee of the Pennsylvania Academy of Science met in session at Edinboro, Pa., Thursday evening, April 2, 1942, at 8 p. m., E. W. T.

The minutes of the summer meeting held at Bedford August 8 and 9, 1941 were read and approved.

The Secretary presented the following report:

REPORT OF THE SECRETARY
April 1, 1942

Senior membership dues paid for 1942	250
Student membership dues paid for 1942	5
Co-operative membership dues paid for 1942	1
Senior members who owe 1942 dues	243
Student members who owe 1942 dues	12
Senior members who owe 1941 and 1942 dues	35
New senior memberships	24
New student memberships	6
Total	576
Deceased members	2
Resigned members	12

The Treasurer presented the following report:

REPORT OF THE TREASURER
April 1, 1942

Receipts:		
Balance on hand, April 12, 1941		$ 1,004.23
A. A. A. S. grant for 1941		100.00
Sale of Proceedings		11.00
Receipts for extra printing in Proceedings		133.98
Membership Fees—		
Senior	$ 700.00	
Student	13.00	
Co-operative	5.00	
		718.00
Total		$ 1,967.21
Expenditures:		
A. A. A. S. Grants		
Alta Schrock	$ 25.00	
Robert B. Gordon	75.00	
		$ 100.00
Secretary's office—postage and supplies		99.61
Secretary's Honorarium		75.00
Membership Committee — expenses		17.83

Printing—	
600 copies Vol. XV Proceedings	596.24
1200 Circulars of Information	48.00
600 Programs, Summer Meeting	7.20
500 Announcements, Eighteenth Annual Meeting	13.50
700 Programs, Eighteenth Annual Meeting	16.00
Expenses for Coatesville Meeting	34.75
Expenses of Secretary to Dallas, Texas Meeting A. A. A. S.	114.65
Balance in Bank, April 1, 1942	844.38
Total	$ 1,967.21

The A. A. A. S. grant of $81.00 for 1942 to be used for research was accepted.

The action of the Secretary in advising Miss Alta Schrock to use in 1942 the uncashed check amounting to $25.00 which was given to her for research in 1941 was ratified by the committee.

The Secretary read a progress report from Robert B. Gordon on the work done so far with the grant of $75.00 in 1941. The full report will be presented at a later date when the work is completed.

Upon motion it was decided that one of the requirements for acceptance of a grant for research from the A. A. A. S. through the Pennsylvania Academy of Science be an acknowledgement of the grant in the published paper or papers resulting from this research. The Secretary was asked to insert this requirement in each letter to persons receiving grants for research in the future, and also to Mr. C. T. Van Meter who received a grant in 1940.

Upon motion it was decided that the paper of E. C. Herber, of Dickinson College, which arrived too late to be placed on the printed program be written in for presentation.

The Secretary, upon motion, was asked to write to Gordon K. MacMillan of the Carnegie Museum calling attention to action taken at a previous meeting of the Academy that only papers that are presented at the meetings of the Academy shall be accepted for publication.

In order to save both time and money, the Secretary was authorized to issue post card receipts in place of the printed membership receipt cards which were previously sent in stamped three-cent envelopes.

Since the Treasurer's report indicates a sizeable balance which is usually kept in a checking account in bank, approval was given to the suggestion that the excess funds be used to buy War Bonds.

The Secretary-Treasurer was authorized to buy bonds to the extent he sees fit, record of same to be carefully kept and presented at the meetings of the Academy.

Upon motion it was decided that members of the Academy who enter the United States' Armed Forces in non-commission rank be exempted from the payment of dues for the duration of the war.

An honorarium of $150.00 for the year 1942-1943 was voted the Secretary-Treasurer.

A committee consisting of Karl F. Oerlein, Robert T. Hance and V. Earl Light was requested to study the matter of membership certificate, seal, and a large placard for exhibition purposes and present recommendations at the summer meeting in August, 1942.

President E. A. Vuilleumier appointed the following committees: Nominating Committee—R. W. Stone, T. D. Cope, and H. W. Thurston, Jr.; Resolutions Committee—Frank D. Kern, C. A. Horn, and Karl F. Oerlein; Auditing Committee—Homer C. Will and Mary E. Hawthorne; Necrology Committee—Robert T. Hance and Pressley L. Crummy.

It was decided that the summer meeting of the Academy be held at the Pennsylvania State College and vicinity August 14 and 15, 1942.

The time of the regular spring meeting of the Academy to be held at Beaver College, Jenkintown, was left to the host institution to decide. Subsequently April 2 and 3, 1943 were the dates set for our next annual meeting.

Upon motion the President-elect, Charles E. Mohr was requested to appoint a committee to study the possible relationship between the Pennsylvania Academy of Science and the Pennsylvania Game Commission.

It was voted that Lloydia, the publication of the Lloyd Library and Museum of Cincinnati, Ohio, be accepted in exchange for the Proceedings of the Academy and that the question of past issues of both publications be decided by the officers of the two organizations.

Approval was given for the presentation of papers by substitutes authorized by the authors of papers.

Authorization was given by the committee to print in the Proceedings the invited papers submitted for publication.

Each year the A. A. A. S. presents a membership to one boy and one girl of the Pennsylvania Junior Academy of Science. Karl F. Oerlein was authorized as Junior Academy sponsor, to officially present these Junior Academy awards.

The incoming president, Charles E. Mohr, was advised to encourage the presentation of papers by students of College grade-post high school and pre-graduate.

The committee on grants reported that a grant of $35.00 be approved for William Parrish, School of Mineral Industries, The Pennsylvania State College, for research on "Optical Properties of Immersion Liquids"; and a grant of $46.00 be approved for John C. Johnson, State Teachers College, Edinboro, for research on "The Parasites of the Molluscs and Vertebrates of the Lake Erie Area." Since there was some doubt about Mr. Parrish being able to do this research work because of war work assigned him, the committee recommended that the Secretary communicate with Mr. Parrish and find out definitely whether or not he will be able to carry on this research, and if not, then in that event the entire amount of the grant of $81.00 should be allotted to John C. Johnson. Upon motion, the report of the Committee on Grants was approved. Subsequently the entire amount was awarded to Dr. Johnson, Mr. Parrish having notified the Academy of his inability to carry on this research at this time.

The incoming president, Charles E. Mohr; the secretary, V. Earl Light; and the editor of the Academy, Robert T. Hance were asked upon motion to confer with Biological Abstracts to initiate a plan whereby abstracts of biological papers presented at the Academy meetings might be submitted for publication in Biological Abstracts, and that the authors of such papers be notified and requested to prepare and submit abstracts in accordance with the requirements of Biological Abstract Publications.

Upon motion it was voted to pay one-third of the travelling expenses from Philadelphia to Erie and return of Dr. A. Glenn Richards, Jr., who presented the Friday Evening Lecture.

A bill of $32.00 presented by John C. Johnson, Chairman of the Committee on Local Arrangements, was authorized to be paid.

At the Friday afternoon session of the Academy twenty-three papers were presented.

Fourteen papers were presented Friday afternoon on the Education and Certification of High School Science Teachers.

Seventy-five Senior Academy members and eighty-nine Junior Academy members banqueted in the College Dining Hall in the evening. After the banquet A. Glenn Richards, Jr., of the University of Pennsylvania delivered the evening address on the subject "The Present Status of Electron Microscopy in Biology." The address was followed by several reels of colored motion pictures on "The Wild Life of Pennsylvania," by Bob Ford, of Homestead, Pennsylvania.

The final business session was held Saturday morning preceding the closing program. The following persons were elected to membership in the Academy:

Waldo F. Bates, Jr., Box 355, Edinboro.
Gerald C. Bench, 908 Chestnut Street, Reading.
Eli H. Bloom, 1744 Belfield Avenue, Philadelphia.
M. Blanche Cochran, Gap.
James M. Cribbins, Dept. of Biology, Univ. of Pittsburgh.
Frances M. Davis, Box 62, Swiftwater.
H. M. Davis, Mineral Industries Building, State College.
Charles F. Dittert, 2955 N. Lawrence Street, Philadelphia.
Edward L. Haenisch, Villanova College, Villanova.
Peter J. Hall, Jr., Box 613, Mississippi Industrial College, Holly Springs, Miss.
Walter H. Hamilton, 1269 E. Chelten Avenue, Philadelphia.
Carl E. Heilman, 352 N. Tenth St., Lebanon.
Charles C. Hill, 624 W. Louther Street, Carlisle.
Richard C. Hitchcock, 415 S. Sixth Street, Indiana.
Dean B. McLaughlin, Observatory, University of Mich., Ann Arbor, Mich.
Rowland Hall Mulford, 700 N. Pearl Street, Bridgeton, N. J.
Charles O. Ohl, 33 E. Holland Street, Summit Hill.
A. Glenn Richards, Jr., Zool. Lab., Univ. of Penna., Philadelphia.
Louis G. Royston, Fox Chapel Road, Pittsburgh.
W. A. Royston, Jr., Fox Chapel Road, Pittsburgh.
Martha Marian Russ, Goss Manor, R. D. 3, Dallas, Pa.
Newell A. Schappell, Bureau of Plant Industry, Harrisburg.
Nelson J. Shaulis, Arendtsville.
Donald E. Shay, Muhlenberg College, Allentown.
Arthur W. Shively, 108 Newry Street, Hollidaysburg.
Duncan Stewart, Jr., Dept. of Geol., Lehigh Univ., Bethlehem.
Dennis W. Strawbridge, 2218 Reading Avenue, West Lawn.
Lee C. Truman, Erie Center, Univ. of Pitt., Erie.

The following persons were elected to student membership:
Jack Ayres, Huntingdon.
Autumn Colby, 404 Concord Street, Corry.
Robert M. Frazier, Jr., 2419 W. Sharswood Street, Philadelphia.
Charles Q. Griffith, 115 Buckley Street, Meyersdale.
Joseph D. Jankus, 1428 Faulse Way, N. S., Pittsburgh.

Paul Jensen, 610 Franklin Street, Reading.
Andrew John Kerrish, 3053 Preble Avenue, N. S., Pittsburgh.
Clara A. Mehr, 538 Miller Avenue, Clairton.
Harrison C. Spencer, 1719 Park Avenue, Carlisle.
Robert N. Smith, 3608 Melon Street, Philadelphia.
Bernice M. Wenzel, 260 Beach Road, Fairfield, Conn.

The Auditing Committee reported as follows:

Edinboro, Pa., April 3, 1942.

We have examined the records submitted by the Secretary-Treasurer and find that they are in order.

MARY E. HAWTHORNE
HOMER C. WILL

The Necrology Committee gave the following report:

The Pennsylvania Academy of Science learns with regret of the death of two of its members, John C. Bechtel, of Philadelphia and Harry S. Hower of Pittsburgh. The Academy expresses its sympathy to the relatives.

Signed,

ROBERT T. HANCE
PRESSLEY L. CRUMMY

The Nominating Committee submitted the names of the following persons as officers for the year 1942-1943:

President, Charles E. Mohr, Philadelphia.
President-elect, Clarence A. Horn, Reading.
Vice-president (Eastern Section), R. L. Chermock, Jenkintown.
Vice-president (Western Section), Thomas Smyth, Indiana.
Secretary-Treasurer, V. Earl Light, Annville.
Editor, Robert T. Hance, Pittsburgh.
Press Secretary, John C. Johnson, Edinboro.
Junior Academy Sponsor, Karl F. Oerlein, California.

R. W. STONE
THOMAS D. COPE
H. W. THURSTON, Jr.

There being no nominations from the floor, the above persons were duly elected as officers for the ensuing year. The reports of all committees were accepted immediately after the presentation of the reports.

The following resolutions presented by the Committee on Resolutions were accepted:

The Pennsylvania Academy of Science wishes to express its appreciation to the President and faculty of Edinboro State Teachers College for their gracious hospitality. The Local Committee is to be congratulated upon the fine and splendid arrangements made for the meetings, and the entertainment of the members and guests. The Secretary is instructed to send a copy of these resolutions to President L. H. Van Houten and to Dr. John C. Johnson.

(a) The Academy commends the efforts of Dr. Johnson and his Committee in arranging the Symposium on the Education and Certification of High School Science Teachers.

(b) We believe that progress has been made in these matters of vital educational importance.

(c) We recommend continued interest and effort looking forward to improved courses, curricula, and certification requirements.

F. D. KERN
K. F. OERLEIN
C. A. HORN

The Resolutions Committee presented a report on the Certification of Science Teachers in Pennsylvania, as follows:

"Be it moved, that the Pennsylvania Academy of Science endorse in principal the recommendations of the Committee for the promotion of Science in Secondary Education for the State of Pennsylvania as given in its progress report November 24, 1941. Particular emphasis should be given at this time to Recommendations 1-a, and 1-c, of Part I."

Recommendations 1-a, and 1-c, are as follows:

1-a, An applicant may be certified to teach Biology or Chemistry or Mathematics or Physics only if he has completed a minimum of 18 semester hours in the one of these subjects for which he is to be certified.

1-c, Certification shall not be granted in these subjects by any other name which would permit the applicant to teach these subjects with less than the preparation listed above. For example, certification shall not be given in Physical Sciences (unless the applicant has 18 semester hours in Physics and 18 semester hours in Chemistry).

The Report of the Resolutions Committee concerning the Certification of Science Teachers was adopted. A Supplementary motion that the Academy go on record as favoring the recommendations listed as 1-a, and 1-c, above was passed.

Following the business session a total of sixteen papers were read in the Saturday forenoon program.

Dr. Lee C. Truman, of the Erie Center of the University of Pittsburgh, conducted an excursion on Saturday afternoon to the summer Biological Laboratory on Presque Isle, Erie.

The Junior Academy of Science was well represented at the meetings. A total of twenty-one papers were presented at their meetings, representing nine different science clubs. Eighty-nine Junior Academy members attended the banquet on Friday evening.

Each year the A. A. A. S. presents a membership in the American Association to one boy and one girl in the Junior Academy who are voted as having presented the best presentations in the Junior Academy meeting for the year. This year the best pre-

sentation was voted to two boys who prepared a report on "High Vacua" as a joint project. These boys are both students of the Taylor Allderdice High School, of Pittsburgh. They are: George Foltz, 765 Greenfield Avenue, Pittsburgh; and Robert Lerch, 6637 Wilkins Avenue, Pittsburgh. The best presentation by a girl was voted to Lou Huntley, Fifth Avenue, Scottdale, a student of the Scottdale High School for her presentation on "A Comparative Study of Vertebrate Bloods."

V. EARL LIGHT, Secretary-Treasurer.

MINUTES OF THE NINTH ANNUAL CONVENTION of THE PENNSYLVANIA JUNIOR ACADEMY OF SCIENCE

STATE TEACHERS COLLEGE, EDINBORO, PENNSYLVANIA

APRIL 3-4, 1942

The ninth annual convention of the Pennsylvania Junior Academy of Science was called to order on Friday, April 3, 1942, at 1:55 P. M., by President Leon Kraintz, at State Teachers College, Edinboro, Pennsylvania.

An address of welcome was given by E. A. Vuilleumier, President of the Senior Academy of Science. Our first guest speaker was Charles E. Mohr, educational director of the Academy of Natural Science. Mr. Mohr gave a very interesting talk on the life habits of bats. Miss Mary Hawthorne, our second guest speaker, and chairman of the student Membership Committee of the Senior Academy, spoke on a new group in the Pennsylvania Academy of Science. This new division is to be the Intermediate Group. Members of this department will be students who graduated from high school and are no longer eligible for the Junior Academy.

The roll was called and the following clubs were present and in good standing:

Ambridge	Science Forum	Ambridge H. S.
Canonsburg	Benzene Ring	Canonsburg H. S.
Crafton	Phy-Chy Club	Crafton H. S.
Harrisburg	Priestly Chemistry Club	John Harris H. S.
Johnstown	Johnstown Academy of Science	Central H. S.
Lawrence Park	Science Club	Lawrence Park H. S.
Martinsburg	Pasteur Scientific Club	Martinsburg H. S.
Meyersdale	Science Club	Meyersdale H. S.
Monongahela	Monongahela Science Club	Monongahela H. S.
Mt. Lebanon	Chemistry Club	Mt. Lebanon H. S.
Pittsburgh	Biology Club	Peabody H. S.
Pittsburgh	Scop Club	Taylor Allderdice
Punxsutawney	Science Club	Punxsutawney H. S.
Reading	Camera Club	Reading H. S.
Scottdale	Scottdale H. S. Science Club	Scottdale H. S.
Washington	Washington H. S. Science Club	Washington H. S.
New Bethlehem	Retort and Scalpel Club	New Bethlehem H. S.
Girard	Maun's Mental Monsters	Union H. S., Girard, Pa.

Committees were then appointed. They were:

Nominating Committee

Taylor Allderdice H. S., Chairman
Crafton H. S.
Lawrence Park H. S.

Resolutions Committee

Scottdale H. S., Chairman
Monongahela H. S.
Ambridge H. S.

We were all urged to attend the Annual Banquet, after which Dr. Richards, Jr., of the University of Pennsylvania, gave an address on the "The Present Status of Electron Microscopy in Biology." This was followed by colored motion pictures on "The Wild Life of Pennsylvania" by Bob Ford, of Homestead, Pennsylvania.

The winners of the A. A. A. S. awards were then announced. They were, the boys—Robert Lerch and George Foltz who spoke and demonstrated "High Vacua," Taylor Allderdice High School. The girl, Lou Huntley, spoke on "A Comparative Study of Bloods." Miss Huntley comes from Scottdale High School. The report of the Resolutions Committee was given.

Resolutions adopted by the 1942 Spring Meeting of the Junior Academy of Science.

Be it resolved:—

I. That members of the Junior Academy of Science who are now seniors in their respective high schools, sincerely consider the continuance of their scientific interests so necessary today by continuing their association with the Academy with a student membership of $1.00 per year. These memberships for members between the ages of 18 and 23, will have a sectional meeting annually on the same date and at the same place as the Senior Academy of Science has its spring meeting.

II. That we thank Dr. L. H. Van Houten for his kindest consideration, time, and cooperation in making our brief stay one of most memorable events in our young lives. Also do we wish to thank Dr. Johnson because of his timely efforts in making it possible for us to come here. We wish to thank Mr. Ellenberg, who is also responsible for our enjoyable stay.

III. That the Junior Academy of Science recognize the cooperation and good works of the retiring officers and commend them as well as those who presented papers at this meeting.

The new officer clubs for the year 1943:—

PRESIDENT

Scottdale High School, Science Club
Scottdale, Pennsylvania.

VICE-PRESIDENT

Steinmetz Scientific Club
Upper Darby, Pennsylvania.

SECRETARY

Peabody Biology Club
Pittsburgh, Pennsylvania.

Miss Smith, of Taylor Allderdice High School, told the Academy about the Junior Science Fair which is held at the Buhl Planitarium every year.

The following papers were given at the meeting:

1. "A Comparative Study of Vertebrate Bloods" ..... Lou Huntley
   Scottdale High School
2. "Mounting Specimens in Plastics" ..... Leonard Lerman
   Taylor Allderdice High School
3. "Archaeological Excavation of Logstown" ..... Louis Carpenter
   Ambridge High School
4. "A Code Practice Osteillotor" ..... Ben Christi
   Central High School, Johnstown
5. "Euscope Demonstration" ..... Robert Ridley
   Taylor Allderdice High School
6. "The Most Deadly Mushrooms" ..... Esther Postgate
   Peabody High School
7. "A Histological Study of Human Blood" ..... Irene Jordan
   Scottdale High School
8. "Burning Ice" ..... Mary Kline and Dorothy Anderson
   Ambridge High School
9. "Problems in Ballistics" ..... Francis Horn
   Central High School, Johnstown
10. "Toothpick Model of a Ferris Wheel" ..... William Snyder, Jr.
    Meyersdale High School
11. "X-Ray Photography" ..... John Jablonski
    Crafton High School
12. "Klystron" ..... Frank Kloiber
    Ambridge High School
13. "Sulfa Drugs" ..... Leo Svegal
    Ambridge High School
14. "Salt" ..... Rollin Marti
    Ambridge High School
15. "Isolation of a Mammals Heart" ..... Leon Kraintz
    Central High School, Johnstown
16. "Astronomy" ..... Kim Steigman
    Monongahela H. S.
17. "Pond Life Under The Microscope" ..... Jean Boehke
    Peabody High School

The meeting was adjourned at 12:00 noon, Saturday, April 4, 1942.

SIZE-REGULATION IN RODENT INCISORS

MARCUS H. GREEN
Albright College

In two papers delivered before the Pennsylvania Academy of Science, the writer described over-size in rodent incisors. Anyone observing such malformations cannot help but become curious regarding their cause.

Most writers suggest that apparently over-grown incisors in rodents are simply normally growing teeth which are not kept properly shortened by attrition. The suggestion that over-size is a true hypertrophy in which growth rate would exceed that of normal teeth is almost entirely neglected. Addison and Appleton ('15) were the lone authors to suggest that over-size is brought about by dietary disturbances.

If comparative measurements were to be made upon the growth rate of teeth, the observer could distinguish between accelerated growth and lack of attrition. Measurements have been made upon the incisor teeth of normal white rats by Addison and Appleton ('15) and it is evident that attrition does occur in these teeth but the rôle played by attrition in size-regulation is, perhaps, overemphasized. The quantitative effect of attrition upon size in teeth could be demonstrated by an artificially induced malocclusion.

In view of the dearth of experimental evidence and the conflicting suggestions concerning over-size, the writer set out to observe the results of surgically-induced malocclusion in a small number of rats, attempting thereby to determine the rôle, if any, played by attrition. The investigation would have been greatly expanded if the operated rats had given any evidence of dental over-size.

The specimens were litter mates of the hooded variety and came from a stock of many rats in which over-size occurred only once in eleven years. They were operated upon thirty-nine (39) days after birth and killed for autopsy when they reached an age of two hundred and five (205) days. The young rats were anesthetised and the extra-alveolar portions of the maxillary incisors were clipped off with bone forceps in three rats and the mandibular incisors in two others. Two litter mates were left undisturbed for comparative purposes. The rats were fed upon cooked oatmeal, salt, hard bread, lettuce, Calo canned dogfood, and irradiated condensed milk.

At first, the operated animals could not grasp food with their muzzles and fed themselves by pushing food into the buccal cavity with their manus. The difficulty in feeding retarded their weight for some time but at death, with the exception of rat No. 6, their weights were comparable with the two normal mates.

Autopsy revealed that the extra-alveolar and total incisor lengths of the experimental animals conformed closely with the measurements made upon the unoperated mates of like age. Furthermore, these measurements correspond closely with those given by Addison and Appleton concerning incisor length at a similar age in the white rat.

			Maxillary		Mandibular	
No.	Sex	Weight	extra-alveolar	Incisor Total	extra-alveolar	Incisor Total
1	M.	226 gms	8 mm.	22 mm.	11.5 mm.	29 mm.
2	F.	151 gms	6.5 mm.	20 mm.	11.5 mm.	28 mm.
3	F.	148 gms	8 mm.	20 mm.	10.0 mm.	27.5 mm.
4	F.	163 gms	8 mm.	21 mm.	11.0 mm.	28 mm.
5	F.	141 gms	8 mm.	21 mm.	10.0 mm.	26 mm.
6	F.	96 gms	7.5 mm.	19 mm.	9.0 mm.	24 mm.
7	M.	205 gms	8 mm.	21 mm.	10.0 mm.	26 mm.

No. 1 and No. 2—Normal rats.
No. 3 and No. 4—Mandibular incisors excised.
No. 5, No. 6 and No. 7—Maxillary incisors excised.

Examinations of the operated teeth, magnified thirty times, showed that gross anatomical recovery was complete except for a short, sharp projection on one maxillary incisor. The molariform teeth were normal.

In one of the skulls, in which the maxillary teeth were clipped off, a marked aberration was observed. The entire segment of the skull, exclusive of the mandible and craniad of the transverse vertical plane passing through the naso-frontal suture, was deflected twenty-five degrees (25°) away from the sagittal plane to the right side. The writer observed similar results in rats in which the temporal and masseter muscles were rendered unilaterally incompetent of performing their usual function.

The writer is fully aware of the fallacy of drawing any conclusions from such meager material but suggests tentatively that improper occlusion does not induce over-size as easily and completely as some writers would have us believe. This experiment,

however, does not rule out the possibility of attrition as a size-regulator in view of the fact that recovery may have been rapid and complete enough to permit attrition to occur and wear off excessive dental lengths. Perhaps, if older rats were subjected to similar experiments, over-size might occur since recovery does not take place as rapidly in older animals. Very much more work of surgical and dietary natures must be expended upon the problem before any solution becomes visible.

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TUBERCULIN TESTING OF COLLEGE STUDENTS

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Tuberculin testing in college students had its beginning about ten years ago, when about ten colleges and universities reported for the first time any program to discover early tuberculosis in their students.

In 1939-40, the Tuberculosis Committee of the American Student Health Association reported 213 institutions conducting programs of tuberculin testing. They reported that during that year 123,389 students were examined with 25.4% showing a positive test. Compare these results with those obtained in 1932-1933, when 14,318 cases were examined showing 35.0% to be positive. These figures are very interesting because during this time measures have been taken in our institutions of higher education and in the country generally to overcome some of the contributing causes of this disease. Surely one of these factors was the discovery of the early cases of active tuberculosis.

METHODS AND PROCEDURES

The students who were tested in this program were from a Liberal Arts college with a student body of less than 500 students. A study of the social and economical status of the families of these

students shows them to be mostly people of moderate circumstances. They were the children of ministers, dentists, doctors, farmers, merchants, clerks, miners and teachers. About half the number came from industrial areas; the remainder came from small towns and rural areas in the eastern part of Pennsylvania, New Jersey and New York.

The mantoux intradermal technic was used in administering the tuberculin. Koch's Old Tuberculin was used for the first half of the study and Purified Protein Derivative was used for the remainder of the investigation. Two injections were made and read 48 hours after each injection. The following amounts were injected with each method: 0.1 cc. of tuberculin was injected in both methods used. In Old Tuberculin, the strength of the first injection was 0.1 mg, and the strength of the second injection was 1.0 mg. With (PPD) Purified Protein Derivative, the first injection was 0.00002 mg, and the second injection was 0.005 mg. This second dose was 250 times the strength of the first test.

TUBERCULIN REACTIONS

FRESHMEN

YEAR	MALE							FEMALE							TOTAL	
	NUMBER EXAMINED	FIRST INJECTION		SECOND INJECTION		TOTAL		NUMBER EXAMINED	FIRST INJECTION		SECOND INJECTION		TOTAL		NUMBER EXAMINED	POSITIVES
		NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT		NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT		NUMBER PERCENT
1932	49	20	51.0	16	25.2	36	56.2	14	3	4.7	5	8.0	8	12.7	63	44 71.1
1933	64	23	25.7	16	18.0	39	43.7	25	14	15.6	8	9.0	22	24.7	89	61 68.4
1934	88	31	33.6	27	22.1	68	55.7	34	14	11.5	4	3.3	18	14.8	122	86 70.4
1935	84	22	18.6	23	19.4	45	38.0	34	9	7.6	10	8.5	19	16.1	118	64 54.2
1936	92	21	17.07	18	14.6	39	31.7	41	10	8.94	11	8.9	21	17.9	123	60 49.5
1937	53	5	5.3	15	17.0	21	22.3	41	5	5.3	16	16.0	20	21.3	94	41 43.6
1938	83	15	12.0	17	13.6	32	25.6	46	6	4.8	8	6.4	14	11.2	125	46 36.8
1939	76	11	10.2	15	14.0	26	24.3	29	3	2.6	2	1.8	5	4.6	107	31 29.3
1940	97	22	16.6	11	8.2	33	24.8	36	8	6.0	5	3.7	13	9.9	133	46 34.6
1941	57	13	10.9	15	12.6	28	23.5	62	13	10.9	4	3.3	17	15.5	119	45 37.8

SENIORS

YEAR	MALE							FEMALE							TOTAL	
	NUMBER EXAMINED	FIRST INJECTION		SECOND INJECTION		TOTAL		NUMBER EXAMINED	FIRST INJECTION		SECOND INJECTION		TOTAL		NUMBER EXAMINED	POSITIVES
		NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT		NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT		NUMBER PERCENT
1932	41	20	37.0	10	18.5	30	55.5	13	6	11.1	2	3.7	8	14.8	54	38 70.3
1937	33	15	32.0	4	16.5	19	40.4	14	7	15.0	3	6.4	10	21.3	47	29 61.7
1938	49	27	36.5	6	8.1	33	45.6	25	11	15.0	2	2.7	13	17.7	74	46 62.3
1935	34	18	32.7	3	5.5	21	38.1	21	9	16.3	3	5.5	12	22.0	55	33 60.0
1940	26	9	14.5	0	0.0	9	14.5	36	15	24.1	4	6.4	19	30.5	62	28 45.1
1941	32	9	15.2	7	12.0	16	27.2	27	9	15.2	6	10.1	15	25.3	59	31 52.5

FIGURE 1

Tuberculin testing of college students during their freshman and senior years. In each case, the females show a lower rate of positive reactions then the males. During the same years no marked difference in the rate of positive reactions is noted between the freshmen and seniors.

RESULTS AND DISCUSSIONS

In 1932, both the freshman and senior students were examined. The examination was required of the freshman but for the seniors it was a voluntary procedure. In both cases 70% of the students showed a positive reaction. For each succeeding year a

decrease in the number of positive reactors was noted until 1940, when an increase from 29.3% to 34.6% was noted among the freshman. Again, an increase of 3.2% was noted in 1941. In 1937, volunteer tuberculin testing was offered to the seniors, who also showed a gradual decrease in positive reactors until 1941, then they also showed an increase from 45.1 to 52.5%. Fig. 1.

The chief purpose of this study was to determine whether during four years of college life there should be any noticeable increase in the number of positive reaction to tuberculin.

It is known that the greatest number of cases of tuberculosis is found in the age range of college students.

The students who were freshman in 1933, were examined as seniors in the Spring of 1937. There was actually a decrease in the number of positive reactors. During the entire testing program there were only three or four cases who were positive in the first year testing program and then were negative when examined in the senior year. When the freshman and seniors of 1937 were compared, the seniors showed 18.1% higher reactions than the freshman. This was true during each year of the entire study. The reasons for these differences are not clear.

Throughout the whole study the women, both freshman and seniors, show a much lower percentage rate of positive reactors. This same difference is shown in the study made by The American Student Health Association. It is to be noted that the percentages in this study are much higher than the figures for the same time in the national study, although the same methods, dilutions and amounts injected were used.

