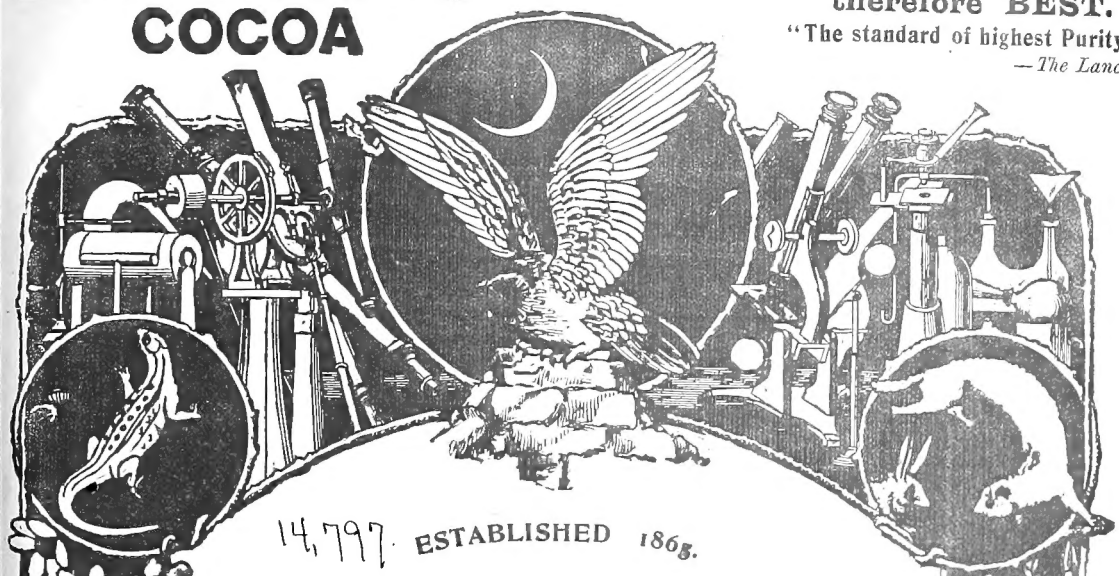

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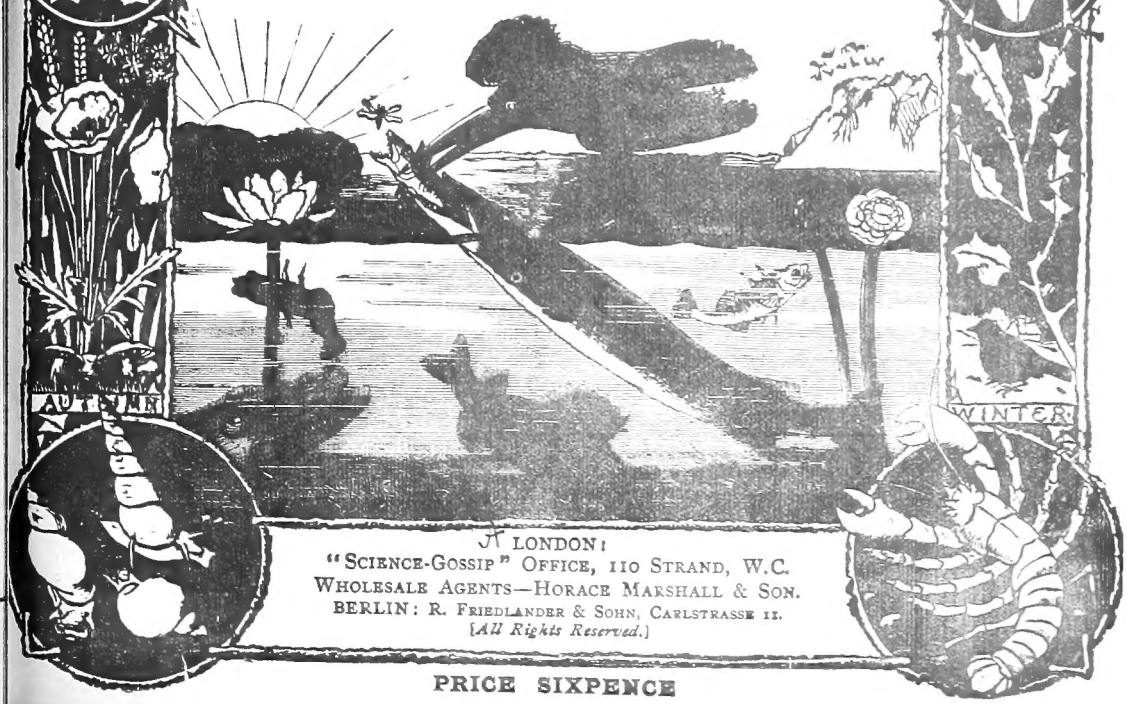

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METEOROLOGICAL NOTES IN SOUTH AFRICA.

By Major H. A. Cummins, C.M.G., R.A.M.C.

LAST year I trekked from near Orange River to Pretoria *viâ* Jacobsdal, Paardeberg, and Bloemfontein. Living during the greater part of the time in the open air, I had an opportunity of observing the local climatic conditions and various other matters, a short description of which may be of interest.

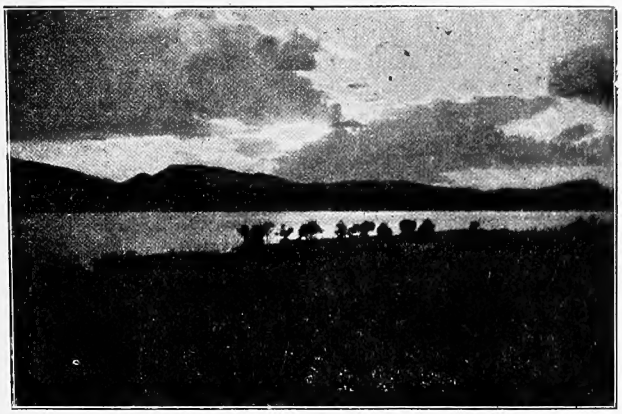


Photo by] [*Dr. A. M. Dodd.*

Narval's Pont, before Heavy Thunderstorm.

My attention was particularly arrested by the character of the local storms, and I noted them as they occurred. While at De Aar, towards the end of January, strong breezes and whirlwinds were, I may say, constant, carrying the dust and sand from the ground which had been worn by excessive traffic, and covering our food and kit. It was almost impossible to see without the aid of a pair of goggles to protect the eyes from the dust.

At Modder River, on February 4th, we encountered a sand storm which lasted from 6 p.m. to 9 p.m. This storm, unaccompanied by rain, must have been a couple of miles in diameter—in fact a glorified "dust devil." The term "dust devil" is used in South Africa to denote a whirlwind, from one yard to twenty yards or so in diameter, which carries a pillar of dust or sand in its vortex. At Enslin on the 10th there was a dust storm followed by rain, on the 13th at De Kiel Drift, and on the 14th dust storms with thunder, lightning, and rain. On February 22nd and on the night of the 23rd we experienced heavy thunderstorms with wind and rain; on the 24th there was another thunderstorm accompanied by heavy wind and rain; on March 1st there was heavy rain at midday; on the 2nd terrible thunder, lightning, and rain at night; from 7 p.m. on the 4th to 2 a.m. on the 5th terrific thunder, lightning, and rain.

During these storms at Paardeberg the ground was flooded, as the surface water was unable to run off with sufficient rapidity; but soon after the cessation of the rain the water disappeared and the sun dried the ground. This gives an idea of the exposure undergone by the soldiers lying in the flooded trenches and in bivouac. It is surprising how one can sleep in the open air in the South African climate and be little, if anything, the worse, except for the extreme discomfort of the occasional deluges of rain. As a rule the soldiers seemed the better for the open-air life.

Paardeberg district, where Cronje and his men were driven to surrender, comprises an expanse through which the Modder River flows. Between the hills there is a large plain, almost level, probably forty square miles in area. Storms frequently travelled up the course of the river bed, which

Photo by] [*H. A. Cummins.*

Rhenoster River, showing Large Watercourse.

seemed to have a power in influencing their direction. They broke with great violence at Paardeberg, passing up the river to Poplar Grove, whence they frequently travelled round the hills and back again, unabated in fury, to Paardeberg Drift.

On March 19th, when travelling to Bloemfontein across the veldt with a few men and an ambulance waggon, I was caught in one of these thunderstorms. One man had his hand on the brake of the waggon, and at the moment the vehicle was struck by lightning, giving the man a shock severe enough to cause temporary loss of power in his arm. One can scarcely realise the brilliancy of the jagged lightning as it appears to rush from the sky to the ground, accompanied by the roar and rattle of the thunder. Soldiers were at times severely burnt by the lightning, or even killed. I have been told by residents in the country that when on "trek" it is not uncommon for a whole span of oxen to be killed by one flash of lightning.

About the middle of April there was very heavy rain in and around Bloemfontein. I left that town in May, and travelled to Pretoria with the general advance, reaching it on June 5th. During our march I have no record of any storm or rain. The climate was perfect; the rather cold days, with scarcely a cloud in the sky, were followed by cloudless frosty nights, illuminated, when the moon failed, by the Southern Cross and other constellations. The cold seemed of a character so intense that it was impossible to get warm.

The undulating veldt in the Northern Orange River Colony and the Transvaal was covered by long coarse grass, dry as hay: the least spark sets this alight, causing a veldt fire, which when fanned by the fresh breeze frequently travels for miles. Grass fires are very dangerous, as the flames frequently leap to a height of five feet or more. On June 3rd, when nearing Pretoria, one of these fires commenced, and burned in the ordinary way among exceptionally long grass. At the same time a whirlwind travelled along, passing through the fire. It lashed the flames into the fury of a furnace, roaring loudly; and, progressing faster than the veldt fire, it carried the flames, whirling them many feet into the air. Cutting a path some twenty yards wide through the grass for about 100 yards distance, it came to a road over which it could not carry the fire; here it took up a pillar of dust forming a thick "dust devil." One of our waggons narrowly escaped being destroyed. On May 28th, at sunset, we counted eight veldt fires burning at the same time. Some of these were on the side of a hill a few miles distant. As the fires progressed on the ridges of the hill they burned into the contour of a colossal hand, the fingers and thumb being quite distinct, pointing north to Pretoria. This seemed a good omen, as we were camped at the time near trenches from which the Boers had decamped the same morning, apparently in haste.

The hills in Cape Colony and Orange River Colony are remarkable from Table Mountain to the Vaal River. They appear as though sliced off at a certain height, just as a turner with his lathe removes first of all the most projecting parts. The hills in the Transvaal always appear to have rounded tops.

The possibilities of agriculture in the Transvaal are, I believe, enormous, and, considering the number of rivers and streams by which the country is intersected, a system of irrigation ought to be simple. The rainfall is considerable, and the surface rain water could be stored in dams much more than is done at present. Rain water is stored at distances from rivers in so-called "dams"—that is to say, the outlet from a collecting area is closed by a bank behind which rain water collects. The ground in the dam becomes very soft from mud often several feet deep. This is dangerous to animals coming to drink. I have seen men ride their thirsty horses into the water and become "bogged," the horse being drowned and the man escaping with difficulty. The so-called "pans" are natural reservoirs of water resembling the "dams": they frequently dry up in the dry weather. They are sometimes several miles in area.

