THE PECULIAR BEHAVIOR OF MOREHOUSE'S COMET.

BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY.

Celestial photography in the wonderfully skillful and capable hands of Prof. E. E. Barnard of the Yerkes Observatory has given to astronomy new wonders of the heavens and fresh problems to be solved in the portrayal of the Morehouse comet. This heavenly visitor, now known in astronomical lore as Comet C 1908, or by its discoverer's name, was found by Prof. Morehouse on a photographic plate taken September 1 at the Yerkes Observatory. Three nights' observations gave data enough to calculate the path of this object in its journey about the sun, and it was found that here was a body that was to be of great popular interest, for it was destined to become bright enough to be seen by the naked eye without the aid of a glass or telescope. Nor did it fail to live up to its reputation, and at the end of October and early in November it was easily visible in the early evening sky. Although the comet did not reach its position of being nearest the sun till Christmas day, it was closest to the earth (about 100,000,000 miles away), and consequently brightest about election day (November 3). After passing around the sun the comet will become visible again in February, March or April, but then can be seen only in the southern hemisphere.

Daniel's comet seen in the summer of 1907 was to the unaided eye much more interesting and picturesque than the Morehouse one, with longer tail and more easily visible, but photographically the 1908 comet far surpassed its predecessor in interest. Prof. Barnard regards it as the most startling comet since the application of the sensitive photographic plate. Daniel's comet was an "orderly, well-behaved body," but Morehouse's has been decidedly sensational ever since the day of its discovery. What has made it specially remarkable has been the wonderful outbursts and transformations in its tail, which has changed its appearance so suddenly and with such force that after twenty-four hours it would not be recognized from its appearance as the same body. The accompanying illustrations, reproductions of excellent photographs kindly furnished by Prof. Barnard, tell their own story. The comet was very favorably situated with a high northern altitude in October, so that the astronomer was permitted to take photographs practically throughout the whole night. The great interest attaching to it is evidenced when it is understood that between September 1 (its discovery) and November 3, Prof. Barnard obtained of it 239 plates.

Remarkable transformations occurred on September 30 and October 1, violent changes taking place on the former date throughout the night. The first exposure on this night was not specially remarkable and gave no warning of the outburst seen on the photograph taken at 14 h. 22 m. central standard time (2:22 A. M., October 1) which is reproduced in Plate 1. In this the comet has become a very remarkable and beautiful object, utterly and entirely different from the first picture; the tail had tapered down to a very narrow connection with the head, and fluffy masses which had been seen on photographs taken a few hours earlier on the northern (lower) side of the tail became on this plate a large projection. The tail appeared cyclonic in form and structure, and doubtless an hour later the whole tail had become disconnected bodily from the head. What a transformation had taken place before the next evening! The same stars may be recognized on the photographs of the two nights, but the tails look not a whit alike. Plate 2 from a photograph taken October 1 at 13 h. 43 m. (1:43 A. M. October 2) shows half way out on the tail a great mass of matter which formed the tail of the night before, and in successive pictures taken throughout the night of October 1, this mass of matter is seen getting farther and farther away from the comet. Several fine thread-like tails may be seen close to the head. Such changes caused the comet to become suddenly brighter to the eye, as was noted by Prof. Wilson at Northfield, Minn., on the night of September 30.

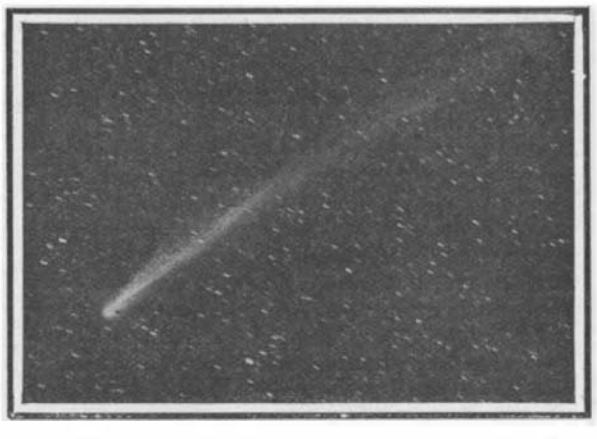
Another great disturbance occurred on October 15 which is represented in Plate 3 and which is remarkable for the most extraordinary secondary tail there shown. No trace of this was seen on photographs taken on October 14, while remnants of these cloudy masses much farther out are shown on plates taken October 16 and 17. Peculiar wavy appearances were seen in the tail about the middle of the month of November, and traces of this spiral motion can be seen in the beautiful photograph of November 18 reproduced on Plate 4.