Many of the students with the strongest reactions were urged to be x-rayed and most students took advantage of this service. In no instance were active cases of tuberculosis found, nor has there developed any active case in any of these people examined. It is interesting to note that a number of these students have had x-ray examinations since leaving college.

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A LIST OF SPIDERS COLLECTED IN WESTERN PENNSYLVANIA

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The spiders of Pennsylvania comprise a large and interesting part of the fauna. For a long time, however, these secretive little animals have received very little attention from the zoologists of the state. This is probably due in large measure to the fact that there was not much readily available literature on the group and practically no material was written in a popular enough manner to attract the interest of new workers in search of fields to conquer. However with Dr. Gertsch's revision of Comstock's *Spider Book* (1) this condition has been remedied to a large extent. Fortunately, also, for newcomers in spider study, a considerable number of the more comprehensive papers on their taxonomy are still available from the various societies which originally published them. These works, together with the *Spider Book*, are sufficient as taxonomic guides to the new worker.

Perhaps the problem of identification has been one of the most important factors in preventing a more universal interest in this group. While at first glance, however, the identification of spiders seems to be difficult, on closer examination the student will discover that it is no more so than that of properly naming the groups of insects. Of course a new vocabulary is required; the names of spider parts are not the same as those of insect parts. But the skill necessary in the locating and describing of them is no greater than that required of the entomologist. One of the most obvious deficiencies in the various technical papers on spiders which are being published today is the absence of illustrations of the body patterns of the species mentioned. As most positive identifications must be based on a study of the reproductive organs, a large majority of the authors have included drawings of only these parts. In a great many instances, the folium on the back of the abdomen is a sufficiently good character for the identification of the species. Wherever this character is sufficiently individualistic, it should be used if for no other reason than because it will serve as an aid in making the work less difficult for the beginning student.

For purposes of ecological study, the spider appears to be an

(1) Comstock, J. H., *"The Spider Book,"* rev. ed. by W. J. Gertsch, Doubleday Doran, 729 pp., plus xi (1940).

animal which has great possibilities. I know of no other group, even including the insects, which can be collected in such great numbers within a limited area. In working on Presque Isle Peninsula at Erie, an area which is strictly limited both as to size and accessibility to other areas, I found 96 different species which represented 45 genera. As this area is almost completely devoid of such excellent spider localities as the valleys of running streams and the thick leaf deposits of a forest floor, this can be considered as a very considerable variation in population. Certain species in this same area, and generally they are the ones which occur in large numbers, were found to be very specific in the type of habitat in which they would live. Further work on specific habitat ranges should be a field of study with definite future possibilities for the interested student.

This list is presented with the idea in mind of its being a guide to which the beginning worker can refer for the names of species which are known to have been collected in the western Pennsylvania area within the last several years. It has been compiled from various sources; principally from the collections of the author, the work of Andrew Lester (2) of Pittsburgh, and the collection of James Cribbins of Erie. No pretense is made to completeness. Undoubtedly a great many species which occur commonly have been omitted because of lack of collection data. However, the list which contains 155 species in 72 genera and 14 families gives every hope that a thorough collection of the state will produce a spider population which will compare very favorably with those of New York, Ohio, Connecticut, and Michigan. New York, which has been worked most thoroughly, has been credited by Crosby and Bishop (3) with 553 species in 176 genera while Ohio, Connecticut, and Michigan are reported respectively by Barrows (4), Kaston (5), and Chickering (6) to have 303 species in 128 genera, 393 species in 167 genera, and 261 species in 113 genera. With the additional collection of the many types of regions in the eastern and central parts of the state which are not to be found in the western part as well as with the identification of additional material from the western part, it should be quite possible to equal or even to surpass these figures.

This list is arranged systematically by families with the genera and the species being placed alphabetically under them.

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List of Spiders from Western Pennsylvania

Uloboridae

ULOBORUS AMERICANUS Walckenaer

Dictynidae

AMAUROBIUS AMERICANUS (Emerton)
AMAUROBIUS BENNETTI (Blackwell)
DICTYNA FOLIACEA (Hentz)

Agelenidae

AGELENA NAEVIA Walckenaer
COELOTES FIDELIS Banks
CORAS MEDICINALIS (Hentz)
HAHNIA AGILIS Keyserling
TEGENARIA DOMESTICA (Clerck)

Pisauridae

DOLOMEDES TRITON VAR. SEXPUNCTATUS Hentz
DOLOMEDES SCRIPTUS Hentz
DOLOMEDES VITTATUS Walckenaer
PISAURINA MIRA (Walckenaer)
PISAURINA MIRA VAR. SUBINFLATA (Walckenaer)

Lycosidae

ARCTOSA CINEREA (Fabricus)
ARCTOSA LITTORALIS (Hentz)
GEOLYCOSA WRIGHTII (Emerton)
LYCOSA AVARA (Keyserling)
LYCOSA AVIDA Walckenaer
LYCOSA CAROLINENSIS Walckenaer
LYCOSA FRONDICOLA Emerton
LYCOSA GULOSA Walckenaer
LYCOSA HELLUO Walckenaer
LYCOSA PRATENSIS Emerton
LYCOSA RUBICUNDA (Keyserling)
LYCOSA SCUTULATA (Walckenaer)
PARDOSA LAPIDICINA Emerton
PARDOSA NIGROPALPIS (Hentz)
PARDOSA SAXATILIS (Hentz)
PARDOSA XERAMPELINA (Keyserling)
PIRATA ASPIRANS Chamberlin
PIRATA FEBRICULOSUS (Becker)
PIRATA INSULARIS Emerton
PIRATA MARXI Stone
PIRATA MINUTUS Emerton
PIRATA MONTANUS Emerton
SCHIZOCOSA BILINEATA (Emerton)
SCHIZOCOSA CRASSIPES (Walckenaer)
SCHIZOCOSA OCREATA (Walckenaer)
SCHIZOCOSA SALTATRIX (Hentz)

Pholcidae

PHOLCUS PHALANGIOIDES (Fuesslin)

Theridiidae

ENOPLOGNATHA MARMORATA (Hentz)
LATRODECTUS MACTANS (Fabricus)
PEDANOSTETHUS RIPARIUS Keyserling
STEATODA BOREALIS (Hentz)
TEUTANA TRIANGULOSA (Walckenaer)
THERIDION DIFFERENS Emerton
THERIDION FRONDEUM Hentz
THERIDION MURARIUM Emerton
THERIDION SEXPUNCTATUM Emerton
THERIDION SPIRALE Emerton
THERIDION TEPIDARIORUM C. Koch
THERIDION GLOBOSUM Hentz
THERIDION UNIMACULATUM Emerton
THERIDION ZELOTYPUM Emerton

Linyphiidae

DRAPETESCA ALTERANDA Chamberlin
FRONTINELLA COMMUNIS (Hentz)
LINYPHIA INSIGNIS Blackwall
LINYPHIA MARGINATA C. Koch
LINYPHIA PUSILLA Sundevall
PITYOHYPHANTES PHRYGIANA (C. Koch)

Argiopidae

ARANEA ANGULATA Clerck
ARANEA CAVATICA (Keyserling)
ARANEA CORNUTA (Clerck)
ARANEA DISPLICATA (Hentz)
ARANEA FRONDOSA (Walckenaer)
ARANEA GIGAS (Clerck)
ARANEA GIGAS VAR. CONSPICELLATA (Walckenaer)
ARANEA MARMOREA (Clerck)
ARANEA MINIATA (Walckenaer)
ARANEA NORDMANNI (Thorell)
ARANEA OCELLATA (Cambridge)
ARANEA PATAGIATA Clerck
ARANEA SERICATA Clerck
ARANEA TRIFOLIUM (Hentz)
ARANEA TRIFOLIUM VAR. CANDICANS (McCook)
CYCLOSA CONICA (Pallas)
EUGNATHA PALLESCENS (F. Cambridge)
EUSTALA ANASTERA (Walckenaer)
GASTERACANTHA CANCRIFORMIS (Linnaeus)
LEUCAUGE VENUSTA (Walckenaer)
MANGORA GIBBEROSA (Hentz)
MANGORA MACULATA (Keyserling)
MARXIA STELLATA (Walckenaer)
META MENARDI (Latreille)
METARGIOPE TRIFASCIATA (Forskal)
METEPEIRA LABYRINTHEA (Hentz)
MICRATHENA GRACILIS (Walckenaer)
MICRATHENA REDUVIANA (Walckenaer)
MICRATHENA SAGITTATA (Walckenaer)
MIRANDA AURANTIA (Lucas)
NEOSCONA ARABESCA (Walckenaer)
NEOSCONA BENJAMINA (Walckenaer)
NEOSCONA NAUTICA (L. Koch)
SINGA VARIABILIS Emerton
TETRAGNATHA CAUDATA Emerton
TETRAGNATHA ELONGATA Walckenaer
TETRAGNATHA EXTENSA (Linnaeus)
TETRAGNATHA LABORIOSA Hentz
TETRAGNATHA PALLESCENS F. Cambridge
TETRAGNATHA SENECA Seeley
TETRAGNATHA STRAMINEA Emerton
TETRAGNATHA VERMIFORMIS Emerton
THERIDIOSOMA RADIOSUM (McCook)
VERRUCOSA ARENATA Walckenaer

MIMETIDAE
MIMETUS INTERFECTOR Hentz

GNAPHOSIDAE
CALLILEPIS IMBECILLA (Keyserling)
HAPLODRASSUS SIGNIFER (C. Koch)
HERPYLLUS VASIFER (Walckenaer)
POECILOCHROA VARIEGATA (Hentz)
ZELOTES ATER (Hentz)

THOMISIDAE
MISUMENA CALYCINA (Linnaeus)
MISUMENA VATIA (Clerck)
MISUMENOIDES ALEATORIUS (Hentz)
MISUMENOPS ASPERATUS (Hentz)
MISUMENOPS CELER (Hentz)
MISUMENOPS OBLONGUS (Keyserling)
PHILODROMUS AUREOLUS (Clerck)
PHILODROMUS PERNIX Blackwall
PHILODROMUS PLACIDUS Banks
THANATUS LYCOSOIDES Emerton
TIBELLUS DUTTONI (Hentz)
TIBELLUS MARITIMUS (Menge)
TIBELLUS OBLONGUS (Walckenaer)
TMARUS ANGULATUS (Walckenaer)
XYSTICUS ACQUIESCENS Emerton
XYCTICUS FEROX (Hentz)
XYSTICUS FORMOSUS Banks
XYSTICUS FUNESTUS Keyserling
XYSTICUS GULOSUS Keyserling
XYSTICUS LUCTANS (C. Koch)
XYSTICUS NERVOSUS Banks
XYSTICUS TRIGUTTATUS Keyserling

CLUBIONIDAE
ANYPHAENA RUBRA Emerton
ANYPHAENA SALTABUNDA (Hentz)
CASTANEIRA CINGULATA (C. Koch)
CASTANEIRA DESCRIPTA (Hentz)
CLUBIONA ABBOTI L. Koch
CLUBIONA MOESTA Banks
CLUBIONA OBESA Hentz
CLUBIONA RIPARI L. Koch
CLUBIONA TIBIALIS Emerton
GAYENNINA BRITCHERI Gertsch

SALTICIDAE
HYCTIA PIKEI Peckham
MARPISSA UNDATA DeGeer
METACYBRA TAENIOLA (Hentz)
METAPHIDIPPUS CAPITATUS (Hentz)
METAPHIDIPPUS MONTANUS Emerton
PARAPHIDIPPUS MARGINATUS (Walckenaer)
PELLENES AGILIS (Banks)
PELLENES PEREGRINUS (Peckham)
PHIDIPPUS AUDAX (Hentz)
PHIDIPPUS CLARUS Keyserling
SALTICUS SCENICUS (Linnaeus)
SYNEMOSYNA FORMICA Hentz

THE INFLUENCE OF ZINC ON GONADOTROPIC EXTRACTS

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It has been demonstrated that zinc and copper will augment the gonadotropic activity of anterior pituitary extracts when injected in conjunction with these extracts (1, 2, 3). However, pregnant mare serum, which has a marked gonadotropic activity in hypophysectomized animals, is not augmented by either Cu or Zn salts (4, 5). In fact, Deanesly (6) lowered the gonadotropic activity of pregnant mare serum by combining this hormone with zinc sulphate.

In the present study, additional evidence is presented to support the view that pregnant mare serum is not augmented by zinc. An attempt to augment the gonadotropic activity of castrate urine extract is also reported.

MATERIALS AND METHODS

A total of 128 female rats were used for these experiments. All animals were 22 days of age at the time of the initial injection. Each animal was injected subcutaneously once daily for 5 days and autopsied on day 6, unless stated otherwise. Body weight of all animals was taken at the start of the experiment and at autopsy.

The ovaries and uteri were weighed after the removal of adhering tissue and the intrauterine fluid was removed by pressing the uteri against filter paper.

Each animal injected with pregnant mare serum (PMS) received a total dose of 20 I. U. alone or in combination with 0.5 mg., 2.5 mg. or 7.5 mg. of zinc. The solutions were prepared for injection by the addition of n/10 NaOH to the hormone in solution. A drop of phenolphthalein was added to verify the alkaline pH and to this solution was then added the designated amount of zinc sulphate solution. Sufficient NaOH was added to permit maximum precipitation of the zinc as zinc hydroxide in the presence of the hormone and the pH was then adjusted to approximately 8.5. The zinc sulphate was made up so that one cc. = 10.0 mg. Zn. = 43.98 mg. $ZnSO_4 . 7\ H_2O$.

Castrate urine gonadotropin was prepared by the tannic acid precipitation method of Levin and Tyndale (7) and assayed in mouse uterine units (M. U. U.) (8). A total dose of 15 M. U. U. was administered and its gonadotropic activity was compared with a similar dosage in combination with 7.5 mg. of zinc.

Pregnant mare serum, "gonadin," was generously supplied by Dr. D. H. Wonder, Cutter Laboratories, Berkeley, California.

RESULTS AND DISCUSSION

The gonadotropic activity of a constant dose of PMS was reduced when combined with Zn but the loss of activity was not proportionally related to the amount of Zn added (Table 1). The largest amount of Zn used (7.5 mg.) was most effective in reducing the activity of PMS but this amount may have been toxic. However, all of our animals exhibited a uniform gain in body weight during the 5-day injection period whereas Evans, et al. (4) observed a loss in weight as a toxic effect of 1 mg. of copper sulphate. The inhibiting effect of zinc on the activity of PMS cites a marked difference between PMS and the gonadotropic extracts obtained from the anterior pituitary gland. The gonadotropic activity of a constant dose of a pituitary extract is increased in proportion with increased amounts of zinc sulphate added (4, 10).

PMS differs from anterior pituitary extracts in that it is slowly absorbed, slowly destroyed in the body and there is little if any excretion of this gonadotropic material (11, 12, 13). The prolonged action of PMS has been demonstrated in hypophysectomized rats in which the same total dose administered as a single

subcutaneous injection was found to be just as effective as 5 subcutaneous injections administered once daily (14). Deanesly (6) has suggested that zinc may further slow the absorption of the hormone so that the total dose may not be completely utilized. In our experiments a longer period during which the hormone could act was provided by administering the PMS alone and in combination with zinc as a single subcutaneous injection and autopsying the rats 120 hours later. A constant dose of 20 I. U. of PMS per animal was injected alone (9 rats) and in combination with 0.5 mg. Zn (7 rats) 2.5 mg. Zn (6 rats) and 7.5 mg. Zn (5 rats). The ovarian weights of each of these groups were 64.0 mg., 60.3 mg., 79.1 mg., and 52.8 mg. respectively. Although the augmentation observed in one group was not significant neither was there a significant inhibition of the gonadotropic activity as estimated from these small groups of animals. These experiments indicate that if the hormone, PMS, has sufficient time to act then zinc does not alter its potency.

TABLE I

Influence of gonadotropins and zinc on immature rats

No. of rats	Body weight Ave. start	Body weight Ave. end	Treatment (total dose)	Ave. ovarian wt.	Ave. uterine wt.
	gm.	gm.		mg.	mg.
Gonadotropic activity of PMS and zinc					
15	44.8	51.5	None	12.0	32.9
11	45.2	58.3	20 I. U. PMS	90.9	137.9
17	43.5	56.8	20 I. U. PMS and 0.5 mg. Zn.	53.8	131.7
15	40.1	51.5	20 I. U. PMS and 2.5 mg. Zn.	61.9	112.2
16	43.7	57.2	20 I. U. PMS and 7.5 mg. Zn.	39.9	121.1
Gonadotropic activity of filtrates of PMS and zinc mixtures					
7	36.1	50.7	Filtrate from PMS and 0.5 mg. Zn.	20.0	66.2
7	37.3	53.0	Filtrate from PMS and 2.5 mg. Zn.	13.3	30.7
5	33.6	46.4	Filtrate from PMS and 7.5 mg. Zn.	13.1	30.1
Gonadotropic activity of castrate urine extract and zinc					
5	45.0	58.0	15 M. U. U. of C. U	50.9	65.6
5	43.4	54.8	15 M. U. U. of C. U and 7.5 mg. Zn.	42.9	98.8

It was of interest to test whether the hormone was associated with the precipitate or the solution in that both were injected. Solutions were prepared in the manner described for injection. After standing for several hours in an ice chest the precipitate was removed by filtration and the clear filtrate tested for gonadotropic activity. The results are shown in Table 1. A small amount of the hormone is in solution when the mixture was prepared so that 0.5 mg. of zinc and PMS were to be the total dose injected. The other combinations show that the hormone is entirely associated with the precipitate of $Zn(OH)_2$. Under these conditions, opportunity for augmenting the hormone should be maximal.

Extracts of the urine of castrate (C. U.) or postmenopausal women are primarily follicle stimulating in nature when tested in hypophysectomized rats (15). These experiments suggest that this gonadotropin is secreted by the individual's own anterior pituitary gland. An attempt to augment the gonadotropic action of castrate urine extract with zinc was unsuccessful (Table 1), and indicates that this substance, too, differs from anterior pituitary extracts in some respects. Similar results were obtained by Evans, Hines, Ceithaml and Koch (4) with a menopause urine extract, gamone, in combination with zinc acetate.

SUMMARY

Pregnant mare serum alone and in combination with zinc was tested in immature female rats. Large amounts of zinc tend to reduce the gonadotropic activity of PMS when administered in daily subcutaneous amounts over a five-day period. However, zinc does not alter the effectiveness of PMS when the total dosage is administered as a single subcutaneous injection. The gonadotropic activity of castrate urine extract was not influenced when combined with zinc.

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RESULTS OF TEN YEARS' BAT MARKING IN PENNSYLVANIA

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The chief bat marking projects I have carried on are the following:—

1. Tagging a summer colony of Little Brown Bats, *Myotis l. lucifugus,* in southeastern Pennsylvania, and removal to study homing ability; 1932-35.
2. Marking Leib's Bats, *Myotis subulatus leibii,* hibernating in central Pennsylvania caves, 1933-1942.
3. Tagging a colony of *Myotis l. lucifugus* in Woodward Cave, 1938-1942.
4. Tagging four species of bats hibernating in the abandoned tunnels of the South Penn R. R. prior to their development into the Pennsylvania Turnpike and transfer of the bats to caves in an effort to save them from destruction, 1939-1940.
5. Marking a colony of *Myotis l. lucifugus* in Durham Mine, 1939-1942.

In 1937 the American Association for the Advancement of Science through the Pennsylvania Academy of Science, made a grant to the writer for the purchase of 2500 aluminum ear tags. Each tag bore a serial number and the message: "Notify U. S. Biol. Surv."

A SUMMER COLONY OF MYOTIS L. LUCIFUGUS.

In June, 1932, nearly 500 *Myotis l. lucifugus* roosting in an unoccupied frame house at Kempton, in northern Berks County, were captured by stretching gill netting over a corner of the building.[1] When the colony was moved to a dilapidated house 12 miles away, the bats returned overnight to their roost, and latter, when tagged and released at distances up to 60 miles from the roost, many returned. Almost all of the bats making the flight were pregnant females. One individual, #394, released at Pipersville on July 13, 1934, was captured at the roost three days later, the minimum flying distance being 40 miles.

Further studies were discouraged when the house was retenanted, and because the bats found so many exits from which to escape that it proved very difficult to capture any of them. Upon returning to the house on July 21, 1939, however, I captured #255, a female *M. l. lucifugus,* which I had tagged on July 15, 1932, and which subsequently had been carried away from the roost on three occasions, a total of about 75 miles. I brought it to Philadelphia where it died and was preserved. Since the bat was at least a year old when tagged this establishes a longevity record of eight years for this species.

1 Mohr, Charles E.: *Marking bats for later recognition.* Proc. Penna. Acad. Sci., vol. 8, pp. 27-28, 1934.

LEIB'S BAT (LEAST BROWN BAT) IN CENTRAL PENNSYLVANIA

In 1930 Miller and Allen[2] listed only 8 specimens of *Myotis subulatus leibii* then known to be in existence. There were at that time 10 additional specimens, however, chiefly in private collections.[3] In January, 1931, I found the first Pennsylvania specimen, and during the following winter, 11 of this species. When, during the third winter, still more Leib's bats were seen I began to band them. Since that time I have marked and released about 80% of the individuals of this species which I have encountered — 198 out of 272.

There have been no foreign returns[4] (away from the cave) in summer or in winter, with a single exception, noted later. Local returns during the following winters have totalled 13% (8 recaptured one year after marking; 7.3% after 2 years; only 3 bats were recovered both the first and second years). One bat, bearing band No. 137, was released on February 28, 1937, and recaptured on April 4, 1942. This establishes a longevity record of five years for Leib's bat. Local returns have been made only in three caves. Among bats found prior to the winter of 1941-42:

In Stover Cave, 81 were tagged and 10 (12.3%) recovered.

In Aitkin Cave, 51 were tagged and 10 (19.6%) recovered.

In Woodward Cave, 25 were tagged and 1 (4%) recovered.

Leib's Bat shows considerable activity during winter, arriving in the caves later and leaving earlier than any of the other five cave species except *Eptesicus,* the Big Brown Bat. The fluctuating nature of the population is indicated by the fact that the number of Leib's bats encountered in Stover Cave on visits during the winter

2 Miller, Gerrit S., Jr., and Allen, Glover M.: *The American bats of the genera Myotis and Pizonyx.* U. S. Nat. Mus. Bull. 144, p. 172, 1928.

3 Mohr, Charles E.: *Pennsylvania bats of the genus Myotis.* Proc. Penna. Acad. Sci., vol. 7, p. 42, 1933.

4 Griffin, Donald R.: *Migrations of New England bats.* Bull. Mus. Comp. Zool., vol. 86, no. 6, p. 229, 1940.

months varied from none to 25. The latter number were counted after a severely cold period that lasted nearly six weeks. While it seems probable that these bats leave the caves during mild spells in winter, no shifting from one cave to another has been noted except in the case of #310, which, after its original hibernating site was closed during summer by a rock-fall, took up winter quarters in a cave several hundred yards away.

Myotis L. lucifugus in Woodward Cave

Although operated commercially in summer, Woodward Cave has a wintering bat population that has remained rather constant. There are several hundred Little Brown Bats, mostly hanging in fairly accessible clusters. As many as could be reached, 236, were tagged in March, 1938. One year later, 57 (24%) were found; two years later, 39 (16%); three years later, 12 (5%); and 4 years later, 10 (4%). The total returns for each year represent the findings of two or more trips; generally not more than two-thirds of the year's returns were seen at any one time. There were many bats which were recovered for the first time two years after tagging, some of which were not seen until the third or fourth year. These later returns raised the number of individual bats recovered from 57 (24%) to 82 (32%).

Only two bats from this colony have been reported while not hibernating. One, a foreign return, was #665, killed in June, 1939, 10 miles across mountain ridges to the southeast. Another, #692, was killed outside the cave on October 7, 1939.

The disproportionate sex ratio already reported[5] among hibernating bats amounted in Woodward Cave to 71.1% male to 28.9% female. The ratio of local returns was 77% male to 23% female.

Bats in the South Penn Railroad Tunnels

During March 1939, I visited eight abandoned tunnels of the South Penn R. R., in the four easternmost ridges of the Appalachian mountains.[6] Preliminary surveys for the projected superhighway had been completed and work was scheduled to begin before summer.

I found seven widely differing bat populations; the eighth tunnel was flooded. A total of 763 bats of four species were tagged, representing most of the populations of five tunnels, and samplings

5. Mohr, Charles E.: *Bat tagging in Pennsylvania*, Proc. Penna. Acad. Sci., vol. 13, pp. 44-45, 1939.
6. Mohr, Charles E.: *Ibid.*, pp. 43-44.

of the larger populations in the two Kittatinny tunnels. East Kittatinny tunnel, the longest and one of the two best preserved tunnels, and the one whose entrance was the most sheltered, harbored a population of nearly 5,000 bats, ten times that of any other tunnel.

One foreign return was reported, #1063, a female *Pipistrellus*, found dead along Chiques Creek, Lancaster County, exactly 50 miles due east of the tunnel, on May 6, 1939.

By November 1939 the full colony was in hibernation despite active tunneling operations. The local returns observed on two visits to East Kittatinny tunnel totaled 17 *M. l. lucifugus* (12%) and 13 *Pipistrellus s. subflavus* (6.2%).

In the hope of finding a way to save the bats from destruction, an experimental transfer was made, 162 bats being carried 25 miles eastward to Conodoguinet Cave at Carlisle where they were tagged and released. In spite of near-freezing weather possibly a third of the bats disappeared outside; some flew directly westward, but the majority entered the cave. Five weeks later 32 (19.2%) of these bats were still there, although some had been killed by visitors.

Since there appeared to be some hope that a transfer would be successful, about 2500 bats were moved 80 miles northward to Aitkin Cave, on January 13, 1940. Unfortunately, illness prevented us from tagging more than 119 of these bats.

The tunnels were completed during the summer of 1940. During October and November maintenance crews reported that hundreds of bats vainly attempted to roost in the tunnels and eventually disappeared. Frequent visits to Aitkin and many other Pennsylvania caves during two subsequent winters have not revealed any of these tagged bats nor any perceptible increase in the population of Aitkin or any other cave.

Myotis L. lucifugus in Durham Mine

The only large wintering bat colony in eastern Pennsylvania is located in an abandoned iron mine in Mine Hill, at Durham, along the Delaware River below Reigelsville. Here about 2,000 hibernating *Myotis l. lucifugus* are concentrated in two chambers. On March 17, 1940, I tagged 202 bats, recovering 22 (10.9%) early during the next winter and 39 (19.3%) two years later. Total returns to date have been 51 (25%). An additional 125 were tagged

on subsequent visits and on April 14, 1942, bird bands, supplied by the U. S. Fish and Wildlife Service, were attached to the wings of 985 *M. l. lucifugus*. Of these, 87 were carried to Philadelphia and released there, 40 miles due south of the mine. Within 36 hours two were reported killed, one .5 mile from the point of release, the other 6 miles away, both having flown in a northeasterly direction.

Since the region around Durham is well populated, particularly by campers and other summer residents, banding such a considerable number offers a good prospect for foreign returns.

Conclusions

1. During winter bats may shift about in a cave, and evidently occasionally may leave a cave, but I have found no evidence of movement from one cave to another.

2. Markedly disproportionate sex ratios have been noted but I have observed no significant sex difference in homing and in return to hibernation.

3. Bats appear to possess a very keen homing desire as indicated by speedy return to their roosts and by their taking up hibernation despite disturbing circumstances.

4. Very creditable powers of flight have been exhibited by bats and attainment of considerable age has been noted.

5. The marking of 3500 bats in Pennsylvania, and many thousands in New England and elsewhere, provides the means for discovering much more about the longevity, homing ability, and seasonal movements of bats.

PROBABLE PARASITIC STALKED BODIES IN ADULT LEPIDOPTERA

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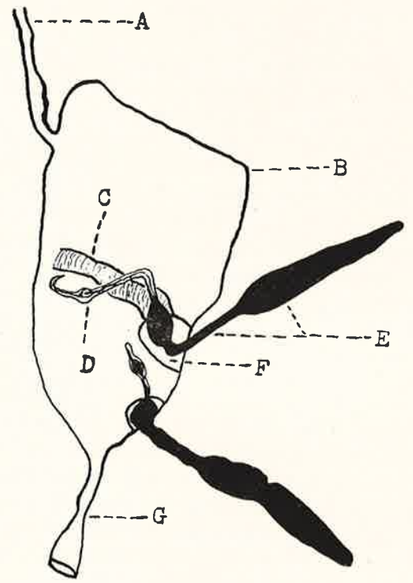
During the Summer of 1941, while studying the internal genitalia of Lepidoptera, peculiar stalked bodies attached to various parts of the internal genitalia of females were encountered. When first exposed these bodies were chocolate brown. Each consists of a sac, which tapers into a small anterior cylinder. The forward end of this cylinder expands into a bulb, which has a proximal tail extending from it. This tail measures approximately .5 mm. long and the remainder of the body about 1 mm. The tail pierces the tissue of the host and traverses it for some distance. These bodies are rare only four being found out of a few hundred dissections representing various species of Lepidoptera. Because of this rarity no effort was made to section them for further study. They were somewhat transparent and appeared to have a definite internal organization. One of these bodies was attached at the extreme end of an accessory gland of *Datana major* G. & R. and another to one of the tubes of the left ovary of this insect. The other two were attached to the bursa copulatrix of *Laetilia coccidivora* Comst. (See fig.). The distant relationship between these species is evident, since the first belongs to the macrolepidoptera and the latter to the microlepidoptera. The tail of the upper body in *L. coccidivora* pierces the bursal wall and its bulbous portion partly enters a tracheal tube. It then pierces the upper wall of the tracheal tube and extends between the muscle fibers for a short distance. A bend in the tail causes its anterior end to pierce both the upper and lower walls of the tube after which it extends between the muscle fibers below. The lower body behaves similarly except for penetrating a tracheal tube. The similarity of these bodies, their attachment to different parts of the genitalia and being in widely different species makes them interesting.

When first examined they were thought to be nematodes and were sent to a number of experts for identification. They were not found to be nematodes or gergarines. Careful examination reveals that they are not a part of the insect's organization. The most interesting suggestion was that they resemble the "tailed eggs" of certain Hymenopterous parasites, but none of these are known to

parasitize Lepidoptera. No free parasites have been noticed in the many adults examined.

EXPLANATION OF FIGURE

Bursa copulatrix of *L. coccidivora* with two stalked bodies penetrating its wall.



