

## THE SMITHSONIAN INSTITUTION

1516

REPORT FOR 1946-47

THE annual report of the Board of Regents of the Smithsonian Institution for the year ended June 30, 1947, \* has now been published as a bound volume, including, besides the secretary's report and that of the executive committee, reports on the United States National Museum, National Gallery of Art, Freer Gallery of Art, Bureau of American Ethnology, International Exchange Service, National Zoological Park, Astrophysical Observatory, National Air Museum, Canal Zone Biological Area, and the Institution's library and publications. In a general appendix are reprinted a series of papers, some original, ranging over such diverse subjects as large sun spots, atomic energy, the use of isotopes as tracers, silicones, new products of the petroleum industry, drowned ancient islands of the Pacific basin, the biology of Bikini Atoll, the senses of bats, the influence of insects on human welfare, mosquito control tests, the primary centres of civilization, and the performance of propeller and reaction-propelled aeroplanes.

The reports from the National Air Museum and the Canal Zone Biological Area are the first to be included since these came under the administration of the Institution. The former, established in August 1946, is concerned mainly with the acquisition of a storage depot for the temporary assembly of material for the Museum. The latter includes the biological laboratory on Barro Colorado Island, which has already been responsible for much valuable scientific work. Some account of this work during the past twenty-four years is included in the present report. Studies cover the testing of wood for proofing against termites, the tropical deterioration of plywoods, textiles and packaging containers, and the effect of fungi on optical glass. Biologists go to the island regularly to study the fauna and flora, and there is a herbarium of 1,533 mounted specimens, as well as a species index containing about 7,000 entries. In addition to rainfall, temperature and relative humidity observations for 1946, the report records trials demonstrating the possibility of using treated timbers to build a termite-free house even where termites are extremely abundant and active.

Nearly 757,000 specimens went to the United States National Museum during the year, including two large and outstanding collections of fishes; but one of the most promising features of the year's work was an opportunity to resume field investigations of fifteenth-century historic Indian village-sites and some of the early Spanish settlements in the West Indies. Field studies were also made in Guatemala on the highland Maya for comparison with the lowland Maya of Yucatan; a survey of the fishery resources of Guatemala was continued and a botanical survey made of St. Vincent. The Bureau of American Ethnology continued the River Basin Surveys instituted in 1945 to recover archaeological and palaeontological information and materials which would be lost through the construction of dams and large reservoirs in many of the river valleys of the United States. Surveys in the Missouri Basin have been followed by others in Georgia, Virginia-North

Carolina, Texas, California and the Columbia-Snake basin, while other investigations related to Eskimo anthropology, an Arctic Bibliography and Roster, the social organisation and ceremonial life of the Seneca nation, and cultural affinities between the northern Iroquoians and the Cherokee of the Great Smoky Mountains. Packages received by the International Exchange Service for transmission increased by 163,296 to 703,798, and the lag due to the War has been decreased to 69,020 lb. Consignments are forwarded to all countries except Roumania and Yugoslavia.

A slight improvement in the supply of animals for exhibition enabled the National Zoological Park to replenish the stock; but although some physical improvements were made, the Zoo was still understaffed. A list of additions and of animals, birds and reptiles in the Park is appended. The Division of Astrophysical Research was concerned first with appraisal of the solar constant values received from its field stations, with planning and developing improvements in instruments and methods, and with Camp Lee measurements of sun and sky radiation. The Division of Radiation and Organisms concentrated its work on the role of light, especially the wave-length effects, on the fixation of carbon by green plants, and on the influence of light on plant growth and development, particularly the mechanism of dormancy in light-sensitive seeds and the developmental physiology of grass seedlings. Of 62,137 accessions to the library, 14,607 went through the International Exchange Service, and 1,693 books were purchased. Like other departments of the Institution, the library was seriously handicapped by insufficient staff and accommodation, and overcrowding and lack of funds for binding caused progressive deterioration of its fine collections.

## IODINE AS A MEANS OF DEVELOPMENT IN PAPER CHROMATOGRAPHY

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IN a search for an agent for revealing the position of choline and other N-methylated alkanolamines separated by chromatography on papers, iodine was found satisfactory. It can be either directly sublimed on to the dried paper or sprayed in alcoholic solution, both methods having their special advantages. During the sublimation or spraying, spots of a brown to yellow colour develop, and they grow more distinct when any excess iodine or solvent is fanned away. Inspection in ultra-violet light sometimes makes the border-lines of the spots more easily discernible. As fading rapidly sets in, the spots are best judged immediately and outlined with pencil. After some heating or hanging at room temperature, the colour of the spots caused by most substances disappears completely. New iodine treatment then again reveals them.

After disappearance of the iodine, the same paper may, without any disadvantage, be developed by some other agent, for example, ninhydrin, the hexosamine reagent according to Morgan and Elson, general sugar indication reagents (ammoniacal silver

\* Annual Report of the Board of Regents of the Smithsonian Institution, showing the Operations, Expenditure and Conditions of the Institution for the Year ended June 30, 1947. (Pub. 3921.) Pp. 471. (Washington, D.C.: Government Printing Office, 1948.) 2 dollars.



*R<sub>f</sub>* values\* of some amines and amine derivatives (Munkelt *MOB* paper, temp. 20–23° C.)

