and the persisting effort to urge certain changes of terminology upon an unwilling science. With respect to this last item, the reviewer hopes, however, that some day meteorology will no longer remain unwilling to adopt McAdie's "hyperbar" and "infrabar."

Let it be clearly said that the general reader will discover in this book much to interest and inform him, a very great deal that is most attractively written, occasionally a little masterpiece. He will, it must be pointed out, feel that the going is sometimes a little uneven, for there are bumps of technical matter by no means adequately smoothed out for the layman. Some of these are probably beyond legitimate smoothing for a book of this kind; they would better be omitted altogether. But the recommendation is emphatically to read "Man and Weather," nevertheless.

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Nomenclator animalium generum et subgenerum. Published by the Prussian Academy of Sciences, Berlin.

THE plan of this work traces back more than twenty years. Franz Eilhard Schulze, the editor of "Das Tierreich," also formed the original plan for this comprehensive index of the correct names of the genera and subgenera of the animal kingdom. After his death, W. Kükenthal became the editor and at the present time it is continued by K. Heider as editor and Th. Kuhlgatz as responsible manager. The work will not only enumerate all the names of the genera and subgenera including the paleontological names, but as far as possible will give for them the exact reference of their first employment. Since it was the original plan not to go beyond the literature of 1909, these detailed statements are given only for those names which came into use previous to this date. For all the names that originated from 1910 through 1922 the references of the *Zoological Record* will be given. Most of the subdivisions have been worked out by specialists, the bureau of the "Nomenclator Commission" of the Prussian Academy of Sciences directly taking care of the few remaining fields for which specialists could not be found.

Doubtless this work, of which four issues have left the press, will prove to be of greatest usefulness to workers in all fields of zoology, and one can but admire the great amount of prosaic work necessary to accomplish it. The entire work will comprise five volumes, each of which will be published in five issues. Subscriptions are to be sent to the Preussische Akademie der Wissenschaften, Unter den Linden 38, Berlin NW 7. The subscription price is 15 marks for every issue (160 pages, approximately) and will change to 20 marks after March 31 of this year.

WALTER LANDAUER

SPECIAL ARTICLES

THE INFLUENCE OF SELECTIVE AND GENERAL IRRADIATION BY A QUARTZ MERCURY ARC LAMP UPON THE GERMINATION AND GROWTH OF SEEDS

DURING the last few months we have been conducting experiments (1) to determine the effects produced upon the germination and growth of seeds by selective irradiation as obtained by the use of filters which screened out, by progressive steps, the various portions of the ultraviolet radiation from a quartz mercury-arc lamp and (2) to determine the daily growth of various seedlings when irradiated from one, two, five and ten minutes, respectively, under the same lamp, and when grown in darkness or under subdued daylight as transmitted by ordinary window glass. The experimental conditions were maintained as uniformly as possible with reference to temperature, moisture, character of containing vessels and methods of handling seedlings. An air-cooled quartz mercury lamp of the Victor X-ray Corporation type was operated at 70 volts and was used at a distance of 50 cm. The lamp was standardized and found to produce a grade 1 reaction (transient erythema) of the normally unexposed skin of the upper arm in three minutes at a distance of 50 cm and a grade 2 reaction (permanent erythema) in six minutes.

SELECTIVE IRRADIATION

Table I contains a sample set of data obtained on the germination and growth of cucumber seedlings; the character of the irradiation, the periods of exposure to the quartz mercury lamp, and the subsequent disposition of the seedlings (that is, whether kept in the subdued daylight of the room or in darkness) are also given.

The conclusions which we believe we are justified in drawing are:

(1) Selective irradiation of the seed modifies the time of its germination and rate of its subsequent growth.

(2) The lesser wavelengths, in general, appear to stimulate while the greater wavelengths inhibit germination.

(3) Wavelengths ranging from about 320 mμ to 390mμ seem particularly effective in inducing growth.

(4) Wavelengths of 270 mμ to 320 mμ appear to be inhibitory in their action, and delay the time and lessen the rate of growth, probably because of changes

which, carried to their extreme, eventuate in coagulation of the seed albumin.

(5) Some of the energy emitted by the lamp and absorbed by the seed may be rendered ineffective by subsequent exposure of the seed to the visible and near infra-red regions of interior daylight.

(6) Certain wavelengths of radiant energy are more potent in germination than temperature. With a constant temperature, germination and growth in the dark greatly exceed those in the daylight as transmitted by ordinary window glass.