ABBREVATIONS

A. Seminal duct
B. Bursal sac
C. Tracheal tube
D. Proximal tail of body
E. Sac, proximal cylinder and bulb of body
F. Area of penetration in bursal wall
G. Bursal duct

THE EFFECT OF A DETERGENT IN THE SOILLESS PRODUCTION OF SWEET POTATO SLIPS

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This history of wetting agents daily increases in fascination. "Tergitol" as an aid to spreading paraffin sections and its adoption as a time saver in staining with Heidenhain's haematoxylin are but two of their many uses in micrology. Wetting agents have extended beyond this field so that throughout biology and chemistry we find more uses that are as practical as they are interesting. Their uses as detergents have been many and varied.

A year of experimentation with tergitol in reference to soilless production of sweet potato slips has revealed more things of interest. Sweet potatoes grown in tergitol were found to show histological effects in their root structure. Treated plants were grown in solutions containing one drop of tergitol per liter of tap water. The average temperature for the experiments was twenty-two degrees.

After fixing the roots in B_3 washing was effected in thirty per cent "cellosolve." Dehydration in the conventional "cellosolve" A and B found eight hours in each best. Eight hours in each of two separate xylols were adequate for infiltration. Embedding was effected in wax similar to the rubber paraffin of Dr. Robert T. Hance of Duquesne University. The slides were mordanted in ferric ammonium sulfate for seven minutes and stained in haemotoxylin for one and one-half minutes.

Sweet potatoes grown in tergitol were found to reveal more mitoses than did the controls. Of interest was the fact that there were obvious differences in the nature of the division process in the tergitol plants and the controls. The treated plants revealed a metaphase that was characterized by a longer spindle as a result of the angles of the lines described by the fibers in the mitotic figures converging to form more acute angles than the similar angles in the controls. The anaphase revealed a more extensive chromosome migration per cell length. The nature of the change pointed to some difference in the rate of division in the cells of the potatoes.

Roots arbitrarily taken from six plants three controls and three treated revealed the following:

	Controls	*No. Mitoses*
Plant A	R_1	11
	R_2	7
	R_3	3
	Tergitol Plants	*No. Mitoses*
Plant A[1]	R_1	19
	R_2	15
	R_3	17
Controls		
Plant B	R_1	4
	R_2	1
	R_3	5
Tergitol Treated		
Plant B[1]	R_1	8
	R_2	14
	R_3	11
Controls		
Plant C	R_1	0
	R_2	10
	R_3	11
	R_4	5
Tergitol Treated		
Plant C[1]	R_1	10
	R_2	9
	R_3	13
	R_4	15

The sections picked were in the same place for each root.
Average mitoses per root in controls counted—5.7.
Average mitoses per root in tergitol roots counted—12.1.

The fact that tergitol acts as a detergent is probably a significant factor in aiding growth. Previous experiments revealed that sweet potatoes grown in solutions that were contaminated suffered retarded growth.

Future experiments will be directed toward a study of the mitotic figures after fixation with Flemming's.

TERGITOL LOWERS THE BACTERIAL COUNT IN HYPDROPONIC CULTURES

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One of the difficulties encountered in the soilless production of sweet potatoes has been the tendency of the solutions to contaminate on standing. Various recommendations have been made, the use of various organic disinfectants has been employed frequently.

"Tergitol" #7, a wetting agent that in addition to aiding growth also greatly lowers the bacterial count in these solutions. The solutions after being treated with one drop of tergitol per liter of solution maintain their freshness and do not have the turbidity that contaminated solutions often show.

Solutions in which sweet potatoes were grown were analyzed for contamination by the dilution plate method. The procedure was the conventional one for this type of analysis. Incubation was allowed for twenty-four hours. The tergitol solutions were found to contain far less bacteria per cubic centimeter than the controls. After making dilutions with sterile water such that the concentrations were one part of solution in nine hundred ninety-nine parts of sterile water the following agar plates revealed:

Tergitol solution ..... no colonies
Control solution ..... 2 colonies

Dilutions of one-one hundred were used and the following results were obtained:

Tergitol solution ..... 2 colonies
Control solution ..... 10 colonies

A control solution from one of the plants was taken and divided into two parts A and B. Part A was used as the control while in part B there was placed one drop of tergitol. The solutions A and B were allowed to stand for twenty-four hours at thirty-seven degrees and when the dilutions were one-one hundredth the following results were obtained:

Tergitol B ..... 2 colonies
Control A ..... 8 colonies

Similar one-one thousandth dilutions from a common solution of sputum in sterile water were made. These plantings on agar showed the following:

Tergitol sputum ..... 2 colonies
Control sputum ..... countless colonies

It is thought that a similar disintegration of the bacterial cells occurred as was found in Fortunato's paramoecia that disintegrated in solutions of tergitol.[1]

It is hoped that these experiments will point to some practical aids in soilless agriculture particularly in reference to the sweet potato. Present work with tergitol is being directed toward the effect of the agent on hormone injected plants.

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SOME ADVANTAGES OF THE SWEET POTATO IN EXPERIMENTATION

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It is difficult for one to disconnect the lowly onion from research on root structures in plants. The onion seems to have established itself as an accepted source of root material for many types of investigation. Experiments for the past two years on the sweet potato have revealed that it has many advantages as a laboratory plant for experimentation of the type mentioned. The potatoes require no exceptional care and the growth of the root structures is of such a nature that the investigator has placed at his disposal large amounts of material.

The potatoes are placed in jars having a mouth of sufficient size to admit one half of the tuber. The jar after having been filled with tap water or a solution can be set aside, usually near a window, until the roots appear. Where two or more plants are placed for growth a jar containing the potatoes should contain a thermometer immersed in its liquid. The high specific heat of water makes temperature recordings in this way better indicators than if they were made from the room temperature. When the researcher is interested in temperature effect plants can be placed in jars that are snugly housed by a box warmed with light bulbs. For larger quantities of material a thermostat arrangement is possible using several potatoes resting in evenly spaced holes in the lid of a tank made for the purpose. The dimensions of the tank will depend on the amount of material needed.

The arrangement in jars or in the tank makes easy the treatment by aqueous solutions of vitamins or wetting agents and such factors as time or appearance of the roots, rate of growth, and nature of the early or first roots can be easily noticed. Toxic effects will reveal themselves either by growth failure or by some type of decomposition.

Where the effect of some agent that is too poorly soluble in water to give effects is used it has been found best to place a weighed quantity of the agent in a known volume of some non-polar solvent. The agent in the non-polar solvent is placed in a culture tube of known volume and the tube is placed in a hole bored in the potato just large enough to receive it. The open end of the tube enters the potato making it possible for the contents of the tube to

be absorbed. The junction of the potato and tube is sealed with melted paraffin. Oil of cloves has been found to be an excellent solvent for injections of this type.

The root production under ordinary conditions after ten days, at thirty degrees Centigrade, or three weeks at nineteen degrees Centigrade, will be profuse. Adequate material from each plant will present itself and gross or histological studies can be made.

The roots run up well in the agents that are ordinarily available in the micrology laboratory. Fixation in B_3 will reveal well cytoplasmic features and mitotic figures. Washing in a thirty per cent solution of "Cellosolve" takes out the picric acid and dehydration can be effected in the conventional "Cellosolve" A and B. Eight hours in each seemed to be adequate. In separate xylols eight hours in each will prepare the roots for paraffin. Imbedding in a rubber paraffin of the type recommended by Dr. Hance of Duquesne University will support the root cells excellently for sectioning. Roots left in "Cellosolve" for as long as forty-eight hours have been found to undergo no appreciable change. Forty-eight hours in xylol, too, produced no hardening of the roots. Mounting and staining with Heidenhain's hemotoxylin will give satisfactory detail. The mitotic figures stand out clearly enough in dividing cells that they make excellent material for beginning students studying the division process. The dividing cells under oil show up with convincing clearness. The roots are sufficiently small that, when cut at ten microns, two and at the most four slides can show all the sections in a longitudinal serial of the tip.

The experiments using vitamins and hormones seem to interest greatly the agriculturist. Sweet potatoes in the farming process undergo a double planting. The first planting produces stems, called "slips." The second planting is a planting of these slips from which the potato for consumption is grown. The orthodox method of "slip" production involved the use of hot beds. The soilless way has many advantages not the least of which is the fact that the temperature of the solutions can be maintained more easily than the bed temperature. Simple experiments in the biological laboratory can be followed through by the energetic student who might plant the slips and then check the new tubers for hardiness, size or palatability. The home economist might even carry the simple experiment one step more and study the baking time of the potato from the slips of the plant that underwent injections in the laboratory of the biologist.

ESSENTIAL COURSES IN BIOLOGY FOR THE PREPARATION OF QUALIFIED HIGH SCHOOL SCIENCE TEACHERS

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A sequence of specifically named courses intended to give the student the sum total of information in a given field may very well hide in its order of events an academic virus as insidious as those that merely make us physically ill. Once down in black and white even those of us who wrote them forget their humble origin and are apt to regard them as a sort of extension of the law and the prophets. When and if we amend our list of required courses we usually do so by adding to them and seldom subtract. What great grandfather approved of is still good enough for us with, of course, a few additions.

Naturally it is convenient and even necessary, considering the enormous accumulation of facts by this year of culture 1942, that the facts be regimented into what we call courses. But in so doing we must be sufficiently aware of our goal to modify our course requirements and to remember to delete as well as to expand.

The goal to be worked for by the High School teacher of biology is one that, to me at least, must be composed of something of the spirit as well as the facts of life. From this point of view I should like all teachers of biology to have real comprehension of the following dogmas.

1. Living matter is the same in principle regardless of appearance. All living organisms must take in food, digest it, build it into living tissues, get rid of the waste products of vital activity, be sensitive to what is going on about them, be able to move, to reproduce, and to grow.

2. These principles are put into operation by means of certain organ systems that vary with the size, complexity, and general needs of the organism.

3. Living material is variable and this variability is expressed by differences in form, function, and (in some of the higher animals) by variations in intellectual capacity and response.

4. The animal and plant is to be regarded for purposes of study as a series of complex chemical reactions that commonly proceed harmoniously when all internal and external conditions are right.

5. Accidents of development, of heredity, or of environment, may interfere with the reactions resulting in illness or death.

6. Hereditary characteristics are transmitted from one generation to another in an orderly and predictable manner.

7. The living organism results from the impact of the environment on the potentialities of the inheritance.

8. A blood relationship exists between all living things.

9. A knowledge of vital phenomena materially contributes to the formulation of a life philosophy which makes for greater individual well being and for better social adjustment.

Obviously these dogmas must be demonstrated by reference to particular examples. There should be more learning by doing in the training of the student than learning by hearing. This is true throughout the training period but it seems to me to be particularly necessary in the introductory courses. Too often today the introductory course is of the so-called survey type which sooner or later rises up to haunt the student with its inadequacies. It is not feasible to survey anything until you have something to survey.

The courses that, properly taught, will afford some comprehension of the nine points listed above seem to me to be in the usual order of their offering: 1. General Biology; 2. Comparative Anatomy of Animals and of Plants (one semester of each); 3. Physiology (General and Comparative); 4. Ecology; 5. Genetics and Evolution. If times permits Embryology and Histology may be added although something of these fields can be made part of other courses. All courses should be taught with the emphasis on the laboratory and the instructor should be constantly alive to the possibility of telescoping courses that have much in common.

The teacher in training should be kept constantly aware of the practical implications of the subjects and to come to think of this new information as contributing to understanding of social activities.

I like the point of view of Raymond B. Fosdick, President of the Rockefeller Foundation expressed in his recent report.

"The Search For Unity"

"If we are to have a durable peace after the war, if out of the wreckage of the present a new kind of cooperative life is to be built on a global scale, the part that science and advancing knowledge will play must not be overlooked. For although wars and economic

rivalries may for longer or shorter periods isolate nations and split them up into separate units, the process is never complete because the intellectual life of the world, as far as science and learning is concerned, is definitely internationalized, and whether we wish it or not an indelible pattern of unity has been woven into the society of mankind."

And so the sooner we see in anatomical details and in physiological activity the mechanisms of living behavior, the quicker will we appreciate our place in the world of living creatures. Such concepts rise with difficulty under too great hampering of course limitations which in the end and after all are merely administrative conveniences.

FREEING FROZEN GLASS STOPPERS AND SYRINGES

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Closely fitted ground glass parts, such as found in syringes and glass stoppered bottles, will not stick if kept clean. It can be pointed out, without further editorial comment, that most laboratories accumulate quite a number of frozen stoppers and syringes during the year and that it would be convenient to be able to "thaw" them out easily.

A number of more or less complicated and ingenious mechanical devices for freeing these articles have been described or offered for sale. They doubtless work satisfactorily but it is much more simple, safer, and less expensive to immerse hypodermic syringes in warm water to which about one half of one per cent of the detergent "Tergitol" #7 has been added. The reduction of the surface tension of the water caused by the Tergitol permits it to penetrate between the frozen parts as untreated water will not do. The glass stoppers of bottles may be loosened by flowing a little of the above Tergitol mixture around the point of union of the stopper and the bottle neck. Gentle flaming of the neck with a bunsen burner will help to create space for the penetration of the Tergitol-water solution.

1. Manufactured by the Carbide and Carbon Chemical Co., 30 E. 42nd St., New York, N. Y.

SAWFLY INFESTATIONS IN PENNSYLVANIA

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Three instances of sawfly infestations are mentioned in this paper. Alone these examples would not seem of great importance, but taken in conjunction with the injury caused by sawflies yearly, the matter becomes of some significance. In addition, sawflies may invade greenhouses and attack the plants growing there or they may infest native and exotic trees and shrubs which are used by the state in reforestation.

In the summer meeting of the Academy at Bedford the members were taken on a tour of the Pennsylvania Turnpike. At the western entrance to the Tuscarora Tunnel a short field trip was made along the route of the old South Penn Railroad. One of the interesting observations noted by the party on this hike was a heavy infestation of the hazelnut by caterpillar-like larvae. Collections of the larvae were made and returned to the laboratory for determination and study. They were identified as the immature stage of the sawfly, Arge macleayi (Leach).

The eggs of this sawfly are inserted in the parenchyma tissue of the hazelnut leaf. They are located along the margin with a large number placed within the same leaf. On hatching, the young larvae issue through the slit made in the leaf by the female in inserting the egg. At once they become attached to the edge of the leaf by means of the thoracic legs and with the posterior portion of the body suspended above. In this striking attitude the larvae become external leaf feeders. In time the entire leaf is skeletonized with everything removed but the larger veins. It was these gregarious edge feeders which attracted the attention of the Academy party last summer.

The larvae cling very tightly to the edge of the leaf and are not easily jarred from the plant. As growth proceeds the prolegs (larvapods) are used to anchor the larvae more firmly in the natural feeding attitude. It is even difficult sometimes to pull them loose with the forceps. The head is brown in color with the remainder of the body white. The length of the feeding time is about two weeks after which a hard cocoon is formed to enclose the larva. The pupal stage is quiescent.

It is quite likely that the larvae observed on the hazelnut last August was a second brood. The great majority of sawflies emerge

early in spring and have largely disappeared by July. In some cases second or third broods may exist. This means that the larvae of spring matured, pupated, and emerged as adults by the middle of the summer. Arge macleayi (Leach) has been reared from

FIGURE I

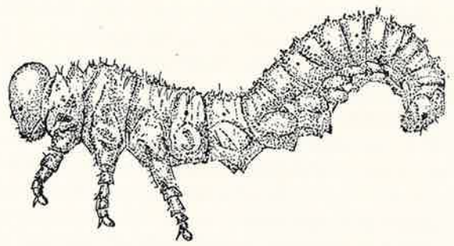

FIGURE II

FIGURE I ARGE MACLEAYI (LEACH) ANTERIOR ASPECT
FIGURE II ARGE MACLEAYI (LEACH) LATERAL ASPECT

a number of different hosts aside from Corylus. Other common hosts are: Azalea, Salix and Betula.

The larvae of the Tenthredinids are cylindrical in form. They consist of a well defined, globular head and thirteen similar segments. The cephalic three belong to the thorax and the caudal ten

to the abdomen. The thoracic segments are more clearly defined and robust than the abdominal segments. The region of the thorax may be easily identified by the presence of thoracic legs. Prolegs are present on a number of the abdominal segments.

The anterior aspect of Arge is shown in Fig. I. The dorsal area of the head is the vertex. The vertex is separated in the middle by the epicranial suture which divides into two arms, producing a figure like an inverted Y. The area enclosed by the two branches of the epicranial suture is the front. Laterally, the vertex extends to the ventral margin of the head. The simple eyes or ocelli are found on each lateral aspect of the vertex. Ventral to the front is the clypeus which is divided by the clypeal suture into the first and the second clypeus. The labrum is entire and is attached to the ventral margin of the second clypeus. The mandibles articulate with the lateral edges of the clypeus and the inner margin of each mandible fits under the edge of the clypeus and labrum. The maxillary palpus closes the ventral part of the anterior aspect.

Fig. II shows the lateral aspect of the larva with the abdomen bent back toward the thorax in a broad curve. The thoracic segments are distinct and bear the fleshy and stout thoracic legs. A pulvillus like swelling beside the tarsal claws is quite characteristic of the larvae belonging to the genus Arge. The ten abdominal segments are not so well defined, with the last segment somewhat different in structure and shape from the others. Prolegs number twelve, occurring on segments two to six and the tenth. Spiracular areas are prominent as observed from the lateral view.

The second example of sawfly infestation occurred in the late summer of 1940. Dr. Guyton, of the Bureau of Plant Industry, Harrisburg, sent me a vial of larvae for identification. It was the azalea sawfly, Amauronematus azaleae Marlatt. Dr. Guyton stated in his letter that the specimens were taken from plants in a greenhouse at Collingdale, Pa. This seems a very striking and unusual case. In all Tenthredinid literature there are few references to attacks of this nature.

The larvae of the azalea sawfly is shown in Fig. III. It differs from the larva previously described in the greater distinctness of the segmentation and the location of the prolegs. The latter are placed on abdominal segments three to seven and ten. A few scattered setae and glands appear in the lateral aspect.

The third instance of infestation concerns Leconte's sawfly Neodiprion lecontei (Fitch). This material was also sent from the Bureau of Plant Industry, Harrisburg, for determination. Dr. Guyton included with the preserved specimens some sample pine twigs with the living larvae. The latter shortly began to pupate and form cocoons at the base of the pine leaves. The cocoons were placed in sphagnum and kept in the refrigerator for a few weeks, after which they were removed and allowed to emerge.

The feeding habits of Leconte's sawfly are rather striking and

FIGURE III
AMAURONEMATUS AZALEAE MARLATT LATERAL ASPECT

FIGURE IV
NEODIPRION LECONTEI (FITCH) LATERAL ASPECT

for this reason more reports of infestation are made than for other species. Men connected with the C. C. C. and Veteran's Camps supplied information of attacks on pines in the State Forests and of seedling pines used for reforestation purposes. To cite an example, the discovery of an infested area came from a Veteran's Camp, located at Kooser Dam on Laurel Ridge in Somerset County. The plants involved in this attack were young pines provided by the state and planted near Bakersville.

The larvae of Neodiprion start feeding at the free end of the pine needles and in time only short stubs remain. Migration to other needles then occurs until the entire branch is largely consumed. Scotch, pitch, Austrian, and white pines are damaged most by this insect. In fact, all Diprionid sawflies are very narrowly restricted in host range to the Pinaceae.

The larval stage of this sawfly is shown in Fig. IV. The thoracic legs are strongly developed and bear a hooked claw. The segmentation of the abdomen is obscure. Rudimentary prolegs occur on segments two to eight and ten. Viewed from the side the abdomen appears almost legless due to the weak development of these abdominal appendages.

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Two former students, Miss Maud Greenwood of the Easton Hospital and Dr. W. W. Middlekauff of Cornell University, aided with the drawings and determinations.

NERVOUS HABITS AND MORALE

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Among laymen nervous habits are most frequently used in the descriptive sense. These forms of behavior can be summarized briefly as stereotyped motor acts which for all intents and purposes are non-adjustive. Usually very commonplace irritants will set off these nervous habits. Physicians oftimes refer to them as tics, however, this designation is somewhat narrow. The fact that these habits are non-adjustive and represent an infantile mode of response warrant the assumption that the possessor is neurotic. These neurotics when faced with real or fancied difficulties respond by exhibiting these nervous habits which serve in part as an escape. It is true that all individuals at some time or another do display a few of these mannerisms, however, they do not tend to persist for a protracted time nor do they increase in variety. During peace time activities these evasive devices can easily be tolerated with very little inconvenience to society, since optimum efficiency is not imperative. Now that we are in a state of war a complete mobilization of energy is required in order to carry out our avowed purpose. As these neurotic individuals instead of responding in a more efficient manner as the pressure increases oftimes break down to a greater degree an ameliorative, or better still direct training of tension-tolerance of these individuals, is in

order. In England no new large group of individuals is being found displaying what might be called "air raid neuroses" etc. The people who have broken down during air raids and its concomitants have been found to be the same individuals who have a history of sub-normal adjustment in strain situations.

The first tangible thing to do is to make an inventory of the individuals within society displaying nervous habits to a pronounced degree. A very useful, as well as comprehensive list of nervous habits can be found in Olson's book, "The Measurement of Nervous Habits in Normal Children." Some suggestive habits to look for are twisting hair, puckering forehead, biting lips, biting nails, clenching fists, shaking foot, etc. These, of course, can all be directly observed as can practically all the others listed by him. One might think much time would be consumed in making such a survey. This does not follow. Most of these individuals display these typical stereotypes within as short an interval as three minutes, even in routine activities. These individuals should then be given a graded series of experiences of increasingly greater frustration and deprivation in an effort to build up their tension-tolerance. Some suggestive situations might be as follows: an initial task for such training might be making the person wait for his meal, say about two hours longer than usual. A more irritating situation would be making the person get up for an air raid alert at about two o'clock in the morning. Should the person take it as part of his contribution and work all the harder we can say his toleration is adequate for this degree of strain at least. Those individuals who respond to this series with a willingness to "give" are responding successfully. Those individuals whose tension-tolerance cannot be increased to a certain desirable minimum level should be evacuated to such locations as are considered safe.

Preliminary work could best be worked out for pupils of school age as they are largely under direct supervision. The isolation of pupils having nervous habits, for study, could easily be executed by the classroom teacher while the pupils are carrying on regular school work. It certainly would be unwise to advertise to the pupils what one is doing. Neurotic pupils are tense to start with and telling them about it would only make it more acute. Their discipline should be made more severe and the teacher should not be influenced by these nervous habits. In fact, these stereotype responses should be discouraged by attaching negative values to

them. Having studied one nervous habit, finger nail-biting, for a period of ten years it has been found that individuals do not relinquish these habits willingly. In other words, the task will be difficult, but without achieving efficiency effective morale will be improbable.

Some more than irritating stimuli will have to be tolerated. It is possible to become, so to speak, adapted to these stimuli so that they do not have their original disruption value. Tension-tolerance can be built-up by gradually increasing that which the individual can tolerate. The tension can also be tolerated for longer and longer intervals, even though the goals might seem more remote than previously believed. The practical details of achieving this end represents a major problem in itself. For the adult population displaying nervous habits this tolerance might be developed through community projects where these neurotic individuals can participate and feel that they have status. As they begin to feel that they have importance, to the extent of contributing in a substantial way to the ultimate goal, the subterfuge of nervous habits becomes increasingly unnecessary. These habits will disappear and the individual will no longer be a neurotic, a partial liability to himself and a potential liability to society in this time of strain.

This leads to our final point, that of morale. Since nervous habits are essentially disciplinary subterfuges they indicate an attitude undesirable to the maintenance of morale. An individual displaying high morale faces adversity with quiet endurance and undemonstrative tenacity for what he feels paramount; the values of democracy. He also maintains a state of alert attention and gives evidence of constructive ingenuity in a discouraging situation. To sustain this needed degree of alertness it is equally important that he is restfully relaxed while sleeping. The greatest danger to the morale of the group as well as to the efficiency of the individual is that of anxious apprehension as to the future.

Recapitulating in a single sentence: Nervous habits and high morale are incompatible.

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THE RELATIONSHIP BETWEEN CIRCULATION IN THE GRAY MATTER OF CAT CEREBRUM AND SPECIALIZATION OF FUNCTION

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The purpose of the observations was to discover some histological evidence of cerebral specialization. The frequency of blood vessels, as indicative of physiological activity, was selected as the object for study on the hypothesis that a greater amount of motor control in certain regions of the cerebrum would necessarily require a greater amount of circulation. The observations were made on the cortex where the cytons, which probably exhibit the greatest metabolic activity in a neuron, are more prevalent. It was hoped that some relationship between circulation and motor activity in the gray matter of the cat cerebrum could be observed.

The fixative used was a modified B_3 solution.[1] The inclusion of Tergitol in the solution made possible more rapid penetration so that the entire brain could be fixed without having been previously dissected. Tissue was taken from the orbital lobe, the ectosylvian gyrus, the suprasylvian gyrus, the anterior sylvian gyrus, the posterior sylvian gyrus, the sigmoid gyrus, the compositus posterior, and the marginal gyrus. The tissue was dehydrated by the alcohol-xylol series. Infiltration was by the oven method for a period of two hours or longer using rubber paraffin (formula according to Hance). The tissue was sectioned on a rotary microtome at ten microns and mounted on slides with Mayer's albumen. It was stained with iron alum haematoxylin[2] and counterstained with eosin, using the alcohol-xylol series. The mounting medium was clarite.

The blood vessels of each region were counted in an area measuring 1.77 square millimeters under a compound microscope using a 44X objective and a 10X ocular. Numerous areas were counted in each gyrus and an average number of blood vessels was obtained for each, as well as a maximum and minimum number. The results were compiled on a bar graph which showed that, in regard to the average number, the anterior sylvian gyrus had the greatest number (289.6). In descending order were the ectosylvian (214.2); the compositus posterior (126.2); the suprasylvian (114.6); the posterior sylvian (112.6); the marginal (75.2); the orbital (70); and the sigmoid (50.4). This relationship was not

the same for the maximum number; in this case the marginal and the orbital were in reverse order. The figures were as follows: anterior sylvian (500); ectosylvian (285); compositus posterior (214); suprasylvian (154); posterior sylvian (145); orbital (106); marginal (81); and sigmoid (71). There was quite a distinct change in the relationship for the minimum number. The ectosylvian was first (120); the anterior sylvian and suprasylvian next (95); the posterior sylvian (92); the marginal (60); the compositus posterior (49); the orbital (31); and the sigmoid (26). Thus a great difference was found among the various ranges. The largest range occurred in the anterior sylvian (95-500 or 405); next the ectosylvian (120-285 or 165) and the compositus posterior (49-214 or 165); the orbital (31-106 or 75); the suprasylvian (95-154 or 59); the posterior sylvian (92-145 or 53); the sigmoid (26-71 or 45); and the marginal (60-81 or 21). In one count a distinction was made in the size of the blood vessels, distinguishing between the larger and smaller vessels. The anterior sylvian and the ectosylvian gyri had the greatest number of large blood vessels (28), but the sylvian had more small ones (350) than the ectosylvian (257). The posterior sylvian had 18 large (145 small); the suprasylvian had 14 large (140 small); the orbital 12 (94 small); the compositus posterior 11 (77 small); the sigmoid 6 (65 small); and the marginal 6 (54 small). The percentages of large blood vessels were between 8% and 14%, a range of 6%.

It is fairly certain that in the human cerebrum, the frontal lobe consists of at least one of the association areas and the center of motor speech; the parietal lobe contains the motor area, center of muscular control, which lies immediately anterior to the central sulcus, and the somesthetic area immediately posterior to the central sulcus; the temporal lobe is the center of auditory speech and hearing as well as head movements in response to sound; and the occipital lobe is the center of vision and reading, and also certain eye and head movements. Those gyri which were found to have the greater blood supply were the anterior sylvian, ectosylvian, and suprasylvian, in the parietal lobe; the posterior sylvian, in the temporal lobe; and the compositus posterior, in the occipital lobe. The gyri with the smaller number of blood vessels were the marginal, in the parietal lobe; and the orbital and sigmoid, in the frontal lobe. The areas of heaviest circulation seem to coincide with the areas which control the most important activities of the

cat. The motor area, the somesthetic area, the auditory area, and the visual area are all well supplied; while the association areas responsible for adaptive reactions and speech in humans are less well supplied.

FOOT NOTES

1. Formula: 75 parts of saturated aquaeous solution of picric acid; 15 parts of formalin; 10 parts of glacial acetic acid; 1 part of urea; 0.1 part of "Tergitol No. 7."
2. "Tergitol No. 7" was added to the iron alum haematoxylin in the proportion of 1 drop to 50 c.c. to speed up the staining time.

SOME NATURE NOTES

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The following notes call attention to some findings that may be of interest to those engaged in studying the distribution of the flora and fauna of Pennsylvania.

Several specimens of the Velvet Convolvulus, *Convolvulus purshianus* nomen novum, were found on a small shale-slope along Tub Mill Run, north of the Lincoln Highway, about halfway between Breezewood and Everett.

Two colonies of the purple-fringed orchid, *Blephariglottis* sp., were found in Adams County. One colony is on the grounds of Camp Nawakwa, about one mile west of Brysonia; the other along a branch of Conewago Creek, just back of a sawmill located on the south side of route 234, about 3 miles west of Arendtsville.

A specimen of the hoary willow, *Salix candida* Flugge, was found along an old logging road about one half mile southwest of Camp Nawakwa, Biglerville, in Adams County.

A colony of the walking fern, *Camptosorus rhizophylus* (L.) Link., is located on a large boulder on the east slope of Culp's Hill, Gettysburg Battlefield; this boulder is not far from the parking space at the summit of Culp's Hill.

Two specimens of the Muhlenberg turtle, *Clemmys muhlenbergii* (Schoepff) were taken in Adams County during the summer of 1941.

Several specimens of the ravine salamander, *Plethodon richmondi* Netting and Mittleman, were taken on ground adjacent to

the Whitaker Camp, north of Neff's Mills in Huntingdon County.

Two specimens of the ground snake, *Carphophis amoena amoena* (Say), were taken on ground adjacent to the Whitaker Camp, north of Neff's Mills in Huntingdon County.

On March 17, 1942 a number of feeding leeches were removed from the fore and hind feet of the spotted salamander, *Ambystoma maculatum* (Shaw). These were identified by Dr. M. C. Meyer of the New Jersey College for Women as *Placobdella rugosa.* Last spring (1941), when the frogs were in the breeding ponds, leeches of the same species were taken off the bodies of wood frogs, *Rana sylvatica* Le Conte.

On March 17, 1942, a specimen of the ravine salamander, *Plethodon richmondi,* Netting and Mittleman, was found by Dick Hershberger, a biology student of mine, under a clod of sod in the garden of his home. This garden is not near any woods.

