but is apparently the only one in harmony with observed facts.

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INFLUENCE OF POLARIZED LIGHT ON PHOTOCHEMICAL REACTIONS

I HAVE read with keen interest and great delight the article by Dr. S. S. Bhatnagar appearing in SCIENCE for October 14, entitled the "Selective Effects of Polarized Radiations on certain Photochemical Reactions." In this article the author announced his findings concerning the remarkable acceleration of chemical reaction between the amalgams of the alkali metals and water produced by exposure to polarized radiations. In the interest of historical accuracy and scientific priority I beg to submit for publication the following information which may not be known to scientists at large. Our esteemed Hindu colleague states in his paper that "As far as the author knows, this is the first purely chemical reaction as distinguished from the biochemical reactions studied by previous investigators which has definitely been shown to be selectively affected by polarized radiations." It is evident that owing to the slow communication between the United States and India he was not aware of the fact that on April 12, 1927, I and Dr. W. T. Anderson, Jr., read a paper before the American Chemical Society at the Richmond meeting entitled "The Effect of Polarized Light on the Pharmacological Properties of Some Drugs." In that paper which was published in the *Journal* of the American Chemical Society for August 5, 1927, and which was broadcast by "Science News," we have described our findings concerning the effects of polarized light on the pharmacological and chemical reactions of certain drugs. The profound changes produced by polarized radiations on the substances studied were certainly due to photochemical changes produced in their chemical structure because the chemicals were first irradiated and only subsequently tested. This was demonstrated not only by pharmacological means but also in the case of cocain by purely physical chemical tests, namely, changes in hydrogen-ion concentration, and in the case of quinin tartrate by the changes produced in its optical rotation. It is hardly necessary to state that the drawing of distinctions between biochemical and other chemical reactions is mere academic quibbling. I wish to call attention furthermore to the fact that a preliminary paper concerning the effects of polarized light on the reactions of certain drugs was published by me and John C. Krantz, Jr., in the *Journal* of the American Pharmaceutical Association for March, 1927.

In the present communication I wish to announce briefly the results of certain other experiments performed by me which I mentioned at the above meeting of the Chemical Society, but which were reserved for publication in a later paper. I have studied the effects of polarized light on five groups of optically active alkaloids. These were the following: Cocain, Epinephrin, Hyoscyamin, Scopolamine (Hyoscin) and Physostygmin. Solutions of each of these alkaloids after irradiation with polarized light were found to have undergone photochemical changes as evidenced by numerous pharmacological tests. An examination of various stereo-isomers in this connection revealed the remarkable fact *that the laevo variety in every case was the one most profoundly affected by polarized light.* These experiments have been in progress for a long time and would have been published at an earlier date had it not been for the unusually unsympathetic attitude towards our investigations on the part of certain American scientists, which fortunately did not discourage us in our work but which did compel us to repeat unnecessarily a large number of experiments otherwise quite clear cut, flawless and fool-proof. It is but fair to add in this place that the whole investigation could not have been conveniently carried out had it not been for the encouragement and facilities extended to us by two private industrial laboratories, namely, the Pharmacological Research Laboratory, Hynson, Westcott and Dunning, of Baltimore, and the Physico-chemical Research Laboratory of the Hanovia Company, Newark.

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FLOOD EROSION AT CAVENDISH, VERMONT

ONE of the tragic but geologically most interesting happenings connected with the recent Vermont flood occurred at Cavendish village, which is located on the east slope of the Green Mountains some fourteen miles from Summit Station on the Rutland Railroad.

Here, during the early morning of November 4, after some twenty-four hours of heavy rain, part of a highway leading from the village down the valley was suddenly engulfed, carrying with it seven houses, numerous barns, garages and their contents. Happily no lives were lost, but the unfortunate people, with almost no warning, witnessed the total destruction of their property and even of the land upon which it stood. The loss is estimated at from $35,000 to $40,000.

The draining away of the waters revealed, where once the road had been, a yawning gully some forty feet deep, two hundred feet wide at the bottom and

probably a quarter of a mile long. The gully opened a new course to the river and, a mile below at the village of Whitesville, the remains of the structures were found, so utterly demolished as to be unrecognizable even to their former owners.