Concerning the climate of Pretoria, taking it on the whole, the weather is charming. The dry period includes the months of April, May, June, July, August, and September. The "Staats Almanak" of the late South African Republic for the years 1891–92, 94–96–97 shows no rainfall in July. June and August are sometimes free from rain. The wet season includes January, February, March, October, November, and December.

The greatest rainfall—namely, about 150 mm. each—occurs during the months of December and January, showing also from fifteen to nineteen wet days in each. From June 1900 to March 1901 the heaviest rainfall occurred in November. That month also showed the greatest rainfall in twenty-four hours—namely, 42 mm. There was no rain in August or September.

Rainfall	Mm.	Days of Rain
1877	539·00 ...	... —
1878	669·00 ..	... 59
1879	773·00 ...	... 64
1894	910·25 ...	... 104
1895	518·00 ...	... 84
1896	565·25 ...	... 86
1897	612·50 ...	... 78

Temperatures	1877	1878	1879
Maximum ...	34° C. ...	35·5° C. ...	33° C.
Minimum ...	6° C. ...	5° C. ...	3° C.

The highest temperatures occur in December and January. These months are damp and warm,

being also considered unhealthy. The lowest temperature given is 3° C., which occurred in August 1879, but I have myself seen frost in July in Pretoria, and of course down country it is much colder. June, also, is a cold month. The elevation of Pretoria is given as 4,471 feet above the sea level, and, roughly speaking, it is 200 miles south of the tropic of Capricorn. The site of the town is in a depression between hills, having an area of approximately ten square miles.

The water supply is good. A small stream is carried through the town in all directions by so-called "sluits" or gulleys, and the water is used for irrigating gardens. The sluit can be closed by a small gate: the water passes through a drain made for the purpose into the garden, and over the ground under cultivation.

During the hot weather the air in the Pretoria valley became heated and dry, and appeared to act as a buffer against storms which approached, deflecting them on to the surrounding hills. The drier the air, the greater this effect.

The storms in South Africa are very remarkable phenomena. Frequently of small diameter, they blow with terrific violence and travel over large stretches of country. They vary in size from the "dust devil" to a storm a couple of miles in diameter. I am told that their violence is at times sufficient to whirl sheets of corrugated iron into the air as if they were pieces of paper. I have never encountered any equal in power to this, but I have seen many trees levelled to the ground by them in Pretoria.

The storms which visited Pretoria during my residence there varied in size from 100 yards to about a mile in diameter. Usually they were accompanied by thunder and rain, the whirlwind coming in front and raising a pillar of dust, sand, papers, branches of trees, etc., which were sometimes carried a couple of hundred feet or more into the air. In the dry weather the whirl pillar may or may not be accompanied by rain and thunder. The lightning from the dry storms is said to be very dangerous, as the lightning discharge is very intense. The whirl pillar appears to be at an angle of 80° or 90°, with the ground sloping backwards from its line of progression to the cloud. The usual speed appeared to be from seven to nine miles an hour

The dust and dirt carried in these storms is evidently one of the causes of the spread of disease. I have heard people attribute an attack of fever to having been overtaken by one of them. I was informed that a nutrient gelatine plate exposed for a second in one of these storms develops thousands of colonies of bacteria.

The barometric readings in Pretoria showed a marked regular diurnal variation in fine weather. On the approach of a storm this became modified, and a steady fall heralded its advent, as may be seen by the observations on March 18th and 24th. In February, before the wet weather commenced, there was a general depression in the mercury.

With regard to the storms themselves they always came against the direction of the surface winds, but when about a mile distant the wind veered completely round, taking the direction of the storm; that is to say, an easterly wind shifted to the west when the storm was about a mile distant from the point of observation.

I had an exceptional opportunity of observing this phenomenon, as there was a very tall chimney over the Electric Supply works belching forth large volumes of smoke, which proved a very delicate wind vane. The direction of the wind as mentioned above showed very clearly the depression near the storm, and the belt of high pressure immediately surrounding the whirlwind. The greatest depression appeared to be about a mile in front of the storm, and to it the air flowed from all points, including the storm itself. The wind flowing from the storm was shown by the shift of wind on its near approach. Before the storm arrived the air was always sultry and oppressive; but when it broke the temperature fell several degrees, as will be seen by the records of March 18th and 29th. To us the air always felt hot and oppressive on the approach of a storm, and when it broke the air seemed excessively cold—more so than the number of degrees of actual descent would lead us to expect.

The contour of the country appears to be well adapted for the production of storms of this nature. The extensive plains and valleys display facilities for heating large bodies of air. The hills are always fanned in fine weather by cool breezes. It was most refreshing to travel from the valley of Pretoria to the top of one of the surrounding hills, which rise to the height of a few hundred feet above the town. Here the air was cool and bracing.

Judging by the direction of the higher clouds, I was led to assume that a fairly constant breeze from the west or south-west existed.

The medium-sized storms, and even the small ones, appear to affect the barometric pressure for long distances, as in my observations there was depression of the mercury for several hours before their arrival, while the sky was still quite clear. In the rainy season the area affected appears to be very large, and is probably of the nature of a monsoon.

The storms usually came from the west or south-west, turning somewhat to the north at the east end of the valley of Pretoria. In the really wet weather the rain-clouds came from the north-east.

The whirl pillars appear to consist of numerous secondary ones, which, besides rotating on their own axes, travel also round the axis of the primary storm. When fences of corrugated iron, houses, or obstacles of the kind are encountered, the axes of the secondary whirls frequently became transverse, and, as it were, rolled along the ground.

The large quantity of rain which falls in a short time enlarges the watercourses to an enormous extent. One could scarcely credit the fact that the large gulleys and rivers which have only a few gallons of water running through them in dry weather can in the course of a couple of hours or less become roaring torrents. The rain has not time to soak into the ground, so that the quantity of surface water to be carried off is enormous. The veldt for miles looks like a lake, but as soon as the storm has passed the sun comes out and rapidly dries up the water which has not run away through the spruits, while in the low-lying damp ground the frogs croak and the insects sing.

I am much indebted to Dr. Schmitz-Dumont, Government Analyst, Pretoria, for kindly giving me a copy of his record of the rainfall during 1900 and 1901. Also to Mr. Cinatti, the Portuguese Consul-General, for being kind enough to obtain for me from the French Consul temperature and rainfall records. Mr. H. Heiberg, of the Mines Department, was kind enough to give me the loan of a Wild-Fuess barometer from his department, with which I took my observations. I desire also to express my thanks to Dr. A. M. Dodd, of Liverpool, for being kind enough to give me some photographs to illustrate the country, one of which is here used as an illustration.

Date 1900	Hour	Barometer	Temperature	Hour	Barometer	Temperature	Hour	Barometer	Temperature	Rainfall, Millimetres	The Temperature is Registered in Degrees Centigrade. The Barometer and Rainfall in Millimetres
	a.m.		°	p.m.		°	p.m.		°		
Feb. 24th	9.35	658.90	22	3.30	656.35	25.2	7.30	656.70	23.5	0	3.30. Sky cloudy and a squall.
„ 25th	8.30	659.10	23	2.45	655.90	25.2	7.30	653.40	23.3	0	2.45. Sky fairly clear, few cirro-cumuli; wind S.E.
„ 26th	8.45	658.90	22	—	—	—	7	656.70	23.2	0	Day fine, wind East; a few cirrus clouds.
„ 27th	8.30	657.35	22	3.45	654.90	27.2	—	—	—	0	Prevailing wind East, passing to South in evening; a few cirrus clouds, sky clear.
„ 28th	8.30	656.30	24	4	653.85	28	7	655.70	26	0	2.15. Sky clear, few cirrus clouds: very warm. 7 p.m. Very cloudy during afternoon. Clouds passing South of Pretoria. No rain; wind S.E.
March 1st	8.30	658.25	21.1	1	657.00	22.2	—	—	—	7.8	8.30 a.m. Heavy rain this morning. 1 p.m. Rain has almost ceased. Heavy rain clouds overhead.
„ 2nd	8.40	660.25	21.5	1.15	656.15	25	7.45	656.15	23.1	0	Very fine day, few clouds, wind East.
„ 3rd	9.15	657.30	22	4.30	653.85	24	7.10	653.95	22.4	0	2.30. Sky very cloudy, rain. 4.30. Heavy thunderstorm cloud at South of Pretoria; no rain from it up to 7.30 p.m.
„ 4th	9	653.55	22.5	3.40	652.25	22.6	5.15	653.85	22.9	5.5	1.10. Very heavy shower and dust storm; wind South; storm came about S.W.; no thunder at present. 3.40. Rain has passed off; wind West, but sky very cloudy all over. 5.15. Sky still cloudy, threatened rain, slight thunder. 11.30 p.m. Bar. 651.15, temp. 21°.
„ 5th	8.30	655.25	21.1	3.35	652.70	24.5	7.30	654.15	22.5	11.3	8.30 a.m. Clouds 6, wind East. 3.35. Heavy thunderstorm, strong wind passed to North-east. 7.30. Second storm to North-west of Pretoria, heavy clouds still. Midnight. Bar. 655.85, temp. 20.1. Heavy rain and thunder, sky clouded all over.
„ 6th	8.30	656.45	20.2	3	653.85	20.8	5.40	655.00	19.8	5.7	8.30. Sky cloudy, 5. 1 o'clock. Threatened showers, sky 6. 3 o'clock. Heavy shower. 5.40 a.m. Just ceased; heavy clouds. 9.40 p.m. Bar. 658.25, temp. 18.5. Cloudy and slight rain, heavy squalls.
„ 7th	9	658.70	18.8	3	658.60	19.5	4	657.10	19.2	21.3	9 a.m. Sky cloudy, 10. Heavy wind from East. 1 o'clock. Clouds 10. No rain. 7.20 p.m. Bar. 657.70, temp. 20. 12 Midnight. Bar. 657.80, temp. 18.
„ 8th	9.15	658.20	18.4	2.30	656.10	19.1	4.30	655.35	19	7.9	9.15. Clouds 10. 7.25 p.m. Bar. 655.95, temp. 19°. Mist and drizzling rain off and on during the day; wind changing from East to South-west.
„ 9th	9 p.m.	657.20	19.2	—	—	—	7.10	655.25	20	7	9 a.m. Heavy rain this morning. 7.10 p.m. Rain during the day.
„ 10th	12.30	656.40	19.5	2.15	655.00	20.5	4	656.20	18.2	7.8	12.30 p.m. Sky cloudy, wind S.E. Misty rain all the morning. 4 p.m. Very heavy showers lasting an hour, also heavy wind, S.E. 9.45. Has been pouring rain since 4 o'clock. Terribly wet day, heavy wind.
„ 11th	a.m. 9.30	658.05	17.4	1.40	649.60	18	4.10	655.70	18 9	26.2	9.30. Raining all the morning, little wind. 1.40. Much rain all morning; clouds 10. 4.10 p.m. Rain ceased, wind S.E., sky cloudy.