Two hog-nosed snakes, *Heterodon contortrix* (L.), in my vivarium in the Everett High School feed readily on the red-spotted newt, *Triturus viridescens viridescens* Rafinesque. A garter snake, *Thamnophis sirtalis sirtalis* (L.) in the same vivarium has never been seen to attempt to seize or eat one of the newts. None of these snakes would take either the larvae, pupa, or adult of the *Tenebrio* beetle.

A QUANTITATIVE STUDY OF SOME MAMMALIAN TESTES

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The measurements listed below are recent additions to my work on the quantitative study of the mammalian testes. The mean seminiferous tubule diameter, and the mean thickness of the tunica albuginea is the average of twenty measurements made with an ocular micrometer.

To indicate the source of the material listed the following abbreviations are used: (N. Y.)—New York Zoological Park; (S. D.)—San Diego Zoological Park; (Bed.)—Bedford County, Pa. The autopsy numbers serve to identify the hosts in the records of each zoological park.

Autopsy Number	Source	Name	Mean tub. diameter, microns	Mean cross-section area of tubules, sq. mm.	Mean thickness of tunica albuginea microns
M-1-39	(Bed.)	Human	156.2	.019	287.2
M-1-41	(Bed.)	House Rat	189.8	.028	33.6
M-11-40	(S.D.)	Orang-utan	169.6	.022	349.4
M-116-40	(S.D.)	Coyote	68.04	.003	157.9
M-172-40	(N.Y.)	Walrus	43.6	.001	819.8
M-134-40	(N.Y.)	South American Fur Seal	115.6	.014	406.5
M-117-40	(S.D.)	Panama Deer	166.3	.021	228.4
M-53-40	(N.Y.)	Rhesus Monkey	40.3	.001	77.2
M-145-40	(N.Y.)	Red River Hog	40.3	.001	189.8
M-69-40	(S.D.)	Binturong	168.0	.021	240.6
M-167-40	(N.Y.)	Common Marmoset	75.6	.004	28.5
M-5-40	(S.D.)	Fennec Fox	152.04	.017	101.1
M-15-40	(S.D.)	California Grey Fox	140.8	.015	107.5
M-2-40	(Bed.)	Skunk	173.04	.023	47.8
M-2-41	(Bed.)	Deer Mouse	119.2	.010	16.2
M-121-40	(N.Y.)	Java Macaque	154.5	.018	171.3

Human—*Homo sapiens.*
House Rat—*Rattus norvegicus.*
Orang-utan—*Pongo pygmaeus.*
Coyote—*Canis latrans.*
Walrus—*Odobenus rosmarus.*
South American Fur Seal—*Arctocephalus australis.*
Panama Deer—*Odocoileus chirisquesis.*
Rhesus Monkey—*Macaca mulatta.*
Red River Hog—*Potamochoerus porcus.*
Binturong—*Arctictis binturong.*
Common Marmoset—*Hapale penicillata.*
Fennec Fox—*Canis pallidus.*
California Grey Fox—*Urocuon cinereoargenteus.*
Skunk—*Mephitis mephitis.*
Deer Mouse—*Peromyscus maniculatus gracilis.*
Java Macaque—*Macaca irus.*

TWO NEW SUBSPECIES OF CERCYONIS ALOPE

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After studying the type material of many of the named *Cercyonis* in the Edwards' collection, we have concluded that it is advisable to describe two new subspecies of *alope*: one a race from North Carolina; and the other, a form of typical *Cercyonis alope*. The latter has frequently been confused with true *maritima*.

Cercyonis alope carolina New Race

Male: Alar wingspread 49 mm.; upper surface of primaries has the yellow of the limbal patch replaced by white; the apical ocellus similar to typical alope; the ocellus between the first and second median nervules reduced in size.

Female: Alar wingspread 54 - 60 mm.; the ocellus between the first and second median nervules of the primaries not reduced, but normal in size; otherwise, similar to the male.

In general, this race is lighter brown in color than typical *alope* and in certain respects, as far as the ocelli are concerned, suggest an approach toward *pegala* Fabr. This race, as far as we know seems to be restricted to the southern Appalachian Mountains around North Carolina and Tennessee.

Holotype, male—Conestee Falls, N. C.

Allotype, female—Gastonia, N. C., September 27, 1933.

Paratypes, nos. 1 - 7, Gastonia, N. C.; and Mt. Eagle, Tennessee.

Cercyonis alope ochracea New Form

This form may be separated from the original normal form by the ochraceous replacement of the yellow in the patch of the limbal area of the primaries. As in the normal *alope*, the amount of ochraceous varies from a large patch to a fairly small one. Erroneously, the name *maritima* has been applied to this form, but on examination of Edwards' type material, and additional material identified as *maritima* by Edwards, the name *maritima* cannot be applied to this form.

Holotype, male—Washington Park, Providence, Rhode Island, July 18, 1933.

Allotype, female—Guys Mills, Pennsylvania, July 24, 1935.

Paratypes, nos. 1 - 30; Providence, R. I.; Cooperstown, Pa.; Aspinwall, Pa.; West View, Pa.; Wall, Pa.; Guys Mills, Pa.; and Pittsburgh, Pa.

NOTES ON COLLECTING *ARGYNNIS DIANA*

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Argynnis diana is one of the most highly prized butterflies found in eastern United States. It ranges from southern Ohio and

West Virginia, through the Appalachian mountains into Georgia and South Carolina, being most abundant in the mountains a little south of the Great Smoky National Park. It is the largest member of the genus, frequently exceeding four inches in wingspread. In contrast to the other eastern Argynnids, *diana* exhibits a marked case of sexual dimorphism, the male having the general brownish-red color typical of the genus, the female having a distinctive blue ground color. The urge to collect this interesting butterfly personally, led the author to Conestee Falls, near Brevard, North Carolina in the early summer of 1941, where he was successful in collecting a series of ninety-two male specimens. The general characteristics of the living insect, observed while collecting, merit description.

The eastern Argynnids: *cybele, atlantis, aphrodite* and *idalia* are usually found in open fields, fluttering around the blossoms of thistle, milkweed and numerous other plants. *Argynnis diana,* in contrast, is sylvan in its habits and no specimens were observed in open fields. The majority of specimens were collected as they were sitting on the dry red clay typical of the rutted mountain roads, with wings folded, but ever ready to fly. They were only to be found in spots where the sun had penetrated the forest shade sufficiently to brightly illuminate a few square yards of clay. It was necessary to approach them very cautiously and slowly, and when sufficiently close, to quickly snap one's net over the prize. If they would escape before one had an opportunity to cover them, they would usually fly ahead for ten or fifteen yards and settle on the ground again, necessitating the repetition of approach. A swing and a miss was a permanent failure regarding that specimen, because it would not fly up the road, down the road, or over the treetops; but quickly through the maze of rhododendron and laurel trunks that prevented pursuit. Only five specimens of the series were collected on flowers; three were feeding on butterfly weed; and two specimens on the blossoms of chestnut. Although chestnut, rhododendron and butterfly weed were abundant, this Argynnid seemed to prefer the dry red road, the color of which blended perfectly with that of the insect. It was noted that this butterfly was attracted to the excrement of a deer along the road, and five specimens were covered at one time with the net. *Diana* is the only species of *Argynnis* that I have ever observed being attracted to bait of this nature.

Ordinarily, this species is a casual flyer, very rarely flapping its wings, but usually having a gliding type of flight about two feet above the level of the ground. When disturbed, however, it becomes a very rapid flyer, apparently filled with the intent to escape. The wings beat quickly, and it exhibits an enviable skill in flying through the tangle of underbrush.

Among the series collected, there was little noticeable variation among the species, and among all the individuals of this species that I have studied, the same constancy in maculation was noted. This appears to indicate that *Argynnis diana* is an old established species, quite distinct from the other, more plastic, members of the genus. The peculiar habits of the living adults which the author was fortunate in observing, have strengthened this opinion.

A NEW MODIFICATION OF IRON ALUM HAEMATOXYLIN AS A CYTOPLASMIC STAIN

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The new modification of Iron Alum Haematoxylin was prepared in the following manner: a saturated solution of iron alum (ferric ammonium sulphate) in 95% alcohol was used as a mordant; the staining reagent was prepared by using 5 c. c. of a stock solution of 10% haematoxylin in alcohol which was diluted with 100 c. c. of 95% alcohol and aged until it turned a deep red color. These two solutions correspond to the 4% aqueous solution of iron alum, and the 0.5% solution of haematoxylin used in the standard Heidenhain's stain. The tissues prepared with the new stain were supra-sylvian of the cat, first ventricle of the cat brain, cerebellum of the rat, and kidney of the cat. All of this material was fixed in B_3 to which was added 0.01% "Tergitol #7," dehydrated by means of the alcohol series, infiltrated with rubber paraffin, and sectioned on a rotary microtome at eight microns. After experimenting with the time required for staining, the following method was found to produce best results:

xylol	5 minutes
95% alcohol	3 minutes
mordant	3 minutes
95% alcohol	wash for 1 minute
stain	3 minutes

95% alcohol	wash for 1 minute
mordant	destaining (time varies)
95% alcohol	3 minutes
absolute alcohol	3 minutes
xylol	5 minutes
mount in balsam or clarite	

It is noticeable from the above method, that the alcohol series required for an aqueous stain is eliminated; and the time actually required for staining, is comparatively short for haematoxylin stains. These advantages, combined with the simplicity involved in its usage, make it available for ordinary class room exercises.

The results obtained with the use of this new modification were distinctive. In the cerebellum of the rat, the nuclei of the purkinje cells were clear, with the nucleoli staining very heavily, and the few chromatin granules also taking the stain; the cytoplasm stained a pale purplish black. The cytons of the cortex were distinctive, and nuclei took the stain very lightly or not at all; while the cytoplasmic structures stained heavily, giving a very granular appearance to the tissue. The granular layer of the cerebellum took the stain very lightly, with the nuclei staining either heavily or not at all; the cytoplasm of the cells and the neuronic processes stained, at best, a very pale violet. In the suprasylvian and first ventricle of the cat brain, the nuclei stained a very light purple with few nuclear structures appearing, and the cytoplasmic granules stained very heavily, giving the tissue a comparatively dark appearance. The blood vessels in these areas were stained a very deep purple black. In the cat kidney, the cytoplasm of the medullary cells stained very lightly, and the nuclei did not stain at all. The cytoplasm of the cortical cells stained a pale violet, while the nuclei either stained very heavily or not at all.

It is obvious, from the above results, that this new modification cannot be used as a rapid substitute for Heidenhain's haematoxylin, because it does not react the same as that stain. However, it is apparent that it is useful as a cytoplasmic stain, affecting most of the cytoplasmic structures found within the cells of the tissue studied. The general picture obtained with this stain is almost the reverse of that obtained with Heidenhain's and the combination of the two stains, used independently in tissue studies, gives a more complete conception of the cytology of the material under study.

ON THE INEXISTABILITY OF H_4O^{++}

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For a generation or more countless chemists have pointed out the significance of hydrogen ion concentration, and of its negative logarithm, called pH. The study of pH has put on a scientific basis such variegated topics as acidosis, butter, candy-making, disinfectants, earth-worms, fermentation, gastric ulcers, hydrogenation, indicators, jelly-making, kaolin, laundering, molasses, neutralization, osmosis, pretzel-baking, qualitative analysis, reaction velocities, sanitation, taxidermy, urine analysis, vitamins, whiskey, xerosis, yard grass and zymotechnology.

In spite of these triumphs the hydrogen ion is in bad odor, in fact, most chemists today deny its very existence. For the oxygen atom of water has two pairs of lone electrons, and where there is a pair of lone electrons, coordinate covalence is inevitable. The hydrogen-atom-minus-an-electron, which is what the hydrogen ion is, if there is a hydrogen ion, would be captured by a lone pair of electrons; it would cease to exist as such, and there would result an oxonium, H_3O^+. As to this chemists today are virtually unanimous.

The inquiring young chemistry student, remembering the two pairs of lone electrons, is sure to ask, if H_3O^+, why not H_4O^{++}? It is the primary purpose of this paper to answer this question.

Since a liter of water weighs 1000 grams, and a mol of water weigh H_2O, or 18 grams, a liter of water consists of $1000 \div 18$, or 55 mols. Be it assumed that a hydrogen ion is captured by a molecule of water. There are therefore left 54 other molecules of water, each as anxious as the first to capture for itself a hydrogen ion. In view of this competition it is unlikely that a given water molecule will capture a second hydrogen ion. Furthermore, when a molecule of water has captured a hydrogen ion the unit is positively charged, and would therefore repel any miraculously unattached hydrogen ion. Therefore the H_4O^{++} ion can safely be assumed to be inexistable.

SOME EXPERIENCES WITH A NATIONAL DEFENSE COURSE IN CHEMISTRY

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The national war effort has now been of sufficient duration that it is not out of place to make a preliminary report on some experiences with National Defense Training Courses offered by the Office of Education of the United States Department of the Interior (1). In the present instance the courses reported are standard college courses in chemistry which have been taught at Washington and Jefferson College in the Engineering, Science, and Management Defense Training Courses. The material covered was not part of a composite course, for instance, of the mathematics-physics-chemistry type which have been given at certain centers. They have, therefore, a particular interest to educators because they offer us an opportunity to evaluate college grade training on an emergency basis. Washington, located some thirty miles from the heart of Pittsburgh is primarily a center of the ceramic industries, and secondarily of ferrous alloys, ferro-tungsten, ferro-vanadium, and ferro-molybdenum. The region also produces gaseous, liquid, and solid fuels. Sufficient chemical activity is centered in the region, therefore, to warrant one in expecting that there should be a demand for chemically trained workers for defense industries.

The original intent of this program was to train for step up within the industry. In our experience, however, only about one-half of our students were employed in the chemical industries and less than one-fifth of our enrolees were employed by industries engaged in munitions production.

Over 90 per cent of these students had had no college training. The enrollees were, for the most part, attracted to these courses not with the motive of preparing themselves for defense jobs, but they have come in order to have a taste of college life and experience. The remaining ten per cent were mostly college graduates who had had one year of college chemistry and who being employed in the chemical industries took our courses as refreshers for their work. About one-tenth of our students have been women.

We have been required to drop enrollees at the end of each month if they have excessive absences. In the chemistry courses our final enrollments have averaged just about 50 per cent of the initial enrollments. The number of enrollees dropped is fairly uniform in every month of a course.

The chief reason given for withdrawal has been "interference with regular work." In other words, most of the drops are unwilling or unable to do two jobs at one time. A few people have taken other jobs, moved from town, or have other good reasons for giving up the work. The most persistent students have been those who commute the greatest distance between place of living and the college.

It must be admitted that by comparison to college standards that the erosion of defense courses enrollments has been excessive.

Attendance among those enrolled for any given month is good at first, being approximately 85-90 per cent, but as the courses proceed attendance becomes worse until it averages only 70-75 per cent of those still enrolled in the courses. On individual evenings attendance may be as low as 50 per cent of the enrollment. Here again, by college standards, the attendance is very bad.

Instructors for these chemistry courses have been mostly recruited from the college staff. Our experience with teachers from industry, even when they have had previous college teaching experience has been unfavorable. The tendency of such men is to forget the necessity for constant reiteration; having once told the students a principle, they expect the student to remember it once and for all, and to apply it always.

When we come to assay the achievement of these courses the results are a cause for uneasiness. It must be admitted that results both tangible and intangible are exceedingly small as compared to the pressing necessity of our present National emergency.

First of all, it seems, we should look for practical results. Approximately 100 students have taken these courses and of these only some 20 were employed in the munitions industries. Of the 100 students only two have gone into jobs in munitions plants, and as far as we can learn only three have been "stepped-up" in their industrial plants.

As a secondary objective the courses were intended to serve as "refreshers" for men who had previously had some chemistry. Since not over 10 of our students had had college chemistry it is obvious that we could refresh only a limited few.

In the third place, we might hope to give to certain routine plant workers some understanding of the significance of their own

plant operations. This we have done, we believe, to a fair extent.

A fourth value of courses such as these lies in the field of appreciation, or the propaganda value of chemistry. We believe that all of our students have attained a better understanding of the part that technology and the trained mind has in the war of production. Not the least of our significant achievements in appreciation has been the inspirational value that these courses have been to three cousins of keen minds, but limited financial resources, who being unable to go to college have had a vision of the joys of intellectual attainment. These boys are employed in the barbers supplies trade, but their horizons, as a result of this taste of college life, are definitely on higher ground. We think also of a splendid girl high school teacher who has greatly profited by this study.

On purely academic ground we may say that class and laboratory discipline has been splendid. Outside study is exceedingly meager in the beginning course but somewhat better in the second course. In the second course the tests and examinations are the same caliber as given our regular students, but the spread of grades is about one letter lower at all levels.

Thus we may fairly estimate that of 100 students passing through the courses about 10 of them have benefited from the experience. The yield is low. On the other hand, in our normal chemistry department enrollment of 250 students less than 25 of them annually graduate on a chemistry major. So perhaps the 10 per cent fraction benefited is not too small.

The contributions to the national war effort which have been made by these courses, it must be admitted, is disappointingly small, and we may examine as to why this should be so. The answer to our enquiry will be found in the objectives of such programs of training.

It will be recognized that such courses might attempt to do one of two things, but not both. First, the objective might be the training of the professional chemist, a "brain toiler," an independent worker. Second, the objective might be the training of the non-professional technician, such as laboratory assistants, probationary laboratory assistants, instrument readers, titrators, oven operators, samplers, glassware washers, or stockroom boys.

The American arts college is equipped and prepared to do the former task, and it is only natural that we should attempt to adapt our customary routines and techniques to the task of training men

for the war effort. Had we attempted to train non-professional technicians we might look for more immediate and concrete results of our labors. (As a matter of fact we have had a part in just such an effort in the summer of 1941 for recent high school graduates, with results similar to those reported by Rose (2)).

But it must be remembered also that the basic training of a professional junior chemist requires a four year program not only in chemistry but also in physics, mathematics, English and the languages. And after such training, in normal times, the junior chemist is regarded by industry simply as a "chemical interne" for two years or longer. When we consider that the people we are now attempting to train for step-up in an ever expanding production industry have had only two years equivalent of the chemistry and none of the other concomittant courses it may be appreciated how great is our task. Added to these considerations is the fact that our trainees are doing a full-time job as well as studying a technical program.

On the whole then, it is too early to look for concrete results. The program has a long way to go before its effect may be felt on our war effort. But if this war proves to be a long term effort then we may well hope to see the scientific instruction of the American college be a real contribution to the training for step-up within industry.

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PENNSYLVANIA GEOLOGICAL SURVEY AND NATIONAL DEFENSE [1]

R. W. STONE
The Pennsyvania Geological Survey

A review of mining geology in 1941 published in MINING AND METALLURGY begins with the statement that in February, 1941, a young Ph. D., Donald E. White, of the staff of the U. S. Geological Survey, was in the laboratory in Washington, D. C., studying cores that he had brought from Yellow Pine, Idaho, where the Bureau of Mines was diamond-drilling a gold-antimony deposit.

Looking through the microscope at a thin section from one

1 Published in Dept. of Internal Affairs, Mo. Bull., Vol. 10, No. 5, April 1942.

of the cores, Dr. White recognized the mineral scheelite, a calcium tungstate. He immediately examined all of his collection under the ultra-violet lamp and found that the tungsten mineral was rather widespread in the cores from the central part of the zone that had been drilled.

$10,000,000 Worth of Tungsten

Following this disclosure, continued drilling by the Bureau of Mines and subsequent drilling and underground work by a mining company showed that tungsten was distributed over a width of 150 feet, an estimate indicating at least $10,000,000 worth of tungsten above the 160-foot level. [2]

Tungsten is one of the seven strategic minerals, those metals for an adequate supply of which we are dependent on foreign countries. Its principal uses are in the manufacture of tools for metal cutting, as a core in armor-piercing bullets, in armor plate, and in gun breeches. The United States has produced about 10 per cent of the quantity consumed. This discovery of a major new tungsten supply was perhaps the most spectacular geologic accomplishment in 1941.

Surveys in Public Interest

The Pennsylvania Geological Survey has done some spectacular things in the past and may again, for the many years behind it have built up a great backlog of publications and knowledge that is available for reference and consultation. Its extensive reports on anthracite and bituminous coal, oil and gas, building stone, limestone, clay and shale, slate, ground water, and lesser mineral products are on file in many public libraries throughout the State and the Nation, and the members of the staff can be consulted freely and without charge by letter or in the office at Harrisburg. The Survey is ready to make special investigations, if necessary, so long as they are in the public interest and not for private gain.

Because of the great backlog of data on geology and mineral resources acquired through scores of years, the Survey has been able to be of assistance on a variety of problems brought to it within recent months and having to do more or less directly with national defense. Among the questions first put to the Survey were queries as to the character of the surface, depth to bedrock, and possible supplies of ground water in large tracts of land being

2 McKinstry, H. E., Mining Geology: Mining & Metallurgy, Feb. 1942, p. 57.

considered for army depots, TNT plants and concentration centers.

One engineer picked a large acreage and found several small coal breakers on it. He wanted to know if the land was underlain by coal. The answer was that the land has no coal, but miners haul coal from several miles away to a convenient stream for washing.

Army Receives Advice

A contractor on a large Army project was advised where to drill for water and got a nice well, and an engineer representing a large steel mill came to Harrisburg to ask about increasing the supply of cooling water. He was told where the prospect would be good and where not to drill for a supply of ground water.

One individual proposed to ask the Reconstruction Finance Corporation for a loan to reopen an old lead mine. He was told that thousands of dollars had been spent on that particular property many years ago, that beautiful specimens of galena had been found, but that the mineral is in too small quantity to be of any value. So far as the Geological Survey is concerned, saving useless expenditure of money is just as valuable service as promoting the useful expenditure of the same sum.

Survey Prevents Loss

Another illustration of saving was that of a group ready to build a modern furnace for smelting a local iron ore "that occurs in considerable quantity." They were told that the iron ore is nodular, not over two feet thick, and too high in phosphorus for use alone. These men wanted to render a patriotic service by producing pig iron from local ore and were considering the design and cost of a furnace before investigating the quantity and quality of the ore. The furnace has not been built.

Manganese is a strategic mineral and its occurrence is mentioned in the reports of the former State Surveys. All known localities were visited by a Survey geologist in the summer and fall of 1941, field studies were made of the occurrences and samples were taken for analysis, thin sections, and polished sections as a means of determining the origin of the ore. Only two localities seem to have enough ore to justify a moderate expenditure for drilling and prospecting. The Survey, therefore, is in a position to discourage hasty conclusions about the value of these deposits.

Prospecting for Chromite

Chromite, another strategic mineral, was once mined extensively in southern Lancaster County; in fact that locality was for a time the world's source of supply. It is known that chromite occurs only in basic rocks, in this case, serpentine, but no method has yet been devised by which concealed deposits of chrome ore can be located from the surface. Gravitational, magnetic, and electric resistivity methods have been tried, but without success. The Geological Survey can furnish a map of the areas underlain by serpentine to anyone who wants to prospect for chromite, but cannot offer much hope that ore will be found, although a lucky drill hole might reveal a large body.

Inquiries have come to the Survey for sources of dolomite and the names of producers of this high-grade magnesian limestone have been furnished. This was possible because Dr. B. L. Miller's 700-page report on Limestones in Pennsylvania, published by the Geological Survey, contains hundreds of analyses showing the content of calcium and magnesium carbonate in this rock throughout the State.

A recent inquiry by telegram from New York was for coarse-grained dolomite for use probably in supplying the magnesite brick industry with material by exchanging the calcium in calcined dolomite for magnesium captured from the Atlantic Ocean. To this we could reply only that in a few restricted areas in Chester County a coarse-grained marble is highly magnesian in certain beds. A field survey would have to be made and samples analyzed to determine whether rock to meet the specifications occurs in sufficient quantity.

Mention of camouflage reminds some people of curious patterns painted on ships, or of tree branches placed over guns, but for walls and roofs of concrete buildings, or large surfaces of asphalt like highways and airplane landing runways another treatment is needed. The Geological Survey has furnished Washington with samples of mineral products that can be produced in quantity for this purpose. We may well wonder if the broad white double band of the Pennsylvania Turnpike should be made less conspicuous from the air by camouflage in some way, especially for a mile or more near the tunnels.

An electrical contractor who had to establish many ground connections on a military construction job wanted to know if holes

for ground wires could be barred to a depth of 12 feet; if not, he must raise his bid.

Within two days, officials of two cities came to Harrisburg to discuss with the Geological Survey proposed increases in their water supply already inadequate because of the greatly increased consumption by local industries engaged in the production of war materials.

Several patriotic citizens have offered free use to the government of clay deposits on their land for the extraction of aluminum, if the material is suitable, which it isn't.

Probably the Survey's largest single contribution to defense has been in regard to oil, in cooperation with the U. S. Geological Survey, U. S. Bureau of Mines, and the Oil Coordinator. Pennsylvania oil is a premium oil in great demand for high-grade lubricating oil. Taking advantage of the large scale work done in recent years in the oil fields, much of it yet unpublished, the Survey staff has prepared large confidential reports on the oil fields for the Oil Coordinator, has cooperated in testing new methods of finding oil and in getting proper samples for analysis. It has even loaned its chief oil geologist to the Federal government for work in Washington.

Caves and underground mines even have some interest in defense for inquiry has been made as to their availability as safe places for the storage of munitions and archives.

The foregoing shows the variety of problems put to the State Geological Survey, all of which were induced by the needs of national defense. Now that the government has turned from defense to offense, from passive to active participation in the war, it may be that the problems presented will be even more urgent. Although the Survey has to flash the red light for stop on some proposals, it as frequently gives the green light for go ahead. In both cases it is serving the best interests of the public. That it is able to render this service is owing to the long-continued support by the Legislature, beginning with the First Geological Survey of Pennsylvania more than 100 years ago.

THE BRUSH CREEK LIMESTONE OF WESTERN PENNSYLVANIA

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The Brush Creek limestone occurs in the lower half of the Conemaugh series of the Pennsylvania period. It lies sixty to sixty-five feet below the Cambridge (Pine Creek) limestone and is five to ten feet above the Brush Creek coal. This coal occurs between one hundred, and one hundred and twenty-five feet above the Upper Freeport coal which marks the lower limit of the Conemaugh series. The Ames limestone which nearly divides this series in half is found about one hundred and eighty-five feet above the Brush Creek limestone.

The Brush Creek limestone was named by I. C. White in 1878 from its occurrence along Brush Creek in Butler County, Pennsylvania and is cited in report Q of the Second Pennsylvania Geological Survey on the Beaver River District. It is commonly from one to three feet thick, usually being less than three feet. It is the lowest in stratigraphic position of the marine, fossil-bearing horizons in the Conemaugh series. The Brush Creek is a nodular, black limestone which is interbeded in black, carbonaceous shales. It averages about two feet in thickness. Many fine fossils have been collected from this nodular layer with only very rarely a fossil being found from the nodules themselves. This stratum is persistent and has been traced from the Allegheny Front to northeastern Kentucky, Maryland, West Virginia and Ohio. In Maryland the Brush Creek limestone has been found in both an upper and lower division but in western Pennsylvania it crops out in a single bed.

The distinguishing characteristics of this limestone are the great abundance of the gastropod, Worthenia tabulata (Conrad), the most prolific species in this limestone; the lack of the many bryozoa so characteristic of the Cambridge limestone; and the dominance of the molluscan group. The characteristic Worthenia tabulata Conrad) is the best aid in identifying this limestone for this species has been found very rarely from either the Cambridge or Ames limestones. A few specimens have been secured from the Cambridge limestone outcrop on the upper bench in the Baltimore and Ohio Railroad cut at Witmer about three miles north of

Etna, a suburb of Pittsburgh; and also from the Ames limestone at the Brilliant Cut-off, Pittsburgh, Pennsylvania.

The Brush Creek limestone fauna is quite similar to that of the Ames and Cambridge limestones, many species being common to all three. The gastropods, the dominant group in this fauna, are represented with thirty species, ten of which are common. The pelecypods also make up a large part of the fauna with thirty-two species identified. However only a few of these are common as Deltopecten occidentalis (Shumard), Allorisma subcuneatum Meek & Hayden, Astartella concentrica (Conrad), Schizodus cuneatus Meek, and Edmondia aspenwallensis Meek. The pelecypods occur in much smaller numbers than the gastropods throughout this stratum. Nineteen species of brachiopods have been identified with only five being of common occurrence. They are of minor importance in this fauna. Cephalopods are more common in the Brush Creek than in either the Ames or Cambridge limestones. Twelve species have been identified half of which are common. The other groups are of much less importance there being two species of bryozoa, one coral, one species of vermes, four foraminifera, four ostracods, one crinoid, one trilobite, two scaphopods, and six species of shark teeth identified from the Brush Creek limestone. One hundred and thirteen species have been secured which is the largest fauna yielded from any of the fossil-bearing, marine, strata of the Conemaugh series.

A few species have been found in the Brush Creek limestone of western Pennsylvania which have not yet appeared in the other fossil-bearing, marine strata of the Conemaugh series. These are the brachiopod, Dictyoclostus americanus Dunbar and Condra which is common in the Vanport limestone of the lower Allegheny series; two species of the pelecypod genus, Myalina; one large species of the gastropod genus, Loxonema; and two species of scaphopods, Dentalium meekanum Geinitz and Dentalium sublaeve Hall. The Myalinas and the Loxonema have not been identified as to species.

A few brachiopods which are very common and characteristic of the Ames limestone are extremely rare in the Brush Creek limestone. These are Ambocoelia planoconvexa (Shumard), Chonetes granulifer Owen, Hustedia mormoni (Marcou), Rhipidomella carbonaria (Swallow), Wellerella aff. osagensis (Swallow), and Derbya crassa (Meek & Hayden). Another brachiopod, Composita ovata Mather, is rather rare in the Ames limestone, has not yet

been identified from the Cambridge limestone, and has been found as a single specimen from the Brush Creek limestone at the fire brick, shale quarry at Valley Camp near New Kensington, Pennsylvania.

The following fauna has been collected from twenty-one Brush Creek limestone localities in western Pennsylvania. Some of these localities which have yielded an abundant fauna are from the Baltimore and Ohio Railroad cut (lower bench) at Witmer; the fire brick, shale quarries at Creighton and Glassmere near Tarentum; the railroad cut just east of Donahoe near Greensburg; and from the outcrop along the road at the west end of the Sewickly Bridge, Sewickly, Pennsylvania.