(7) A certain amount of energy, apparently produced under the action of the lesser wavelengths of sunlight, is normally stored up within seeds. Under proper conditions of light and moisture this energy induces germination.

(8) Lesser wavelengths of light act as stimulative agents which modify the control of endogenous processes and accelerate germination, while subsequent growth and development of the plant is doubtless a function of the visible or infra-red wavelengths.

General Irradiation

In these experiments, various seeds (lettuce, radish, and turnip) were placed in similar containers and kept under identical and as nearly as possible uniform conditions of temperature and moisture. Table II contains a specimen set of data upon the germination and daily growth of turnip seedlings when directly irradiated by the mercury lamp for daily periods of one, two, five and ten minutes, respectively. Half of the seedlings were kept in darkness, while the others were placed under diffuse daylight.

From these series of experiments we conclude:

(1) In seeds which normally germinate and grow in darkness and underground, the most rapid germination and maximal growth were attained by the normal non-irradiated seeds and roots kept constantly in darkness.

Table I

Length (mm.) of seedlings grown under varying experimental conditions

	I		II		III		IV		V	
Elapsed time in hours	Ultra glass (a) dark	(b) light	Vitaglass (a) dark	(b) light	Ordinary glass (a) dark	(b) light	Direct radiation (a) dark	(b) light	Control (a) dark	(b) light
40	4	4	3	1	2	0	3	0	0	0
64	14	14	10	6	9	0	7	1	9	0
88	36	24	27	14	23	1	19	5	28	2
112	54	30	42	20	35	2	30	8	52	6
136	65	37	47	25	44	3	31	5	63	8
184	70	40	55	25	60	3	31	5	82	6

Pots I(a) and I(b) were exposed to the radiation of the mercury quartz lamp for 20 minutes each day. Pots II(a) to IV(b) inclusive were irradiated by the same source for 5 minutes daily.

Ultra glass (Corning 586 A W) transmits from 390 to 320 mμ with a maximum at 370 mμ. Vitaglass (Lamplough) transmits to 270 mμ; ordinary glass to 320 mμ.

Table II

Daily growth of turnip seedlings (mms.) under specified experimental conditions

	I		II		III		IV		V	
Elapsed time in hours	Irradiated 1 minute daily dark (a)	light (b)	Irradiated 2 minutes daily dark (a)	light (b)	Irradiated 5 minutes daily dark (a)	light (b)	Irradiated 10 minutes daily dark (a)	light (b)	Non-irradiated controls dark (a)	light (b)
28	1	0.5	2	1	2	2	2	2	3	0
52	5	2.5	3	4	6	5	6	5	7	0.5
76	18	6	14	12	11	15	7	12	25	1
100	24	11	20	19	12	15	7.5	12	33	1
124	35	20	27	25	13.5	14	9	12	42	4
148	42	30	35	35	15	13	10	13	50	4
172	46	35	42	40	15	13	10	13	60	12
196	50	40	47	52	15	13	10	13	70	12

All seeds and seedlings irradiated by a mercury quartz lamp, operated at 70 volts, at a distance of 50 cm. Seedlings grown in a dark cabinet are indicated by (a); those grown under subdued or interior daylight as transmitted by ordinary window glass are designated (b).

(2) The amount of growth of the seedlings kept in darkness decreases with the amount of irradiation. The total growth (L) of the root is inversely proportional to the logarithm of the total time of irradiation (n·t). That is,

$$L = k\frac{1}{\log\ (n \cdot t)}$$

in which t represents the daily time of irradiation in minutes, and n is the number of days.

(3) The least rapid germination and minimal growth were attained by normal, non-irradiated seedlings kept under maximal periods of diffuse daylight as transmitted by ordinary window-glass. In the light transmitted there is no appreciable ultraviolet content below 380 mμ; hence, practically speaking, no ultraviolet portion.

(4) The action of diffuse daylight is to inhibit germination of seeds and growth of roots. Since there is a preponderance of greater wavelengths and an absence of ultraviolet radiations in subdued interior daylight, it is evident that the greater wavelengths inhibit (or at least do not stimulate) the germination of seeds and the growth of roots of those seeds which normally germinate and grow underground.

(5) Irradiation by a quartz mercury lamp accelerates the germination of seedlings kept in subdued interior daylight as compared to the germination of normal non-irradiated seeds under similar conditions.

(6) In general, optimal conditions for continuous maximal growth of seedlings kept in interior daylight are attained under irradiation periods of two to three minutes a day.

