THURSDAY, DECEMBER 5, 1872

THE COMETARY STAR-SHOWER

SOME months have now elapsed since an announcement by Mr. Hind informed astronomers that a well-known telescopic comet, first seen in the years 1772 and 1805, and rediscovered in 1826 by the astronomer Biela, of Josephstadt, in Bohemia, when it was first recognised as periodic, would make its nearest approach to the earth towards the close of this year; and its apparent place on successive nights was duly foretold, to assist them in their search for its existence. On the last two occasions of its expected returns, in 1859 and 1866, no signs of the missing comet were detected. The favourable circumstances under which it was expected to be observed, during its last approach to the earth in 1869, and the absence of any notice of its having been seen during the last two months of its anticipated reappearance in the present year, makes it hardly doubtful that, as an interesting study and examination with the most powerful modern telescopes, it has at length ceased to be any longer visible. When at its greatest brightness in the year 1805, it was seen by Olbers, with the naked eye, and in its subsequent returns, it was frequently attentively observed with the most powerful means and by the most expert astronomers. During its appearance in 1846 it was first distinctly perceived to separate into two portions, gradually receding from each other until they gained a greatest distance, which was estimated on that occasion at 157,000 miles. The two portions remained visible as two distinct comets at their next return in 1852, with a widened interval between them, which had increased to 1,250,000 miles. With nearly equal brightness, and with perfect cometary appearance, these two bodies travelled side by side, and journeyed together, doubtless, to separate still further from each other in their further circulations round the sun. Such is the telescopic history of Biela's comet. In the year 1818 a telescopic comet was discovered by Pons, the astronomer, at Marseilles, whose date of appearance, at least a year before the time of a punctual return, cannot have been a reappearance of Biela's comet, but the position of its orbit, as far as it could be calculated from the imperfect data that were obtained, are so similar to that of Biela's that its relation to that comet appears not improbably to be of the same kind as that which formerly connected together the two portions of the recently divided cometary pair, and the orbit and periodic time of this third comet probably differ but little from those of the principal comet from which it may fairly be presumed to have been derived. Such groupings of comets on nearly parallel courses appear to be distinguishable in the more remarkable cases, recently pointed out by Hoek, of some comets with hyperbolic orbits; and the revolution of more than one telescopic comet is thought to have been discovered in the same orbit with the periodically-returning comet of 1866, with which the meteor-current of the great November star-shower, at its recent return, was shown by Schiaparelli, Adams, and Oppolzer, to be in remarkable agreement. In a later letter to the *Times*, in August last, Mr. Hind pointed out the satisfactory coincidence of which Prof. Schiaparelli, the former coadjutor of Secchi, and now the able director of the Observatory at Milan, was the first discoverer, between the orbit of another comet of considerable brightness seen in 1862, and the course of the meteors of the well-known August star-shower, an unusually bright display of which was recorded shortly after the appearance of that comet in the following year. Another example of distinct resemblance between the orbit of a meteor current and that of a periodic comet was early discovered by the German astronomers Drs. Weiss and Galle in the case of the meteor shower of April 19-20 and the comet I, 1861, to which Prof. Kirkwood, of the State University in Indiana, U.S., has lately added the interesting observation that the earliest records of this meteor shower, as well as of a conspicuous star-shower annually visible about October 18-20, indicate a periodic time in their maximum returns, which corresponds, like that of the November meteor system and its attendant comets, to an ellipse whose major axis is very nearly the mean distance of the planet Uranus from the sun. The time has thus arrived when systematic observations of meteor showers may be regarded as an important auxiliary to astronomers in certain cases where the orbits of comets are intersected by the earth's path, by vying with the telescope in detecting the hidden courses of such comets as, by comminution or disbanding of their substance, have so lost their brightness, as at length completely to elude their search.

The probability that the orbit of Biela's comet is marked by a considerable meteor stream was first shown, almost simultaneously, by the two eminent directors of the national observatories at Vienna and Copenhagen, Drs. Weiss and D'Arrest. The meteor stream to which the comet appears in this instance to have given rise, was principally observed in Germany, France, Belgium, and the United States of America, in the years 1798, and 1838, occurring on December 6 and 7 in those years; and again by the astronomer of Münster, Dr. Heis, at Aix-la-Chapelle, on December 6, 1847. Either of the periodical returns of the comets, 1818, I., or of Biela's comets, it was found by Weiss and D'Arrest, would perfectly account for the dates of appearance of these meteor-showers, and for the observed direction of their radiation from a point of divergence between Cassiopeia and Andromeda. The situation of this meteor stream is such that the meteors enter the earth's atmosphere with almost the least possible speed, of about eleven miles per second, that meteors can have; while the Leonides, or meteors of November 14, penetrate it with a velocity which is about four times greater. The position of the orbit is also such that it undergoes very rapid changes by the attractions of the planets; so that, while encountering the earth on December 7 in 1798, the meteor particles, at the last visible return of the comet in 1852, must have extended across that point in the earth's course which it passed on November 28 in that year. A few meteors from the same radiant point were seen by the late Signor Zezioli, of Urbino, the most zealous contributor of shooting-star observations to Prof. Schiaparelli, on November 30, 1867, diverging from the indicated place. The probability that the shower formerly witnessed on December 6 and 7 has thus advanced with the node of