Date 1900	Hour	Barometer	Temperature	Hour	Barometer	Temperature	Hour	Barometer	Temperature	Rainfall, Millimetres	The Temperature is Registered in Degrees Centigrade. The Barometer and Rainfall in Millimetres
	a.m.		°	p.m.		°	p.m.		°		
March 12th	9	655.75	18	4	653.80	19,5	7.30	654.45	19	0	9 a.m. Cloudy, wind, threatened rain. 12 midday; misty, rain, cloudy. 4 p.m. Rain ceased, sky cloudy, one glimpse of sun at 3.30. 7.30. Rain at 5 p.m. and again at 7 p.m.; cloudy and damp.
„ 13th	9	655.10	20	3	654.70	23.6	7.30	655.70	21.2	22	9 a.m. Sunshine, also rain-clouds, no rain at present. 1.10. Sunshine, clouds about 4. 3 o'clock. Sky 4, sunshine. 7.30 p.m. No rain, wind West.
„ 14th	9.30	658.45	21.9	1	657.20	24	—	—	—	1.8	9.30. Day fine, sky clear, wind West; a heavy thunderstorm occurred about 5.30 p.m.
„ 15th	8.30	658.85	20.8	3.40	657.15	22.2	7.10	656.96	20.6	0	3.40. Heavy shower, thunder, and heavy squalls, chiefly to West. 7.10. Heavy thunderstorm, lightning said to have struck telegraph office; severe storm in neighbourhood. Midnight somewhat cloudy, no rain.
„ 16th	9	659.45	20.2	2.10	657.10	23.2	—	—	—	0	9 o'clock. Sky cumuli 4, wind N.E.
„ 17th	11.15	656.70	21	1.40	654.80	23	12 midnight	654.45	20	0	11.15. Fresh breeze, sky cumuli 4. 1.40. Wind strong West, clouds 4. Midnight windy, sky fairly clear, no rain.
„ 18th	8.30	653.95	21	11.15	652.95	25	3.30	552.20	24	3.5	8.30 a.m. Wind East. 1.45. Sky clear, bar. 652.45, temp. 25°. 3.30. Heavy storm coming up from West, sky cloudy 8. 4.15. Storm passed after very heavy lightning and rain, thunder still audible, wind North-west. 7.15. Storms around Pretoria, lightning, thunder, wind East. 11.40 p.m. Bar. 653.50, temp. 19°; night fine, shows condition of mercury on approach and presence and departure of storm and warning of approach.
	—	—	—	4.15	652.95	21	7.15	653.30	20 2	—	
„ 19th	8.30	656.35	19.9	3.35	655.10	20	7.30	656.70	20.1	2.0	8.30 a.m. Cumulus clouds. 2.30. Moderate rain and thunderstorm for half an hour. 7.30 p.m. Slight rain, dry afternoon, sky fairly clear.
„ 20th	9	659.50	18.8	4.30	657.20	21.2	6.15	657.20	20.1	.9	12.15 a.m. There have been heavy showers. 2.30. Day fine, clouds high and few, fair moderate breeze, North. 4.30. Sky cloudy 8. 12 midnight. Sky clear, bar. 658.55, temp. 19°.
„ 21st	9	658.35	19.5	2.40	655.10	20.2	6.15	654.80	18.2	20.0	9 a.m. Cloudy, no rain clouds. 12.10. Sky cloudy. 2.40. Heavy clouds, storm threatened, wind North, low scud. 6.15. Drizzling rain during afternoon.
„ 22nd	9.30	655.60	19.2	2.10	654.50	20	6.30	655.20	20.1	0	2.10. Drizzling rain, clouds 10. 6.30. Heavy clouds North and West of Pretoria. 12 midnight. Sky cloudy, but no rain.
„ 23rd	9.30	657.15	20.1	2.40	655.80	23	9.30	656.95	21	0	9.30. No rain, sky 5, white clouds. 1 o'clock. Threatened rain. 2.40. Threatened showers. 12 midnight. No rain, sky cloudy, bar. 656.85, temp. 20.8°.
„ 24th	9	656.85	22	3.30	654.25	23.5	8.15	655.45	20	.5	11.30. Heavy showers after 9 o'clock. 3.30. Sky fairly clear, wind North. 8.15. Heavy thunderclouds approaching, thunder and lightning, wind N.
„ 25th	9	656.10	20.8	1	655.30	24	7.20	655.35	22	0	9 a.m. Sky clear, fresh breeze. 1 o'clock. Fresh breeze, sky clear. 7.20. Day has been very fine.
„ 26th	—	—	—	1	654.95	24.9	11.30	654.95	19	0	1 o'clock. Day very fine, fresh breeze, few clouds; wind N.W. 11.30 p.m. Day fine; cold wind from South, warm in sunshine; evening chilly.
„ 27th	9	655.50	21	1	654.18	23.8	4.30	653.90	23.5	0	Beautiful day. Warm in sunshine, cool breeze.
„ 28th	p.m. 1	654.14	23.5	4	653.50	24	6.30	653.70	23.2	.2	1 p.m. Fine day. 4 o'clock. Warm; sky clear 1. 6.30. Wind very slight, North-west; air oppressive, storm clouds at West. 11.40 p.m. Wind veered to S.E.
„ 29th	9	656.35	20.8	1	654.55	24	7	655.90	20	9	9 a.m. Wind N.W., scud of cirrus clouds rapid, clouds 5. 7 p.m. Very heavy storm passed South of town; whirlwind caused slight dust storm; thunder and lightning, slight rain in town; very little change in mercury after 1 o'clock until now. Storm began about 4.30, and sky still very cloudy. 11.4. No rain, but sky overcast; clouds 9; no wind.

Date 1900	Hour	Barometer	Temperature	Hour	Barometer	Temperature	Hour	Barometer	Temperature	Rainfall, Millimetres	The Temperature is Registered in Degrees Centigrade. The Barometer and Rainfall in Millimetres
	a.m.		°	p.m.		°	p.m.		°		
March 30th	9	657.35	21	4.20	656.70	23.3	7	657.15	19.3	7.3	9 a.m. Sky cloudy. 1 o'clock no rain; clouds 10. 4.20. Heavy rain since 2.15 with thunder; air calm. 7 p.m. Rain ceased at about 5 o'clock Sky still cloudy 8.8. 12 midnight. Rain; sky fairly clear.
„ 31st	9	658.40	19.4	4	656.30	22	6.30	656.40	20 8	8.7	9 a.m. Fresh breeze, morning fine. 2.30. Wind East, clouds 5; some heavy clouds. 6.20 Wind North, beautiful sunset, clouds 5; cirrus and cumuli. 10.30. Night fine, few clouds, no wind.
April 1st	9	657.69	19.8	1	655.95	20.5	11.15	656.10	20.5	—	9 a.m. Sky cloudy, wind North-east. 1 o'clock. Showers of rain, clouds 10. 11.15. Misty rain, clouds 10.
„ 2nd	9	656.50	20	3.15	654.20	20.8	7 15	654.70	20	—	9 a.m. Rain at 8.30; sky cloudy. 3.15. Heavy showers at 3 o'clock; no thunder. 7.15. Heavy rain until 4.15. About 1 inch must have fallen in an hour.
„ 3rd	9.30	655.35	20	12.45	654.45	21.2	—	—	—	—	12.30 a.m. Misty rain; shower and misty rain during the morning.
											The weather continued uncertain until the middle of the month showing no excessive rainfall.

My readings are not corrected to the sea level. I regret the period of readings is so short, but my official work and the difficulty in procuring a barometer prevented my commencing earlier.—29 *Nightingale Place, Woolwich: September 24th*, 1901.

VACCINATION.

By H. H. Baker, B.A. (Oxon.)

NOW that small-pox is again among us, when hundreds of people are being re-vaccinated, and the anti-vaccinator is raising his voice in a howl of protest, it seems advisable to look back to the original causes which led to the almost universal adoption of vaccination.

Jenner's discovery was first published in the year 1798. Before that date the ravages of small-pox were simply appalling, not only in this country, but all over the world. We are told one in fourteen of all that were born died of small-pox. Of those taken ill with the disease one in five or six died, and many were deprived of sight or permanently disfigured. In Russia 2,000,000 deaths from small-pox are reported to have occurred in a single year of epidemic. "La petite vérole nous décime," said Condamine of France. Dr. Lettsom calculated that the average number of deaths from this cause in Europe was 210,000 annually.

About the year 1720 the method of inoculation was introduced into this country. A second attack of small-pox in the same individual, though not unknown, is very rare. Therefore, after a severe course of discipline, designed to bring the body into a fit state to resist it, a slight attack of small-pox was brought on by inoculation, which usually rendered the patient secure against further infection. About two per cent. of such artificially produced cases were fatal; but this was small compared with the mortality in accidental cases. The great objection to it, however, was that inoculated small-pox, even when very slight, was just as infectious as the natural product, and thus the practice tended to spread the disease and to keep the germs alive instead of exterminating them.

The words of a peasant woman—"I cannot take that disease, for I have had cow-pox"—first riveted Dr. Jenner's attention on what he already knew as a vague tradition among the milkmaids of Gloucestershire. The account of his first actual experiment in this subject is best given in his own words. In a letter to Gardner, dated July 19th, 1796, he wrote: "A boy of the name of Phipps was inoculated in the arm from a pustule on the hand of a young woman who was infected by her master's cows. . . . I was astonished at the close resemblance of the pustules, in some of their stages, to the variolous pustules. But now listen to the most delightful part of my story. The boy has since been inoculated for the small-pox, which, as I ventured to predict, produced no effect." Jenner's subsequent experiments and observations

were embodied in his "Inquiry," which was published in 1798. One case which particularly interested him is worth quoting. A poor widow of Cheltenham was obliged to live with her four children in a house in which there was a man suffering from small-pox. After being exposed for five days to infection they were all vaccinated. One child only showed slight symptoms of a skin disease; the rest were untouched.

Within a very few years vaccination was introduced in many different parts of the world, and always with excellent results. Between 1802 and 1810 Christie practically exterminated small-pox in Ceylon; about the year 1812 Balmi's celebrated expedition performed the same good office for Venezuela; and in 1813 it was calculated that 1,000,000 people had been saved to the population of South America by its means. In a letter to William Dillwyn, Jenner complains that in England as much was not being done as might be to make vaccination more general; but he adds that "since the first promulgation of my discovery, in the year 1798, the deaths by small-pox in the British realms, according to the best estimate I can form, are reduced from more than 40,000 to less than 6,000." From Sweden, France, Germany, and Austria came the same tale. Dr. Sacco wrote from Milan on July 13, 1824: "Vaccination is carried on very extensively throughout the kingdom. Almost all the new-born children are annually vaccinated, so that we have now no fear of the small-pox. It is occasionally imported from the neighbouring States of Parma, Piedmont, etc. . . . Such occurrences never fail to prove the efficacy of the preventative, for the disease never becomes epidemic."

Are we not now receiving similar proof of the efficacy of the preventative? There are a considerable number of cases in London just now, but the disease does not spread to anything like the extent it did in former times It may be objected that this is due to the more efficient means which are now employed for isolating patients and thus preventing infection. This doubtless is an important factor, but it must be remembered that persons suffering from attacks of small-pox, so slight as to be passed by unnoticed among the poorer classes, are capable of giving it to others in its most malignant form.

I have dwelt on statistics and opinions given during the few years immediately following the introduction of vaccination, because they were given by men who had the opportunity of directly comparing the state of things existing just before and just after its application became general. We have no reason to suppose that there was any sudden increase of precautions in isolating patients, or, as some maintain, that small-pox naturally died out about that time. From all parts of the globe we have reports of the retreat of small-pox before the advance of vaccination, manifesting itself so plainly to those who were actually on the spot, as to leave no doubt in their minds that the one was the cause of the other. We frequently see nowadays great statistical attempts to prove the uselessness of vaccination. Its adoption has become so universal that we have little opportunity of comparing vaccinated with unvaccinated communities; but the very profusion of arguments and counter-arguments brought forward, shows that the evidence against the practice is as nothing compared with the evidence in its favour deduced from the great sweeping-away of small-pox in the early part of the nineteenth century. Much has been said on both sides about the epidemic at Gloucester a few years ago. The fact remains that it occurred in one of the few cities where there was a large number of unvaccinated persons.

