applying this method to several important problems and in describing in this book the processes used by him. This method undoubtedly has a great future, and will make possible computations that are so laborious by ordinary processes as to make them impracticable. The cost of renting the machines, which at present is the only way they are made available, is necessarily high; but with their more extended use this cost will unquestionably be reduced. In the meantime astronomers have reason to be grateful to the Thomas J. Watson Astronomical Computing Bureau for its services, which cost nothing more than the salaries of the operators on any piece of work accepted by its Board of Managers. Yale Observatory has especial reason to express such thanks, several very large projects having been made possible in this way.

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JOHN ALFRED BRASHEAR

John Alfred Brashear, Scientist and Humanitarian. By HARRIET A. GAUL and RUBY EISEMAN. viii + 220 pp. Philadelphia: University of Pennsylvania Press. 1940. $2.25.

THIS biography of a man who was born a hundred years ago and died twenty years ago, is a sympathetic portrayal of the life of a man who was not great in his scientific achievements, but who had a great influence upon others, who in their turn gave money to encourage and support scientific and educational enterprises in Pittsburgh. It is written not for the scientist but for the layman and is one in a series of lives of prominent Pennsylvanians. The life of "Uncle John" is a success story of the nineteenth century. Here a young man of humble parentage and little book learning rises from millwright to helper of the eminent Langley and to friend of the millionaires, Frick, Schwab, Phipps, Thaw and Carnegie. He is recognized in science for the "Brashear" method for silvering mirrors and for the fine optical instruments, including spectroscopes, rock-salt prisms and telescopes, made in his shop. But this book does not dwell at length on these achievements as much as on the civic responsibilities he assumed and on the influence he had over educational Pittsburgh at the turn of the century as the director of the Allegheny Observatory, as the chancellor of the Western University of Pennsylvania—now the University of Pittsburgh—as a trustee of the Carnegie Technical Schools, and finally, as the administrator of the Frick Educational Commission. The biography is simply written in a conversational style; it is at times amusing when anecdotes relating to the "Mill Lords" are told.

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SPECIAL ARTICLES

PARTIAL PROTECTION OF RATS BY RIBOFLAVIN WITH CASEIN AGAINST LIVER CANCER CAUSED BY DIMETHYLAMINOAZOBENZENE*

THE regular production of hepatic cirrhosis and cancer by the oral administration of dimethylaminoazobenzene (butter yellow) to rats has been reported by Kinosita.[1] The animals were fed 20 cc of a 3 per cent. solution of the chemical in olive oil mixed with 1,000 grams of a diet composed of unpolished rice supplemented with carrot. Subsequently, Nakahara[2] and his co-workers showed that no cirrhosis or cancer developed when this régime was supplemented with liver, and Ando[3] found that yeast had a similar effect.

Kensler, Sugiura and Rhoads[4] measured, by a modification of the method of Hodson and Norris,[5] the riboflavin levels in the livers of rats fed upon the basal diet as used by Kinosita, but without added butter yellow. The levels were found to be significantly lower than those of rats fed a stock laboratory diet. Moreover, if butter yellow was mixed with the rice, even less riboflavin was present in the livers. Most striking was the fact that the tumors which resulted from the carcinogenic régime contained only about 20 per cent. of the amount of riboflavin found in normal rat livers. If a protective supplement of yeast (Fleischmann 20–40) was administered, however, normal riboflavin levels in the livers were maintained and no cirrhosis or cancer resulted.

Further studies provide evidence that the basal diet as fed in this laboratory is inadequate in its content of riboflavin, since it supplies only about 6 micrograms of the vitamin daily. It is usually stated that about 15 micrograms daily are required to maintain rats in health. Furthermore, experiment proved that the animals fed the basal diet alone excrete in the urine very little riboflavin (2 micrograms daily per rat), less than 20 per cent. of that excreted by animals which receive the usual laboratory ration. If butter yellow is administered with the basal diet, a

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1 R. Kinosita, *Trans. Soc. Path. Jap.*, 27: 665, 1937.

2 W. Nakahara, T. Fujiwara and K. Mori, *Gann*, 33: 57, 1939.

3 T. Ando, *Gann*, 32: 252, 1938.

4 C. J. Kensler, K. Sugiura and C. P. Rhoads, SCIENCE, 91: 623, 1940.

5 A. Z. Hodson and L. C. Norris, *Jour. Biol. Chem.*, 131: 621, 1939.