BRUSH CREEK LIMESTONE FAUNAL LIST

c common r rare

BRACHIOPODA

Juresania nebrascensis (Owen)	c	Neospirifer triplicatus (Hall)	c
Composita subtilita (Hall)	c	Chonetes granulifer Owen	r
Linoproductus aff platyumbonus D. & C.	c	Marginifera splendens (N. & Pr.)	c
Derbya crassa (Meek & Hayden)	r	Dictyoclostus americanus D. & C.	r
Ambocoelia planoconvexa (Shumard)	r	Composita ovata Mather	r
Crania modesta White & St. John	r	Cleiothyridina orbicularis (McChesney)	r
Punctospirifer kentuckyensis (Shumard)	r	Rhipidomella carbonaria (Swallow)	r
Linoproductus prattenianus (N. & Pr.)	r	Lingula sp.	r
Cancrinella boonensis (Swallow)	r	Squamalaria ? perplexa (McChesney)	r
		Echinoconchus semipunctatus (Shephard)	r

BRYOZOA

Septopora biserialis? (Swallow)	r	Rhombopora lepidendroides Meek	r

CEPHALOPODA

Pseudorthoceras knoxense (McChesney)	c	Eoasianites sp.	r
Poterioceras curtum (Meek & Worthen)	c	Pennoceras seamani M. & U.	c
Ephippioceras ferratum (Cox)	r	Metacoceras cornutum Girty	c
Metacoceras perelegans Girty	c	Solenocheilus brammeri M., D., & C.	r
Liroceras? sp.	r	Mooreoceras normale M., D., & C.	c
Domatoceras sp.	r	Schistoceras missouriense (M. & F.)	r
		Megagloceras ? sp.	r

CRINOIDEA

Crinoid columns	c	Delocrinus hemisphericus (Shumard)	r

COELENTERATA

Lophophyllum profundum (M., E., & Haime)	c		

FORAMINIFERA

		Haplophragmium sp.	r
Ammodiscus sp.	r	Archeodiscus sp.	r
Spirillina ? sp.	r		

GASTROPODA

Pharkidonatus percarinatus Conrad	c	Worthenia tabulata (Conrad)	c
Euphemites carbonarius (Cox)	c	Soleniscus primogenius (Conrad)	c
Phanerotrema grayvillensis (N. & Pr.)	c	Straparollus cattiloides (Conrad)	c
Pleurotomaria carbonaria N. & Pr.	c	Soleniscus typicus Meek & Worthen	c
Patellostium marcouianum (Geinitz)	r	Trepospira depressa (Cox)	c
Patellostium montfortianum (N. & Pr.)	c	Soleniscus brevis White	r
Orthonychia parva (Swallow)	r	Bellerophon stevensianus McChesney	r
Naticopsis scintella Girty	r	Loxonema sp.	r
Cyclonema sp.	r	Phymatopleura nodosa (Girty)	r
Soleniscus medialis (Meek & Worthen)	r	Zygopleura sp.	r
Naticopsis torta Meek	r	Pleurotomaria insecta	r
Orthonychia spinigerum (Worthen)	r	Bulimorpha chrysalis? Meek & Worthen	r
Soleniscus regularis Cox	r	Auriptygma simplex Knight	r
Aclisina stevensana (Meek & Worthen)	r	Pleurotomaria perhumerosa Meek	r
		Soleniscus intercalaris Meek & Worthen	r

OSTRACODA

Bairdia (4 species)			

PELECYPODA

Deltopecten occidentalis (Shumard)	c	Allorisma subcuneatum Meek & Hayden	c
Parallelodon obsoletus Meek	r	Pinna peracuta Shumard	r
Nucula anodontoides Meek	r	Astartella concentrica (Conrad)	c
Parallelodon sangamonensis Worthen	r	Leda bellistriata (Stevens)	r
Schizodus cuneatus Meek	c	Nuculana wewokana (Girty)	r
Solenomya trapezoides Meek	r	Pseudomonotis hawni Meek & Hayden	r
Anthraconeilo taffiana Girty	r	Nucula parva (Hall)	r
Pleurophorus oblongus Meek	r	Aviculopecten herseri? Meek	r
Solenomya parallela? Beede & Rogers	r	Edmondia reflexa Meek	r
Nuculopsis ventricosus? (Hall)	r	Astartella vera Hall	r
Edmondia gibbosa McCoy	r	Edmondia subtruncata? Meek	r
Aviculopecten sculptis Miller	r	Edmondia aspenwallensis Meek	c
Edmondia ovata Meek & Worthen	r	Pteria? sp.	r
Lima retifera Shumard	r	Leda arata Hall	r
Myalina (2 species)	r	Cardiomorpha missouriensis Shumard	r
Yoldia carbonaria Meek	r		

PICES

Petalodus ohioensis Safford	c	Deltodus angularis Newberry & Worthen	c
Sandalodus sp.	r		
Peripristis ? semicircularis ? Newberry & Worthen	r	Agassizodus variabilis St. John & Worthen	r
Fissodus inaequalis St. John & Worthen	r		

TRILOBATA

Ameura major (Shumard)	r

SCAPHOPODA

Dentalium meekanum Geinitz	r	Dentalium sublaeve Hall	r

VERMES

Serpulopsis insita White	c

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MANGANESE MINERALIZATION IN PENNSYLVANIA [1]

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During the field season of 1941 the writer examined the known and reported occurrences of manganese minerals in Pennsylvania, especially with a view to their possible commercial exploitation because of the imminent need for production from domestic manganese ore resources to meet the growing needs of a nation at war. The detailed results of the field investigation and of five months laboratory study of the minerals are being prepared for publication. The purpose of this short paper is to classify and present the different types of occurrence of manganese minerals in Pennsylvania. Only the salient features of the different types are given.

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SEDIMENTARY OCCURRENCE

Only one deposit of manganese oxide in Pennsylvania can be classed as sedimentary. A two-to-eight-inch gravel bed cemented by soft, black manganese oxide and associated with more than five feet of Quaternary gravel occurs near the Huntingdon-Fulton County line and the village of New Grenada; it can be seen in the bank of Roaring Run a short distance above its mouth.

HYPOGENE OCCURRENCES

Hypogene manganese minerals in Pennsylvania are of mineralogic interest only. Rhodochrosite of hypogene origin occurs in the magnetite body at Cornwall in Lebanon County; hypogene oxides were reported from the French Creek magnetite body in Chester County; spessartite, tephroite, and piedmontite are all manganese bearing minerals associated with the Piedmont gneisses of southeastern Pennsylvania; and some questionable hypogene manganite has been observed at the Reading Banks ore pit near Boiling Springs in Cumberland County. None of these is important.

SUPERGENE OCCURRENCES

Manganese minerals of supergene origin are fairly common in Pennsylvania; as a matter of fact, the soft black oxide of manganese, commonly called wad, is ubiquitous and may be observed on the joints or bedding planes of rocks of every different age and character in the State. Some occurrences are significant because of the quantity of manganese minerals located at one spot or because of the frequency of occurrence of manganese minerals in a certain stratigraphic horizon; these are treated in this paper.

GENERAL NATURE OF THE OCCURRENCES

The following general observations apply to most of the occurrences: 1. All of them are manganese oxide minerals; manganese carbonate was not observed in any. 2. Nearly every occurrence is associated with iron oxide minerals; all of the important ones are. 3. All of the manganese minerals have been derived from overlying rocks by solution and deposition from meteoric waters, and accumulated as replacement bodies and associated fracture fillings in lower horizons.

The following table lists the stratigraphic formations in which manganese oxides occur and the geologic age of the associated rocks. Each of these is treated in the order listed:

Occurrence of manganese oxide	Geologic age of associated rocks
Gneiss	Pre-Cambrian
Antietam sandstone	Cambrian
Tomstown dolomite	Cambrian
Gatesburg dolomite	Cambrian
Ordovician limestone	Ordovician
Oriskany sandstone	Devonian
Chemung sandstone	Devonian
Catskill sandstone and shale	Devonian
Pocono sandstone	Mississippian
Bogs	Mississippian
Mauch Chunk shale	Mississippian
Underclay	Pennsylvanian

Gneiss. Small bog-like accumulations and fracture fillings of soft, black manganese oxide occur in the gneissic rocks of the Piedmont. The source of the manganese is the spessartite, and to a lesser extent the tephroite and piedmontite, contained in the gneiss. None of these deposits have value.

Antietam Sandstone. Stringers and, locally, masses of psilomelane associated with pyrolusite and wad, occur in the top of the Antietam sandstone, always closely associated with basal ore-bearing Tomstown dolomite. The occurrence is chiefly as replacements in brecciated quartzite and sandstone and as space-filling matter. The source of the manganese is clearly the basal Tomstown dolomite. Some of the ore contains 48 per cent of manganese.

Tomstown Dolomite. The most prominent manganese mineral-bearing horizon in Pennsylvania is the Tomstown dolomite. Manganese deposits occur at several localities and at least one is a commercial possibility. The Tomstown formation crops out along the flanks of South Mountain and the Reading Hills from Northampton County to Franklin County. The ore occurs in three ways:

1. Nodules of psilomelane and limonite in residual yellow clay, weathered from the Tomstown dolomite, not far above the base of the formation.

2. Thin beds and stringers of psilomelane and limonite in tan and yellow clay about 200 feet above the basal beds. Soft black clay, bearing irrecoverable wad, is associated with this type of deposit at many places.

3. Fairly solid, massive, mixed psilomelane and limonite with a slumped bedded character, carrying thin interbeds of white and

yellow clay, situated at the base of the Tomstown, and in contact with the Antietam at some places.

The source of the manganese is uncertain; probably it is from the relatively impure, semi-clastic beds of the lower and middle Tomstown. The manganese content of these occurrences ranges from 2 to 45 per cent.

Gatesburg Dolomite. Psilomelane, pyrolusite, wad, and limonite are associated with each other as replacement deposits in the basal white clays of the Gatesburg formation in central Pennsylvania, and occur in two ways as massive, slumped, bedded ore; and as nodular ore.

The nature and occurrence of the minerals is similar to that in the Tomstown formation. The source of the manganese may have been in the semi-clastic beds of the middle and upper Gatesburg. Locally the ore contains 50 per cent of manganese. Several localities average 5 to 10 per cent of manganese.

Ordovician Limestone. The lower Ordovician limestones, including the Beekmantown, Chambersburg, Conococheague, and Conestoga formations, contain numerous pockets of manganese-bearing residual clay throughout the entire length of the Great Valley. These clay pockets contain chiefly limonite, both massive and nodular; small stringers of psilomelane cut the limonite and, at some places, make individual "beds" of ore with the limonite. The manganese content of these deposits is rarely more than one or two per cent. Locally it is as much as 18 per cent. The source of the manganese is uncertain; it is clearly genetically related to the limonite.

Oriskany Sandstone. Psilomelane and wad occur as fracture fillings and as partial replacements of the Oriskany sandstone in south-central Pennsylvania. A deposit near Orbisonia, Huntingdon County, once produced a siliceous ore reported to carry 35 per cent of manganese. The source of the manganese is unknown.

Chemung Sandstone. Soft, black manganese oxide and small quantities of psilomelane have been observed as replacements in sandy beds of the Middle and Upper Chemung rocks of northern Pennsylvania. A small occurrence near Mansfield, Tioga County, contains 5 to 10 per cent of manganese; the accumulation is structurally controlled by a small synclinal roll on a monocline.

Catskill Sandstone and Shale. Small fracture fillings and many thin films of black manganese oxide on the joint and

bedding planes of the Catskill redbeds of Bedford and Fulton Counties are common. The quantity of manganese present at any occurrence, however, is very small.

POCONO SANDSTONE. Impregnations and fracture fillings of wad and psilomelane are not uncommon in the topmost beds of the Pocono (Burgoon) sandstone. These minerals are occasionally associated with nodular limonite in small weathered pockets. Sandstone talus on the slopes of mountains underlain by the Pocono sandstone is locally impregnated with manganese oxide. The source of the manganese is, in most cases, the basal ore-bearing beds of the Mauch Chunk red shale.

BOGS. Throughout the plateau country of northwestern and northeastern Pennsylvania there are numerous old and some growing bogs which contain mixed manganese and iron oxides. The bogs are rarely more than 100 feet in diameter or 10 feet in depth. The manganese content has a maximum of about two per cent. In northwestern Pennsylvania, the source of the manganese is probably in the overlying iron-bearing Mercer beds.

MAUCH CHUNK SHALE. The second most important single horizon in Pennsylvania that bears manganese minerals is the basal Mauch Chunk red shale of Bedford and Fulton Counties.

The ore occurs as psilomelane replacements along thin shale laminae and massive bedding. At one locality, in Sherman Valley south of the Broad Top coal field, an open cut exposes two ore zones.

1. An upper zone, one foot thick, of high-grade psilomelane ore bearing 45 to 50 per cent of manganese.

2. A lower zone, 10 feet below the upper, which is three to four feet thick and contains about 18 per cent of manganese. This bed consists of mixed psilomelane and limonite.

Manganese oxide also occurs as thin films of wad and pyrolusite along joint planes between the two zones.

All the beds dip 18° NW. The source of the manganese is uncertain; it may have been in sandier phases of the Mauch Chunk shale which occur sporadically throughout the formation.

UNDERCLAY. Sandy clay under the middle coal of the Bernice coal field in Sullivan County is impregnated with and partly replaced by black manganese oxide which is probably wad, possibly pyrolusite. The clay contains less than five per cent of manganese. Source of the manganese is unknown.

SUMMARY

Supergene deposits of manganese oxide occur in twelve different stratigraphic horizons of the Paleozoic rocks of Pennsylvania. Most of the deposits are replacements or fracture fillings. Though the manganese minerals are, for the most part, of mineralogic interest only, the occurrences in the Tomstown dolomite, the Gatesburg dolomite, and the Mauch Chunk shale are of sufficiently high grade to be possible commercial deposits. Exploration work to determine the quantity and extent of ore would be necessary to prove their value.

DR. ANTOINE F. SAUGRAIN, PENNSYLVANIA'S EARLIEST MINERALOGIST

WAYNE F. O'NEILL
Bethlehem, Pa.

Chilling tales of intrepid adventure with the Indians and an amazing story of a gentleman of Science were unfolded by a brief article (3) * handed to the author by Allen Barthold, head of the Romance Language department at Lehigh University. Further research revealed this gentleman, Dr. Antoine Francois Saugrain (De Vigni), as an able and learned man possessing an astonishing knowledge of earth's mysteries.

Saugrain was born in Paris on February 17, 1763. Little is recorded of his early years, but it is known he was well schooled in chemistry, mineralogy and physics. His scientific background served him well in his later travels and explorations in this country, for, in succeeding years, he was to trek through much of the wilderness of the western part of Pennsylvania and finally to join a party of French settlers who founded Gallipolis on the Ohio river.

In the two years preceding his work in Pennsylvania, our Doctor-Scientist was in the service of the King of Spain (5), examining mines and mineral production in Mexico. Upon concluding his mission there, he sailed for France, but was soon at sea again, bound for America and the life in the wilds that he loved. When he arrived in this country, he set out on the long journey to the Ohio valley where he and M. Piquet, a botanist friend, intended to study the flora and search for a feasible site for the establishment of a French colony. The cold of winter overtook them at

Fort Pitt, and here they were forced to remain until Spring. Thus Saugrain's brief mineralogical search in this vicinity was carried on during the period from October, 1787, to March, 1788, when he delved deeply into the mineral resources of the area.

Staying in an abandoned cabin a few miles from the fort the two men spent the winter, suffering greatly from the cold, living on venison and potatoes, but busying themselves nevertheless with all manner of scientific works. Saugrain examined mines and pits in the neighborhood and found iron, lead, copper and silver. "He set up a crude laboratory, built a furnace, collected and assayed many samples of ore, and briefly made the first scientific survey of the mineral wealth of the Pittsburgh region." (3)

Hair-raising adventure attended their journey onward in the Spring, ending in Piquet's death when Indians attacked them. Saugrain struggled six days through the forests, his foot in a gangrenous condition, finally reaching Fort Steuben. While recuperating from his experiences, Saugrain again set up a laboratory and built furnaces to assay minerals. He says of himself at this time, "I have here the reputation of a great mineralogist, and, as I found at Fort Pitt a little silver in a lead mine, they believe in this part of America that I am going to find all the gold of Peru. So, they bring specimens in abundance, and the greater part are only iron or copper pyrites. There is a lead mine here that yields abundantly but with a considerable quantity of bismuth." (2, 6). He made fixed alkalies for the doctors at the fort, amused the settlers with electrical experiments, and made thermometers and barometers in his spare time. Having found some stones encrusted with sea shells, he wrote, "There is no doubt in my mind that all this country has been covered by the waters of a sea or has been a lake." (2)

No mention has been found in geological literature recognizing Saugrain's mineralogical investigations in the Pittsburgh area, but surely we can credit this remarkable man of science with some of the earliest study of the mineral resources of Pennsylvania.

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*Numbers in parentheses refer to references at end of this article.

A SIMPLE DEVICE FOR MEASURING THE COEFFICIENT OF RESTITUTION OF SMALL SPHERES

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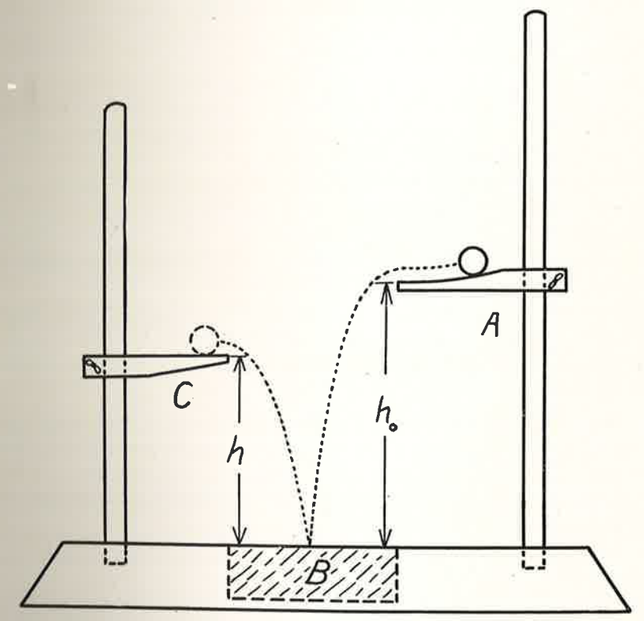
Elastic impacts are closely associated with several important problems in physics and form the basis of a number of interesting laboratory experiments, one of which is the determination of the coefficient of restitution.

For two given materials, impinging against each other, the



ratio of the velocity of separation after impact to the velocity of approach before impact is constant and is independent of their masses and their velocities within reasonable limits. This interesting relation was discovered by Newton, and is called the coefficient

of restitution. It is sometimes called the coefficient of impact.

If one of the masses is very large by comparison with the other, its velocity change after the impact can be neglected. Thus, a small sphere, dropped from a height h_0 on a large flat block would have a velocity of approach given by:

$$u = \sqrt{2 g h_0}$$

If the ball rebounds to a height h after the impact, it would have a velocity of separation given by

$$V = \sqrt{2 g h}$$

The coefficient of restitution is then given by:

$$e = \frac{u}{v} = \sqrt{\frac{h}{h_0}}$$

One difficulty in some forms of this experiment has been the determination of the height of rebound, h. A simple device which avoids this difficulty is shown in figure 1. The device consists of a small chute, A, whose height h above the steel block B can be varied, and a platform C whose height above the block is adjusted to the maximum value for which the ball can land on the platform. The chute, A, which gives the ball a slight tangential velocity is circular in form so that at the point of projection, the ball moves horizontally, the velocity of approach thus depending only upon the force of gravity and the distance of fall h. By varying the distance of the chute from the block, several sets of observations can be made.

An interesting check on the preceding method was developed as follows: If a ball having a coefficient of restitution e, falls from a height h, on a smooth plane of large mass, and continues to oscillate until it finally comes to rest, the total distance traveled by the ball can be shown to be:

$$D = h \frac{1 + e^2}{1 - e^2}$$

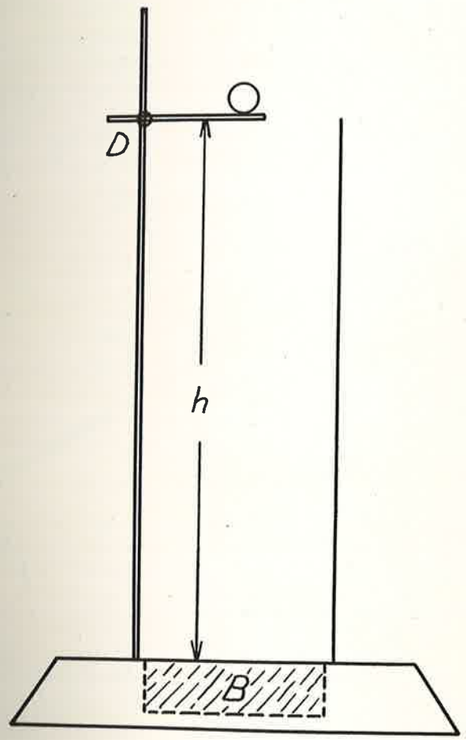
and the total time required for the ball to come to rest given by:

$$T = \sqrt{\frac{2 h}{g}} \frac{1 + e}{1 - e}$$

By measuring the time and solving the above equation for e, the coefficient of restitution is obtained:

$$e = \frac{T - \sqrt{\frac{2 h}{g}}}{T + \sqrt{\frac{2 h}{g}}}$$

To measure the time required for the ball to come to rest, a

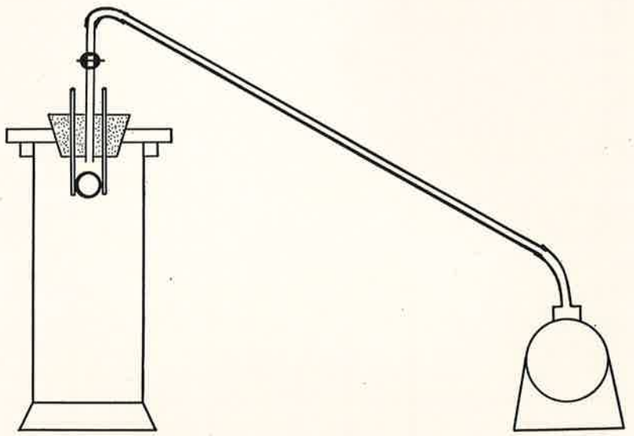


smooth tube having a diameter about that of the steel block was mounted as in figure 2. A trip platform was fastened to the tube so that the ball could be released at a known distance above the block. The ball was assumed to be vertically at rest when the

sound of the impacts cannot be heard. The following table compares the average values for the coefficient of restitution by the two methods for a golf ball and a ping-pong ball.

Type of Ball	Coefficient of Restitution First Method	Second Method
Golf Ball	0.85	0.84
Ping-pong Ball	0.91	0.89

The distance used in the first method was 20 cm, while in the second the distance was 50 cm. The air resistance to the motion of the ball introduces a noticeable error unless the distance the ball falls is small. This is especially marked in the case of the light ping-pong balls. To determine the amount of this error, the coefficient of restitution for a ping-pong ball was obtained at a reduced air pressure of about 10 mm of mercury. The second method mentioned above was used, modified as in figure 3.



A glass cylinder about 14 cm in diameter and 30 cm high, having a flat ground rim, was sealed by a flat plate having a large rubber stopper in the center through which the air was evacuated. Two small rods were sealed through the stopper near edge and were used to control two metal strips which served as a clamp to hold the ball at a fixed distance above the bottom plate and to release it at a given instant. By sealing the rods in the stopper with flexible rubber cement, the slight motion of the rods could be accomplished without permitting air to enter the cylinder. A small vacuum pump was placed several feet away from the cylinder and connected to it by a combination of glass and rubber tubing. The seals were poor and when the cylinder was cut off from the pump, the pressure would rise from 10 mm to 50 mm of mercury in from 5 to 10 minutes. By running the pump continuously, a pressure of about 8 mm could be maintained.

In order to prevent the effect of a relative change in pressure on the inside and outside of the ball, several small holes, 1 mm in diameter, were drilled through its surface. Drilling the holes did not change the coefficient of restitution at atmospheric pressure.

The following is a typical set of readings for the time of oscillation, the distance of fall being 22.5 cm. The cylinder was sealed off from the pump. The time is in seconds.

5.2	5.2	5.0	4.8	4.6	4.4
5.4	5.2	5.0	4.7	4.6	4.4
5.4	5.0	4.8	4.8	4.4	4.5
5.2	5.2	4.8	4.6	4.6	4.4

It required 14 minutes to obtain the above readings. The pressure changed from 10 mm to 50 mm in six minutes. The pressure at the end of the observations was more than 50 mm but definitely less than atmospheric pressure.

The air was allowed to enter the cylinder and a set of readings taken, the time of oscillation in seconds for several trials being as follows:

4.0	4.2	4.2	4.2	4.0	4.2
4.2	4.0	4.2	4.0	4.1	4.0

The pump was then operated continuously and the pressure reduced to 8 mm of mercury. The time of oscillation was then found to be as follows.

5.2	5.4	5.2	5.2	5.0
5.2	5.2	5.4	5.3	5.2

As seen from the above values, the effect of air resistance on the time of oscillation was to decrease the time by 20%. The effect of air resistance on the coefficient of resitution was only about 2%, changing from 0.92 at a pressure of 8 mm of mercury to 0.90 at atmospheric pressure. If, however, greater distances were used to obtain more accuracy, the effect of air resistance would become more pronounced, especially in the spheres of low density.

A NEW A. C. pH ELECTROMETER

H. C. O'BRIEN
Duquesne University

A pH electrometer is a device which indicates from potentiometric measurement the hydrogen ion concentration of a solution directly in pH units.

Of the various methods of pH measurements the glass electrode system combines the greatest accuracy, flexibility, and ease of operation. This electrometer was designed to embody the following features: (1) A reasonably rugged glass electrode and calomel half cell system. (2) A standardized potentiometric measuring circuit with a direct reading scale of 0-14 pH including an enclosed Weston standard cell, a simple temperature compensator in the potentiometric circuit and an accessory potentiometer for balancing out the combined calomel half cell and as symmetry potential of the glass, permitting calibration of the system by means of a buffer. (3) A single, sensitive, stable A. C. vacuum-tube galvanometer as balance indicator.

GLASS ELECTRODE

The electrode proper consists of a thin walled glass bulb, which is blown on the end of a glass tube the whole containing hydrochloric acid of approximately 1 pH.

The resistance of this membrane is approximately twenty megohms. A quinhydrone electrode in this solution forms the electrode terminal. The pH response of the assembly is now generally considered to be due to the direct transfer through the bulb of $(H30)+$ ions which impart a charge depending upon their concentration. Voltage measurements are made in the usual manner between the inner quinhydrone electrode and a calomel reference electrode immersed in the test solution.

THE CALOMEL CELL

The calomel cell was made from a test tube with a capillary contacting arm welded on the side to dip into the solution to be measured. A small amount of mercury is placed at the bottom of the tube. On top of this a thin layer of mercury and calomel paste is placed; the remainder of the tube and contacting capillary arm are filled with potassium chloride and calomel solution. A contacting platinum tip electrode is submerged in the mercury in the bottom of the tube. The capillary arm then becomes the means of contacting the solution to be measured. It develops no potential with the solution, however, the calomel cell itself develops a reference potential which varies somewhat with the temperature and saturation of the KCL solution. At 25 °C with Sat. KCL the potential is .2458 volt.

POTENTIOMETER DESIGN

The potentiometer circuit of the pH apparatus was designed to cover 0 to 14 pH units in Voltage standardized with a standard cell and to include a novel method of temperature compensation. It was designed so that its circuit used but a small amount of current, ensuring stability. An accessory potentiometer, somewhat simpler was provided to balance out the calomel cell and as symmetry potential and permit buffer calibration of the unit.

The following table gives a picture of the millivolts drop per pH unit at different temperatures.

TEMPERATURE °C	MU. DROP ON 0-14 PH SCALE	MU. DROP PER PH UNIT
15	799	57.1
25	826	59.1
35	855	61.1
45	883	63.1

VACUUM TUBE NULL-GALVANOMETER

The null-indicating device or instrument by which it is determined that the potentiometer voltage exactly balances the glass electrode voltage must be a high resistance instrument and sensitive enough to detect very few millivolts through the high resistance of the glass electrode membrane. Necessarily the glass which is suitably selective to hydrogen ions is passing a current. The magnitude of this current must be exceedingly minute to prevent polarization and consequent IR error. A current of only .0001 microampere causes polarization. Therefore, a high resistance meter is a necessity and if it is sufficiently sensitive permits measurements with negligible IR drop through the glass membrane.

A vacuum tube amplifies small changes in grid potential in the form of plate current changes. Depending upon the conductance and other tube characteristics certain vacuum tube circuits may be chosen as suitable amplifying and indicating devices.

The general trend has been toward the use of two or three stage vacuum tube voltmeters as null indicators.

Such V. T. meters for this purpose are usually battery type being portable and stable.

The A. C. type tubes offer more advantages in characteristics

favorable to a V. T. null-indicator. A. C. operation if made possible by voltage regulation of the "B" supply also obviates the use of all but two small dry cells. In this electrometer advantage was taken of the high mutual conductance of the type 1852 tube, ie. a greater change in the plate current meter ensues for a given change in the input grid voltage than in any other suitable commercial tube. A single tube of this type furnishes sufficient sensitivity.

Voltage for the 1852 is supplied from the A. C. by an '80 rectifier and regulated by a VR105. A square 4" 0-1 ma. milliameter is used as balance indicator.

The pH vacuum tube galvanometer operates as a null-indicator, ie. at any input load resistance the meter current remains the same so long as no voltage appears across the input terminals. This is the condition of potentiometer balance with the cell chain.

When the input grid hangs free it assumes a potential with respect to the filament. This potential may be thought of as due to residual grid current in the tube, since current does not flow unless a potential exists. When the free grid assumes a charge (usually positive to the filament) due to bombardment by electrons a minute current flows from the grid to the filament, through ions in the air, through the glass of the envelope and through the insulations of the tube. These factors may be minimized but not eliminated.

To obtain a null-instrument the free grid potential must be balanced out. This is accomplished with a balancing potentiometer which brings the low input terminal to a potential away from the filament but in an opposite direction so the filament potential is the null point and the input terminals are equidistant from it. A shorting switch is used in adjusting for null point. This and the standard cell switch must have good insulation material since the indicator is very sensitive to small potentials even through high resistances.

By means of the plate balancing resistor the meter is maintained at ½ scale deflection. It is upset similarly to a bridge when plate current flows. A negative grid voltage on the 1852 swings the meter to the right. The null galvanometer is more than sensitive enough to detect .1 pH unit through* membrane of 150 megohms. All parts other than electrodes are built into a 7" x 14" gray metal cabinet.

