the structure of certain isomers of androsterone excreted during pregnancy in the mare.

Miss M. M. MacKenzie, of the University of Western Ontario, studied the relation of age of rats to susceptibility to cancer induced by benzanthracene. She found younger rats more susceptible than older ones, but the strain of the rat was found to be much more important than its age or sex.

Miss D. B. Mundell, of the University of Toronto, has devised a simple method for the purification of tissue cholinesterase from dog pancreas. One milligram of the purified esterase hydrolyses 4–5 grams of acetylcholine per hour. This degree of purity is about 100 times greater than that obtained by Stedman.

Dr. L. T. Newman and Messrs. W. A. Ladd and J. H. L. Watson, of the University of Toronto, worked on several applications of the electron microscope to medical research. With Dr. D. Irwin, a study was made of the size of the particles of mine dust, and it was found that particles 0.03–0.20 microns in diameter were much more numerous in drilling than in blasting dust. With Dr. J. Craigie, School of Hygiene, University of Toronto, several hundred photomicrographs of vaccina virus, typhoid bacillus, rickettsia and bacteriophage were taken.

Miss H. M. Perry, of the University of Toronto, performed experiments which showed that the lessened carbohydrate stored in scorbutic conditions was due to inanition and not to the deficiency of vitamin C. A peculiar condition of fat storage in vitamin C deficiency was substantiated, but fatty or cirrhotic livers were not observed. Experiments also showed that the capillary fragility is not a good index for the clinical estimation of either vitamin C or P deficiency.

H. C. Read, of Dalhousie University, found that the X-zone of the adrenal glands of the mouse degenerate during pregnancy and will regenerate after pregnancy but that regeneration is delayed by lactation. In immature animals the X-zone can be made to disappear by injections of oestrone, testosterone, A.P.L. and P.M.S. hormones.

Dr. K. Sternbach, of the University of Toronto, tested the activity of 104 new compounds of the sulfanilamide type, prepared by Dr. Schnitzer, against meningococcus infection. Ten showed definite activity but no more than that of drugs already known. Of a smaller series of drugs prepared by Dr. Siebenmann, two were found which were as efficacious as sulfanilamide with regard to meningococcus infection and were decidedly less toxic. Dr. Sternbach has also obtained a method of infecting animals with gonococci, so that sulfanilamide compounds could be tested against this type of infection in animals.

Dr. P. G. Weil, of the Royal Victoria Hospital, Montreal, has made further studies with regard to the histamine content of blood and tissues in shock. He has also investigated the value of certain substitutes for whole fresh blood in the treatment of the condition.

The trustees wish to point out that in addition to financially assisting the above-described individual researches, the foundation gave a block grant, amounting to almost half the income of the foundation, to the Banting and Best Chair of Medical Research, University of Toronto.

The trustees wish to remind medical research workers in Canada that funds are available each year to financially assist individuals who submit problems which meet with the approval of the trustees. Meetings at which applications are considered are usually held in May, August and December.

V. E. HENDERSON
THE BANTING RESEARCH FOUNDATION,
TORONTO, CANADA

SPECIAL ARTICLES

THE EFFECT OF COLORED IONS ON THE PHOTO-INACTIVATION OF INVERTASE

AGULHON[1] showed that invertase is inactivated directly by ultraviolet light of wave-length shorter than 3022 Å, while longer wave-lengths have no effect. However, von Tappeiner[2] had shown that the addition of fluorescent dyes to solutions of invertase preparations sensitized the enzyme to the action of sunlight. It seems apparent from these experiments that the radiant energy absorbed by the dye is in some way transferred to the enzyme molecule where it inactivates the prosthetic group. However, the task of proposing a theory of actual mechanism of energy transfers of this type is greatly complicated by the polyatomic nature of the dye molecule, for at least two possibilities exist: (1) the free dye molecule might be activated by light and transfer energy to the enzyme molecule in a collision process; or, (2) the dye molecule and enzyme molecule might form a complex which absorbs light energy, inactivating the enzyme and possibly freeing the dye molecule which may then take part in further inactivations. In a detailed discussion of the available evidence Blum[3] favors the latter mechanism.

[1] H. Agulhon, *Compt. Rend. Acad. Sci.* (Paris), 152: 398, 1911; *ibid.*, 153: 979, 1911; *Ann. Inst. Pasteur*, 26: 38, 1912.

[2] H. von Tappeiner, *Ber.*, 36: 3035, 1903.

[3] H. F. Blum, "Photodynamic Action and Diseases Caused by Light," p. 82, Reinhold Publishing Corp., New York (1941).

It seemed desirable to attempt to find out whether some monatomic ion having a suitable absorption spectrum could be found which would sensitize invertase to the action of light; for here, presumably, the first of the above possibilities would not exist. In this paper are reported the results of a preliminary investigation of the effect of certain inorganic ions on the photo-inactivation of invertase.