the comet's orbit to an earlier date in November, is now fully corroborated by the conspicuous appearance of the same meteor-shower which has recently appeared. Had it, indeed, been possible to estimate exactly the motion of the comet's nodes during the interval since their previous return, the date on which the great meteor-shower observed on Wednesday last occurred, might have been accurately foretold. The Luminous Meteor Committee of the British Association requested observers to co-operate for its observation on the evenings of the 28th to 30th of last month, and to keep an occasional watch for its return from the 25th until the last day of November. The observations received from some of these observers are ample proofs of their success; and among the copious descriptions of the shower which have appeared by many expert astronomers throughout the kingdom, little can be desired to increase the extent or accuracy of the information which has been obtained. Should it, however, be observed that a star shower like that seen by Heis, and earlier observed on the 6th and 7th of December, is again visible on about the 5th of December in this year, its connection with the companion comet I., 1818, of Biela's comet, may become a matter of interesting deductions from such observations, and of further satisfactory investigations.

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*FERMENTATION AND PUTREFACTION**

II.

IN the interesting inquiry into the life-history of mildews, a well-known one, abundant wherever organic matter, in a somewhat inert state, is exposed to damp, *Aspergillus glaucus*, may be taken as well as the *Mucor mucedo*. This consists in the first place of a mass of mycelium filaments, which are formed of delicate cells in chains, that is to say, the fibres are divided into series of true cells by diaphragms. The cells are full of protoplasm, at first showing a distinct nucleus, and afterwards a number of vacuoles containing water. The filaments grow at the ends, and new partitions there grow up—at first close together, and afterwards separating and becoming more distinct. Some of the filaments become spiral at the end and finally develop peculiar reproductive organs which will be noticed presently. *Aspergillus* frequently presents for long nothing but this spreading jointed mycelium, feeding upon the surface, and penetrating into the substance of organic matter, and rotting and burning it; producing water, carbon dioxide, sulphuretted hydrogen, various butyric compounds, and other products of decomposition, without developing any special organs of its own. In this state it is perfectly impossible to distinguish it from the mycelium of many other fungi. No doubt there are differences—there are marked differences from some mycelia, for instance those of the Mucors where the filaments are undivided—but most have divided filaments, and these organs are so small, so simple, and so variable, that it is next to impossible to appreciate the distinctive characters. Under favourable circumstances, in the light and air, *Aspergillus* rises into the form of a bluish mould. This under the microscope shows a multitude of one-celled upright stalks, which form a kind of fur on the surface which it has attacked. Each of these stalks, which may be called *conidia-stems*, is dilated at the upper end, and from this dilatation there project, bristling all over the knob, a number of conical protuberances called *sterigmata*. Each sterigma becomes pointed towards its free end, and at length produces at the point a small round cell filled with protoplasm, which remains attached to the sterigma by a fine pedicel. Behind this cell, between it and the end of the sterigma, another cell then forms, and then another, until little chains of cells stand out free from the ends of the sterigmata; and as all these are of the same age, they are symmetrical, and of the same length. The farthest from the sterigmata are, of course, the oldest, and some of these soon get dry and ripe; so that an impalpable dust of these propagating buds or *conidia* is perpetually coming off, wafted by the slightest breath, or even by the imperceptible convection-currents from which the air is never free, from the surface of a mould patch. The conidia are buds capable of germination, of producing plants which go through the same course as their parent, but they are not reproductive products. At the ends of the spiral curls of the mycelium filaments at certain seasons, and under favourable circumstances, large bodies are produced by a form of conjugation in which cells are multiplied till they form a mass of considerable size of a bright yellow colour, called a *utricle*. Some of the cells composing the utricle become dissolved, while the greater number are developed into oval sacs or *asci*, in each of which eight spores are produced. These utricles are the true sexual reproductive organs. We have thus two kinds of spores—conidia, which are non-sexual buds, and asci-spores, the product of a form of sexual union. *Aspergillus* often bears conidia without utricles, and this is always the case when the fungus is badly nourished. It never, apparently, bears utricles without conidia. The appearance of the two modes of reproduction is so different, that the name *Aspergillus* was, until lately, restricted to mycelium bearing the conidia form of multiplication, while the utricle-bearing filaments and utricles were placed in another genus, *Eurotium*.

When sown, say on a solution of sugar or on any other suitable soil, the behaviour of the two kinds of spores is exactly the same. The spores send out tubes, which take the character of mycelium; and whose filaments in either case subsequently bear conidia or utricles according to circumstances.

Botrytis cinerea, a fungus specially abundant on decaying vine-leaves, produces conidia in elegant panicles, and a utricle which assumes such large proportions, and such a definite form, that it has been placed in the great genus *Peziza*, under the name of *P. fuckeliana*.

Not to multiply examples too much, I will briefly refer to a form, the life history of which is not yet thoroughly known—the mould which so often occurs in sour milk, though it is by no means confined to that station—*Oidium lactis*. The mycelium of *Oidium* is extremely like that of *Aspergillus glaucus*, having filaments divided into distinct cells by marked septa. From the mycelium long single shoots rise in the air, and give off chains of conidia; each shoot representing one of the sterigmata of *Aspergillus* with its progeny. *Oidium* attacks all kinds of fermentable substances, and consequently its conidia are frequently, almost constantly, met with in fœcal matter;

* From the Opening Address for the Session 1872-73 to the Botanical Society of Edinburgh, delivered on Nov. 14, by Prof. Wyville Thomson, F.R.S., President of the Society. Concluded from p. 62.