in such large areas as the Pacific. It would give a broad basis on which to plan more detailed research cruises.

The impact of science on society was implicit in all papers read, and Sir John Russell, in his presidential address, raised some controversial points about the powers of science. He said:

It can do much to overcome material difficulties and, better still, to satisfy man's thirst for knowledge of the universe in which he lives, and it can insist continuously on our high duty to seek out the truth fearlessly and honestly, and having found what we believe to be the truth, to proclaim it—but in all humility and recognizing that we may be wrong. Apart from that, science can give little guidance in those great moral and spiritual problems which lie at the root of our most serious troubles today. It opens up many possible ways of life but gives no help in choosing which to follow, it deals with the facts of existence but not with the values of existence. It offers us great possessions but, as the old aristocracy knew, great possessions imply great personal responsibilities. Democracies still have this to learn. That is one of our greatest problems today.

Science can help us best if we have a sustaining faith, a high purpose in life and unflinching courage to pursue it.

Sir Alfred Egerton summed up the general feeling when he said:

Looking back to the turn of the century and remembering the stage of chemical science at that time, then seeing in my mind's eye the integrated achievements of chemists since those days, I cannot but believe in a bright future: "That which they have done is but an earnest of the things they shall do."

Next year's meeting is to be held in Birmingham, and the new president of the British Association for the Advancement of Science is Sir Harold Hartley. The 1951 meeting is to be held in Edinburgh, under the patronage of the Duke of Edinburgh.

TECHNICAL PAPERS

A Reversible Photochemical Alteration of Uracil and Uridine[1]

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Various lines of evidence (*1, 3, 4*) have suggested that the primary effect of lethal and mutagenic doses of ultraviolet radiations upon living cells may be partially reversible, or at least compensated within the cell. In connection with a general study of the photochemistry of nucleic acid derivatives, we have discovered that, under certain conditions, the initial photodecomposition product of the pyrimidine, uracil, and the corresponding product of the ribose nucleotide, uridine, may spontaneously revert to the initial substances, uracil and uridine, respectively.

A distinction must be made between the effects of radiation in the longer wave pyrimidine absorption region, 2300–2800 A, and the effects of short wave radiations of wavelength less than 2300 A. The former radiation gives rise to the partially reversible effect, whereas the latter produces—with a much higher quantum efficiency—an irreversible decomposition.

In our experiments we have employed as a radiation source a low pressure mercury discharge tube, wound in the form of a spiral, obtained from the Hanovia Chemical and Manufacturing Company. The principal radiation from this tube is the 2537-A mercury line, but photochemically significant quantities of 1849-A, 1942-A, and 2224-A radiation are emitted. We have filtered these latter out with a 1-cm path of absolute ethyl alcohol.

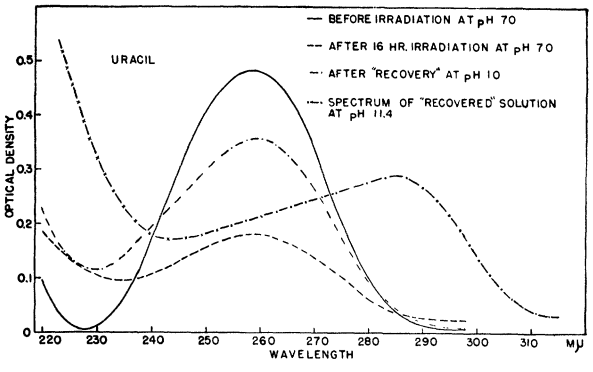

FIG. 1.

The solutions have been irradiated directly in the silica cells of the Beckman DU Spectrophotometer. Under these conditions, it is possible to destroy 63% of the absorption of a uracil solution (6.2 μg/ml in M/100 PO_4 buffer, pH 7.0) at the uracil maximum, 2590 A, in 16 hr of irradiation (Fig. 1). If now the pH of the irradiated uracil solution is changed to 1.0 (by addition of 1 ml 1 M HCl to 3 ml of irradiated solution), the absorption at 2590 A is then found to rise exponentially, following first-order kinetics, with a rate constant of 14 min at room temperature. As shown in Fig. 1, 74% of the

[1] This study was supported by the American Cancer Society, acting through the Committee on Growth of the National Research Council.

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initial absorption can be recovered. That the substance responsible for the recovered absorption is uracil is indicated by the absorption spectrum and by the characteristic shift in absorption (*2*) upon making the solution of the recovered material alkaline to pH 11.4.