Another argument often brought forward against vaccination is, that it does not give absolute immunity from small-pox. It is true that occasionally a person may take small-pox after having had cow-pox, just as a second attack of small-pox itself is sometimes met with; but such cases are very rare. Many of the supposed instances are due to improper vaccination in the first place. Jenner himself pointed out that the lymph from a cow-pox pustule may produce no effect at all, or it may even raise eruptions resembling those of true cow-pox, but that nevertheless, to the trained eye, are different, and which do not give immunity from small-pox. He insisted that doctors should be specially trained in this branch of their art, and that children should be brought back to them, after the vaccination has taken effect, to see if they have, as he termed them, "correct" pustules. If not, the vaccination should be repeated.

Again, it has sometimes happened that other diseases have been given to children by the process of vaccinating them. This is liable to occur in arm-to-arm vaccination, if great care is not taken that lymph is only drawn from perfectly healthy individuals; but the method is now being everywhere adopted of using only calf lymph, and where this is done with proper precautions the danger is exceedingly small. Cow-pox never causes death, and is not itself infectious; and therefore vaccination is not open to the same objections as inoculation with small-pox. In the old days, when the dreadful effects of small-pox were obvious to everyone, very many were found willing to undergo inoculation in spite of its great disadvantages. Now that we have practically got rid of the disease, we must not be forgetful of its possibilities, and refuse to take a precaution which involves a risk to ourselves so infinitely small, compared with the danger of neglecting it, not only to ourselves but to the whole community. It may be added that, with ordinary care, cleanliness and the use of antiseptics, the chance of any evil, even what is termed a "bad arm" occurring after vaccination, is reduced to a minimum.

20 *Manor Gardens, Holloway Road, N.*

BUTTERFLIES OF THE PALAEARCTIC REGION.

By Henry Charles Lang, M.D., M.R.C.S., L.R.C.P. Lond., F.E.S.

(*Continued from page* 112.)

Genus 17. *GONEPTERYX* Leach.

Edinb. Encycl. ix. p. 128, 1815. Lg. B. E. p. 64. Stgr. Cat. 1901, p. 20. *Rhodocera* Boisd. 1836. Stgr. Cat. 1871.

All the wings with an angular projection; without any dark border. On each wing at the edge of the discoidal cell is an orange spot, which has a slightly silvery centre beneath. Antennae red and curved downward. Body downy. The species forming this genus were separated from *Colias* Fab. by Dr. Leach to form the genus *Gonepteryx*, which certainly has the preference over Boisduval's *Rhodocera*, so generally adopted by Continental entomologists, including Staudinger.

The larvae have the same shape as those of *Colias*, but the pupae differ in having the wing-cases very large and forming a conspicuous bulging mass. This form of pupa is seen in some of the allied exotic genera.

The Palaearctic species of *Gonepteryx* exhibit a remarkable gradation as regards the acuteness of the angular projections, the extreme forms in the series being *G. aspasia*, which has very pointed projections, and *G. cleobule*, in which they are

G. aspasia.

comparatively slight. The species enumerated here are perfectly distinct, and there does not seem the slightest reason for considering them variations of the same specific form, as is hinted at by some writers, several of whom maintain, for instance, that *G. cleopatra* is only a form of *G. rhamni*, notwithstanding that Linnaeus considered them distinct. No one who has seen *G. rhamni* in company with *G. cleopatra*, as it is possible to do in the South of France, could for a moment hold this opinion.

1. **G. aspasia** Mén. Bull. Acad. Petr. xvii. 213.

52—60 mm.

F.w. very acutely pointed at the apex. H.w. about the same in shape as those of *G. rhamni*. ♂ F.w. sulphur-yellow, sometimes greenish-white towards apex and h. marg. H.w. greenish-white; disc. spot of all the wings small, but distinct. ♀ differs from ♂ in having all the wings uniformly greenish-white, without any yellow shading. U.s. greenish-white, with no markings except the disc. spots, which are very inconspicuous, and a few dots upon the costa of f.w. Sometimes there is an antemarginal row of dots on the h.w.

Hab. Amur. (Wlad. Chabfk.) III., IV., and VII.

Larva on *Rhamnus dahurica* V. and VI. (R. & H.)

a. var. *acuminata* Feld. Wien. Mts. vi. (1862). Stgr. Cat. 1901. Has all the wings sulphur-yellow in ♂. Hab. N. China. This form hardly belongs to the Palaearctic Region.

2. **G. rhamni.** (The Brimstone Butterfly.) L. Syst. Nat. x. 470. Lg. B.E., p. 65, pl. xiv. fig. 4.

52—57 mm.

Angles of f.w. not so acute as in *G. aspasia*. ♂ has all the wings sulphur-yellow. Disc. spots reddish-orange and quite conspicuous, those on the h.w. being more developed. ♀ resembles ♂, but has the ground colour greenish-white. The projecting angle of h.w. is about the same as in *G. aspasia*, but the general shape of the wings is squarer and less elongated. Thorax and abdomen black, thickly covered with whitish hairs, which give a grey appearance to the body.

Hab. The whole region except the Polar portion and the Canary Islands. VII.e to X., and II. to V. after hibernation. In some parts of the region it is on the wing throughout the year.

Larva cylindrical, but slightly thicker in the middle than at the extremities. Dull green, covered with minute excrescences, from each of which springs a small white hair. A lateral white waved stripe runs throughout the whole length of the body. Food plant *Rhamnus frangula* and *R. catharticus* V. and VI.

Pupa bright green, pointed at both ends; the wing-cases form a considerable round-shaped projection; head and thorax shaded with purplish-brown.

a. var. *amurensis* Graes. Berl. e. Z. 1888, xxxii. p. 69. Stgr. Cat. 1901, p. 20. Has the orange disc. spots larger than in the type, and the ground colour in ♂ deeper yellow. Hab. Amur.

b. var. *maxima* Butler. R. & H. p. 732. A still more deeply coloured form, larger than the type. ♂ has the f.w. tinged with orange. HAB. ? Amur, Japan, China.

3. **G. farinosa.** Zell. Is. 1847, p. 5. Stgr. Cat. 1901, p. 20. *Rhodocera rhamni* var. Stgr. Cat. 1871.

55—61 mm.

Differs from *G. rhamni* in the much squarer shape of the f.w. Not that they are less acuminated at the apices than in that species, but broader and having the outline of the costa more bulging towards an. angle. H.w. have the portion of the costa between the angular projection at the termination of the median nervule and the anal ang. distinctly wavy in outline, which is not the case in *G. rhamni*. The ground colour of the wings in ♂ is much lighter, as though it had been sprinkled with some white substance. The disc. spot in both sexes is very much less conspicuous than in *G. rhamni*, especially on f.w. Abdomen much lighter in colour. U.s. of all the wings lighter and with less of the greenish tinge seen in *G. rhamni* u.s.

HAB. Western Asia, Amasia, Alai, Turkestan. V.—VII.

LARVA on *Zizyphus vulgaris*. V. (R. & H.)

I was in error in my former work in including this form as European, but I was misled by several writers; one of these erroneously describes it from Southern France.

4. **G. cleopatra.** L. Syst. Nat. xii. 765. Lg. B. E., p. 66, pl. xiv., fig. 5.

46—60 mm.

On an average the expanse of the wings is greater than in *G. rhamni*. The f.w. have the apices less acutely angled than in *G. farinosa*. The h.w. are much less angulated, and have not the wavy outline of margin near the anal angle. Ground colour of ♂ brighter yellow than in *G. rhamni*. F.w. of ♂ chiefly occupied by bright orange patch, varying in intensity in different specimens, but not extending to the ou. marginal portion. The disc. spot is more or less absorbed in this orange patch. H.w. much the same as in *G. rhamni*, but with the disc. spot rather larger. ♀ as in *G. rhamni* as regards coloration, but as a rule rather paler and with brighter and larger disc. spots.

HAB. South Europe, North Africa, Asia Minor. Occurs at Monte Bré Tessin, Switzerland. V.—X.

LARVA. Similar in shape to that of *G. rhamni*: dull bluish-green, rather darker on the dorsal aspect; lateral streak narrower than in *G. rhamni* on *Rhamnus alpinus* and *R. alternus*.

a. gen. aest. *italica* Gerh. Berl. e. Z. xxvi. p. 125 (1882). Stgr. Cat. (1901), p. 21. ♂ sulphur-yellow beneath. HAB. The neighbourhood of Marseilles and the Western Riviera.

b. v. *taurica* Stgr. Hor. xv. (1881). Cat. 1901, p. 21. *antonia* Butl. Ann. and Mag. (5), xv. (1885). Larger than type, paler in colour, the orange patch less extensive. HAB. Syria, Taurus.

c. var. *maderensis* Feld. B.E.Z. v. 1862, p. 473. Stgr. Cat. 1901, p. 21. The orange patch extending over the entire surface of the f.w. in ♂. HAB. Madeira.

5. **G. cleobule** Hub. Zutr. Ex. 455–6 (1825).

55—67 mm.

Angular projection at apex of f.w. generally less marked than in *G. cleopatra*. That of h.w. hardly perceptible. Margins of wings and costa of f.w with dark brown and red points at the extremity of

G. cleobule.

the nervules. ♂ f.w. completely orange-yellow, not so deep in colour as the orange patch in *G. cleopatra*; disc. spot somewhat more conspicuous than in *G. cleopatra*. H.w. bright yellow, deeper than in *G. cleopatra*, with a well-marked disc. spot. ♀ all the wings yellow, sometimes inclining to orange, with deeper orange disc. spots. The ♂ shows a slight tendency to the violet fluorescence so common in the orange species of *Colias*.

HAB. The Canary Islands. I.—VI.

"It is found from January to June in most localities on, and at a little distance from, the coast; gardens and fields seem somewhat favoured, but it is by no means common anywhere. There seem to be several broods between the months mentioned above, but the larva and pupa have not been observed."—A. E. Holt White, "Butterflies and Moths of Teneriffe," p. 35.

Genus 18. *EUREMA* Hub.

Verz. bek. Schmett. p. 96 (1816). *Terias* Swainson, Zool. Ill., t. 22 (1820).

Small or moderate sized butterflies of a yellow or white colour, with the apices of f.w. black, or with a black border, more or less extending along the ou. marg. of the wings. The u.s. have generally small dark brown spots. Abdomen slender. Palpi small. Antennae short and slender, not red, as in *Colias* and *Gonepteryx*. Wings short and broad. H.w. rounded, without angular projection. The species of this genus are mostly confined to tropical Asia and Africa. A few inhabit China,

and two species are described by Leech as occurring in Corea, and I therefore include them here.

1. **E. hecabe.** L. Syst. Nat. i. 2, p. 763, n. 96 (1767).

40—45 mm.

♂ wings bright yellow. F.w. with a black border, broadest towards apex, narrowing towards its middle, and widening out again towards ou. ang. There is a very faint indication of a disc. spot. H.w. with a narrow black marginal border. There is no disc. spot. U.s light yellow, with small circular spots; some of these on h.w.

E. hecabe.

arranged in rows. ♀ resembles ♂ in markings, but is lighter in colouring, being greenish-white; generally smaller. H.w. with only a trace of marginal border.

