by two seconds. The mean result for the surface material of Jupiter between latitudes 40° to 85° north gave 9h. 55m. 38·9s. ± 1·20s., this being the length of a sidereal rotation expressed in mean solar time. Observations of some dark, well-defined spots in 1891 gave as a value for the period of rotation 9h. 55m. 38·5s., while Denning found (1894–5) the value 9h. 55m. 39·0s., still closer to that given above.

It will be noticed that up to the present the observations of Stanley Williams do not corroborate a reduction in the rate of rotation in higher latitudes, as would be expected from Lohse's discussion. The observations of the two may, however, be harmonised to some extent if, as before, one supposes that they observed markings at different levels in the atmosphere of the planet. If this were so, then very probably Stanley Williams generally watched those markings in the higher regions, while the spots observed by Lohse were situated at a far deeper level, and in which perhaps were strong currents.

A spectroscopic investigation of great interest is that due to Dr. Belopolsky, who undertook the determination of the velocity of a point in the equatorial region of Jupiter. The method of procedure was as follows. He assumed that the equatorial region of this planet made one rotation every 9h. 50m.; knowing the angular diameter of the disc from measures made with the micrometer, he then calculated the velocity of a point on the equator, the resulting velocities being 12 and 13 kilometres per second, according to the special value of the diameter used. The second part of the work consisted in observing the east and west limbs of the planet spectroscopically, using the principle of Doppler to find out the displacement of the lines due to the velocities in the line of sight. The value he obtained was 11·4 kilometres per second, a number smaller than that which would apparently be expected. The great difference between the observed and computed velocity may be due to errors of observation, but its magnitude calls for another explanation. Belopolsky himself prefers to account for this difference by regarding it as a result of refraction, an assumption which is quite permissible, as Schmidt has shown in his theory of the sun.

Perhaps the best idea of the drift of the Jovian surface can be gathered from a summary of the determinations of the length of the period made from surface-markings at different Jovian latitudes. This table we owe to Mr. Stanley Williams, and it appeared in a previous number of NATURE (vol. liii. p. 376). It will be noticed that the nine zones represent practically nine distinct currents in the planet's atmosphere, their boundaries being described as sharply defined. These currents completely encircle the planet, and have an east and west direction; very little indications of motion towards the poles having been noticed.

Zone.	Lat.	Period: In time. h. m. s.	Period: In terms of equatorial period.
I.	+85° to +28°	9 55 37·5	1·0089
II.	+28 ,, +24	9 54 30	1·0071
		9 56 30	1·0104
III.	+24 ,, +20	9 48 0	0·9973
		9 49 30	
IV.	+20 ,, +10	9 55 33·9	1·0089
V.	+10 ,, −12	9 50 20	1·0000
VI.	−12 ,, −18	9 55 40	1·0090
VII.	−14 ,, −28	9 55 40	1·0090
VIII.	−18 ,, −37	9 55 18·1	1·0084
IX.	−37 ,, −55	9 55 5	1·0081

Curiously enough, the zone numbered VII., which represents the red-spot zone, has not an equivalent in the northern hemisphere, that numbered III. having a much quicker drift.

Apropos of this red spot zone, we may mention that Mr. Stanley Williams expresses the opinion that the mysterious red spot acts in the same way as, and has some analogy to, an island in a river (*Knowledge*, April). The spot lies between the south equatorial belt and the south temperate belt, and as the white material between these two belts drifts past the red spot with a velocity of sixteen miles per hour, it is obliged to force a passage round the spot. Most of this white material passes to the north side of the spot, making a depression in the south equatorial belt; but some of it finds a way through a very narrow channel on the south side. There is less resistance to the passage of the material on the north side of the spot, probably for the reason that the surface is most plastic in the equatorial regions. As the channels on the north and south sides of the red spot are together narrower than the main channel, there is a heaping up of white material on the following side of the spot and in the channels, and this seems to possibly explain the bright annulus which is frequently seen encircling the red spot. The union of the two currents produces a commotion on the preceding side of the spot, giving rise to the hazy patch which is usually visible in that position. As a working hypothesis, the idea seems likely to be of use in suggesting observations, but it is admittedly difficult to conceive how such an effective obstacle as the red spot can drift about in the way it has done.