Some increase in absorption takes place if the irradiated solution is allowed to stand at pH 7.0, but the rate of increase is extremely slow at room temperature. This rate may be accelerated by increase of temperature; immersion of the irradiated solution into boiling water for 15 min can bring an increase in absorption comparable to that produced by addition of acid. Recovery in acid solution, however, has given more reproducible results.

Irradiation of uridine has led to qualitatively similar results. Uridine appears to be some 16 times as labile to ultraviolet irradiation as uracil, when compared at pH 7.

Under these conditions of irradiation, thymine, cytosine, adenine, and guanine, and adenylic and guanylic acid are not decomposed. However, preliminary experiments have given evidence of a similar reversible phenomenon with cytidylic acid.

More complete details of this work will be published elsewhere.

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A Polarographic Determination of Digitoxin[1]

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In conjunction with a polarographic investigation of a variety of organic compounds of pharmaceutical interest, a study of the polarographic properties of digitoxin was instituted. Fieser (*1*) reported that the cardiac glycosides gave polarographic half-wave potentials in the region between −1.9 and −2.0 volts. The present investigation confirms Fieser's work and elaborates on the qualitative and quantitative polarographic properties of digitoxin. The results of this study show that digitoxin may be determined in concentrations as low as 0.1 μg in 50% alcohol solution and may also be extracted by means of suitable solvents from complex mixtures and determined in similar low concentrations.

The method used to carry out these investigations was as follows: A stock solution of the pure drug[3] was prepared by dissolving 25 mg of digitoxin in 12.5 ml of absolute alcohol and diluting to 25 ml with distilled water. Varying amounts of the stock solution were added to 0.5 ml of 0.2 *N* tetraethyl ammonium hydroxide in a Heyrovsky reaction vessel and diluted to 5 ml total volume with 50% alcohol solution in order to study the half-wave potential and height of break at different concentrations. For extremely low concentrations, a stock solution of lower concentration was prepared and diluted in a similar manner. Nitrogen was bubbled through the prepared solutions for a period of 15–20 min and the polarogram recorded. This process was repeated until a satisfactory curve of height versus concentration had been determined for the concentrations under investigation and the average half-wave potential was calculated.

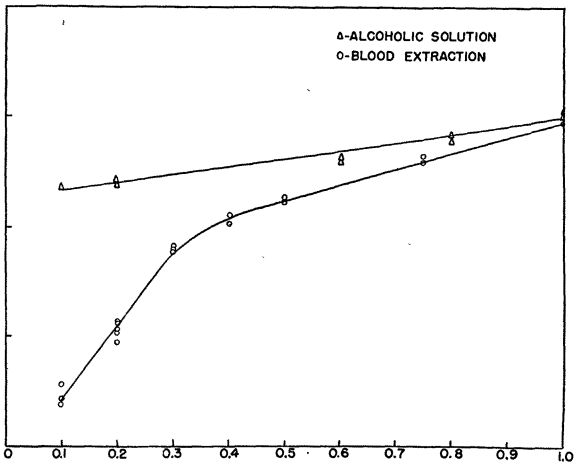

FIG. 1. Height versus concentration curves for digitoxin between 0.1 and 1.0 μg. Upper curve (△), alcoholic solution; lower curve (○), extraction from blood. Abscissas, concentration of digitoxin in μg; ordinates, height in in. (1 in. = 0.508 μa).

The study of digitoxin in blood was carried out by a combination of extraction and polarographic work. The most satisfactory extraction solvent was found to be petroleum ether. The procedure followed for the investigation in this portion of the experiments was as follows: Varying amounts of stock solution were added to 10 ml of mixed blood, and 2.5 times the total volume of petroleum ether used for extraction. The combined mixture and extraction solvent solution was placed in a separatory funnel and shaken. After thorough settling, the residual blood was drawn off. The remaining solution was shaken and allowed to settle until no blood residue appeared after shaking. The petroleum ether fraction was placed in an evaporating dish and evaporated to dryness. This residue was dissolved in 2.5 ml of absolute alcohol and decanted so that no alcohol-insoluble components would be in the final solution. The alcohol solution of the residue was diluted to 5 ml with distilled water and 2.5 ml of this solution was placed in a reaction vessel with 2.0 ml of 50% alcohol solution

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[2] The author wishes to thank Dr. C. L. Gemmill for suggesting this problem and for his guidance in this study.

[3] Grateful acknowledgment is made to Dr. K. K. Chen, Eli Lilly and Company, Indianapolis, Indiana, for the purified digitoxin used in this study.