Hab. Corea.

(*To be continued.*)

RECENT CRITICISMS ON THE ZOOLOGICAL SOCIETY.

THE grooves in which our learned societies lie, although by no means so time-honoured as those containing the older Universities, are yet so deep that the spirit of the age enlightens them but little. Hence much well-deserved criticism is aroused, which from time to time finds expression in the newspapers, and as by reason of its gardens the Zoological Society is ever before the public, its conduct is most openly called into question.

There is no doubt but that every true naturalist who is familiar with the "Zoo" has found out some of its failings, and thought over the possibilities of greater usefulness which it pre-eminently possesses. Here and there also the difference between natural conditions and those of captivity force themselves, uninvited, upon his attention, and he feels something akin to pity for the creatures.

It is chiefly from this sentimental point of view that one of the latest attacks (1) upon the Zoological Society has been made, and although "facts" have been chosen as it were to fit a theory, and much that has been said is far-fetched, yet a great deal of sober sense has been shown and food provided for the "proper conscience with regard to animals which is still," we are told, "a growth of the future."

The excuse for the series of articles when they first appeared was the criticism of a book called "A Walk through the Zoological Gardens," by Mr. F. G. Aflalo. In this, according to the Saturday Reviewer, the author, while giving some interesting, but not copious, information among his "vulgarisms," shows a tendency "to sympathise with some of the unhappy creatures wearing out their lives in the beast Bastille of the Gardens."

To return, however, to the criticism on the "Zoo." In his general tirade against that old bugbear, the cruelty of captivity, the writer of the articles has picked out and harped upon one or two exceptional cases of "the most unmercifully severe confinement," which anyone with no further information might wrongfully consider as typical of the London Zoological Gardens.

There is no doubt but that the "languid and uninterested public" does require a deal of arousing before it expresses a distinct and definite desire for a change. Hence, no doubt, the endeavour to make out a case of cruelty which a section of the press (2) was only too ready to take as proved, in order to stir up a wish for a "Zoo" upon more modern principles. We may, nevertheless, look for some good to come out of the so-called "exposure of abuses," as it appears to have led up to a more serious attempt to improve the work of the Zoological Society.

We may descend to details for a few moments and consider some of the "evidence" brought forward by the Saturday Reviewer. Of actual physical discomfort the only cases that could be found—and it speaks well for the care and attention of the keepers—were the possible ones of the overgrown nails of the kangaroo and the lame left leg of a bustard. The kangaroo, we are assured, felt little inconvenience from its claws, which would have been cut if necessity had demanded. The animal in question was born in captivity, lived for eleven years in the Gardens, was the father of a family, and died some nine months or more before the articles we are discussing were printed. The most is made of the second instance, for it is recorded no less than three times in four articles. The bird in question was in the diseased condition described when it arrived at Regent's Park, and, although it might have been better to destroy it, the feelings of donors have to be taken into consideration as well as those of the animals and Saturday Reviewers. Everyone will concede that "a small wash-bowl" is not big enough for a swan to swim in, and that the dimensions of some of the cages appear ridiculously small when quoted, and even when unscientifically com-

(1) "The Old Zoo and the New." By Edmund Selous. Published by the Humanitarian League, and reprinted with the addition of illustrations from the *Saturday Review* of March 16th, 23rd, 30th, and April 6th, 1901.

(2) "The Case against the Zoo," *St. James's Gazette*, April 8th, 1901.

pared with familiar pieces of furniture, such as wardrobes, sideboards, and meat-safes.

The wild cat might well be furnished with a larger domain, and also, as these animals will breed in captivity, a mate. In spite of what the Reviewer says, it must be pointed out that many visitors do take an interest in this fine British animal. It will, indeed, accept pieces of meat from those who know better than to offer it buns or biscuits, though it seldom overcomes its natural instinct to utter a growl, which has been construed into a "striking sound eloquent of fierce suffering." Some of our well-beloved domestic cats will often purr and growl, practically at the same time, when one strokes them, and unfriendly is a mild description of the behaviour of many towards strangers. In a general criticism of the Zoological Gardens one would expect to find the restricted dens and cages dealt with very strongly; but why begin to attack it on this score alone? Nearly all pets and many domesticated creatures, like pigs and rabbits, live under similar circumstances, and the crusade might be directed against the system generally. The fact remains that animals in the necessarily small cages of a travelling menagerie are often in much finer condition than those which have more space in which to move. Again, it must have been evident to the reviewer that good health is a probable sign of a happy mind, for he takes the trouble to conjure up a picture of human prisoners in the Bastille, and their misery in spite of presumed good health, in order to dispose of what he must have seen was an almost conclusive argument against himself. The mental disquietude of the animals at the Zoo is assumed all through the article, and upon this assumption the whole charge of cruelty practically rests. Darwin is, moreover, quoted with regard to "the discomfort, indeed the misery," which an unsatisfied instinct produces in animals; but instincts are capable of much modification and reasoning powers, which are the result more widely possessed by living things than even perhaps the reviewer would care to allow. When, therefore, the readers of the "Saturday Review" go to look for cases of "misery," they will see on every side the outcome of modified instincts in the general contentment and happy adaptation to circumstances which prevails.

The dream of future changes deals with "The Zoo" as the "Saturday Reviewer" would have it, and for the most part his reasons for the alterations are exceedingly sound, though his ideas are somewhat impracticable. If we had the gigantic cages and enclosures which are suggested, the creatures would rarely be seen at all by the visitors. The reviewer, for instance, can hardly have spent half an hour in the apes' house, when not overcrowded by visitors, and indulged in a game with the lively and zealous chimpanzee, or the stolid but persistent orang utan. Otherwise he would have appreciated that more of their characters, if not habits, could be learned in that time than in a month were they given the extended domain three times the size of the Reptile House, which he suggests. Palm trees would be a very pretty addition to the scene for a few days, but after that one would say that the foliage of the valuable tropical forest in miniature would soon be destroyed, and the place become a wilderness.

The description of the liberating of the birds by a bank-holiday crowd of all things, and the shutting up of the superintendent in a toucan's cage, may amuse some people. More would be pleased to see a parrots' aviary, which the imaginative Reviewer instals in the place of the present house. On the other hand, few would be sorry to see the vultures and eagles away from their melancholy surroundings, and one is inclined to agree with the statement that they would be more pleasing if "stuffed." The value of the suggested object lesson to be learned from hauling beehives to the tops of high trees in a bears' enclosure is not obvious, and makes one doubt, at least, the sincerity of the reviewer. It must be said, moreover, that he himself lapses into the vulgar, and what he is pleased to call "newspaper," style he complains of in Mr. Aflalo.

In the letter addressed to the President and Council of the Zoological Society which a Fellow, Mr. Matthew Davenport Hill, M.A., has written in explanation of an adjourned resolution he is to move at a meeting on November 21st, all that is sensible in the articles we have discussed is advocated, and a great deal more, towards improving the work of the Society. Mr. Hill contends that the Gardens have come to be a national institution, and may be looked upon as representative of what Britain does in this respect. Yet whether we look at it as a popular exhibition or as a place for scientific investigation, it is open to all kinds of objections in a greater or less degree. It is, moreover, the property of a learned society, and any improvement of a marked character can only follow a change in policy upon the part of the Council.

This new critic is in accord with Mr. Selous, the Saturday Reviewer, in wishing to see the animals, so far as possible, live their lives. We quote the following from that part of Mr. Hill's letter which deals with the general condition of the menagerie:

"Of late years, it will be generally admitted, ideas as to the scope and function of a zoological garden have greatly altered. Menageries of the type of Exeter 'Change are no longer tolerated. Unless an animal can live and thrive under conditions to some extent, however remotely, resembling nature, the sight of it in captivity can give no pleasure or interest. Are the Zoological Society's Gardens sufficiently free from reproach on this head? I think not; nor do I believe that there is room for two opinions in the matter. I am told that efforts are being made to pull down and rebuild many of the present houses and aviaries.

but that it is not possible to do everything at once. My point is, that not nearly enough is being or has been done in this direction for the last twenty-five years. Few of the present premises accord with modern ideas—many are totally opposed to them."

The Northern Aviary is put down by Mr. Hill as the worst, perhaps, in the Gardens; and he continues: "I have seen sometimes as many as five large owls kept in a rectangular hole 4 feet by 5 feet by 4 feet. (I quote from memory, but these figures are above rather than below the truth.) The birds have scarcely room to turn, and the fact that few of them live any length of time bears out my statement. Further, the aviary having a south aspect, by no means sufficient care is taken to protect the night-owls from the sunlight. I do not think it too much to say that the condition of this aviary has far too long been a reproach."

There are several other houses which come in for summary condemnation; but Mr. Hill soon puts aside the question of humanity, and dilates upon the advantages of following the methods adopted in most Continental menageries, where enclosures are built so as not to offend the human eye, and where an attempt to imitate the natural surroundings is made to some extent. This is one of the points brought forward by Mr. Selous, and it follows that, more room being necessary, for this reason alone the reproach of cruelty would vanish. An instance cited by both writers is the picturesque enclosure for the seals at Cologne, where the rocks, water, and shore are arranged so as to give a remarkably natural effect. By comparison with the latter the circular basin, wooden chair, and diving platform at Regent's Park are sufficiently odious.

Before going on to discuss the scientific work of the Society, another important popular aspect of the collection of animals is treated upon, which other naturalists have before considered without avail. At present the educational value of the menagerie, even as a mere living museum, is as small as it well can be. The only exchange for the descriptive labels which the modern curator is learning to attach to his stuffed specimens is the fact that the animals are alive, and that one is told their generic and specific names, the locality, date of arrival, and sometimes the name of the donors, or that the specimen was born in the menagerie. In many cases several distinct species are contained in the same cage, and although an attempt has been made to enable visitors to distinguish some of the birds by the attachment of a sketch to the bars, the result is not of much account. A properly constituted guide-book might help in the same educational direction, which cannot be said of the present publication.

In urging a complete reorganisation of the Zoological Society's scientific work, Mr. Hill divides Zoology into (*a*) Comparative Anatomy, and (*b*) Bionomics. The elucidation of the former he would naturally rather leave to museums, while it must be pointed out that there are other societies which might publish the papers that go to fill the costly "Proceedings" and "Transactions" of the Zoological Society. We make a further quotation from the letter in connection with the second heading:—"Observations on living animals, hybridisation, the effects of changes in environment, food, etc., are slowly perhaps, yet surely, becoming recognised as of equal importance in solving some of the most important problems in zoology. Can it be said that the Society is making the most of its opportunities in this direction, or that it is doing for Bionomics what South Kensington Museum is accomplishing for Comparative Anatomy? If we examine the published work of the Society, it will be hard to answer in the affirmative. Is it not possible that with more enterprise and energy in this direction the Society's Gardens might become a centre of study for animal, as the Royal Gardens at Kew are for plant Bionomics?

"Furthermore, interest in the acclimatisation of animals grows but slowly in England, the country *par excellence* in Europe of parks, coverts, and protected areas. Is it too much to say that the lack of interest in this most important branch of Bionomics is to some extent due to the lethargy shown by the Society in the study of its problems?"

This important letter, which has met with widespread sympathy, concludes with a number of detailed suggestions to the Council as to possible methods of reform. Five of these deal with the remodelling of certain specified buildings, and we note that it is advocated that the diving birds living in the Fish House should be kept in totally different quarters, where they can be seen at other times than when in the water, and where adequate space can be provided. The question of labelling is touched upon, and it is urged that a more systematic method be adopted in arranging the places occupied by genera and species. Visitors may recall the fact that the clouded tiger is put among the mice, that often the most interesting inhabitants of the Insect House are birds, and that the sheep are scattered all over the Gardens.