(7) The stimulus to most rapid germination of

seeds kept under interior diffuse daylight is an initial irradiation of from five to ten minutes. Longer periods of irradiation appear to have no additional stimulative effect. Two or three periods of daily irradiation of from five to ten minutes each induce the maximal growth in seedlings kept under interior daylight. Therefore we may believe that such quantities of irradiation are able to counteract the untoward conditions relative to germination and growth induced by daylight.

(8) These experiments, in toto, lend support to the hypothesis that ultraviolet radiation in the so-called biologic or "near"-ultraviolet region aids in the germination and growth of a cell or normal functioning of an organism which is kept under an unphysiologic environment.

(9) These experiments also support the hypothesis that biologic or "near"-ultraviolet radiation stimulates the endogenous growth of the cells and of the organism as a whole, while the greater wavelengths influence the exogenous metabolic processes.

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THE EFFECT OF SODIUM BICARBONATE ON THE TITRATION OF IODINE WITH THIOSULFATE

THE well-known reaction between iodine and sodium thiosulfate has been studied under different hydrogen-ion concentrations by a number of investigators.[1,2,3,4] In the course of a recent investigation, it became desirable to titrate iodine in the presence of iodate in an initially acid solution, and it was considered possible to accomplish this result by adding an excess of sodium bicarbonate and titrating with thiosulfate.

Since the results were found to vary with the amount of bicarbonate added, the following experiments were carried out: Twenty-five ccm of standard iodine solution were titrated under the following conditions: (1) In different concentrations of hydrochloric acid; (2) in initially neutral solution; (3) in initially neutral solution to which various known amounts of sodium bicarbonate were added; (4) in a solution initially 0.08 normal in hydrochloric acid to which sodium bicarbonate was added in known excess of that required just to neutralize the initial acidity.

[1] Bray, *Z. physik. Chem.*, 54, 471–2 (1906).
[2] Kolthoff, *Zeit. anal. Chem.*, 60, 343 (1921).
[3] Abel, *Z. anorg. Chem.*, 74, 393 (1912).
[4] V. Auger, Compt. Rend. 154, 1806–7 (1911); and others.

The table shows the results obtained. The volumetric ratio found in acid solution, namely, 1.236, has been taken as standard[5,6] for the calculation of percentage error.

THE TITRATION OF IODINE BY THIOSULFATE UNDER DIFFERENT CONDITIONS

Initial concen. HCl	$NaHCO_3$ excess grams	Volume of thiosulfate in ccm	Ratio ccm thio/ ccm iodine	Percentage error Schupp	Percentage error Kolthoff
2.0 N.		30.90	1.236	0.00	
0.03		30.90	1.236	0.0	
		30.84	1.234	0.2	0.0
	0.1	30.52	1.221	1.2	
	0.25	29.96	1.198	3.1	
	0.5	29.67	1.186	4.0	4.2
	1.0	28.64	1.146	7.3	4.6
	2.0	28.21	1.128	8.7	9.6
	3.0	27.92	1.117	9.7	16.0
	5.0	27.16	1.098	11.2	
0.08	3.0	30.82	1.233	0.2	
0.08	6.0	30.23	1.210	2.1	

In each titration, 25 ccm of approximately 0.1 N. iodine solution in 0.12 N. potassium iodide were used. Initial volume, 25–35 ccm. Each titration was made almost immediately after adding the bicarbonate.

The results, which compare favorably with those of Kolthoff[2] given in the last column of the table, and with the work of Bray,[1] are low if the iodine solution is initially neutral and sodium bicarbonate added. This is doubtless due to the formation of sodium hypoiodite and iodide from the hydrolysis of the bicarbonate, and to the oxidation of the thiosulfate to sulfate instead of to tetrathionate by the hypoiodite thus formed. If the solution is initially acid, the results agree closely with the accepted ratio, even when a small amount of bicarbonate is present. If the solution is more than normal in bicarbonate at the time of titration, even though saturated with carbon dioxide, less than the theoretical amount of thiosulfate is required. The results also indicate that the titration of iodine with thiosulfate can be made with approximately the same accuracy in an initially acid solution not over normal in bicarbonate as in a neutral solution of iodine. However, if the iodine solution is made more concentrated in bicarbonate, even if also saturated with carbon dioxide, the results are always low.

The direct titration of iodine in the presence of an acidified iodate solution is probably not accurate, since the iodate-iodide reaction takes place to some extent in the presence of carbonic acid.

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[5] Vosburgh, *J. A. C. S.*, 44, 2120 (1922).
[6] Bray and Miller, *J. A. C. S.*, 46, 2204 (1924).