* Wiring diagram furnished on request to author, H. C. O'Brien, 990 4th St., Beaver, Pa.

BOTTLED SPEED

ROBERT T. HANCE AND HAROLD C. O'BRIEN
Duquesne University and Rosco Laboratories, Inc.

Speed up production has been dinned into the ears of the nation for the past several months by radio, press and word of mouth. To get this greater output two methods have been emphasized. The workers must work longer hours and more machine tools must be made so that the unit production can be increased. The latter is, of course, based on the correct assumption that a machine is limited to a certain rate of operation. However, few machines in service ever achieve the potential speed that their makers have built into them. This, in the main, is due to the great heat generated in the cutting and grinding of metals which, if not properly dissipated could ruin the stock, the tool, the machine or all three.

If this heat could be more efficiently controlled the effect on production would be equivalent not only to the addition of new machines in a ratio proportional to the increased output of the old tools now in service but also to more man hours from the same staff.

It is therefore with very real enthusiasm that the writers now announce the discovery of a fluid mixture that, properly used, so completely dissipates the heat of machine tool operations that the speed of these operations may be increased from 25 to 300 per cent. This increase can be achieved without mechanical or physical change in plant or equipment.

Heretofore, the heat generated in the machining of metals was controlled to some extent by the use of water, sulphonated oils, lard oil and the so-called soluble oils. Water alone is objectionable because it may rust and in any case is useful in only certain types of operations. Lard oil is considered good but its cost and limited supply rule it out for anything but the most exacting work. Most of the other cooling compounds contain sulphur which causes severe skin irritation in many of those exposed to it. None of these compounds keep the work piece and the tool sufficiently cool to permit the machine to run at maximum capacity.

Metal cutting operations generate a temperature of about 600 Fahrenheit at the point of contact between the cutting edge and the stock, while 2400 develop in grinding. Any of the commonly used coolants will, of course, materially reduce these temperatures

but frequently not below the point where the metal being cut is blued by heat. These high temperatures not only injure the structure of the metal and prevent working to close tolerances (due to the expansion of the metal stock and tool) but hot chips flying from the cutting tool are very real hazards to the workmen.

Our cutting compound can be made in concentrated form which in use may be diluted from twenty-five to three hundred times. In factory tests and in continuous operation for over five months, it has kept every kind of metal cold. With the use of currently available cutting compounds, to increase the speed of operation is to *increase the development of heat.* However, with our new coolant mixture faster speeds *increase the cooling.*

Since, with certain limits, increased speed of operation results in better finish, the use of our coolant permits not only the greater output already stressed but the finish in many cases is improved. This has, in some instances, justified the elimination of certain finishing operations.

The theory behind the action of this new coolant is based upon a multiple phase system each part of which contributes to the function of the other. The whole system automatically absorbs and quickly releases the heat from the machined stock and the system is instantly "rewound" or restored to the state in which it can again absorb more heat.

The general characteristics of our new coolant have been found in actual service to be as follows:

Keeps the machine, tools, and stock COLD at INCREASED SPEED and FEED.

Counteracts many other destructive effects of machine tooling.

Gives superior cooling under high temperature conditions.

Permits the fastest cutting on all types of stock that has ever been possible.

Affords new opportunity with the respect to the grinding and shaping of tools.

Eliminates the expansion of tool or stock, permitting closer tolerances.

Will prevent accidents due to hot chips or coils.

Keeps the machine, pump, and supply lines CLEAN.

Removes all old oil, grease, grit, metallin particles and dirt.

Is clean for the machinist to handle and does not cause skin irritations.

Gives longer tool life, lessens the frequency of tool sharpening, keeps grinding wheels clean and reduces the number of times they have to be dressed during a work shift.

BETWEEN THE ACTS

W. A. ROYSTON, JR.
Rosco Laboratories, Inc., Blawnox, Pennsylvania

It is a distinct privilege to relate conclusions drawn from forty years experience and present engagement in research, production, trade, as consumer and negotiator between th acts. One would betray that privilege if he did not cherish the hope that the light of at least one small experience would brighten the way for a weary fellow traveller.

The title assigned this subject may at first seem rather misleading when the matter under discussion deals with the translation of the products of research into human progress. Usually, "between the acts" at the opera is a period of relaxation for the audience, but not so for the scene shifters, upon whose shoulders fall the responsibility of creating the proper atmosphere for the portrayal of the next act.

All the world is a stage and as the curtain lifts each day, the student of history settles back as if to say "I've read this story many times, but the press notices indicate that this is a Hollywood production and not a stock company."

The playwrights and stage managers of our modern war drama have made the most colossal mistake of all times in underestimating the audience who though stunned by the audacity of the first act, have risen enmasse determined to rewrite, stage and finish the play.

The public must be served; it is slow of motion, always preferring the line of least resistance and the even tenor of its way. The public is suspicious of any innovation whether it be good or bad; most tenacious in holding any possession it has acquired and mighty in its wrath against evils thrust upon it.

Every vocation must serve a human need or desire to be worthy of the time and effort. Every worker must find in his task, not only the means of livelihood but the avenue of expression of his

highest ideals. Here lies a basis for a union in which all capital and labor could join, which would not tolerate injustice nor slavery. Of such brotherhood the watchword could well be "AND"; and the fraternal handclasp signify "YOU AND I."

"AND" means joined or interdependence. "Between the Acts" means "AND"; after the new stage is set, the play will go on.

The world has often witnessed great dramas staged by science and industry. Ofttimes the first act has been played by the researcher in presenting a discovery or invention that would revolutionize human habit and prove to be a public benefaction, yet the applause has been so silent that the actor thought he had lost his hearing, and industry has refused to go on for the second act. Why? The actor for the part to be played between the acts has not been employed or had failed in his duties.

The steam boat, railroad, telegraph, telephone, wireless, automobile and the Saturday night stationary bath tub had to be SOLD to a public that wanted none of such contraptions. Perhaps the most outstanding example of the reluctance to adopt new ideas is shown in our haste to produce thousands of airplane bombers and fighters, after enemy salesmen proved that our battleships were not safe on the high seas without protection from the air. This present war will not be won with the implements, the methods or the materials that prevailed during the last one.

Denied by the priority system of many critical materials the cry goes out for this and that synthetic or substitute and appealing eyes are turned toward the research laboratories. But don't expect a normally skeptical public to accept, willy-nilly, any substitute, until proven. But the public can eventually be sold something that satisfies its needs or desires.

The Executives in industry are generally men of vision ever on the alert in investigating new methods and materials in order to keep abreast, if not ahead of competition. This attitude toward new methods and materials fades out gradually with the diminishing rank of the employee, until we reach the lowest class of labor that is interested only in his own pay-day. However, the backbone of industry comprised of the shop foremen and skilled mechanics who have won their spurs by faithful performance and strict adherence to successful established practice, is the least susceptible to any change. These fellows are so jealous of their recognized abilities, and rightfully so, that they are very apt to resent and

resist any suggestion that their workmanship may be improved by new methods or materials.

It becomes more and more evident that good salesmanship must not only become the shock absorber between research and industry but the spark plug, as well as the spark, to bridge the gap. As salesmanship can be no better than the salesman, perhaps we had better examine the required qualifications.

He must be a student of public relations, market trends, supply and demand, etc., must have wide acquaintance with industrial leaders and have an established reputation for square dealing.

He must have a sympathetic understanding of the temperaments of those with whom he is to deal as well as an intelligent grasp of the subject to be discussed.

He must be an ambassador of good will bringing good news; conservatively enthusiastic, forceful, positive, but without giving offense.

He must be possessed of that quiet dignity born of self confidence, not egotism; that kind of courtesy that overlooks no little detail and tact that dominates every circumstance.

If he is also a mind reader and a prophet, so much the better.

You say there is no such animal and you are probably right, but nevertheless he must exhibit those qualities that inspire the utmost confidence in himself and have the ability to transmit that confidence to both sides of the deal or it is unlikely that an equitable negotiation will be consumated.

Having established mutual confidence, the industrialist still has to be sold convincingly to induce him to adopt the laboratory brain child as an aid to increased profits, decreased costs, a safeguard to present investments or as a betterment to his competitive position. He must be approached as a business man and not as a philanthropist.

The ultimate goal in business is consumer satisfaction which creates the Good-Will upon which business depends for continued success. Consumer satisfaction can and must be considered and anticipated before capital can be interested in investment.

Goods and services which create capital, are end products of research, ancient and modern, which produced the ideas, discoveries, inventions, plans, methods and processes.

In the final alaysis it can be shown that science and industry,

men and materials, are interdependent in the service of human welfare.

The great drama of consumer satisfaction has been going on since the beginning of time. True the scenery has changed, but the acts, characters and the lines are much the same.

During the past several months when it has fallen to my lot to play educator to the manufacturer concerning the new machine tool cooling fluid just described by my colleagues, Hance and O'Brien. Failures have naturally occurred between successes and had to be analyzed to determine whether the machine or the principle on which the coolant operated was at fault. Rather more rapidly than is usually the case the successes were becoming more regular and spectacular new production records are being made. No little of the rapid development of this new fluid has been due to the interest and patience of the manufacturer that gave us all time to secure the desired results. Without this encouragement and the opportunity to use production machines we could have gone ahead slowly, if at all.

BLACK-OUT AND CAMOUFLAGE

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Believe it or not, we are at war; an all-out war in which the battle lines reach to the hearthstone of the humble dwelling. That it "can't happen here" is an attitude of neglect as well as an open invitation to the enemy to attack without meeting resistance. All-out war calls for all-out defense and all-out offense.

All-out defense of our homes and production plants is a strategic war measure and the first obligation of the stay-at-home contingent in support of the fighting forces. The war must end if the production line fails.

The art of camouflage has been practiced in warfare even before the day of the Trojan Horse, but there was never a time at which the practice was more necessary, with the possibility of demolition and incendiary bombs dropping from the sky on defenseless objectives.

The highly developed art of aerial photography, using the infra red film makes reconnaisance flights the basis for a picture gallery in the enemies camp. With a picture before him and marked with his objective, the Bomber pilot sets his course. With surprising accuracy, the destructive shell can be launched.

The reconnaisance flight and aerial photography is being used in preparation for camouflage. The aerial photograph in the hands of the skilful artist becomes the working model for camouflage. By the use of the imagination plus paint, grass, trees, shrubbery, either real or fake and sometimes by the erection of skeleton buildings, a production plant may be made to resemble from a birds-eye view, a farm or village, or vice versa. Anything is good defense that deceives and misleads the enemy in directing his aim away from a vital industry, better if the enemy plane can to lead within range of anti-aircraft guns.

Defense camouflage is not for the amateur, who may often do more harm than good. It calls for the master artist to design and execute the camouflage that will deceive the eagle eye of the trained flyer or the sensitive infra red film.

Even the best camouflage will be ineffective if window glass is not sufficiently veiled in some manner so as to prevent the penetration of artificial light from the interior. If no other means is adopted, neglect to Black-out is inviting trouble.

The dark night is the most favorable time for an air raid and a well illuminated manufacturing plant is the hunter's delight.

The ultra modern plant has no windows, depending upon artificial light entirely and upon air conditioning for ventilation. It therefor seems advisable to adopt this principal for the duration of the war and Black-out all existing plant windows. Plants now working three shifts, twenty-four hours per day, report no noticeable difference in the production of each shift. It appears perfectly reasonable under the circumstances to declare constant "night time" within the plant and let daylight saving apply to other more useful purposes.

Where it is possible to cease all activities during an air raid alarm, the simplest method is to turn out the lights. However, this simple procedure should be planned carefully. Concealed lights should be arranged to afford sufficient light for free movement in emergencies; stairways and such hazardous possibilities should be made reasonably visible by lighting or luminous paint. Quick access to gas, water and electric supply lines should be provided against emergencies. All means of exit should also be planned and marked.

While opinions differ, prominent lighting engineers seem to

agree that as applied to glass, dim-out coatings are superior, in that they permit light to filter through sufficiently to guide those in close proximity, yet to be invisible from a comparatively short distance away. Others favor total black-out.

Asphaltum base coatings can be made to serve either theory; out of the same container. Applied in a thin coat and a dull red glow will be visible for only a short distance, but applied in a heavy coat and total black-out will result. Skilled workmanship is not required; a trial application to one pane of glass is all the experience necessary.

All coatings should be applied on the exterior to avoid a mirror effect and therefore it is important that the coating have good weathering qualities and show great resistance to atmosphere laden with acid dust and fumes. Of course the coloring must be inconspicuous.

No one at this time can predict *when* the war will end although all of us are willing to say *how* it will end. By preparing for a long war, we may possibly hasten the end.

And so durability of black-out coatings are important from the standpoint of cost of labor and materials. Asphaltum base coatings are inexpensive and are readily applied by unskilled labor and will give long service.

When the necessity no longer exists, this type of black-out can be removed as readily as it was applied. First applying a petroleum solvent to soften the film, the black-out coating may be removed with rags or waste. The coating will resist removal by almost any other means. When the coating is removed, the surfaces will be found in the same condition as when the coating was applied.

THE ROMANCE OF ASPHALT

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The word romance has several meanings. It may be a fictitious tale, such as a novel or just a plain falsehood but it has another definition that accounts for its use in the present instance; romance is an imaginative habit of mind, tending to dwell on the unusual.

The word asphalt comes to us from the Greek through the Latin and French to English. Its original meaning was firm, stable, secure or to secure. The oldest recorded use of asphalt is for cementing or securing things. It is because of the prehistoric age of asphalt, the innumerable uses for which it has been employed, its place in early literature and its benefits to mankind that there is created a romantic atmosphere that continuously excites the imagination.

In presenting a brief history of asphalt may it be considered as having two purposes, that of giving pause to pay tribute to its service and to encourage the efforts to release for the benefit of human welfare many secrets still remaining locked within its structure.

The Rancho-la-Brea asphalt pits in Los Angeles County, California, provides one of the most interesting studies of asphalt. From these pits there have been excavated trunks of trees, mastodons, mammoths, the giant sloth and numerous other species of animal and plant life, all now extinct. These skeletons have been marvelously preserved and there age is placed by archeologists as belonging to the Glacial Period, at least 25,000 years before the advent of man upon the earth.

Many old tablets and carvings are now in museums of Paris in evidence of man's early use of asphalt.

About 3000 B. C., the Sumerians used it as cement for decorating their stone carvings with shells. The Persians, about 2,500 B. C., cemented the jeweled eyes in statuary, and used drinking vessels carved out of rock asphalt.

The Egyptians used asphalt in preparing their mummies which is the earliest record of a religious use. The early use of asphalt by the Egyptians was primarily for the purpose of preserving forever a considerable portion of the deceased in order that all of the parts could be more readily gathered together and reassembled in the same individual in the life to come. Many of the treasured articles removed from King Tut's tomb in 1923 were preserved by asphalt impregnation.

Assyrian kings built dikes to keep the Tigris River out of Nineveh. U. S. Army Engineers use asphalt mats to keep the Mississippi River out of New Orleans.

Ur of the Chaldees had gutters lined with asphalt, built 5000 years ago, and they are there now. The Babylonians were experts in the use of asphalt. Excavations reveal that Babylonian pavements, public baths and burial vaults were built of asphalt mastics.

One of the Gildamish tablets, 2500 B. C., tells of the story of the Babylonian flood and records that the inside of the boat was coated with six coatings of asphalt and the outside was coated with three coats. The Old Testament tells of Noah "Pitching the ark to render it watertight." The Tower of Babel was built of "brick for stone" and "slime" for mortar. Moses' basket was daubed with slime and pitch. This seems reasonable as most of the early dugouts or boats were daubed in this same manner, to keep them watertight.

Recent excavations in Northwestern India show that an asphaltic mastic composed of a mixture of asphalt, clay, gypsum and organic matter was installed between two brick walls in a layer about one inch thick for water proofing purposes. Here again we find a bathing pool in front of an ancient temple probably for ritualistic cleansing purposes, made of asphalt mastic.

There are many old references as to the use of asphalt for medicinal purposes. The medicines were sold under the name of "mumia," which in many cases were asphalt actually scraped from the mummies taken from tombs. Its alleged curative purposes were explained by the fact that it preserved the dead for so many centuries. It was recommended for curing boils, inflammations, coughs, asthma, etc. The early Greeks prescribed the drinking of bituminous water as the best remedy for dropsy and from Asia Minor comes a story that asphalt diluted with water prevents loose teeth from falling out and among other things, it cures magical illusions and evil incantations and was often used in love potions.

According to an ancient Assyrian code, asphalt was poured upon the heads of delinquents in molten state.

Asphalt was also used in warfare and was called "greek fire." A mixture of sulphur, asphalt, sand and quick-lime was enclosed in a bronze vessel, which would ignite spontaneously by the simple addition of water. This device was used to burn the walls and capture cities.

So down to modern times asphalt has been in continuous use.

Asphalt was used for the sidewalks at the Merchants Exchange Building in Philadelphia in 1838 and soon thereafter, asphalt road ways were layed in Washington, D. C., and then the use as roofing material was modernized.

Asphalt is found scattered in all parts of the world. There are the native rock asphalt, the lakes asphalts, found at Bermudez Lake

in Venezuela, and the famous Trinidad Lake. Thousands of tons of asphalt are produced yearly from crude petroleum.

Of the ancient uses of asphalt there still exists, in these days, the uses with which we are all familiar, such as paving, water proofing and roofing mastic, but it is also interesting to point out a few of the lesser known present day uses of asphalt.

Rubber heels, rubber tires, rubber hose, rubber insulated wire, and most black rubber goods contain as much as 15 to 20% asphalt. Cracker boxes, salt cartons, etc., frequently have a layer of asphalt between the layers of paper to keep the moisture in or out. Many industrial brushes have their fibres set in place with asphalt and many of the attractive labels on beverage bottles are accomplished with metallic pigments in an asphalt vehicle.

The box toes of shoes, floor mats, battery boxes, all contain more or less asphalt.

The present day use of asphalt in the manufacture of corrosion resistant coatings for metal is perhaps one of the most important applications of this wonderful substance. Of equal importance is the asphaltic treatment of concrete by impregnation and other processes for water proofing and preservation.

It is accomplishing its worthy purpose in manufacturing, railroads, mining, agriculture, shipping, public utilities, in fact in all industry. Some of the native pyrobitumens show the greatest resistance to acids, alkalies and electrolysis, and there is a constantly growing demand for coatings for the protection of critical materials in process, storage and in transit. So effective can asphaltic coatings be made that its use provides a further benefit in saving cargo space, so vitally important in the service of supply during this war. Products have been developed to provide the only protection, eliminating wrapping and boxing of steel products for export shipment, thus eliminating the necessity for excess cargo space. Asphaltic coatings, being readily soluble in oil can be readily removed by petroleum solvents, leaving the surfaces of the steel products in the same condition as before receiving the coating. This is practically all the unpacking necessary to make the products immediately available for the assembly line or other intended use.

Asphalt is finding other worthy uses in substituting for critical war materials, such as tin, and zinc for many purposes that were heretofore unexplored. While any announcement at this time would be premature, there is reason to predict the use of an as-

phaltum base coating as a rubber tire paint, which gives promise of doubling the resistance against atmospheric attacks on tires particularly when not in active service.

The relation that asphalt bears to other similar hydrocarbon substances gives rise to the thought that many of its possibilities remain to be explored and will be ever open for further investigation.

AN ASYMMETRICAL UNION OF THYROID AND THYMUS IN THE CAT

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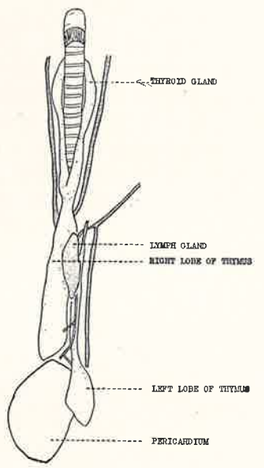
A dissection specimen secured from one of the biological supply companies during the fall of 1941 showed an unusual connection between the thyroid and thymus glands. While a connection between these glands is not at all unknown, this particular case was so marked as to seem worth a description. In fact, a superficial examination suggested complete fusion of the right thyroid lobe with an ascending limb of the thymus. The specimen was a fully mature female but its slightly smaller size indicated that it might have been somewhat younger than the others in the same group.

The thymus gland of the cat is normally located in the anteroventral part of the thorax within the mediastinal septum. Its size is variable but usually it is not larger in adults than about 45 millimeters in length by 10 millimeters in diameter. It is a bilobed structure but such a condition is not always recognizable in the adult. Ordinarily the thymus extends from the anterior wall of the pericardium to the level of the first or second intercostal space.

The thyroid gland of the cat consists of two lobes, each lying on a lateral aspect of the trachea dorsal to the lateral margin of the sternohyoid muscle and just caudad of the larnyx. The two lobes are usually connected at their caudal ends by a median lobe or isthmus that passes ventrado of the trachea and in close contact with it. Each of the lateral lobes is an elongated and flattened mass, rounded on the ends and approximately 20 millimeters long by five in diameter. The cranial end of the gland is at the level of the caudal border of the cricoid cartilage.

The thyroid and thymus glands have distinctly separate embryonic origins. The former developing from the ventral floor

of the pharnyx as an entodermal groove that evaginates in the midplane at the level of the first pharyngeal pouches. The thymus, on the other hand, is derived from the region of the third pharyngeal pouches and sometimes from the fourth also. Each of the pharyngeal pouches in this region develops a ventral sacculation. These primordia are then set free and give rise to the paired thymus gland. Hoskins and Chandler (1), Arey (2), and Gray (3), as well as others, have pointed out that the thymus may occasionally be connected to the thyroid even in the adult human. Such connections are usually mere thin strands of connective and thymic tissues.



In the case under consideration, the left lobe of the thymus was relatively large being 60 millimeters long, 11 millimeters broad at its caudal end and three millimeters broad at its cranial end and averaging approximately three millimeters in thickness. This lobe was located distinctly to the left of the median plane. The caudal end extended well beyond the anterior wall of the pericardium. The right lobe occupied a more median position and barely touched the anterior wall of the pericardium. It was 13 millimeters in diameter and at the level of the first rib bifurcated to form two ascending limbs, each five millimeters in diameter at its caudal end. The

right limb tapered to 2.5 and the left one to three millimeters at its cranial end. These ascending limbs each came into contact with the thyroid gland on its respective side. The thyroids appeared to be normal in every respect except for the union with thymic limbs. A closer inspection showed that the left thymic limb was distinctly separate from the thyroid, a narrow band of connective tissue being interposed. The right limb, however, was not so obviously separate and necessitated a histological study.

Studies were made of isolated sections taken from various levels throughout the entire thymus and thyroid glands and also of serial sections taken from the level of union between the right thyroid and the ascending thymic limb of that side. Comparisons of these sections with those taken from another specimen and prepared in the same manner showed that the thymus and thyroid tissues were quite normal and readily recognized. The study of serial sections revealed that a very thin but distinct band of connective tissue separated the thymus from the thyroid, even where they superficially appeared to be fused. A careful examination of the serial sections gave no evidence whatsoever of an intermingling of the two types of glandular tissue nor of any fusion between the glands.

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AN EASILY CONSTRUCTED AND ADJUSTABLE DISSECTION TABLE

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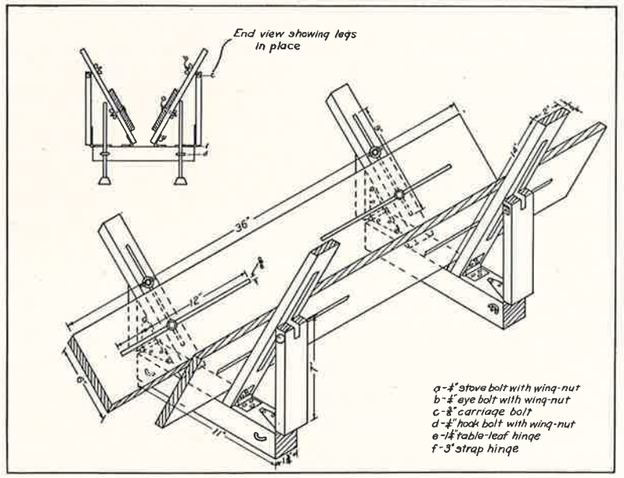
The high school biology laboratory, as well as that of the smaller college, is usually too crowded to permit the installation of dissection tables for work with the larger vertebrates such as cats and dogs. The experimental morphologist in a small college is also often handicapped by the lack of an operating table since it is too expensive an item for his modest budget and since it would occupy too much of the valuable space in his laboratory when not in actual use. The writer has devised the adjustable and easily dismantled table described below in an effort to solve these two major problems: economy and conservation of floor space. While it was

originally designed for surgical operations, it has also proved to be a great aid in dissection. The dimensions given in the list of *materials* have proved to be satisfactory for animals ranging in size from that of a large rat to that of a medium sized dog. In order to accommodate larger or smaller specimens it is only necessary to vary the dimensions accordingly.

This table is constructed primarily of pieces of scrap lumber to be found around the ordinary carpenter shop and is thus quite economical. The most expensive and hard-to-secure parts are the hinges and other metal accessories such as bolts and wing nuts. These have been secured at a neighborhood hardware store in part



and also in part at a small machine shop. The original design calls for 3-8 inch iron rods to serve as optional legs, but the present demands for such rods may make necessary the substitution of wooden dowel pins or other more readily obtainable material. Originally, the rubber tips for the iron legs were secured from the laboratory as number four rubber stoppers. However, such finishing touches as rubber tips are not essential to the satisfactory use of the table.

Quarter-inch slots cut into the side boards and also into the supporting pieces, as shown in the diagram, permit a wide range of adjustments to accommodate animals of various sizes and to

hold the specimen in any one of several possible positions. The use of legs that slide through hook bolts further facilitates adjustment of the tables' position. Such detachable legs permit one to use this table on top of another that may be either high or low as is most convenient. Rawhide thongs are used to secure the specimen to the table while administering the original anesthesia and to support the limp appendages of the anesthetized animal. These thongs are merely tied to the supporting pieces or to the side boards of the table. If desired, cleats could be fastened to the supporting pieces for the purpose of tying the thongs but such cleats have not been needed up to the time of writing.

LIST OF MATERIALS

LUMBER

2 pieces—1″ x 6″ x 36″
2 pieces—2″ x 2″ x 11″
4 pieces—1″ x 2″ x 7″

HARDWARE AND OTHER MATERIALS

2 pair 3″ strap hinges with wood screws
2 pair 1¼″ table hinges with wood screws
4—⅜″ x 2¼″ carriage bolts (no washers)
4—¼″ x 2¼″ stove bolts with wing nuts
4—¼″ x 2¼″ eye-bolts with wing nuts

OPTIONAL MATERIALS

4—¼″ x 2¼″ hook-bolts with wing nuts
4—⅜″ x 12″ iron rods for table legs
4—#4 rubber stoppers with holes to fit ⅜″ rods
16—¼″ iron washers

THE INCREASING IMPORTANCE OF GENETICS IN THE PREMEDICAL CURRICULUM

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It is a matter of common knowledge that the study of heredity has advanced by leaps and bounds into the category of a science. This forty-two year old science is recognized today as being in the forefront of biological pioneering. Genetics is now the most quantitative of all biological considerations. It closely approaches, if it does not already rank with, the physical sciences in its application of mathematical principles and has thus in the words of the late Raymond Pearl (1) "emerged ——— to take an assured place in the hierarchy of the established sciences."

In the development of this science to its present status of respectability a great store of knowledge has been built up. Most of the known facts have been learned by study of inheritance in the

lower organisms. Applications of this knowledge has permitted man to improve his domesticated plants and animals in many ways, even to the point of developing disease resistent strains. Yet in spite of all this detailed knowledge and its practical applications, man has been very slow to accept it in his study of himself. Morton Schweitzer (2) says "It appears somewhat strange that medicine should have been so slow to incorporate into its thinking the fundamental conclusions of genetics." Perhaps it is because of the lowly origin of so much of our genetic information that the layman and even the older practicing physician is so hard to convince that man obeys genetic laws also.

Dice (3), as well as others, has pointed out that the length of time between generations in the human, the complexity of inheritance of some characters, and the lack of control over matings have all added to the difficulty of accumulating accurate knowledge on the inheritance of man. It is, however, coming to be more and more widely recognized that much of mankind's suffering is due to certain defects that are either known to be hereditary themselves or are known to develop in the presence of susceptibilities that are hereditary. In the former case, when recognized, education can do much towards eliminating the condition in succeeding generations for the vast majority of people want to protect their children from unnecessary hardship. In the latter case, proper precautions to avoid environments that are favorable to the development of the defect or abnormality may permit an individual to escape entirely. That is, as Roberts (4) has pointed out, when a special hereditary susceptibility is known to exist earlier treatment can be instituted than might otherwise be the case. The great burden of responsibility for recognizing such inherited tendencies in a family and for advising the affected individual falls upon the shoulders of the family physician. Of even greater importance is the fact that the physician can do much in the way of increasing the knowledge of human heredity by keeping proper records and building up family histories that might be of outstanding importance to the trained geneticist. Such histories must necessarily include information gathered by medical examination of all members of the family and be published in medical or other scientific journals. Bauer (5) has recently published an excellent illustrative family history to show how inclusive such records need to be.

In spite of the great responsibility that is the medical man's for advising his patients concerning those conditions now known

to be hereditary and his peculiar opportunity to add to the present knowledge in this field, it is still only recently that the medical schools have begun to make attempts to acquaint their students with the basic principles and facts of genetics. Within the last few years an increasing number of these schools are providing isolated lectures on Human Genetics and still more recently others are even establishing full-time departments for the study of this important topic. Such an awakening to new demands is highly commendable and assures us that the medical profession is dynamically active. However, even a superficial examination of the medical curriculum shows us that no time is available for teaching elementary principles. It is already crowded to overflowing. How then can the physician of the future be provided with a thorough grounding in this phase of his work? Not only must he have a superficial notion of the principles but he must also be able to apply them in his practice. The answer to the problem lies in the preprofessional colleges. If the medical schools were to require a study of genetics for admission, then they would need only to give a supplementary specialized course in that field. A very few, if any, of the medical colleges have such a requirement for admission at present but some of the more progressive ones do recommend genetics as a part of the premedical work. It is stimulating to know that at least some, and perhaps many, members of the profession are advocating such a procedure as outlined above. For example, Spillman (6) in his review of Snyder's recent book on Human Genetics says "physicians of the future are going to have to know something about genetics and they must learn it in the arts and sciences required for entry to medical school."