The cause of these peculiar outbursts is a little difficult to find. Early observers of comets noted that the tail was always directed away from the sun and explained this by some force seated in the sun which repelled the particles of the tail while gravity attracted the comet as a whole and made it move about the sun. Modern astronomy with its great advances has, within the last few years, given the nature of this repellant force, and has stated that it is due to a pressure excited by sunlight on the finely divided matter forming the comet's tail. What we call light consists of waves very small in size moving with great velocities. If six hundred millions of millions (600,000,000,000,000) of waves enter our eye in a second of time, we say that the light is green in color.

1. On September 30 the comet showed a well-marked fan-like tail.

2. On the next night the tail had almost disappeared, giving way to a few streamers.

3. On October 15 another most remarkable change occurred. Note the cloudy masses near the head.



4. On November 18 the tail showed a wave-like form with many diverging streamers.

THE PECULIAR BEHAVIOR OF MOREHOUSE'S COMET.

These waves, tiny though they are, exert a pressure on any object on which they fall just as the ocean waves exert a pressure when they pound in on the sands of the shore. The pressure of sunlight on ordinary objects is excessively small, but if the bodies become smaller and smaller so that the surface becomes relatively larger with respect to the mass (the mass decreases as the cube, and the area as the square of similar dimensions) a point will be reached in the subdivision of matter that particles will be repelled by the pressure of the sun's light rather than attracted by the force of gravity. This is the present accepted explanation of the cause why the comet's tails point always from the sun, nor is it an idle theory with no practical backing, for Professors Nichols and Hull have been able to make an artificial comet's tail in the laboratory by the pressure of light. But while this pressure theory explains the general behavior of comets' tails, it fails to give the cause of the sudden outbursts and changes in brightness and directions observed in the Morehouse comet. The sun, by its heat, undoubtedly starts activity in the comet nucleus, and this activity increases as the comet approaches closer and closer to the sun. Just how the head behaves and how it gives forth particles to form the tail, are problems which science at present cannot solve. The splendid photographs of this our latest comet taken by Prof. Barnard, will go a long way toward helping us explain the riddles of comets and their tails.

A $500 Prize for a Simple Explanation of the Fourth Dimension.

A friend of the Scientific American, who desires to remain unknown, has paid into the hands of the publishers the sum of $500, which is to be awarded as a prize for the best popular explanation of the Fourth Dimension, the object being to set forth in an essay the meaning of the term so that the ordinary lay reader can understand it.

Competitors for the prize must comply with the following conditions:

1. No essay must be longer than 2,500 words.
2. The essays must be written as simply, lucidly, and non-technically as possible.
3. Each essay must be typewritten and identified with a pseudonym. The essay must be inclosed in a plain sealed envelope, bearing only the pseudonym. With the essay should be sent a second plain sealed envelope, also labeled with the pseudonym, and containing the name and address of the competitor. Both these envelopes should be sent to "Fourth Dimension Editor, Scientific American, 361 Broadway, New York, N. Y."
4. All essays must be in the office of the Scientific American by April 1, 1909.
5. The Editor of the Scientific American will retain the small sealed envelope containing the address of the competitor and forward the essays to the Judges, who will select the prize-winning essay.
6. As soon as the Judges have agreed upon the winning essay, they will notify the Editor, who will open the envelope bearing the proper pseudonym and containing the competitor's true name. The competitor will be notified by the Editor that he has won the prize, and his essay will be published in the Scientific American.
7. The Editor reserves the right to publish in the columns of the Scientific American or the Scientific American Supplement three or four of the more meritorious essays, which in the opinion of the judges are worthy of honorable mention.

Prof. Henry B. Manning, of Brown University, and Prof. S. A. Mitchell, of Columbia University, will be the judges.

If it is a fundamental axiom that an organism actively asserts or maintains a specific structure and specific activities, it is clear that nutrition itself is only a constant process of reproduction: for the material of the organism is constantly changing. In enunciating this principle before the recent meeting of the British Association for the Advancement of Science Dr. Haldane pointed out that not only is there constant molecular change, but the living cells are constantly being cast off and reproduced. It is only a step from this to the reproduction of lost parts which occurs so readily among lower organisms; and a not much greater step to the development of a complete organism from a single one of the constituent cells of an embryo in its early stages. In all these facts we have simply manifestations of the fundamental characters of the living organism. The reproduction of the parent organism from a single one of its constituent cells separated from the body seems to him only another such manifestation. Heredity, or, as it is sometimes metaphorically expressed, organic memory, is for biology an axiom and not a problem. The problem is why death occurs, what it really is, and why only certain parts of the body are capable of reproducing the whole.