Many places have been damaged in the past and some destroyed because a dam failed; here was one which suffered because the dam held.

The village of Cavendish is situated on the north margin of the flood-plain of the Black River, which rises in the mountains and flows in a generally southeasterly course to its confluence with the Connecticut. The valley is perhaps half a mile wide at the village. Just east a large hill rises dividing the valley into two branches. The river flows through the south branch, where it has been dammed; while the highway in question ran through the north branch to Amsden, Ascutneyville and the Connecticut River. A dike in the valley, west of the hill, protected Cavendish from the impounded river water, while a storm-sewer laid under the highway drained the surface water down past the hill, where it could join the river. When the flood came the dam held fast but the dike broke and the sewer sections probably became loosened and carried away, thus enabling the flood waters to erode both above and below the highway with the disastrous results noted.

The great gully, eroded down to an easterly-sloping, gneissic bedrock, reveals the pre-glacial channel of the river, showing striations, chatter marks and pool-basins at the foot of the old rapids. The retreat of the ice-sheet filled the valley with till and impounded a lake whose terraces are in evidence for several miles up the valley. Later the river found a new outlet, this time to the south of the hill mentioned, and its old hidden course became a highway.

And so, unwittingly, the villagers built their houses "upon the sand" and the floods have borne out the truth of the old parable as they probably have been doing ever since it was uttered.

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ILLUSTRATIONS WHICH DO NOT ILLUMINATE THE PROBLEM

IN a recent issue of SCIENCE (November 4, 1927), Dr. R. G. Aitken, associate director of the Lick Observatory, contributes an article entitled "Old Problems with new Illustrations" in which certain statements of recent astronomical observations have been somewhat peremptorily challenged. The name of none of the offenders is mentioned, yet, in one case, the quotations used coincide verbatim with sentences in a recent article of mine, "Island Universes" (*Natural History,* Vol. 26, 286, 1926, and Harvard College Observatory Reprint No. 32). Dr. Aitken furnishes additional identification marks showing that the quotations are from my article. In view of this I feel justified in trespassing upon the columns of SCIENCE in order to present the facts of the case.

Four points are specifically brought up by Dr. Aitken.

1. The total number of stars in the Galactic system is put down in my article as "about fifty billion," whereas Dr. Aitken says that, "according to the most careful and reliable investigation so far made" this total number is very hesitatingly put at thirty billion. There is good evidence that the fraction of all the stars in space which are visible even with the greatest telescopes is probably in the neighborhood of one or two per cent. The estimated total therefore involves great extrapolation. In describing the results in a popular article, where, as is evident, the argument requires an upper limit for this total number of stars, the use of fifty billion instead of thirty billion is not only justified by its practical equivalence, but it is almost necessary.

2. An objection is made against my statement that a star may be a thousand times as large as the sun in diameter. The facts are, as Dr. Aitken says, that the largest measured diameter is certainly not more than half, and possibly not more than one third of this value.

In 1906 Hertzsprung published a formula for predicting the angular diameter of a star when the color and the apparent magnitude are known. When in 1920 the first stellar diameters were measured, they proved to agree within thirty per cent., which, I am sure, astronomers generally regard as an excellent agreement in the case of such pioneer work. We may then perhaps be allowed to consider the formula used by Hertzsprung as well established, and use it, to extend our values to other stars which had hitherto fallen outside the region of calculations. In Harvard Reprint 25 and Harvard Circular 271, 1925, Shapley cites the existence of some very red stars in the Magellanic Clouds which, on the basis of the formula predicting stellar diameters would have linear diameters of the order of magnitude of 10^9 kilometers, the sun's diameter being 1.4×10^6 kilometers. Here I should say that I can not satisfy the reader who looks for an exact statement to the nearest million miles; round numbers, which imply large uncertainties, are more to my liking.

3. I am accused of having remarked "blithely" that "fifty billion years is but a short interval in the life of an average star." I should indeed be most grateful to Dr. Aitken if he could produce any valid arguments to the contrary. Recent papers on stellar ages mention figures of the order of 10^{13} to 10^{15} years,