"The work of the Secretary being too much for one should be shared by two gentlemen: one who will direct the Library, Scientific Meetings, and publications of the Society; the other a practical naturalist, who will reside in the Gardens and take over their entire administration."

Lastly, it is recommended that funds now devoted to the sending out of expeditions to collect dead specimens should be used to maintain one or two trained naturalists, besides the Prosector and his staff, for bionomical investigations in the Gardens.

There is little doubt but that all these and other improvements could be successfully carried out if only the younger generation of zoologists would make up their minds to profit by their training and the lead which has been given to them.

AN INTRODUCTION TO BRITISH SPIDERS.

By Frank Percy Smith.

(*Continued from page* 139.)

GENUS *MICRONETA* MENGE.

This genus may be distinguished from *Tmeticus* by the legs being more slender and the eyes more closely grouped. The lateral eyes are placed upon distinct oblique prominences; the falces of the male are attenuated and divergent towards their extremity.

Micronetа sublimis Cb. (*Neriene sublimis* in "Spiders of Dorset.")

Length. Male 2 mm., female 2 mm.

Cephalo-thorax pale brown, with darker margins and some dark converging lines. Legs pale orange, the femoral joints being the most richly coloured. Abdomen glossy, black, with fine hairs. The eyes of the posterior row are equidistant, one diameter apart. The clypeus is slightly lower than the ocular area. A rare spider found in mountainous districts.

Micronetа rurestris C. L. Koch. (*Neriene fuscipalpis* in "Spiders of Dorset"; *N. gracilis* + *N. flavipes* Bl.)

Length. Male 2 mm., female 2.2 mm.

Cephalo-thorax nearly black. Legs dark reddish yellow. Abdomen almost black. This species may be distinguished from *M. sublimis* Cb. by its coloration and by the digital joint of the male palpus being conically prominent near its base. It is rather common.

Micronetа conigera Cb. (*Neriene conigera* in "Spiders of Dorset.")

Length. Male 1.7 mm., female larger.

Cephalo-thorax yellowish-brown, marked and veined with black. Legs yellow. Abdomen glossy black with a few hairs. Digital joint of male palpus with a very pronounced conical prominence at its base. This species may be distinguished from both *M. sublimis* Cb. and *M. rurestris* Koch by the clypeus being wider than the ocular area. Rare, but widely distributed.

Micronetа subtilis Cb. (*Neriene subtilis* in "Spiders of Dorset.")

Length. Male 2 mm.

Cephalo-thorax warm yellowish-brown. Legs reddish-brown, paler at the articulations of the joints. Clypeus wider than ocular area. Distance between central eyes of hind row less than that between one of them and the adjacent lateral. Rare.

Micronetа innotabilis Cb. (*Neriene innotabilis* in "Spiders of Dorset.")

Length. Male 2 mm.

May be distinguished from *M. subtilis* Cb., *M. sublimis* Cb., and *M. rurestris* Koch, by the distance between the central eyes of the hind row being greater than that between one of them and the adjacent lateral. The clypeus is not wider than the ocular area. Rare.

Micronetа mollis Cb. (*Neriene mollis* in "Spiders of Dorset.")

Length. Male 1.5 mm.

Eyes of both rows equidistant. Extremely rare, apparently only a single specimen having been taken.

Micronetа mystica Cb. (*Neriene mystica* in "Spiders of Dorset.")

Length. Female 2 mm.

Cephalo-thorax yellowish-brown, tinted with green. The whole upper surface when viewed in profile is very irregular, and the clypeus projects considerably. The epigynum is very prominent. Extremely rare.

Micronetа jugulans Cb. (*Neriene jugulans* in "Spiders of Dorset.")

Length. Female 2 mm.

Cephalo-thorax yellow, with a blackish marginal line. Legs of a darker hue. In front of the genital aperture is a large roundish convexity. An obscure and extremely rare species.

Micronetа nefaria Cb. (*Neriene nefaria* in "Spiders of Dorset.")

Length. Male 2 mm.

Cephalo-thorax greenish yellow-brown, with a black marginal line. Clypeus wider than ocular area. Legs yellow. Abdomen black. A very distinct spiracular opening in front of the spinners. Extremely rare.

Micronetа decora Cb. (*Neriene decora* in "Spiders of Dorset"; *Micronetа clypeata* F.O.P.C.)

Clypeus more than twice as broad as ocular area. An extremely rare species. The width, or breadth, of the clypeus and ocular area must be taken to indicate the measurement made at their central part in the direction of the main axis of the spider. The same measurement is often referred to as the height of the clypeus.

Micronetа viaria Bl. (*Neriene viaria* in "Spiders of Dorset.")

Length. Male 2.5 mm.

Easily distinguished by the possession of a tuft of coarse hairs upon the fore extremity of the cubital joint. Uncommon.

Microneta saxatilis Bl. (*Neriene saxatilis* + *N. rustica* + *N. campbellii* in "Spiders of Dorset.")

Length. Male 2 mm.

Cephalo-thorax brown. Abdomen nearly black. The radial joint is of characteristic form and is figured. I have received specimens of this rare spider from Mr. W. Falconer, of Slaithwaite, Huddersfield.

GENUS *SINTULA* SIMON.

This genus is closely allied to *Microneta*, but the falces of the male are neither greatly attenuated nor divergent, these organs being similar in both sexes.

Sintula cornigera Bl. (*Neriene cornigera* in "Spiders of Dorset.")

Length. Male 2 mm.

Digital joint of male palpus with a long, conical, horn-like process near its base. Very rare.

Sintula diluta (*Neriene diluta* + *N. demissa* in "Spiders of Dorset"; *Leptyphantes plumiger* F.O.P.C.)

Length. Male 1.3 mm., female 1.5 mm.

Cephalo-thorax yellow. Legs dark reddish-yellow. Abdomen olive brown, speckled with yellow. The epigynum of the female is furnished with a very long slender process pointing backwards. It must not be confounded with *Bathyphantes concolor*, which will be described later. The falciform process of the male is illustrated. Not common.

Sintula nigrotibialis Cb.

Length. Female 1.6 mm., male unknown.

The tibae, especially of the first and second legs, are suffused with black. The vulva is figured. Very rare.

Sintula prominens Cb.

Length. Female 1.4 mm., male unknown.

Cephalo-thorax yellowish-brown, with a rather wide black margin and some blackish converging lines. Legs pale yellow, femoral joints darker. Abdomen black. The vulva is figured. Very rare.

Sintula aëria Cb. (*Linyphia aëria* in "Spiders of Dorset.")

Length. Male 2 mm., female 2.2 mm.

Similar in colour to *S. prominens* Cb. The falciform process is figured.

Sintula oblivia Cb. (*Linyphia oblivia* in "Spiders of Dorset.")

Length. Male 1.6 mm.

Cephalo-thorax yellowish-brown, with dark marginal and converging markings. A large black brown patch at hinder part of caput. Legs brownish-yellow. Abdomen glossy black. Very rare.

Sintula morula Cb. (*Neriene morula* in "Spiders of Dorset.")

Length. Male 2 mm., female larger.

The radial joint is furnished at its fore part with a tapering, slightly curved apophysis, whose length is nearly equal to that of the joint itself. Very rare.

Sintula frederici Cb. (*Linyphia frederici* in "Spiders of Dorset.")

Length. Male 1.3 mm.

Cephalo-thorax yellow brown, with dark marginal and converging lines. Legs dull yellow. Abdomen black, freckled with yellow. Extremely rare.

Sintula fausta Cb.

Length. Male 1.6 mm.

Easily distinguished by the form of the radial joint, which is figured.

Sintula pholcommoides (*Linyphia pholcommoides* + *Neriene pholcommoides* in "Spiders of Dorset").

Length. Male 1.3 mm.

The eyes are grouped somewhat as in Pholcomma, hence the name. A very rare species.

Sintula nescia Cb.

Length. Female 2.75 mm.

Cephalo-thorax pale orange. Legs orange, paler at the articulations of the joints. Abdomen black. The vulva is figured. An extremely rare spider.

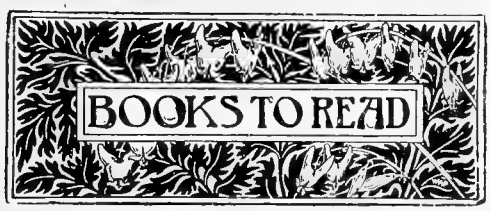
Sintula pygmaea Cb. (*Neriene pygmaea* in "Proc. Dorset Field Club," vol. xiv. p. 155. Not *N. pygmaea* in "Spiders of Dorset.")

This rare species is described *loc. cit.*

(*To be continued.*)

SUGGESTED CURE FOR CANCER.—It having been observed in America and elsewhere, that in those regions where malarial disease is prevalent cases of cancer are almost, if not actually, unknown, a suggestion has been made to inject into the veins of cancer patients some of the blood of human beings affected by malaria. This, we understand, is to be tried as a cure and preventive for cancer.

DIFFERENT SYSTEMS OF LIGHTING.—M. Lauriol, in a review upon this subject, shows the relative cost of the different methods of lighting in common use. He maintains that incandescent light using coal gas costs nearly twice as much as incandescence by acetylene; but that the high price of calcium carbide brings the cost of acetylene gas by itself to a much higher figure than that of the incandescent coal gas. He points out the different methods employed in the production of water gas, which is obtained by passing steam over red-hot carbon. In England petroleum vapour is often mixed with water gas. A practical mixture is thus obtained comparable with ordinary gas from three points of view—lighting, heating, and motive power. Heating by electricity amounts to about six times the cost of coal gas. It must, however, be remembered that in heating by ordinary gas at least one-half the heat is lost in the chimney; so that if gas heat could be completely utilised it would only cost one-twelfth that of electric heat. —*W. H. Cadman, Silverdale House, Silverdale, Staffordshire.*



Deschanel's Natural Philosophy. Part III. Electricity. By J. D. EVERETT, M.A., D.C.L., F.R.S. 358 pp., $11\frac{3}{4}$ in. $\times 7\frac{1}{2}$ in. (London: Blackie & Son. 1901.) 4s. 6d.

Treatises on electricity may be divided into three classes; namely, mathematical, experimental, and descriptive. Those of the first two classes appeal to the science student alone. The present treatise belongs to the third class, and as such is accessible to the general reader. It contains a fairly complete summary of the leading experimental facts concerning electricity and magnetism, together with descriptions and illustrations of the principal apparatus used both in the laboratory and in practical applications. It need hardly be said that, in order to be kept up to date, a treatise on electricity must be in the main newly written, and an examination of the book before us shows that this has been done. A new chapter contains an account of Maxwell's notions with regard to electric action in dielectrics, but we think it is a pity some reference to this is not made in Chapter I. in connection with the old-fashioned "one fluid and two fluid theories." Then, again, magnetic hysteresis is fully discussed, and the various meters—wattmeter, voltmeter, potentiometer, ammeter, joulemeter, etc.—are included among the apparatus described. In electrochemistry the modern theory of ionisation is expounded; while, among other new features, the properties of electric oscillations are treated in a chapter near the end. We have mentioned the book as being descriptive rather than mathematical, but nowadays no one can learn electricity properly without knowing much of mathematics, and Professor Everett has done wisely in introducing mathematical formulae where they are required. To understand these, the reader must be able to use the differential calculus; and he will also have to learn the meaning of such phrases as "line integral," "surface integral," "curl of a vector," especially in connection with electric waves. To those who understand such notations the formulae will give no difficulty; those who do not, will have to confine their attention to the portions of the book dealing with general descriptions, but it will not be long before they will try to pick up the smattering of mathematical knowledge required to understand the rest.—*G. H. B.*

Advanced Exercises in Practical Physics. By ARTHUR SCHUSTER, Ph.D., F.R.S., and CHARLES H. LEES, D.Sc. 368 pp., $11\frac{3}{4}$ in. $\times$ 7 in. (Cambridge University Press. 1901.) 8s.