	Reaction to		<i>n</i> -Butanol, 40%; ethanol, 10%; water, 50%	<i>n</i> -Butanol, 40%; acetic acid, 10%; water, 50%	<i>n</i> -Butanol-phenol†
	Iodine	Ninhydrin			
I. Amino-acids					
Glycine	+	+++	0.16	0.32	0.04
Alanine	+	+++	0.22	0.39	0.09
Serine	+	+++	0.20	0.28	0.03
Threonine	+	+++	0.23	0.35	0.05
II. Amines					
Amino-ethanol	++	++	0.31	0.43	0.34
Histamine	+	++	0.32	0.25	0.73
Glucosamine	+	++	0.30	0.28	0.09
III. <i>N</i> -methylated amines					
Monomethylamino-ethanol	++	+	0.41	0.45	0.49
Dimethylamino-ethanol	++	(+)	—	0.47	—
Choline	+++	—	0.19	0.45	0.45
Sarcosine	++	++	0.24	0.36	0.10
Betaine	+++	—	0.26	0.40	0.34
Acetylcholine	+++	—	0.31	0.48	0.60
Neurine	+++	—	0.23	0.46	0.55
Trimethylamine (-sulphate)	++	—	—	(0.43)	—
Trimethylamine-oxide	+++	(+)	0.36	0.54	0.61
Adrenaline	+	+	0.24	0.47	0.24
IV. Guanidine bases					
Arginine	+	+++	0.12	0.14	0.07
Guanidine	++	—	0.27	0.50	0.41
Guanidine-HAc	sl. +	—	0.21	0.39	0.12
Creatine	sl. +	—	0.22	0.37	0.11
Creatinine	+++	—	0.43	0.50	0.48
V. Purines and pyrimidines					
Adenine	sl. +	—	0.17	0.35	0.06
Xanthine	sl. +	—	0.12	0.36	0.05
Guanine	sl. +	—	0.13	0.37	0.12
Uracil	sl. +	—	0.13	0.34	0.08
Thymine	sl. +	—	0.13	0.36	0.07

\* *R<sub>f</sub>* values indicate the ratio between the distances of the substance and the solvent fronts from the initial position of the substances.

† 20 parts of water-saturated *n*-butanol mixed with 7 parts of water-saturated phenol were separated and the upper layer used in the trough.

nitrate, *m*-diphenylendiamine), picrate solution. After ninhydrin treatment, a paper may be developed by iodine (preferably by spraying) with similar results as though ninhydrin had not been used.

A great many nitrogen-containing compounds examined (in spots in most cases containing about 20–30 μgm. of substance) gave positive reactions of varying intensity and quality. I was especially interested in certain amines and their *N*-methylated derivatives, known or expected to be constituents of lipids. Most of the substances tested of this class gave very distinct and characteristic brown to flame-coloured spots. But various amino-acids, guanidine bases, pyrimidines, purines, etc., also were coloured, though in most cases much more faintly. Subsequent to iodine development most amino-acids gave the usual purple colour with ninhydrin; but some, for example, tryptophan, histidine and cysteine, retained iodine for a long time, thereby modifying the ninhydrin colour to a browner tint.

The method may be of value in qualitative analysis of mixtures containing only a few positively reacting substances. Thus it was found very suitable for my own purpose, namely, a study of nitrogenous constituents in lipid hydrolysates (to be published elsewhere).

Data for some solvents used in these studies are collected in the accompanying table. Several other solvents have been tested and found less useful; thus it may be mentioned that in water-saturated phenol alone the methylated amines move unduly fast, and that nitrogenous solvents, due to their own reactivity with iodine, must be very thoroughly removed before iodine treatment, and therefore some of them are less convenient.

Due to their volatility, trimethylamine and dimethylaminoethanol do not appear at all, monomethylaminoethanol only with reduced strength on papers run in neutral or alkaline solvents in air. After adding one or two per cent of acetic acid to the solvent, the foregoing substances will be retained in the paper. Such solvent mixtures are now being studied.

Hitherto I have examined mainly substances which might be expected to be constituents of lipids or contaminants in lipid extracts. Purines and pyrimidines, owing to their slight solubility and faint iodine reaction, will probably not lead to errors in lipid analysis by the iodine reaction. On the other hand, the strongly reacting creatinine was identified in a distinct spot, deriving its origin from an alcoholic fraction of a lipid extract of a brain in uraemia.

In the table may be noticed several examples of the influence on its chromatographic behaviour of an OH- or CH<sub>3</sub>-radical entering into a substance. This may be of some guidance in interpreting unknown spots.

Also in quantitative experiments with paper chromatography, iodine may prove convenient by revealing the position of the substances to be estimated; particularly as the iodine later sublimes, leaving outlined spots for excision, soaking and chemical or physical determination.

The ready formation of iodine addition compounds by amines and amine derivatives seems to be the cause of the iodine reaction, at least in most instances.

## VISUAL AIDS TO EDUCATION

THE application of visual aids to education has been stimulated during the last decade mainly because the value of the still and motion picture projectors is being increasingly realized. Visual aids have existed for a long time; but it is only comparatively recently that their significance as an educational medium has been fully appreciated. This was recognized by the Harvard Report on "General Education in a Free Society", which states: "Traditionally language deputises for what has to be absent. It tells us what we might see or hear. But it too often gets in the way of, or replaces, all that could give it a meaning. Now that the things and events themselves can be brought to us, the role of language is reversed. Instead of words having to explain or represent things, it is rather things or actual processes taking place before us, which explain words or call them in question."

To-day visual aids to illustrate and explain the written or spoken word are commonly used in the form of pictures, charts, diagrams and plays, while there is a growing interest in, and use of, still and motion pictures. The use of the latter in education was discussed by Mr. R. Beloe, chief education officer of Surrey County Council, in his address to the Education Section of the British Association at