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PRODUCTION OF MOTHER SPOROCYSTS IN *NOTOCOTYLUS URBANENSIS*

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Notocotylus urbanensis is a trematode belonging to the family Notocotylidae which is characterized by a complete absence of a ventral sucker and a pharynx. In the adult stage it is parasitic in the colon of muskrats and laboratory rats. The intermediate stages of *N. urbanensis* develop in snails of the genus *Physa.* and include mother sporocyst, mother redia, daughter redia and cercaria (Herber, 1939, 1940). After emerging from the snail cercaria commonly encyst on vegetation. When these cysts are eaten by suitable hosts the worms mature in the large intestine and eggs, deposited with the fecal material, containing miracidia infect the snail. In this communication a method for the production of early larval stages of *N. urbanensis* in *Physa gyrina* is presented.

P. gyrina, the intermediate host, is found in cold fresh water streams and lakes. These snails grow quite prolifically in water cress beds located near Carlisle, Pennsylvania. Found along the creek bottom and the under side of leaves and stalks of the water cress the snails were easily collected by the use of a fine mesh dip net.

In the laboratory large wide mouth jars were three quarters filled with cold stream water to which was added Elodea, aquatic moss and sand. Into each of these jars were placed 30 to 40 of the smallest specimens of *P. gyrina* taken from a group which had a natural infection of about 4 per cent. These jars were then placed on a north window sill at a temperature of about 70°F for several days before experimental infection took place. This lapse of time insured further development of the naturally infected snails so that they could be easily differentiated from the experimental infections.

For the collection of eggs adult specimens of *N. urbanensis* were found in startling abundance in naturally infected muskrats in this vicinity. The muskrat is a natural definitive host of this fluke and the adult worms are usually found in the folds of the large intestines. In this experiment 15 muskrats obtained from a Dillsburg, Pennsylvania, furrier were examined.

From these intestines were recovered 100 specimens of *N. urbanensis* measuring about 3 mm and having a pinkish appearance

making them distinguishable with the naked eye. These specimens shed eggs after being placed in watch glasses containing saline and were then torn up with needles in order to free the remaining eggs. When eggs are not fully developed they must be allowed to remain for a considerable period of time in culture dishes before they become infective.

With a clean pipette the eggs were distributed in approximately equal portions to each of the loosely covered jars which were then dated. Small pieces of lettuce and bits of liver were fed to the snails every 3 or 4 days for 30 days. After this period the snails were examined individually in watch glasses with the use of the binocular dissecting microscope. The bodies of the snails were teased with needles and the mother sporocysts were usually found in the tissue of the digestive gland. Some of these were collected with long narrow pipettes and fixed in warm Bouin's solution.

This successful method for producing large numbers of mother sporocysts of *N. urbanensis* can be adapted in many laboratories. In this particular experiment 50 out of 82 snails were experimentally infected. From these snails 184 mother sporocysts were identified. They were round varying from 0.03 to 0.17 mm in diameter and contained 4 to 8 mother rediae.

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PROCEEDINGS

of the

PENNSYLVANIA

ACADEMY OF SCIENCE

AUTHORS INDEX

VOLUMES I TO XV

1926 - 1941

THE FOLLOWING AUTHORS AND SUBJECT INDEXES HAVE BEEN PREPARED BY RALPH W. STONE, PENNSYLVANIA GEOLOGICAL SURVEY, WHO SERVED AS EDITOR OF THE MAJORITY OF THESE VOLUMES.

— A —
Anderson, J. E., VIII 7, X 75
Ashley, Geo. H., VI 91, VIII 7, XII 15, 88
Auten, J. T., I 57, III 43
Avinoff, A., II 68

— B —
Babb, M. J., VI 161
Beach, W. S., V 37
Beck, Lyle V., VII 183, 184
Behney, Wm. H., IV 25, VI 22, VII 110
Bell, Frank H., XV 207
Benkert, J. M., IV 97, VII 121
Benkert, Lysbeth H., VII 120
Bennett, Geo. W., XIV 20
Benson, Frances M., VIII 62
Bergstresser, K. A., X 112
Berman, Joseph, XII 89
Binkley, E. Raymond, V 34, VI 127
Bitner, W. P., IX 91
Blew, Michael J., V 127
Bolden, Frank E., X 114, XII 129
Bollinger, O. P., II 106
Bonine, C. A., III 18
Bosian, Nelta C., IV 84
Bostian, C. H., III 32, IV 82
Bowen, Paul R., XIV 95
Bown, Olive, X 125
Brooks, Betty Watt, II 117
Brown, Edwin A., XV 93
Brown, Florence, II 99
Bruce, Harold A., VI 87, 89, VII 65, VIII 53, 54
Buck, Warren S., IX 100, XI 20, XII 84
Butts, D. C. A., IV 117, V 139

— C —
Campbell, W. A., VIII 114
Cartledge, J. L., VII 78, 79, 82
Cary, B. F., IV 122
Cassel, Robert, X 36, XI 81
Chandler, D. S., II 101
Charles, D. R., III 34, IV 85
Chermock, F. H., XIV 138
Chermock, R. L., XV 59
Chermock, F. H. & R. L., XII 49, XIV 137, 140, XV 46, 51, 52
Clark, Ruth S., VI 60
Claus, Edward P., XIII 27
Clayton, Janet, XIII 39
Cleaves, A. B., IX 141, XI 64, XII 124
Cline, David L., XIV 92
Collins, H. H., V 100, 101, 102, 122, VI 164, 165, 186, VIII 101, 102, 126, 139, IX 115, 117, 120, X 102, 117, 124
Conover, L. F., XV 120
Conway, Albert E., XII 51
Coover, C. A., VII 43
Conn, Anna A., XIII 134
Cope, Thomas D., VI 65, VII 165, XII 149
Courtney, John, XV 133
Crawford, S. C., V 54, VIII 96, XII 16, XIV 122
Cressman, G. R., XV 128
Cretcher, L. H., II 101
Crowell, M. F., II 102
Critzinger, John I., XIV 84, XV 203
Crummy, Pressley L., VI 167, VIII 127, X 51, 54, XI 13, XV 155
Cunningham, R. B., VIII 140
Cutright, Paul R., V 42, 132, VI 154, 157
Cutuly, Eugene, VI 171

— D —
Dambach, Geo. J., VIII 101, X 112, 146
Darbaker, L. K., X 131, XII 146
Darrah, Wm. C., VI 110, 115, VIII 7
Davey, W. P., III 26, 75
David, P. R., IV 80
Davis, R. N., II 50, 108, III 26, V 116, VI 153
Dearolf, Kenneth, XI 42, XII 64, XV 170
Denny, Frances J., VIII 129
Derickson, Cloyd, XV 131
Derickson, S. H., I 71, 72, II 27, IV 27, VII 8, IX 11, XI 85, 87
Dickerson, Bessie, I 106
Dieter, Clarence D., X 127
Dietze, Alfred G., VII 49
Dinger, C. C., XIII 116
Doak, K. D., VIII 7, IX 86
Dryden, Lincoln, X 42
Dryden, Lincoln and Clarissa, XII 97, XIV 49, XV 73
Dutcher, Dean, I 75

— E —
Eddy, M. W., IV 12, VI 27, VIII 140, IX 91, XII, 19, XV 164
Edwards, John K., XIII 24
Eller, E. R., XV 119
Emerson, Alfred, II 95
Engel, J. A., VIII 37
Espenshade, A. H., III 63
Everett, H. S., I 80
Ewing, Maurice, X 72, XII 31
Eyster, W. H., XV 209

— F —
Ferguson, J. A., VII 73
Fettke, Chas. R., I 66
Finney, R. J., IX 136
Foose, R. M., XIII 144, XIV 64, XV 107
Fortunato, Frank, XIII 18, 21, XIV 124
Frankston, Jane E., X 112, 119, 146
Fraser, Donald M., VIII 76, IX 31, 34, X 66, XI 57, XIII 94, XIV 43
Fretz, A. Henry, VIII 92
Freyburger, Jr., W. A., XV 180
Fuller, J. Osborn, VIII 83

— G —
Gamble, John T., V 97
Getz, Albert J., XIII 94
Glasser, M., XIII 88
Gleim, D. I., VI 27
Goldsmith, N. R., X 96
Gordon, Alfred, VI 68, VII 71, VIII 23, XV 148
Gordon, Robert T., XV 194
Gorman, Jos. M., XII 103, XIII 150
Gottschall, R. Y., IV 69
Graham, E. H., IV 65, V 28, VII 58
Graner, David, II 108
Gray, Jean R., XIII 54
Greb, Raymond J., VII 117, IX 98, X 92, 99, XII 56
Greb, Magnhild Torvik, XII 56
Green, Marcus H., VI 146, VII 188, VIII 19, IX 22, X 78, XI 18, 20, XII 27, XIV 24, XV 28
Gress, E. M., I 71, III 92, IV 29, V 67, VI 73, VIII 30, IX 69, XIII 30
Guiher, Ruth E., IX 110
Guy, J. H., VI 96
Guyton, T. L., I 102, IX 96

— H —
Ham, W. R., I 78
Hance, R. T., II 102, III 44, 90, IV 39, 46, V 103, 114, VI 129, 134, VII 180, 182, 183, VIII 51, 52, 53, IX 10, 79, 80, X 110, 111, XII 147, 149, XIV 114, 133, 142, XV 145, 147
Hartline, D. S., III 90, V 45
Heilemann, J. J., VII 166

Hein, Illo, II 117, III 92
Heisen, Aaron J., XII 45
Henry, Edward C., XIV 126
Henry, LeRoy K., IV 60, V 28, VI 119, 121, VIII 9, XIV 100
Henry, M. B., IV 59
Henschen, G. N. C., II 24, VIII 7, XI 36
Herber, E. C., IX 136
Herrold, K. F., XII 59
Hickok, 4th, W. O., VII 55
Hicks, Fred J., IX 57
Higbee, Edna, VIII 133, IX 107, X 103, 104
Hill, J. Ben, XII 33
Hilsman, Helen M., VI 172, 174, VII 176, 177, 186
Hirst, J. Mendel, XIII 153
Hoffmann, J. V., II 31, 79
Holridge, F. L., I 82, II 51
Honess, A. P., III 12, 52
Hoover, Earl, VI 57
Horn, Clarence A., VI 26, VII 75, VIII 76, IX 26, X 148, XI 22, XII 138, XIII 22, XIV 27, XV 41
Horowitz, Norman, X 105
Hostetter, D. R., VII 8
Houtz, R. L., II 40
Howe, T. D., XIV 117
Hudson, H. B., IV 55
Hughes, Stella M., IV 91
Hutchinson, W. G., V 13, VI 14

— I —

Idzkowsky, Henry, VI 176, IX 49, 50, 52, X 108
Itter, Henry A., XIII 135

— J —

James, A. P., II 108
Jennings, O. E., I 23, 105, II 25, 100, III 42, 43, IV 30, VII 192
Johnson, H. M., II 43, III 38
Johnson, J. C., IV 29, VI 105, VIII 144, XIII 68, XIV 124
Jones, Edgar P., II 97
Jones, J. Lorain, VI 178
Jones, T. Husband, IX 126

— K —

Kane, Evan O'Neill, IV 107, V 74
Kantor, Jerome H., IX 146
Keener, Paul D., VII 130
Kekilty, E. Eileen, IX 121
Keller, Jr., Fred, XV 65
Keller, John W., III 98
Kelley, K. L., VI 96, 180
Kelly, J. P., XIII 30
Kern, F. D., I 63, III 12
Kirby, R. S., XIII 41
Kettlekamp, B. H., IV 35, V 121, 137, VI 82
Killeen, Pemberton L., V 62
Kinsey, V. Everett, IX 66
Kirk, H. B., VIII 30
Klepper, M. R., XIII 88
Knepp, Thomas H., X 39, XI 35, XII 61, XIII 58, XV 159, 164
Kozelka, A. W., II 116
Kreidl, N. J., XV 35
Kronenberg, Jr., E. S., IV 12
Krynine, P. D., XII 93, XIII 79, 88, XIV 60
Kutchka, Gordon M., X 143

— L —

Landsberg, H., XI 88, XIII 110, 116, XV 65
Lanfear, L. H., VII 24
Lapp, Walter S., IX 131, XII 157, XV 141
Lauer, K. W., II 37
Leathem, J. H., XIII 51, XIV 87, 109, XV 183
Leung, Yuk Yi, VII 177
Lewis, C. J. S., IX 112
Light, V. Earl, I 72, III 106, IV 95, V 67, X 81, XI 71, 73, XV 21
Lipman, H. J., IX 38, 68
Lisi, Alfred G., IX 86
Little, T. M., V 14, VI 104
Lloyd, Wm. E., XIV 133, XV 58, 224
Lutz, H. J., VI 125, VII 28

— M —

MacMillan, Gordon K., XIV 34
Marshall, Lawrence, XIV 141, XV 217, 225
Martin, Geo. W., I 113
Martin, Wm. H., X 132
Mattimore, H. S., I 56
McCorkle, Paul, VIII 7
McCrady, Jr., Ed., IV 88
McCubbin, W. A., I 58, 82, II 51
McIlvaine, H. R. C., VIII 56
McKinley, G. M., IV 43
McKinniss, Elizabeth E., VII 64
Michaelson, Stanley, IX 37
Miller, B. L., I 64, 77, 89, IV 107, XI 55, XII 105, XIII 98, 101, XV 82
Miller, Eugene C., VI 187
Miller, Forrest W., V 75, VI 143, VII 66, 69
Miller, Ralph L., XII 107, XIV 68, XV 68
Miller, R. E., VIII 99
Mohr, C. E., III 94, IV 50, V 17, VI 189, VII 39, VIII 26, X 62, XI 38, XIII 43, 76
Morgan, Raymond, VII 166
Morgan, Russell E., IV 91
Morrissey, R. V., III 47, VI 80
Moser, G. Paul, XII 36
Munch, James C., XIV 118
Myers, Philip B., VIII 87

— N —

Nelson, E. H., IV 99
Nelson, William, II 101
Netting, M. Graham, VII 100, X 25, XIII 50
Nevin, Hilliard R., XIII 46
Newcomer, Earl H., XII 150
Nickerson, Jr., W. J., X 59
Nixon, E. L., III 74

— O —

O'Brien, Harold C., XIV 134, 142, XV 59, 221
Oerlein, Karl F., VI 54, VII 35
Olivier, Chas. P., VI 94, VII 172
Olshevsky, D. E., II 95
O'Neill, Wayne F., XIV 45, XV 75
Orton, C. R., I 63
Overholts, L. O., VIII 108, 114, XII 68, XIII 121

— P —

Paessler, R. T., IV 112
Parlin, W. A., XI 47, XII 154, XIII 105, 108, XIV 129
Parrish, William, XV 102
Perry, Geo. S., II 86, V 123, VI 136, VII 43, VIII 48
Pinckney, J. S., XIV 81
Piper, Wendell D., XII 132
Popp, H. W., II 99
Postel, A. Williams, XII 114, XIII 141, XV 115

— R —

Raring, Jane C., XV 164
Raup, H. M., I 68, II 99

Raup, Lucy C., II 99
Razek, Joseph, I 59
Reese, Elwyn, XIII 70
Reynolds, J. B., I 81, 108, V 106, VII 92, VIII 73
Richards, Horace G., VII 167
Robinson, C. W., XII 93
Rock, C. L., XV 125
Roddy, H. Justin, I 76
Roedder, Edwin W., XV 93
Root, W. T., II 108
Rothrock, A. M., I 101
Runser, K. W. O., X 111
Russell, Geo. C., XV 89
Rutschky, Jr., Chas. W., XV 200

— S —

Schmidt, Jr., E. C. H., IX 63, XII 133
Schubert, W. A., VI 85
Scott, Earl B., IX 71
Seaman, David M., XIV 77, XV 60
Seltzer, George S., XV 111
Shaffner, M. N., XII 119
Shaw, Reuben T., XV 189
Shortess, S. I., IV 102
Silverman A., I 113, II 96
Simpson, Geddes W., III 92
Singer, Marcus, XII 135, 136
Smith, Floyd P., I 83
Smith, R. Dale, XII 161
Smyth, Thomas, X 15, XIII 62
Snyder, E. Bayne, XV 39
Snyder, G. E., IV 32, VIII 50
Speicher, Benj. R., V 79, VI 152, VII 66
Springer, R. E., IV 99
Springer, Ruter W., X 85
Spurr, George, XV 213
Stanaka, Wm., VII 98
Stancati, Milton F., VII 121
Starkey, Wm. F., IX 57, 59, X 123, XII 133, 138, XIII 51, XIV 87, 109
Stear, J. R., II 54
Stewart, N. H., I 60, II 21, III 97, IX 82
Stichter, G. B., II 53, V 40
Stiefel, J. R., VI 183
Still, Esther D., VIII 43
Stone, R. W., I 63, 100, II 34, IV 162, V 112, VI 106, VII 88, VIII 124, IX 74, XI 78, XIV 19, 39
Strauser, M. C., IV 17
Surface, H. A., III 36
Sutton, Geo. M., I 84
Swartz, Frank M., III 75
Sweadner, W. R., V 71
Sweadner, W., XIV 137

— T —

Taylor, N. W., XV 35
Tepe, William, XV 223
Terres, J. Kenneth, X 19
Thomas, W. Stephen, XV 136
Thurston, Jr., H. W., I 63, VII 140
Tolmachoff, I., II 94
Torgeson, R. A., VI 96
Torvik, Magnhild M., III 31, IV 87, VII 119, X 92
Trimble, F. M., I 56
Troutman, Ray A., I 74
True, Rodney H., VI 95
Trumper, Max, IV 193, V 130, VI 141, VII 61, VIII 7
Turner, H. G., IV 104
Tuttle, O. F., XIV 55.

— U —

Udine, E. J., XIV 81
Urban, Walter G., VI 186, X 117

— V —

VanDersal, W. R., VII 82, X 136, 138
Vichoever, Arno, VIII 7
Vuilleumier, E. A., IX 45, XI 83, XII 156, XIII 115, XIV 119, XV 169

— W —

Wachter, W. L., V 136
Waldron, R. A., I 107
Wallace, Howard K., VI 98
Warga, Mary E., II 96
Warmkessel, Carl A., VIII 94
Watson, Fred, XV 217
Watt, Betty P., II 54
Wayman, J. H., I 75, II 60, 102, III 108
Weidlein, E. R., II 82
Weigand, G. E., II 43, III 38
Wherry, Edgar T., VI 32, VII 160, 164, VIII 34, IX 150, X 12, XI 52, XII 42
Whitcomb, Lawrence, VIII 37, IX 123, XI 61, XIV 31
White, J. W., III 37
White, Marsh W., I 78, 101
White, W. Lawrence, VII 140
Whiting, Anna R., III 28, IV 79, VII 118
Whiting, P. W., II 94, III 30, IV 79, VII 116, 117, VIII 103, IX 60, XI 50, XII 74
Will, Homer C., V 82, VI 38, 42, VII 30, 32 VIII 106, IX 147, 149, X 135, XI 13, XV 45
Willard, Bradford, V 62, VI 46, VII 55, 148, VIII 57, IX 39, 126, X 30, XI 26, XII 121, XIII 126, XIV 37, XV 97
Williams, Joseph L., XV 53
Williams, S. H., III 108, V 88, VI 106
Williams, Jr., T. W., IX 45, 47, X 124
Wills, Doris M., VII 172
Witmer, Enos E., VI 62
Witmer, J. Donald, XI 75
Wohlert, Alice, VIII 100
Wolf, E. A., II 95, III 92, V 122
Wolf, Joseph M., IX 31
Wolf, Leonard N., IX 53, X 121, 123
Wolff, Emily T., XII 80
Wright, L. K., XIII 41
Wright, W. H., VIII 126, X 102
Wurtz, Charles B., XII 77, XIII 54, XV 32

— Y —

Yeagley, H. L., I 101
Yocum, L. E., VI 96
Yoder, Harold D., XIV 90

— Z —

Zebrowski, Geo., I 62, 107
Ziegler, E. A., I 65, 113, II 72
Zundel, Geo. L., VII 122

PROCEEDINGS

of the

PENNSYLVANIA

ACADEMY OF SCIENCE

SUBJECT INDEX

VOLUMES I TO XV

1926 - 1941

— A —

Abscesses in rats, XIII 22
Academy of Science, constitution of, IX 13
  founders of, IX 20
  growth of, adjustment to, V 45
  in retrospect, IX 11
  meetings of, IX 16
  organization of, I 9
  publications, cost of, V 6, 7
  functions of, VIII 144
  relation to Science Clubs, VI 54
  research and, VI 73
Action, opportunity for, XII 144
Adaptations, nocturnal, V 54
Adiantum cuneatum spores, XIII 24
Adrenalin chloride, effect on mice, V 136
Adrenal, histological zones in, XII 138
Age of drift sheets, XII 88
  of man, XII 15
Aid, government, in biology projects, XI 13
Alcohol, in beer, effect of, VII 61
  influence on progeniture, VII 71
Algae, blue-green, list of, VII 82
  culture of, V 67
  in western Pennsylvania, VII 79
  of Berks County, IX 100, XII 84
  on Presque Isle, III 47
  in sulphur spring, X 136
Alizarin, stained mammalian fetuses, IX 38
  red S, IX 68
Aluminum, emissivities of, V 34
Amanita muscaria, abnormal, IX 86
Ames limestone, XIV 77
Amphibia, habits in winter, III 94
Amphibian, see Triturus
Amphibians of Bedford County, XI 35
  of Berks County, XIII 76, XV 164
  of Blair County, XIV 90
  of Indiana County, X 25
  of Lackawanna County, VII 98
  of Pennsylvania, VII 100
Amphibian skin, pattern regulation in, IX 117
Amphipod and hydra, IV 25
Amphipod responses, VI 22
Anatomy of (4-legged) **Gallus domesticus,** XII 27
Anatomical material, storage of, VIII 101
Anatomy of gulf dog-fish, VIII 100
Anatomy, vertebrate, teaching, VIII 102
Anchisuaripus, manus print, XIV 37
Animal activity at dusk, XIV 122
Anomalies, somatic, VIII 23
Anomaly, arterial, in **Rana,** VII 110
Antennae, linkage relations of, IV 80
  fused, IV 84
  movement in wasps, VII 66
  segments of **Tenthredo,** IX 147
Anthracite, correlation of, IV 104
Ants, aphids attended by, I 102
Antuitrin, injection in newt, IX 52
Aphid, digestive epithelium of, VI 148
  wing venation in, VII 69
Aphids attended by ants, I 102
  reproductive system of, V 75
Aphis rubiphila, life habits, I 83
Apparatus, vapor pressure, XI 83
Apple tree, protozoa in, II 102
Aquarium, marine, XIV 117
Archilestes grandis from Mexico, XV 44
Arctic exploration, II 94
Arithmetic, marvel in, VI 153
Assimilation, igneous, IX 34
Astronomy, II 96
  exploding universe, X 85
Atresia, follicular, in salamander, VII 176
Atrophy, cerebral, in rats, VIII 19

— B —

Bacteria, intestinal, of **Polygyra,** XIII 54
Bacteriophage, X 96
Bagworm, evergreen, genitalia of, XV 53
Banding in fissure veins, IX 31
Barberry eradication, XIII 41
Barton, Thomas, XV 200
Basilarchia arthemis, XV 46
Bat, Least Brown, X 62
Bats, genus Myotis, VII 39
  marking, VIII 26, XIII 41
  seasonal distribution, VI 189
  tagging, XIII 41
Bedford County amphibians, XI 35, XV 164
Bees, sex determination in, VIII 103
Beer, effect of drinking, VII 61
Beetle, Japanese, I 113
  control of, II 58
  flight of, V 40
Beetles, chromosomes of, VIII 50
Bellefonte, wind directions at, XV 128
Benzoate, estradiol, effect on cat uterus, XIV 87
Bentonite, III 18
Berks County algae, IX 100, XII 84
  amphibians of, XIII 76
Biological effects, IV 43
  generalizations, XIV 84
Biological survey, Mt. Gretna, VII 8
Biology, aids to teaching, X 51
  government aid in, XI 13
  teachers of, XII 149
Biparental male wasps, IV 85, 87
Bird life, value of, I 84
  study, IV 59
Birds on Presque Isle, VII 192
  water, of Chester County, XII 51
Birth, prominent men, month of, IX 136
Blair County, amphibians of, XIV 90
Blind students, VIII 53
  teaching zoology to, IX 10
Blood cell changes in rats, X 148
  white, changes in, XV 41
Bog, Mercer, IV 31
  plants, Fayette County, XV 207
  and swamps near Corry, X 138
Boiling point mixtures, XII 156
Boletaceae in Pennsylvania, IV 17
Bonasa umbellus, dimorphism in, XIII 62
Bowmans Hill flower preserve, VIII 34
Bowmans, faults near, XV 93
Boxwood, disease of, V 13
Brachiopods, Greenbrier, VIII 62
Brain grafts in **Triturus,** X 127
Brain sizes in rats, VII 188
Brookville coal, XV 107
Brown rot, spread of, I 113
Building stone, I 100
  durability of, V 112
Butterflies **(Coenonympha),** XII 49, XV 46, 51, 52
  Mexican, XV 45

— C —

Calcium in soil formation, II 86
Calvert formation, X 42
Cambridge limestone, XV 60
Captivity, effect on **Triturus,** VII 186
Carnegie Museum herbarium, fungi for, XIV 100
Cat, polydactylous, IV 91, X 78
  spinal musculature of, IX 63
  syndactyly in, XV 155
  uterus, response to estradiol benzoate, XIV 87
Cave concretions, VI 106
Caves, origin of, VI 106, XV 68
  relation to geological structure, IV 103

molluscs and myrapods of, XII 64
Cave invertebrates, XI 42, XV 170
vertebrates, XI 38
Shafer Run, XIII **150**
Caverns, breathing, XII 105
Cell division in sheep, VIII 53
size in pea, VI 89
Cellosolve, use of, XV 58, 225
Cenangium abietis, parasitism of, XIV 95
Ceramic industry, colloid science in, XIV 126
Chains, inextensible, theory of, VII 92
Channel, buried stream, XII 119
Chemical cultures, XV 39
formulae of feldspar, XV 103
Chemistry, forensic, IV 112
instruction in, II 96
laboratory, high school, XII 157
Chemist, medical, IV **108**
Chemung of SW. Pennsylvania, VII 148
Chester County, vegetation of, XV 194
water birds of, XII 51
Chick embryo, twinning of, II 106, V 57
twisting of heart in, XI 85
triple, IX 146
Chicks, infection in, XII 59
effects of propionation, XIV 27
Chitin, sectioning method, XV 59
Chromosomes, of bettles, VIII 50
of **Habrobracon,** VII 119
of mouse, V 42
of pigeon, VI 134
of **Polygonatum,** VII 78
of termites, VII 121
of **Vallisneria,** X 112
salivary, smears of, X 112
smears of, X 146
Chromosome number variation, VII 182
number, IV 97
Chromosomal lengths in pea, VI 87, 89
Church and evolution, XV 203
Clam, phosphatase in, IX 57
photoreceptors in, III 106
Clay, glacial from Washington, XIII 79
Clavarias of Pennsylvania, XII 89
Cleaning of glassware, XIII 115
Climatic differences for 1 degree, XV 131
Climatological service, XV 120
Coal mines, explosions in, II 102
Coenonympha, new, XV 52
(butterflies), XII 49, XV 52
College graduates, accomplishments of, VIII 73
Collegiate instruction, II 108
Colloid science in ceramic industry, XIV 126
Coloration of snails, X 143
Color atlas, II 95
Color pattern of **Triturus,** V 122, IX 53
Color variant of **Sarcina,** XIV 92
Columnar limestone, XV 75
Color variations, VI 105
Conchology, Cuban, VII 167
Concretions, calcareous, I 76
cave, VI 106
Conewago Lake, biological survey of, VII 8
Conifer, fossil, VII 164
Constitution, of Academy, I 15
Coral reef, Hamilton, X 30
Cordyceps in Pennsylvania, XII 68
Corn borer, eggs of, IV 99
Corn, x-rays on, IV 32
Corry, bogs near, X 138
Cosmic radiation, II 40
Cove Mountain, structure of, XV 111
Crepescular life, VIII 96
Crinoid, Silurian, new, XI 75
Crystal Cave, origin of, XV 68
Crystal etching, III 52
Crystals, halite, casts of, XI 55
Cyclones, speed of, XIII 116
Cytological structures in lilium, VIII 66
studies in salivary glands, X 110
Cytoplasmic relations, X 111

— D —

Damping-off, control of, II 37
Darlington, William, botanist, X 59
Darluca, characteristics of, VII 130
Deer, cause of death of, III 97
Delaware River, preglacial course, XII 107
Dental malformations, XV 28
Detecting fiber adulteration, II 40
Devonian contact, IX 39
nomenclature, XI 26
Diagnosis of malignant neoplasms, IV 117, V 139
Differences, individual, effects on, VII 49
Dike, alteration of, XV 89
Dimorphism, sexual, in **Bonasa,** XIII 62
Dinosaur foot tracks, VII 55, XIV 37
Diptera, smears of glands of, X 146
Dog-fish, anatomy of, VIII 100
circulation, VI 96
Dragonflies, Mexican, XV 44
Drainage, asymmetrical, II 34
Drift sheets of Pennsylvania, XII 88
Dust on plaster walls, VI 65

— E —

Earthquakes, origin, occurrence, XI 88
Earthworm, leucocytes of, XIII 39
life history, I 71
studies in, VI 27
twinning in, XV 21
Ecology, I 68
flora, VI 119
flora, Long Island, IV 60
animal, Presque Isle, V 88
beetles, Presque Isle, V 97
Ecological studies, plants, VI 32
Education, biologist looks at, VII 180
program for, V 52
Education, graduate students, V 114
tests in science, VIII 54
and radio, III 44
Electric effect, in corn seed, IX 71
Electrons, variations of mass of, I 78
Electrostatic effects, XV 221
fields, effect of, IV 43
measurements, XV 218
Embryology of salivary glands, XII 132
Embryonic fixation by cellosolve, XV 58
Emissivities of metals, V 34
Euphydryas phaeton, XIV 140
Environmental stimuli, VI 22
Epithelium, digestive, of aphids, VI 148
Erythrocyte counts, variations in, IX 91
Evolution and church, XV 203
Eye, sensitivity of to light, XIII 108
Examinations in science, VIII 54
Explosions in coal mines, II 102
Eye color in **Habrobracon,** IV 82
Eyes, variegated, in **Habrobracon,** VII 118