We note that this volume is intended for students who, having obtained an elementary knowledge of experimental physics, desire to become acquainted with the principles and methods of accurate measurement. The large and increasing number of students who have to be taught simultaneously in physical laboratories renders it necessary that the instructions supplied to them should be fairly complete, and that the exercises should be of such a nature as to enable the teachers easily to check the accuracy of the results obtained. A demand has thus arisen for a text-book which will supply students with most of the explanatory matter required to enable them to work out the experiments largely by themselves, and certainly the present book gives the impression of having been very carefully compiled for the purpose. As no two physical laboratories are likely to be supplied with exactly the same apparatus, a few short hints contained in an appendix, giving the most convenient dimensions of rods, tubes, etc., have been added. The preliminary portion, dealing with errors of observation and such matters, will be very useful for the advanced class of students. The exercises comprise mechanics, heat, sound, light, magnetism, and electricity.—*G. H. B.*

Shell Life: an Introduction to the British Mollusca. By EDWARD STEP, F.L.S. $7\frac{3}{4}$ in. $\times$ 5 in., 414 pp., with numerous plates and illustrations. (London: Frederick Warne & Co. 1901.) 6s.

The book is written as a companion to "The Romance of Wild Flowers," and forms a second volume in the "Library of Natural History Romance." Such a title as this last cannot fail to be most useful, for anything which a critic finds not to be natural history may reasonably be put under the heading of romance. Any popular writings, be they books or articles, which, like "Shell Life," encourage the study of living organisms, are to be commended and welcomed more or less cordially as they contain less or more fantastic exaggeration, silly errors, and, what is even worse, loose writing. The first fault is not very evident in the volume before us, but one need not search to find examples of the others. On p. 306, for instance, at which we opened the book, it is stated with regard to the Pulmonata that "the members of the order are distinguished by the possession of two pairs of tentacles," whereas the pond snails of which the chapter treats have but a single pair. Again, halfway down the second page of the introduction, when we begin to read the book we find the description of the common garden snail: "The shell is packed with a solid jelly of greenish hue—the living creature that formed the hard shell by excretion from its outer surfaces—but at present it is without form, a mere jelly in a jelly-mould." This, it is hardly necessary to point out, is a good example of loose writing, and begins to border upon the fantastic, for the application of lukewarm water, we are next told, causes the animal to emerge from the shell and assume a definite shape in a way which makes one, unwillingly perhaps, call to mind the smoke issuing from a vase in the "Arabian Nights," and turning into a genie of prodigious size. It seems surprising that publishers should not submit the books they decide to print to a specialist in order that he may pick out inaccuracies before they are given to the public to digest. It is not our intention to make up a list of the drawbacks to the volume, but rather, having shown that it is not perfect, to give what praise we can. The plates, which are mostly "half-tone" reproductions from photographs of the actual shells, are very pleasing examples of this work, and really give an excellent idea of the specimens. There is also a prodigious amount of information, particularly of the interesting kind,

which deals with the uses of colour and many of the curious habits of molluscs. We doubt, however, whether the introduction of English names for creatures which possess no good ones, or none at all, will commend itself to many naturalists. — *W. M. W.*

Illustrated Natural History. By W. G. Ridewood, D.Sc., F.L.S., F.Z.S. With 27 coloured plates, and several illustrations in text. (London, Paris, and New York: Raphael Tuck. 1901.) 6s.

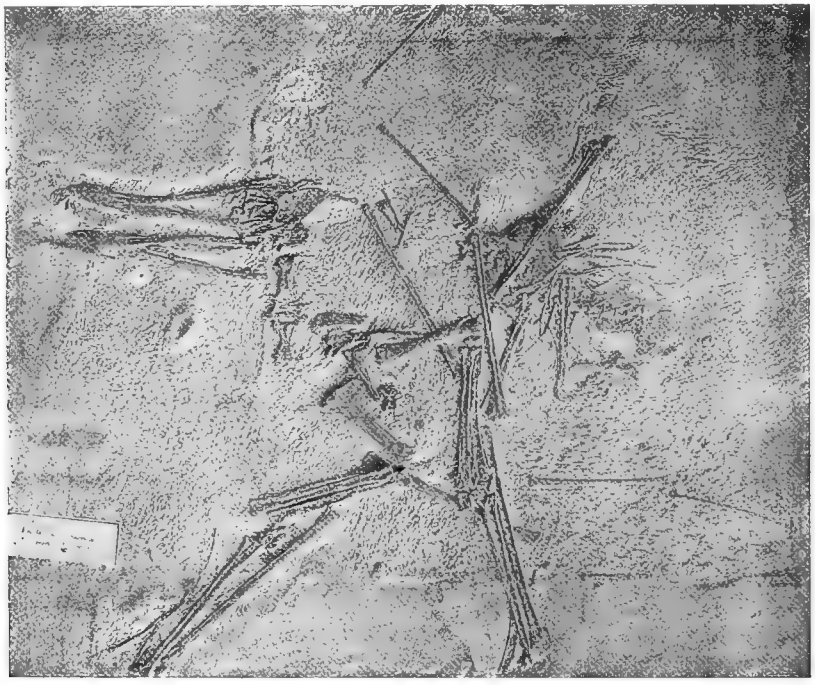
This is a nicely produced work for young people. The coloured illustrations, which are in most instances of a high standard of excellence, are by Paul Wagner, the black and white drawings being the work of Mr. W. J. Webb. The letterpress gives short and concise accounts of many of the mammalia, some birds, fish, insects, and other groups, including scorpions, centipedes, and various other animals. There is not any attempt to illustrate more than a few animals in each order, but the general effect is sufficient to create a taste among children for further knowledge.

Land and Fresh-water Shells. By J. W. Williams, with a chapter by J. W. Taylor and W. Denison Roebuck. Third edition, 112 pp., 7¼ in. × 5 in., illustrated. (London: Sonnenschein. 1901.) 1s.

Fifty-seven pages of this little work, which is one of the "Young Collector Series," are devoted to the anatomy of the snail and the fresh-water mussel. Thirty-five pages are also given to the genera, species, and varieties of British land and fresh-water shells. There is further added the Conchological Society's census for the counties and vice-counties. No attempt is made to illustrate all the British shells, though they are briefly described, as probably in such case it would be impossible to produce the book as one of the cheap and generally excellent series to which it belongs. No doubt those who have not access to a more pretentious book will find it very useful; and to conchologists who want the census of the Conchological Society it is worth more than its price.—*W. M. W.*

The Golfer's Guide to North-East England. By "N. G." 7⅝ in. × 4½ in., 87 pp. illustrated. Published by the North-Eastern Railway. 6d.

Naturalists and sportsmen have much in common, but the interests of the former are hardly so well looked after by themselves or by other people. Sometimes, however, the man of net or collecting tin may share the advantages given to his brother of gun or golf club. In the present little guide, which is crowded with pretty vignettes and full-page views of the ruins and fine scenery of North-East England, much of interest may be picked out by the rambler and amateur photographer; even from the advertisements one learns that there are such things as 1,000-mile tickets, consisting of a book containing 1,000 coupons, each representing a mile, the cost for travelling first class being about a penny-farthing for this distance. What is more, the purchaser, his family, guests, and employés may all make use of them without the lets and hindrances we are used to down South.—*W. M. W.*

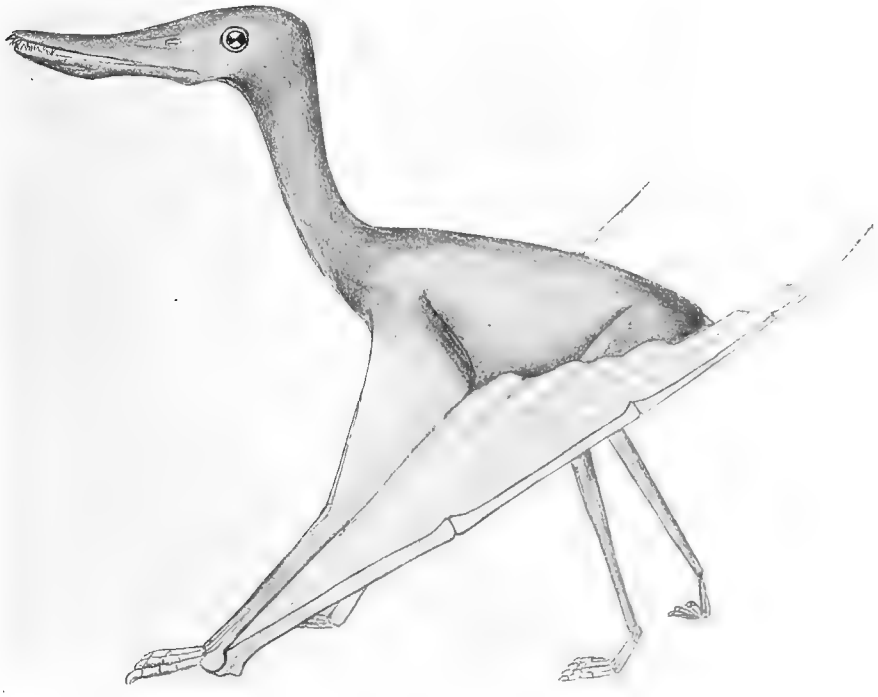


Cycnorhamphus suevicus. Fossil State.

(*From "Dragons of the Air." By Professor H. G. Seeley.*)

Dragons of the Air. By H. G. Seeley, F.R.S. xiii + 239 pp., 7½ in. × 5 in., with 80 illustrations. (London: Methuen & Co. 1901.) 6s.

Professor Seeley has produced a delightful book, indited with the same charming literary style which is so well known in his general writings and lectures. The real object of the book is described in its sub-title, being "An Account of Extinct Flying Reptiles." This is no new subject to the author, as long ago—for no less a period than ten years—he worked with the late Professor Sedgwick in gathering remains of these extraordinary and deeply interesting animals in the Cambridge Green Sand. Since then much more has been learned about them, and many have been restored, and by



Cycnorhamphus suevicus. Restored.

(*From "Dragons of the Air." By Professor H. G. Seeley.*)

human imagination clothed as with their original flesh. Among the illustrations—which, by the way, have been cleverly drawn by Miss E. B. Seeley—are several of these restorations, two of the plates being here reproduced by the courtesy of the publishers, one showing the fossil bones as discovered and the other the restoration of *Cycnorhamphus suevicus* from the Solenhofen slate, showing their scattered position. The original fossil is in the museum at Tübingen. A particular feature of the restoration is that showing the position of the wing membranes. As a popular description of extinct creatures represented in most museums, but little understood by the public, this is one of the best books of its kind which it has been our pleasure to meet with in our experience.