The latest observations regarding Jupiter's surface thus show us that the whole disc of vapour that we see is in a state of slow circulation in currents more or less parallel to the equator. The rifts that appear to traverse the disc in the north and south direction may be the effects of a slow circulation in this direction.

The east and west currents do not then necessarily increase their rate of rotation the nearer the equator is approached; but there may be zones of quicker rotation, followed by zones of slower rotation before the equator be reached. It will thus be seen that a very accurate value of the period of rotation of Jupiter is difficult to determine, since the several drifts are in relative motion one with another. W. J. S. L.

THE LIFE OF JOSEPH WOLF.[1]

IT seems now to be rather in fashion to write lives of persons still in existence. In some cases, such as the present, there is little to be said against this practice; in others, it may be open to very serious objections. But when the biography of a living person is given to us by an intimate personal acquaintance, we have, at any rate, one advantage: it may be assumed that the narrative has been more or less supervised by the person to whom it relates, and that the facts and incidents stated are generally correct. Such, we know, is not always the case with biographies of departed heroes.

Joseph Wolf, well known to all zoologists as the "Prince of Animal Painters," and one whom savants and artists alike agree to class as "absolutely unrivalled" in his special department, was the son of a German farmer, or what was formerly called in the south of England a "yeoman," farming his own land at the little village of Möerz, between Trèves and Coblentz. Born in 1820, Wolf was sent to the village school at Metternich, where his observant habits and "superior skill in drawing maps" told favourably with the master. But to his fellow-scholars a boy who "refrained from bird-nesting on principle," and would fight any of them in defence of a nest of young birds, was somewhat of a puzzle. Here, however, Wolf had many opportunities, both during his school-days and in the course of the initiation into farm-life which followed, of studying nature. A fine wild country was around him, where beasts and birds were abundant, and he soon taught himself to observe them,

[1] "The Life of Joseph Wolf, Animal Painter." By A. H. Palmer. Illustrated. Pp. xviii + 328. (London: Longmans, 1895.)

to collect them, to capture them as models, and to draw their pictures. Notwithstanding these facilities, which, however, could only be enjoyed at off-times, the monotonous drudgery of farming became at length unbearable to the nascent artist, and he at length secured his father's consent to desert the plough, and to become an apprentice to the brothers Becker, a firm of lithographers at Coblentz. At the age of sixteen, therefore, Wolf managed to struggle out of agriculture into a profession which had, at all events, an artistic character about it, and a good knowledge of which must have been of paramount value to him in after-life.

FIG. 1.—A Family Group of the Eastern Red-footed Hobby.

His apprenticeship being over, Wolf's second step in life was still more decidedly in advance. As he passed through Frankfort in search of work, his sketch-book at once attracted the notice of Rüppell, the distinguished traveller and naturalist, to whom he had been advised to show it. Rüppell sent him on to Kaup, the director of the museum at Darmstadt, where the young artist ultimately settled. At the same time, Rüppell engaged Wolf to prepare the plates for his "Systematische Uebersicht der Vogel Nord-Ost-Afrikas," upon which he was then engaged. The fifty figures of this volume, published in 1845, were the first lithographs of this sort that Wolf ever produced. They are a little rough in execution, but no one can doubt their truthfulness and artistic merit. The receipt of this book in England quickly attracted the attention of our zoologists, who at once understood that an artist had come into existence who could figure birds in a way hitherto almost undreamt of, and very different from Spix's "Aves Brasilienses," or even the best designs of Temminck's "Planches Colorées."