— F —

Family stock betterment, VI 68
Faults, near Bowmans, XV 93
Fayette County, plants in, XV 207
Feldspars, plagioclase, XV 102
Ferns, fossil, VI 115
Fern, **Lygodium palmatum,** III 90
Ferns, notable Pennsylvania, XI 52
rare, list of, VIII 30
Fertilizer for grass, III 37

Fibers, adulteration of, II 40
Films, on metal, VII 166
Fingers, crooked, inheritance of, X 81
Fire, effect on forest soil, VII 43
Fireballs, VI 94
Fish scales reveal age, V 82
Fishes, distribution of, III 92
survey of at Lewisburg, IX 82
toy, VI 85
Fission, in Hydra, XI 87
Flood burden of Lehigh River, VIII 94
Flora of Kartabo, Br. Guiana, IV 65
Flora, mildew, powdery, XIII 70
program of symposium, XIII 30
of central Pennsylvania, XIII 30
Flotation in ore dressing, IX 87
Flour-moth, dessication effects, V 79
Flow structure, VIII 76
Folding in granodiorite, XV 115
Food of ruffed grouse, X 15
Forests, extending State, I 65
Forest fires, II 31
effect on soil, V 123, VII 43
increment, I 113
productivity, II 86
rehabilitation, II 79
soils, survey of, III 43
taxation, II 72
Fossil brachiopods, VIII 62
coral reef, X 30
hackberry, II 54
hunting grounds, VI 46
jaws of worms, XV 119
localities, VII 148
foot tracks, VII 55, IX 126, XIV 37
plants, VI 110
ivory, I 81
Triassic conifer, VII 164
wood, I 66
xiphosuran, **Euproop,** IX 126
Fossils, plant, II 117
and fossilization, V 62
Frick Park, pulmonates of, XII 77
Frog, arterial anomaly in, VII 110
sex reversal in, VII 112
Fungi, **Boletaceae,** IV 17
(Cordyceps), XII 68
coral, XII 80
new records of, XIV 100
parasitic, VII 122, 130
parasitism of, XIV 95
Porin, XIII 121
rust, VII 140
ecological distribution, I 68
Fur identification, XV 164

— G —

Gallus domesticus, anatomy of, XII 27
Game propagation, VI 106
Gene, pursuit of, II 94
Genitalia, of bagworm, XV 53
Geo-electric investigations, XV 65
Geography, States least known, IX 123
Geology and allied sciences, XV 82
Ames limestone, XIV 77
applied, VII 88
Calvert formation, X 42
Chemung group, VII 148
Devonian contact, IX 39
fissure veins, IX 31
flow structures, VIII 76
Godfrey Ridge, XIV 45
igneous assimilation, IX 34
seritization, X 66
structural, of New Bloomfield, IX 141
Spitzenberg, VIII 37
Tully limestone, VIII 57
Turnpike tunnels, XII 124
Geologic section (Mauch Chunk) in Somerset County, XI 78
structure and caves, IV 103
Geranium cuttings, rot in, II 51
Glacial potholes, III 26
Gladiolus, response to pH, XV 39
Gland, pituitary, in **Triturus,** X 123
Glands, cloacal, of newt, X 104
hedonic in newt, X 117
salivary, mammalian, X 110
pig, XII 132
Glass, I 118
cover, plastic, XIV 142
sand, mineralogy of, XIII 88
silicate, properties of, XV 34
Glassware, volumetric, cleaning, XIII 115
Glowworm, II 27
Glycerin, distribution of in a column of water, XI 47
Gneiss, alteration of, XII 114
Godfrey Ridge, structure of, XIV 45
Gonadotropic extracts, reaction to guinea pigs, XIV 109
Goose, teratological, XI 18
Government aid, XI 13
Gradiant apparatus, VI **27**
Graduate School, duty of, V 103
Graduate student, training, V 114
Grafting in **Triturus,** XII 136
Grafts, brain in, **Triturus,** X 127
larval, in newts, X 102, 107
asymmetrical, X 114
Graft, natural, cherry and oak, IV 127
Grafting in domestic fowl, II 116
Granite, black, I 63
Granodiorite, folding in, XV 115
Grass, fertilizer for, XII 37
sensitive, III 43
Gravitation, nature of, V 116
Grouse, ruffed, food of, X 15
Guinea pigs, reaction to gonadotropic extracts, XIV 109
Gynandromorphs in **Habrobracon,** VII 117
Gypsy moth, IX 96

— H —

Habrobracon, antennal movement, VII 66
causing mutation, XI 50
chromosomes of, VII 119, 120
decrease in males, XII 74
diploid males in, III 28, 31, 34, IV 79-91
laboratory material, VII 117
method of drawing, VII 118
reproductive reactions of, VII 118
unstable gene in, X 92, XII 56
sex ratio in, VII 121
x-radiation in, VII 121
x-ray mutations in, IX 60
variegated eyes in, VII 118
Hackberry, fossil, II 54
Haemutococcus, culture of, V 67
Hair classification, XII 19
identification, XV 164
Haldeman, S. S., reminiscences of, XI 36
Hardyston quartzite, XIII 94
sandstone, tubes in, XIII 101
Harrisburg axis, XV 97
Martinsburg shale at, XII 103
geologic structure at, XIII 144
Heart, twinning in chick embryo, XI 85
Heat measurements, specific, XIV 129
Heavy mineral studies, XII 97
Helderberg group, III 75
Helicoids and helices, I 81
Hen, thymus gland removed, VI 187
anatomy of, XII 27
Heparin in tadpole, IX 59
Hepaticae, list of, V 14, VI 104, VII 24

Hepatecomy, results in newt, IX 121
Herbarium collections, V 28
Heredity, alcoholic effect, VII 71
  somatic anomalies, VIII 23
Highway protection, beautification, III 98
Histogenesis of blastema cells, VI 171
Histological changes in rats, VII 65
  effects of x-radiation, X 54
  response of sweet potatoes, XV 217
  variations, thyroid, XII 161
Histology of **Tradescantia**, XV 223
History, instruction in, II 108
Honeybrook upland, zircon in, XV 73
Hormones of mouse, XII 133
Hornworm, tobacco, XI 13, XII 139
Horses, "Pinto," variations in spotting of, XII 33
Huntingdon County, mastadon in, X 135, XII 93
Hydra catches amphipod, IV 25
  in limestone springs, I 74
  longitudinal fission in, XI 87
Hydrochloride, use of, XIII 46
Hybrids, moth, V 71
Hydrogen, evolution of, IX 66
Hydrogen ion concentration, XIV 119
Hydrothermal alteration, XV 89
Hymenoptera, VI 38, 42, VII 30. See Habrobracon, Sawfly, Wasps.
Hypophysis of mouse, hormones on, XII 133

— I —

Identification by tattooing, V 74
Indiana County, amphibians and reptiles in, X 25
Infection in chicks, XII 59
Inheritance of crooked fingers, X 81
  of paralysis, XI 73
Injection of lymphatic system of **Triturus**, IX 45
Insect intestine, mitochrondria of, VII 75
  prediction hazards, II 54
Insects, scale, I 56
Instruction in chemistry, II 96
Instrument for electrostatic measurements, XV 218
Intelligence test, II 108
Invertebrates, cave, XI 42, XV 170
Ionics of x-ray tube, I 101
Ionization constant K, XIV 119
Ions, removal of, VII 166
Isopod, parasitic, XI 71
Ivory, fossil, I 81

— J —

Jasper, muscovite and graphite in, XIV 43
  origin of, VIII 87
  replacement of quartzite by, XI 57
Junior Academy, constitution, VIII 149
  operation of, VIII 51
  proceedings of, VIII 147, IX 156, X 152
  report of committee on, V 7, VII 6

— K —

Kartabo region, Br. Guiana, IV 65, V 54
Kittatinny Mountain, structure, XIII 144

— L —

Laboratory chemistry, XII 157
  experiment, XII 156
  model tracing curves, XIII 105
  specific heat measurements, XIV 129
  teaching, VI 129
Labidia, synopsis of, IX 147
Lackawanna County, amphibians, VII 98
Lactuca saligna L., V 67
Lake levels, periodicity in, XV 133
Lancaster County, poliomylitis in, VI 14
Leaf-hopper, II 54
Leaf spot on tobacco, V 37
Left-handedness, VI 68
Lehigh River, burden of, VIII 92
  in flood, VIII 94
Lepidoptera **(Coenonympha)**, XII 49
  Euphydryas, XIV 140
  Mexican, XV 45
  new sphinx, XIV 137
  Pennsylvanian, XV 46
Lesley, J. Peter, XIV 31
Lettuce, willow, V 67
Leucocytes of earthworm, XIII 39
Lewisburg, spadefoot toad at, XV 180
Life, origin of, X 12
Light, red and green, XIII 108
Lilium, cytological structure, VIII 66
Limestone, Ames, XIV 77
  Cambridge, XV 60
  Greenbrier, VIII 62
  Lehigh Valley, seismic study of, X 72
  origin and use of, I 89
  Silurian columnar, XV 75
Limestone, casts of halite crystals in, XI 55
  decomposition of, I 77
  dolomitic, staining studies of, VIII 83
Limnology of Pike Run, XIII 153
Locating buried power shovel, XII 31
Lock Haven, geol. structure at, XIV 64
Log, calcified, I 66
Log-perch, age of, V 82
Lungworms, hog, control of, I 62
Lupine, toxicity of thorium to, VI 96
Lymphatic system of **Triturus**, injection of, IX 45
Lygodum palmatum, III 90

— M —

Macrophage in **Triturus**, IX 50
Magnetic measurements, locating buried shovel by, XII 31
Magnolia, sprout ring, VII 28
Malformations, dental, XV 28
Malignancy in rat, VI 26
Malignant neoplasms, IV 117, V 139
Mammalian tissues, transplanted, VI 176
Mammals, list of Pennsylvania, V 17
Man, how old is, XII 15
Mankind, study of, VI 157
Manus impression, fossil, XIV 37
Map interpretation, XIII 135
Mare serum, influence of, XV 183
Marigolds **(Tagetes)**, XV 209, 213
Martinsburg shale, XII 103
Mastodon, discovery of, X 135
  at Saltillo, XII 93
Mathematics, II 95, V 106, VI 153, VII 92
  college courses in, I 80
Maze behavior of mice, V 136
Meanders in Raystown Branch, IX 74
Measurements, electrostatic, XV 218
Mechanics of quarry blast, II 24
Mechanism, physical, protoplasmic, XV 147
Mechanistic phantasy, IV 46
Medical examination, time of, XII 36
Meetings, Academy, where held, XIV 19
Melanin in transplants on **Triturus**, IX 49, 50
Melitaea harrissi, XV 51
Melting point technique, XV 169
Members elected, I 12, 87, II 5, 6, 8, 13, 65, III 9-10, IV 9, V 11, VI 12, 13, VII 7, VIII 6, IX 8, 9, X 5, 9, 10, XI 6, 8, XII 5, 8, 9, XIII 7, 12-14, XIV 7, 14, XV 8, 9, 15-17
Members, list of, I 17, II 14, VIII 152, XIV 144-151
Mercer bog, IV 31

Metabolism, respiratory, XII 139
Metal poisoning, I 58
Metals, emissivities of, V 34
  surface film on, VII 166
Meteorology, XV 120
Meteor rates, VII 172
Meteors, VI 94
Meteorites in Pennsylvania, VIII 124
Meteorological factors, II 31
Methylene blue, VII 184
Miasma and water supply, V 127
Mice, maze behavior of, V 136
Microradiator, ultra-violet, II 96
Micrological technique, XIV 114
Micrology, plant, cellosolve in, XV 225
  use of plastics in, XIV 134
Microorganisms in rats, XIII 22
Microrespirometer, VIII 16
Microtome knife, new, VII 183
  sectioning, XV 221
Microtus, variation in, X 125
Mildews, powdery, VIII 114, XIII 70
Mineralogy of glass sand, XIII 88
Minerals, heavy, non-opaque, XIV 49
  Ordovician-Silurian boundary, XIV 55
  Paleozoic, XIV 60
  studies, XII 97
Mitochondria of insect intestine, VII 75
Models, anatomical, IX 47
Mold filaments, staining, XV 224
Molds and yeasts, pathogenic, XII 45
Mollusks, Cuban, list of, VII 167
Mollusca, pulmonates, XII 77
  terrestrial, in Washington County, XIV 34
  of Pennsylvania caves, XII 64
Molting, induced in **Triturus**, VIII 129
Monkey, Rhesus, dissection material, X 124
  spinal musculature of, IX 63
Monroe County plants, V 31
Mont Alto State Forest, III 43
Month, birth, of prominent men, IX 136
Morels of Pennsylvania, VIII 108
Morphogenesis in **Mycelium**, II 117
Morphology of **Schizanthus**, VIII 43
Moth, flour, growth of, V 79
  gypsy in Pennsylvania, IX 96
  Hawk, **Ceratonia**, XIV 137
Moths, hybridization of, V 71
  melanic, new, XIV 138
Motion, linear, XIII 105
Mount Gretna, lake at, VII 8
Mouse, chromosomes of, V 42
  hyphysis of, XII 133
  maturation, VI 154
  meadow, variation in, X 125
  thyroid, XII 161
Muscle contraction, VI 152
Muscovite in jasper, XIV 43
Muscovite-plagioclase-symplectite, XII 89
Musculature, pelvic, VI 98
  spinal, of cat and monkey, IX 63
Mussel, oxygen consumption of, VIII 140
Mutations, Habrobracon for testing, XI 50
Mycelium, morphogenesis in, II 117
Mya, photoreceptors in, III 106
Mycorrhizae, VIII 9
Mycorrhiza of trees, VI 121
Myriapods of Penna. caves, XII 64
Myxophyseae of sulphur spring, X 136

— N —

Nails, shingle, rust resistance of, VII 73
Naturalists, amateur, research program for, XV 136
Necturus, pelvic muscles of, VI 98
Nematodes, II 49
Nerve endings in **Triturus**, X 119
Nervous system, central, X 108
New Bloomfield quadrange, structural geology of, IX 141
Newt, see **Triturus** vermillion spotted, I 106
Nocturnal adaptations, V 54
  animals, radiation benefit for, XII 16
Nomenclature, Devonian, XI 26
  plants, III 12
Nymph, chromosome number of, IV 97
Nymphea, stereids in, XI 20

— O —

Odonata from Mexico, XV 44
Oecanthus, egg parasites of, XIV 81
Ohiopyle, IV 31
Onyx cave, origin of, XV 68
Orchids, notable Pennsylvania, XII 42
Ordovician shales, XIII 126
Ore-dressing developments, IX 87
Organ, pearl, in fishes, I 60
Origin of life, X 12
Oriskany formation, thickness, XI 64
Osteology of goose, XI 13
Ovaries, implantation of, X 103, 104
Ovarioles, effect of x-rays on, IV 88
Ovulation, induced, in **Triturus**, X 123
Oxygen consumption of mussel, VIII 140

— P —

Paleobotanic investigations, VI 110
Parabola, evolutes of, I 108
Paleogeography of glacial clay, XIII 79
Paraffin-embedded tissues, XV 221
Paraffin sections, spreading, XIII 21
Paralysis, muscular, inheritance of, XI 73
Paramoecium, arresting motility in, II 95
  population curves of, II 97
  spiraling in, XI 81
Paramecium caudatum, in agar medium, XIV 124
Paramphistomum magnum, XIII 68
Parasite, intra-muscular, in salamander, VII 64
  trematode, survey of, XIV 124
Parasites, egg, of **Oecanthus**, XIV 81
  from cow stomach, XIII 68
Parasitic isopod, XI 71
Parents, aged, of psychotics, XV 148
Peaches, metal poisoning in, I 58
Peach yellows, I 82
Pea, garden, VI 87
Peanut, absorption hairs of, I 167
Penn's cave, geo-electric test at, XV 65
Penn's cave, woods, rehabilitating, II 79
Periodicity in lake levels, XV 133
Phagocytes, human, X 111
Pharmacognosy, XIII 27
Phengodes laticollis, II 27
Philadelphia area, alteration of gneiss in, XII 114
  heavy minerals in, XII 97
  symplectite of, XII 89
Philosophy, Doctor of, V 103
Phosphatase in clam, IX 57
Photochemistry, IX 45
Photoflood lamp, IX 45
Photoperiod, effect on spores, XIII 24
Photoreceptors in **Mya**, III 106
Physiography, teaching by maps, XI 61
Physiology of prostate, IV 35, VI 82
Physics, curriculum, VII 35
Physiographic studies, VI 91
Phytopharmacological test, IX 98
Pigeon chromosomes, VI 134
Pigmentary system of **Triturus**, VI 180, X 121
Pike County plants, V 28
Pioneers in science, III 63, XIV 20

Pike Run, limnology of, XIII 153
Planaria, studies on, VI 27
Plant biography, II 100
  fossils, II 117
  geography, III 42
  indicators, VI 125
  micrology, XV 225
  societies, I 23
Plants, endemic of shale-barrens, VII 160
  Fayette County, XV 207
  Monroe and Pike County, V 28
  naming of, III 12
  Presque Isle, VII 192
  phytopharmacological test on, IX 98
  range limits of, I 105
  Silurian land, XII 121
Plastic cover glass, XIV 142
Plastics, use in micrology, XIV 134
Poisoning, metal, in peaches, I 58
Polemoniaceae of Pennsylvania, IX 150
Poliomyelitis, epedemic of, VI 14
  pollution in, IV 69
  of streams, V 130
Polydactylous cat, IV 91, X 78
Polygyra, bacteria of, XIII 54
Polyploid **Tagetes,** XV 209, 213
Polysaccharides, acidic, II 101
Population increase, negro, I 75
Poria, new species of, XIII 121
Potatoes, tyrosinase in, VIII 52
Preservation, areas for, IV 30
Preserve, State Wild Flower, VIII 34
Presque Isle, IV 30
  algae on, III 47
  animal ecology of, V 88
  beetle ecology, V 97
  birds on, VII 192
  growth of, II 25
  plants on, VII 192
  seeds on, VI 80
  Triturus at, IV 55
Presque Isle Bay, phytoplancton in, IV 69
  polution in, IV 69
Pressure apparatus, vapor, XI 83
Prisms, floating, V 106
Prostate gland, IV 36, VI 82
  feeding to tadpoles, V 121
  effect of x-rays on, V 137
Prostate-thyroid interrelationship, VIII 99
Protoplasmic mechanism, XV 147
Protozoa in apple tree, II 102
Protractor, geologic structure, XIII 141
Psychology, VII 49
Psychotic disorders, XV 148
Pulmonates of Frick Park, XII 77
Punxsutawney, buried channel near, XII 119
Pymatuning swamp, IV 30
  mycorrhizae from, VIII 9

— Q —

Quartzite, Hardyston, XIII 94

— R —

Radiation benefits for nocturnal animals, XII 16
Radiation, heat, from metals, VI 127
  ultra-violet, XIII 110
Radio and education, III 44
Radish seeds, ultra-violet rays on, II 99
Radium ores, II 50
Ragwort, cat's-paw, IV 29
Rana, see Frog
  arterial anomaly in, VII 110
  sex reversal in, VII 112
Rat, hypertrophic teeth in, XIV 24
  splenectomized, VI 26
  splenectomized, life span of, IX 26
Rats, abscesses in, XIII 22
  blood cell changes in, X 148
  brain operation on, VI 146
  brain sizes in, VII 188
  cerebral atrophy in, VIII 19
  effect of heat on, VII 65
  exterpation of skull parts in, IX 22
  influence of mare serum on, XV 183
  reactions to injections, XIII 51
  white, yeast in lungs of, IV 12
Ray machine, ultra-violet, XII 146
Reading program for zoology, V 132
Refractometer, simple, XII 151
Regeneration, in Triturus, IX 112
  of appendages, VI 133
Rehabilitating Penn's woods, II 79
Relativity energy equation, I 78
Reproductive system of aphid, V 75
Reptiles of Bedford County, XV 164
  Indiana County, X 25
Research and science, XV 145
Research, field of, VI 73
  programs, amateur, XV 136
  scientific, II 82
Respiration, cellular, class study of, VII 184
Reticulitermes flavipes, IV 97
Rittenhouse, David, anniversary, VI 161
Road-building material, I 56
Rock varnish, XIII 98
Rodentia, dental malformations in, XV 28
Rot, brown, spread of, I 113
  control of, II 51
Rusts (flora), I 63
  list of, VII 140
Rust resistance of nails, VII 73

— S —

Salamander, amblystomid, IV 50
  habits of, III 94
  ravine, XIII 50
  see **Triturus**
  Wehrle's, X 28
Salivary glands of pig, XII 132
Samia hybrids, V 71
Sand wasp, colonies of, IX 149
Sarcina, color variant of, XIV 92
Sawflies, list of, VI 38
Sawfly, notes on, VIII 106
  wing venation in, VII 30
Scaphiopus holbrooki, XV 180
Schizanthus, morphology of, VIII 43
Science, XII 147
  and research, XV 145
  coming of age, II 68
  course in, IX 80
  in secondary schools, X 132
  teaching, committee on, XV 141
  teachers, organization of, XV 189
Sciences, border lands of, I 64
Scientific communications, IV 39
Scientist, Thomas Barton, XV 200
Scientists, pioneer, XIV 20
Scolecodonts, removal of, XV 119
Scolithus tubes, XIII 101
Sectioning chitin, XV 59
Sections, spreading paraffin, XIII 21
Seed production of Presque Isle, VI 80
  radicles, corn, electric effect on, IX 71
Seisholtzville, dike at, XV 89
Seismic study of limestone, X 72
Senecio antennariifolius, IV 29
Sericitization, X 66
Serpentine-barren plants, VI 32
Serum, mare, on rat organs, XV 183
Sex-determination in bees and wasps, VIII 103
Sex ratio in **Habrobracon,** VII 121
Sex reversal in **Rana,** VII 112

Sexual character of **Triturus,** modifications of, VIII 133
Shafer Run Cave, XIII 150
Shale-barren plants, VII 160
Sheep, cell division in, VIII 53
Silurian land plants, XII 121
Skin, amphibian, pattern in, IX 117
Sleep, depth of, III 38
  measurements of, II 43
Smears from glands of Diptera, X 146
  of salivary chromosomes, X 112
Smuts, list of, VII 122
Snails, land, coloration of, X 143
  mantle of, XV 32
Snakes, two-headed, IV 95
Soil, calcium in formation of, II 86
  effect of forest fires on, V 123
Soil Conservation Service, X 19
Soil fertility, putting greens, III 37
Soil, forest, VI 125
  effect of fire on, V 123, VII 43
Soils, surveying forest, I 57
Soil tests, IX 131
Solar spectra, II 96
Somerset County, geologic section in, XI 78
Sparrow, English, weight of organs of, X 36
Specialization, hazards of, VI 141
Sphinx, new, XIV 137
Spiraling in **Paramecium,** XI 81
Spitzenberg conglomerate, VIII 37
Splenectomy, human, XV 41
  in rats, effect of, VI 26, IX 26
Spore formation, XIII 24
Sporobolus uniflorus, I 71
Spring, sulphur, algae in, X 136
Springfield granodiorite, XV 115
Stain reactions, XII 129
Staining, biological, XII 150
  fetus skeletons, IX 38
  mold filaments, XV 224
  studies of limestone, VIII 83
Stains, iron haematoxlin, X 110
State flower, II 65, III 8
States, least known, IX 123
Stations, central power, I 59
Steroids in **Nymphea,** XI 20
Stratigraphy, at Brookville, XV 107
  of Cove Mountain, XV 111
  Godfrey Ridge, XIV 45
  Harrisburg axis, XV 97
Streptococci, dissociation of, XIII 18
Structural elements, relation of, XIII 141
Structural relations of Kittatinny Mountain, XIII 144
Structure, geologic, near Lock Haven, XIV 64
  of Cove Mountain, XV 111
Students, work for, XII 147
Survey, course in science, IX 80
Surveying forest soils, I 57
Susquehanna River, weather forecasting for, XV 125
Sweet potato roots, response of to B1, XV 217
Symplectite of Philadelphia area, XII 89
Syndactyly, bilateral, in cat, XV 155
Synonymy of **Tenthredinidae,** VI 42

— T —

Tadpoles, feeding prostate to, V 121
  heparin in, IX 59
Tagetes (marigold), XV 209, 213
Tail, bifid, in **Triturus,** VIII 127
Tar extract, effect of x-ray on, X 99
Tattooing infants, V 74
Taxation, forest, II 72
Taxonomist, criteria for, VII 58
Teacher training, museum for, X 75
Teachers, science, organization of, XII 149, XV 189
  secondary school, X 132
Teaching science, committee on, XV 141
  requirements, X 7
Teaching science, V 49, VI 129, VII 35
  high school biology, X 51
  vertebrate anatomy, VIII 102
  zoology, method of, IX 79
  to blind, IX 10
Teachers, selecting, VI 132
Technique, melting point, XV 169
  micrological, XIV 114
  hair identification, XV 164
Teeth, incisor, in rat, XIV 24
Tenthredinidae, list of, VI 38, 42
  wing venation in, VII 30
Tenthredo, antennal segments of, IX 147
Tenthredopsis, list of, VII 32
Termites, II 95
  chromosomes of, VII 121
Testes, dog, cat, sheep, etc., X 39
  mammal, XII 61, XIII 58
  mammalian, size of, XV 159
  newt, implantation of, X 103, 104
Textbooks, zoology, errors in, IX 115
Texts, biological generalizations in secondary, XIV 84
Thorium, toxicity of, VI 96
Thymus gland of hen removed, VI 187
Thyroid, mouse, variations, XII 161
Thyroid, postate interrelationship, VIII 99
Thyroxin, mammalian, XII 139
Tick, morphology of, I 107
Timelapse machine, X 131
Tissue frozen before fixation, XIV 133
Tissue, stain reactions in, XII 129
  paraffin-embedded, XV 221
Toad, parasite of, II 49
  spadefoot, XV 180
Tobacco hornworm, metabolism in larvae of, XI 22, XII 139
Tobacco, leaf spot on, V 37
Tomato, stem anatomy of, VI 60
Topographic maps, use of, XI 61
Toy fishes, VI 85
Tradescantia, maturation in, XV 223
Transplantation of head glands, VI 186
Transplants, in **Triturus,** XII 135
Tree antagonisms, VI 136
Trees, increment rate of, VIII 48
Trematode parasites, larval, XIV 124
Triodopsis tridentata, mantle of, XV 32
Triturus, amputation of tail of, VI 171
Triturus as laboratory animal, VIII 139
  asymmetrical grafts on, X 114
  bifid tail in, VIII 127
  brain grafts in, X 127
  castration and grafts, IX 107
  cloacal glands in, X 104
  color pattern in, IX 53
  effects of captivity on, VII 186
  effects of human urine on, VII 177
  egg-laying induction in, IX 52
  follicular atresia in, VII 176
  grafting experiments in, XII 136
  head glands in, VI 186
  hedonic glands of, X 117
  hepatectomy in, IX 121
  implanted tissues in, VI 176
  induced molting in, VIII 129
  induced ovulation in, X 123
  interaction of tissues in, VIII 126
  larval and adult tissues, IX 120
  larval graft to, X 107
  lymphatic system, injection of, IX 45
  melanin production, IX 49, 50

mesenteries of, IX 110
negative geotropism in, V 102
nerve endings in, X 119
nervous system of, X 108
organismal differentiates in, X 105
pattern regulation in, IX 117
pigmentary system of, VI 180, X 121
Presque Isle, IV 55
regeneration in, IX 112
regeneration of appendages of, VI 183
regenerative capacity, V 100
seasonal changes in gonads of, VI 174
sex ratio, V 101
sexual characters, modification of, VIII 133
testes and ovaries in, X 103, 104
transplants in, XII 135
ultra-violet radiation on, V 122
Triturus viridescens, VI 27
anomalies in, VI 165
life history of, VI 164
parasite in, VII 64
x-radiation on, VI 167, X 54
Tunnels, geology of Turnpike, XII 124
Turnpike, geology of tunnels, XII 124
Turtle, double, I 72
Twenty-five years out, VIII 73
Twinning, in chick embryo, II 106, VI 57
in earthworm, XV 21
snake heads, IV 95
turtle, I 72
Two-headed snakes, IV 95
Tyrosinase in potatoes, VIII 52

— U —

Ultra-violet radiation on **Triturus,** V 122
radiations, XIII 110
ray machine, XII 146
rays, II 99
Uncertainty principle, VI 62
Uniformitarianism, concept of, XIV 68
Urine analysis, XIV 141
human, effect on salamander, VII 177
Universe, exploding, X 85
Urodele, see **Triturus**
Ustilaginales, list of, VII 122
Uterine action of viburnum X, XIV 118

— V —

Vallisneria, chromosomes of, X 112
Vapor pressure apparatus, XI 83
Variations in spotting of horses, XII 33
Vegetation in West Goshen Twp., Chester County, Pa., XV 194
Veins, fissure, banding in, IX 31
Vertebrates, cave, XI 38
rare, II 21
Vibrio metchnikovi, invection in chicks with, XII 59
Viburnum, uterine action of, XIV 118
Volcanic rocks, Colorado, XIII 134

— W —

Wading River, ecology of, IV 60
Washington County scientists, XIV 20
terrestrial mollusca, XIV 34
Wasp, giant sand, IX 149
Wasps, heredity of, III 27
biparental male, IV 85, 87
parasitic, see **Habrobracon**
long antennae of, IV 80
sex determination in, VIII 103
Water, chemist looks at, IV 108
quality of, V 130
supplies and miasma, V 127
under the earth, XIV 39
Water hemlock kills, IX 69
Wax, anatomical models in, IX 47
Weather, II 60
forecasting, XV 125
predictions, I 75
Weight of organs of sparrow, X 36
see Testes
Wildlife program, X 19
Wind direction aloft, XV 128
Wing venation in sawfly, VII 30
in aphids, VII 69
Wood, petrified, I 66
Wool identification, XV 164
Work for students, XII 147

— X —

Xanthene compounds, IV 117, V 139
Xiphosuran, new, IX 126
X-rays, II 102, III 27
on corn, IV 32
on prostate, V 137
on tar extract, X 99
on **Triturus,** X 54
technique, IV 122
tube, ionics of, I 101
mutation, III 30, 32
in **Habrobracon,** IX 60
on ovarioles, IV 88
X-radiation in **Habrobracon,** VII 121
X-raying sperm in **Habrobracon,** XII 74
X-rayed tyrosinase, III 90

— Y —

Yeast, in rat lungs, IV 12
oxidation-reduction potential of, VII 183
and molds, pathogenic, XII 45

— Z —

Zircon, hyacinth, XV 73
Zoology, reading program, V 132
teaching, IX 79
textbooks, errors, in, IX 115