cultivate. Given this desire for research, which is the inevitable result of the habit of experimentation in every one whose mind is fit for scientific pursuits, and all other difficulties, those of time, opportunity and equipment can be overcome. Certain lines of investigation which one would gladly follow must indeed be abandoned for lack of means with which to pursue them; but he who keeps alive his knowledge of scientific progress by the systematic reading of the literature of first sources need never lack topics of research.

The proper stimulus for scientific work is the love of experimentation for its own sake rather than any desire or expectation of fame; the delight of witnessing the wonderful performances of matter under conditions conceived and imposed by ourselves, rather than the hope of achieving some momentous result. At the same time we should not forget that the very simplest phenomenon of nature is worthy of our closest, even of our reverent attention and that some experiment as seemingly unimportant as the shooting of quartz fibers, may, like that now famous operation of a fellow teacher (Boys), be ultimately of inestimable value to science.

Edward L. Nichols.

Physical Laboratory of
Cornell University.

ON ECLIPSE PHOTOGRAPHY.

Some months ago the writer suggested that the dangers of over-exposure in photographing eclipses might be avoided by a long exposure covering the entire totality of the eclipse, and a development of the plate as a positive in the light. Since that time the interval of exposure in the camera has been considerably reduced by increasing the illumination of the plate while in the developing bath. Plates can with proper exposure be developed in direct sunlight, with a reflected beam of sunlight also thrown down upon the plate. But while such pictures leave nothing to be desired for clearness and sharpness of detail, they do not show any details which can not be brought out in a negative. Moreover, the exposure required to produce a good positive is still rather too long to make this method in its present condition seem of much advantage in eclipse work.

But it has also been found that the developer best suited to producing fine positives will develop beautiful negatives in the dark-room, on plates that have been over-exposed as much as two thousand times. Such plates thus exposed may be developed either as negatives in a perfectly dark room, or as equally good positives in a light room, and with the same developer. Where the normal camera time is a tenth of a second, the exposure may be as great as three minutes and a half, and still secure a sharp crisp negative. With greater exposures it is better to develop the plate as a positive in the light room.

The developer recommended, as the best so far tried, is hydrochinone made up according to Cramer's formula, with the bromide left out. The sodium carbonate solution may be made up at half the strength given in the formula if the developing is to go on slowly. To half an ounce of the mixture of solutions one and two, add an ounce and a half of water and four or five drops of saturated hypo solution.

When the plate has been normally exposed and it is treated with this developer containing two drops of hypo, in a covered tray in the dark room, nothing will develop for 30 or 40 minutes. But in course of an hour and a half the picture will be fully developed. The details will show sharply through the film. The tray should be uncovered as little as possible. The plate is sensitive even to red light. Until the last stages of development are reached, the exposures for examination of the plate

should be as infrequent and as brief as possible.

A Cramer 'crown' plate placed in a printing frame under a thin or fast printing positive, will yield a negative picture when held for one second at a distance of three meters from a 16-candle incandescent lamp. The exposure may be gradually increased to an exposure of an hour at a distance of one meter from a 300-candle Packard incandescent lamp. How much longer the exposure may be is not yet known. All exposures up to three and a half minutes at a distance of one meter from the 300-candle lamp can be developed as fine negatives in the dark room. This last exposure may also be developed as a positive in light somewhat feebler than direct midwinter sunlight in St. Louis. With greater exposures, the illumination of the light room must be decreased, in order to obtain the best results. With the highest exposures producing developable results, the plate must be developed in the dark room.

The actinic values over this vast range are now being measured. The plates as developed are laid in proper position upon a series of large tables, about 40 feet in length. The coordinate values determining the position of the plate upon the tables are, exposure and illumination of the developing room.

The point which it is desired to urge in this communication is, that in the coming eclipses of this year and next, there is no need of losing any plates from over-exposure, even if they are exposed during the entire time of totality. It is hoped that this communication will cause those who are to take part in that work to lose no time in becoming familiar with the possibilities of development in a bath such as has been here described.

This communication has been prematurely published in order to direct the attention of those who are to take part in the observations of the next eclipse to a matter which may have great importance. It may be that some of the statements may require modification. For example, it is perhaps questionable whether exposure in a printing frame at a distance of a meter from a 300-candle lamp for three and a half minutes is an over-exposure of 2,000 times.* It is certainly a very great over-exposure.

FRANCIS E. NIPHER.
WASHINGTON UNIVERSITY.

*Since writing the above it has been found that potassium bromide will do all that has been done with hypo as above described. The earlier failures in the use of bromide were due to insufficient quantity. In developing some good pictures near the zero condition a ten-per-cent. solution of bromide has formed a sixth of the bath. The bromide pictures are somewhat more brilliant, but do not seem so sharp and hard as some obtained by hypo. It may safely be stated that any camera exposure, from the shortest possible, to those lasting for hours, may be developed into a good picture. When the exposure is too great for development in the dark room as negatives, the plate may be as successfully treated in the light room and developed as a positive. A plate which will develop as a beautiful positive in the light of a 16-candle lamp, will develop a foggy mongrel picture, partly positive and partly negative in a perfectly dark room.

THE PROBABLE SUCCESSORS OF CERTAIN NORTH AMERICAN PRIMATES.

THE credit for the discovery of the affinities of the fossil Primates of the Eocene deposits of this country have been variously claimed by both Marsh and Cope. Leidy, however, appears to have clearly preceded both these investigators in this respect in his 'Vertebrate Fauna of the Territories,' published in 1873. In this work, in describing the lower jaw of *Northarctus tenebrosus*, a fossil monkey from the Bridger Eocene, he makes the following significant remarks: "In many respects the lower jaw of *Northarctus* resembles that of some of the existing American monkeys quite as much as it does that of any of the living pachyderms. *Northarctus* agrees with most