On visiting Leyden shortly afterwards, Kaup showed the young artist's portfolio of sketches to Schlegel, and Schlegel, who was then engaged on his "Traité de Fauconnerie," immediately secured Wolf's services for that work, to which he contributed eleven or twelve excellent plates. But after a few years at Darmstadt, Wolf came to the conclusion that there would be a better market for his artistic talent in England, where several naturalists of the day required his services. The late G. R. Gray, of the British Museum, was then engaged on "The Genera of Birds," which Mitchell had undertaken to illustrate but could not find time to complete. On Wolf's arrival in London, Gray at once set him to work on the plates of this folio work, in the Insect Room at the British Museum. The *Proceedings* and *Transactions* of the Zoological Society were, at this period, also much in want of a good artist for their better illustration. For the *Proceedings*, commencing in 1848, Wolf drew figures of a large number of mammals and birds, of which we have a list given to us in the appendix to the present work. Wolf continued to supply the illustrations of mammals and birds required for the *Proceedings*, and the greater number of those of birds wanted for *The Ibis* for about twenty years. After this our artist grew rather tired of the minute and technical details required for scientific bird-structure, and it became difficult to persuade him to undertake such subjects except on special occasions, when a new parrot was discovered, or a rare antelope brought home from Africa, of which the artist was assured that no one else could make a proper picture.

Among Wolf's drawings in *The Ibis* will be found some of the very best examples of his excellent handicraft. Hawks and falcons were always favourite subjects of his pencil, and the family group of the Eastern Red-footed Hobby (*Erythropus amurensis*), (Fig. 1.) which we are enabled to reproduce here through the favour of the publishers of the present work, is one of the prettiest of them. Not less attractive is the elegant figure of the Guatemalan Swift clinging to its rocky home (p. 8), while its pendent nests and flying companions are shown in the background. Mammals have also been always equally within the range of Wolf's able pencil, and not even Mr. Stacy Marks

himself can surpass Wolf in the introduction of feeling and humour into pictures of mammal-life.

Although after deserting scientific work Wolf was hardly the less active, and executed a large number of pictures, both in oil and in water-colours, these products of his brain and pencil are not, perhaps, so well known as his earlier work. Wolf was not elected a Royal Academician, as he certainly ought to have been, and very seldom exhibited pictures in the galleries of Burlington House. His splendid efforts are mostly hid away in the palaces and country mansions of certain great patrons, who were always ready to give him full employment. Such mansions as Lilford Hall, Colebrooke, and Guisachan, must be visited by those who wish to examine Wolf's paintings of this class. But, after all, we agree with the biographer that oil is not the material in which Wolf most excels, although it may be as an oil-painter that he prefers to be known. The best of his productions are in water-colour, and in charcoal and chalk. Such, at least, is the opinion of those who regard his work from a scientific point of view.

Before concluding this notice, we cannot avoid alluding to the way in which Wolf's scientific work has been plagiarised in Germany. On turning to the last page of the present volume, the "Royal Natural History" will be found given in the list of the most recent works which Wolf's genius has served to illustrate. Wolf's pictures, however, have arrived here in this instance by a curious route. Originally prepared for the *Proceedings* of the Zoological Society and other works, they were copied by the artist employed on Brehm's "Thierleben." Not only was this done, but in some cases Wolf's initials were removed and those of the copier ("G. M.") inserted in their place. The blocks thus altered for Brehm's "Thierleben" were subsequently purchased by Messrs. Warne and Co. for use in the "Royal Natural History," and have been so employed without the slightest acknowledgment that the designs were originally the products of Wolf's pencil. To prove this, we have only to compare the figure of the "Variegated Spider-monkey," in the "Royal Natural History" (vol. i. p. 64), with the original figure of Wolf in the *Proceedings* of the Zoological Society for 1867 (plate xlvii.). It will be seen that the former figure is initialled "G. M.," but the latter "J. W."