The enzyme used in this study was a commercial preparation[4] labeled "invertase scales"; it had been obtained from bottom fermenting yeast and contained some melibiase. For each experiment 0.03 gm of this preparation was dissolved in 4 cc of distilled water containing 1 drop of 0.1 N HCl and the desired concentration of the inorganic salt. After the enzyme had completely dissolved, 2 cc of this solution were placed in a quartz test-tube for irradiation and 2 cc reserved as a control in a glass test-tube of the same dimensions, but wrapped in black paper. Both tubes were then placed at a distance of 10 cm from a glass enclosed Type H-3 General Electric mercury vapor lamp for a measured length of time. The solution in the quartz tube thus received the full radiation from the lamp, while the control in the glass tube was affected only by the heat radiated from the lamp.

Following irradiation, the enzyme solutions were brought to 25° C. and each thoroughly mixed with 10 cc of a 20 per cent. sucrose solution. The rates of inversion of sucrose at 25° C. were then followed simultaneously in the 20 centimeter tubes of two polarimeters.

TABLE I

EFFECT OF COLORED IONS ON THE PHOTO-SENSITIVITY OF INVERTASE

Experiment number	Ion concentration (Mg/cc)	Length of time irradiated (min.)	Degrees of rotation			
			Original	20 min.	40 min.	60 min.
1.	None	0	12.5	8.0	4.6	2.4
		15	12.5	8.0	4.8	2.5
2.	0.1 mg Cu^{++}/cc	0	12.5	6.0	1.25	0.8
		15	12.3	12.0	12.0	12.0
3.	0.1 mg Cu^{++}/cc	0	12.33	7.48	4.15	2.1
		8	12.35	8.12	5.93	3.75
4.	0.4 mg Cu^{++}/cc	0	11.5	9.0	8.4	....
		15	11.5	11.5	11.5	....
5.	0.1 mg Fe^{++}/cc	0	12.3	7.45	3.75	1.25
		15	12.3	7.45	3.80	1.25
6.	0.1 mg Ni^{++}/cc	0	12.1	7.48	3.75	1.20
		15	12.1	7.48	3.98	1.98
7.	0.1 mg Co^{++}/cc	0	12.0	7.47	3.80	2.0
		15	12.0	7.47	3.83	2.38
8.	0.11 mg UO_2^{++}/cc	0	11.25	10.25	10.18	....
		15	11.30	10.31	10.31	....

The results are shown in Table I, which contains in successive columns the number of the experiment, the ion concentration, the length of time of irradiation and degrees of rotation in the polarimeter at various times after mixing the enzyme solutions with sucrose. From the results of Experiment 1 in which no salts were added to the enzyme, it is seen that 15 minutes irradiation of the enzyme alone had no effect on the activity. Experiment 2 shows that, while 0.1 mg Cu^{++} (as $CuSO_4$) per cc has a negligible direct effect on invertase activity, 15 minutes irradiation of a mixture containing this concentration of Cu^{++} results in almost complete inactivation of the invertase. In a supplementary experiment similar inactivation was found to result from 15 minutes irradiation of a solution containing only 0.05 mg Cu^{++} per cc. Experiment 3 shows that an 8-minute period of irradiation of invertase in the presence of 0.1 mg Cu^{++} per cc results in only partial inactivation of the enzyme. Experiment 4 shows that 0.4 mg Cu^{++} per cc partially inactivates the enzyme even without radiation, while irradiation increases the extent of inactivation by this concentration of Cu^{++}.

Experiments 5, 6 and 7 show that the colored ions Fe^{+++}, Ni^{++} and Co^{+++} in concentrations of 0.1 mg per cc bring about negligible inactivations of invertase even when the solutions were irradiated. Uranyl ion as $UO_2(NO_3)_2$ containing 0.1 mg of uranium per cc almost completely inactivates the enzyme; irradiation in the presence of uranyl ion causes still further inactivation. In another experiment Ca^{++} was found to have no effect.

The results suggest that, in order to bring about a photo-inactivation, a monatomic ion must have first, a suitable absorption spectrum, and second, a means of transferring the absorbed energy to the enzyme molecule. It seems probable that the cupric and uranyl ions form complexes with the invertase which, themselves, are capable of absorbing energy and decomposing to form inactive material. It would appear that the other colored ions used were incapable of forming such complexes and were therefore ineffective. Further work will have to be done to elucidate further the mechanism of the reaction.

HENRY LARDY
THOMAS F. ANDERSON
DEPARTMENTS OF BIOCHEMISTRY AND CHEMISTRY,
UNIVERSITY OF WISCONSIN

[4] From Wallerstein Laboratories, New York, N. Y.

THE OCCURRENCE OF FITS IN PYRIDOXINE DEFICIENT RATS

CHICK *et al.*[1] described fits of an epileptic nature in rats maintained on pyridoxine deficient diets for a period of four months or more. No such fits have been reported in this country, although thousands of

[1] H. Chick, M. M. El Sadr and A. V. Worden, *Biochem. Jour.*, 34: 594, 1940.