We will now only add an anecdote of Wolf, extracted from Mr. J. G. Millais's recently published "Breath from the Veldt." Mr. Millais, who appears to be as great an admirer of Wolf as his father is known to be, tells us that one day, some years ago, Wolf was busy on one of the superb panels which grace the walls of the late Lord Tweedmouth's Highland residence, Guisachan. Landseer, who was staying at the same house, and who, it should be remarked, was a firm believer in the pre-existence of man in other forms, came up behind Wolf, who was hard at work, and stood gazing at his picture for some time without making any remark. At last Wolf got a bit nervous, and fidgeted about. Then turning round to Landseer, on whom he was afraid the picture had created an unfavourable impression: "Well, Landseer," he said, "you might say something: I'm afraid you don't like it." "Well, not exactly that," was the dry reply; "for I was just thinking that before you were a man, Wolf, you must have been an osprey" (the bird at which the artist was working).

CHARLES CHAMBERS, F.R.S.

WE have already briefly announced the death of Mr. Charles Chambers, who for thirty years has directed the Calàba Observatory of Bombay, and who, by his zeal and ability, has materially increased its reputation, and worthily upheld the cause of science in the East. Mr. Chambers received his practical and scientific training under the late Prof. Balfour Stewart, at Kew; and when, in 1866, he was appointed Superintendent of the Bombay Observatory, the fortunes of that institution appear to have been at a low ebb, and its continued maintenance by the Indian Government open to question. Mr. Chambers's appointment was at first of a temporary character, and his office the thankless one of discreetly covering the shortcomings of his predecessors, and of making the results of their observations available for scientific use. The difficulties which he had to overcome are hinted at in some of his numerous papers, which have appeared as appendices to the volumes issued from the Bombay Observatory, or in the publications of the Royal Society. For instance, in his discussion on the meteorology of the Bombay Presidency, it is mentioned that the whole of the original manuscript registers prior to the year 1847 (the observatory was founded in 1841) had disappeared, that it was doubtful, in some of the printed records, whether the time was referred to the Bombay or the Göttingen Meridian; while other evidences of looseness hindered the preparation, or necessitated the rejection of his predecessors' work.

The magnetic results appear to have been in a more satisfactory condition, and very soon after his appointment he was able to report the probability of their turning out trustworthy and valuable. With the mass of accumulated arrears Mr. Chambers grappled manfully, and in the *Philosophical Transactions* for 1869, the Bombay observations from 1859–1865 are employed to discuss the solar variation of magnetic declination at that station. The energy displayed by Mr. Chambers, and the favourable position of the observatory, intermediate in longitude between Kew and Nertchinsk, induced the Scientific Committee, consulted by the Indian authorities, at the head of whom was Sir Bartle Frere, to continue the grant to the observatory, and to supply it with new instruments of the Kew pattern. Some delay appears to have occurred in sending out these instruments from England, a delay which permitted Mr. Chambers to organise his staff and reduce his arrears.

Trained in the school of Sabine and Stewart, Mr. Chambers's earliest investigations had reference to the possibility of referring the disturbances of terrestrial magnetism to the sun, considered as a magnet with its axis perpendicular to the plane of the ecliptic. The conclusion at which he arrived was that no effect of the sun's action as a magnet is sensible at the earth. This decision, at the time, received the approval of the late President of the Royal Society, and subsequent and more elaborate investigations have tended to confirm the conclusion. This tendency to trace the magnetism of the earth to the sun, induced Mr. Chambers later to investigate, from long series of observations, the solar and lunar variations of the three magnetic elements observed at Bombay, and likewise the effect of sun-spot on terrestrial phenomena. It is not easy to do full justice to the long series of varied researches which have come from the Bombay Observatory under his able direction, or to the heavy loss which that institution sustains in his removal.

Not the least of his services to science is to enable his successor to continue the observatory under more efficient conditions than he himself found, and with a reputation considerably enhanced by his devotion.

NOTES.

A MEETING for discussion will be held at the Royal Society next Thursday; the subject, "Colour Photography," will be introduced by Prof. Lippmann.

A MEMORIAL has been projected in Germany to the late Prof. Hermann Hellriegel, of Bernburg, who died in September last. It is proposed to erect a monument in the churchyard at