The World of the Great Forest. By Paul Du Chaillu. xiii + 322 pp., 8¼ in. × 5⅝ in., with 50 illustrations. (London: John Murray. 1901.) 7s. 6d.

This beautifully produced book, with the striking illustrations by Messrs. C. R. Knight and J. L. Gleeson, will appeal to young people generally, as well as to the majority of their elders. M. Du Chaillu's long experience in many parts of the world, especially in the great Central African Forest, is known to most naturalists, as are also his romantic writings. In this book, as did Rudyard Kipling in his "Jungle Stories," the author endows his animals with human speech, and makes them tell much of their own stories. It is needless to say that from the pen of the author we have many that are not only sensational but highly entertaining. Naturally, as one would expect, knowing Du Chaillu's acquaintance with gorillas, they form an important feature of the work. There could be no better gift-book for the coming Christmas-time than the volume before us.

The Story of Books. By Gertrude Burford Rawlings. 174 pp., 6 in. × 3¾ in., with frontispiece and 16 other illustrations. (London: George Newnes, Limited. 1901.) 1s.

This is another issue in the Library of Useful Stories, and forms one of the most interesting. It traces the history of bookmaking from the beginning until recent times. The illustrations are quaint and suitable, some of the ancient blocks and black letter used in mediaeval times being reproduced.

THE London branch of the Conchological Society will hold meetings at 7 p.m. on the third Friday in each winter month at Room 22, 11 Queen Victoria Street, E.C. Members are requested to bring specimens for exhibition and for exchange.

WE have received the recently issued edition of the "remainder" catalogue published by Mr. H. J. Glaisher, of Wigmore Street, London, which contains a number of good modern scientific works. This catalogue is sent free on application by naturalists.

WE regret to note that the unfortunate explosion which occurred at the beginning of October in the Chemical Laboratory of Cambridge University has caused the death of Mr. W. T. N. Spivey, M.A. one of the most promising of University lecturers, who died on the 22nd of the month in Addenbrooke's Hospital from septic pneumonia.

THERE have been so many rumours with regard to the discovery of the cancer microbe that one looks with suspicion upon any statement to that effect. We hope, however, the latest, that it has been identified, cultured, and stained in the bacteriological department of the Government of India. may be true. If it is once identified there will be a basis for the study of its extermination.

IN his address at the commencement of the Session at University College, Prof. R. Russell urged on his audience the necessity for cultivating a spirit of scientific inquiry. Every scientific investigation, if properly conducted, might be expected to disclose some new fact, and it was to men of science that every real advance in medicine was due. The so-called practical man could really only apply and utilise the discoveries of the investigator.

THE Ashmolean Natural History Society of Oxfordshire has received a handsome gift from Mr. Henry Willett, of Brighton. It consists of five acres of wild ground near Abingdon, which contains several local and scarce forms of native flora and fauna. The site is intended to perpetuate the memory of John Ruskin, and is to be used rather for observation of nature than as a collecting ground. Such gifts, to preserve wild animals or plants in this country in a state of nature, cannot be too much commended.

THE Rev. E. A. Woodruffe-Peacock, of Cadney, near Brigg, records an outbreak of bird enteritis in that part of Lincolnshire. He states that thousands of partridges have died. The disease appears to be endemic in the district, and has been noticed for some few years past. Death usually occurs within twenty-four hours to forty-eight hours after the disease is manifested; and Mr. Peacock quotes a case of 4,800 pheasants perishing in less than a week out of 5,000 of these birds. It has extended also to the smaller species in the local avifauna.

AMONG the recent publications of the U.S. Department of Agriculture, Division of Entomology, is a monograph on the "Insect Enemies of the Spruce in the North-West." It is copiously illustrated, and forms an interesting contribution to the science of arboriculture.

WE are informed that an expedition is shortly to be sent to Christmas Island by the London School of Tropical Medicine for the purpose of investigating "beri-beri." The leadership has been accepted by Dr. H. E. Durham, who will join the steamship "Islander" at Port Said about October 16th.

THE winter season of the Croydon branch of the Selborne Society has commenced. At the first meeting a lecture on "Porriwiggles, and other Freshwater Creatures," was given by Mr. Edward A. Martin, F.G.S., the local honorary secretary. The subjects included in the lecture were various animals which are met with in almost every pond and stream in the neighbourhood.

DR. GRASSI has contributed an important paper to the "Atti dei Lincei," x. 6. on the district Massarosa, which is situated about eight kilometres from Viareggio. He has written to point out its freedom from malaria, although the species of *Anopheles* which disseminates this disease is abundant, and the conditions are all favourable to the occurrence of the fever.

THE enterprise exhibited in the Manchester Museum at Owens College is to be commended. We have received another of the Museum Handbooks, that is numbered 34, and entitled "Correlation Table of British Strata," by Bernard Hobson, M.Sc., F.G.S., Lecturer in Petrology and Geology in the Victoria University. The size of the book is 15 in. × 10 in., with large folding tables dealing with the various geological systems. This work is of considerable importance.

IT is not generally known that after the collision which sank the French mail steamer "Bourgogne" a fund was instituted by the heirs of the victims entitled the Pollock Prize for inventions of apparatus for saving life at sea. A preliminary trial of such an appliance, invented by Lieutenant De Issay, has taken place in Vienna. It is founded upon the insertion of calcium carbide in a portion of the wearer's dress, so that, on becoming wet, acetylene gas is generated in a gas-tight bag, which keeps afloat the person immersed.

THE public at large are apt to make fun of some of the attempts of municipal bodies in their efforts for the betterment of the social condition. After a course of London fogs such as have this autumn already afflicted those who are obliged to stay within its area, the announcement will be welcomed that a substantial grant is to be applied by the London County Council for their study. The matter will be placed in the hands of a competent gentleman, under the supervision of the Meteorological Council, to formulate instructions for observations and to conduct investigations. The Metropolitan Fire Brigade stations, with their staff of firemen, will be available to assist in obtaining data, which will be collated and studied at the Meteorological Office in Victoria Street, Westminster. Other observations in and outside London will be added; so we may expect valuable results, as a really scientific tone seems at present to be pervading the plan.

We regret to observe the death, at the age of sixty-nine, of M. Koenig, who was well known for his researches in acoustics, light, and heat.

With the object of counteracting the baneful influence and frequent misstatements of the organised opposition to vaccination, there has been formed in London a Vaccination League. This has been already influentially supported, and is likely to become of national importance. The offices are at 110 Strand, London, W.C.

Mr. Henry Bartlett desires us to state that he now undertakes the setting of Lepidoptera in any recognised style. This applies to specimens from abroad in papers, as well as to freshly caught and bred specimens. We can recommend our readers to Mr. Bartlett, whom we have known for many years.

The International Congress of Physiologists at their recent meeting at Turin paid a noteworthy tribute of esteem to Sir Michael Foster on his resignation of the presidency. This consisted in the presentation of a plaque, inscribed with a eulogistic testimony to the work done in Physiology by Sir Michael.

The vacancy in the appointment of a demonstrator of biology in the Royal College of Science at South Kensington, caused by the lamentable death of Mr. Martin F. Woodward, has been filled by the appointment of Mr. J. S. Moore, noted for his scientific explorations in the regions of Lake Tanganyika in Central Africa. Mr. Moore has made two journeys to that interesting part of the world.

On September 30th a statue of Pasteur was unveiled at Arbois, the home of his childhood, and the place where he latterly spent his holidays. M. Decrais, Minister of the Colonies, stated in the course of his speech that Drs. Mardoun and Simon had been nominated by the Pasteur Institute to accompany M. Salimbeni, an eminent Italian, to Brazil, to study means of preventing yellow fever.

It is gratifying to hear that any obstacle which might retard such an important industry as that of the Thornton-Pickard Manufacturing Company at Altrincham has been removed. There has been a regrettable and long-continued law-suit between the Company and Mr. Thornton, but this, we understand, is now ended by Mr. Thornton having accepted the position and withdrawn his threatened appeal to the House of Lords.

The Right Hon. Robert Hanbury stated in a recent speech at Glasgow that the British Government would cause an official and exhaustive inquiry into the scourge of the louping-ill among sheep. It will be remembered that Mr. E. G. Wheler has brought this trouble prominently before our readers in his articles upon sheep-ticks. Mr. Wheler, who is commissioner for the estates of the Dukedom of Northumberland, was induced to study the disease in consequence of the serious annual loss of sheep among the tenant farmers on the Borderland estates. Some of them have lost little short of 1,000 sheep in a single year through louping-ill, which is conveyed by sheep-ticks from diseased to healthy animals. Mr. Wheler has been most successful in his investigations, and has now correspondents on the subject in many parts of the world.

The meeting of the Association of Russian Naturalists and Medical Men will be held in St. Petersburg from January 2nd to 12th, 1902. Sections will be devoted to mathematics, mechanics, astronomy, physics, physical geography, chemistry, botany, zoology, medicine, hygiene, agronomy, and other branches of science.

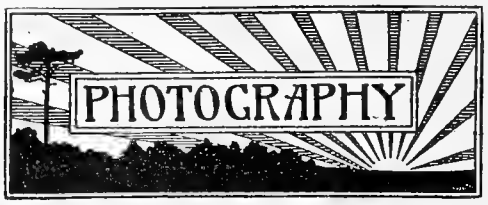
The winter session of the London School of Tropical Medicine in connection with the Dreadnought Hospital at Greenwich was inaugurated at a meeting held on October 16th. Lord Brassey gave the opening address, and amongst the speakers was Dr. Manson, who said that the desire of the School was to fulfil two functions: (1) The education of the medical man who proposed to practise in the tropics; (2) the attempt to advance medical science as regards tropical disease.

For a young lady of eleven years by her own observation to add a plant new to the flora of the country in which she lives is not only a matter of credit, but also of promise for future good botanical work. This is the case with Miss Ellinor D'Arcy, daughter of the Dean of Belfast, who has found *Carex irrigua* at Parkmore, Co. Antrim, an addition to the flora of Ireland. The incident is described in the "Irish Naturalist" for September last.

Major Ronald Ross, in his address to the Liverpool Chamber of Commerce on October 21st, stated he had satisfied himself during his recent tour in West Africa that a complete reform was taking place in the management of sanitary affairs in that country, and he believed this sudden reformation was principally due to the action of the Liverpool School of Tropical Medicine. Major Ross is still of opinion that for practical purposes drainage is the proper way of dealing with malaria in large towns, in order to reduce the *Anopheles* by destroying their breeding-places.

The Amesbury Parish Council passed the following resolution at their last meeting:—"This Council being strongly of opinion that an obstruction has been placed at Stonehenge, thus interfering with the free access hitherto enjoyed by the public, and this opinion being generally sustained by the public at large, as confirmed by the Press, the said Council desire to enter a strong protest against the said obstruction." On February 28th this same Council had passed a resolution to the effect that they desired to obtain the opinion of the District Council as to whether the owner was within his rights in having such obstruction so placed.

An exhibition will be opened on October 31st at the Examination Hall, Victoria Embankment, of scientific apparatus constructed by pupils and teachers of the School Board for the purpose of teaching and illustrating some of the branches of experimental science. The exhibits will number nearly two hundred. Among them are induction coils, telegraph instruments; Boyle's tube, balances, etc., for use in chemical work; lantern and microscopic slides for botany, physiology, and zoology, with many others of general use in scientific work. The exhibition will be free, and it is earnestly hoped that ratepayers and others will take this opportunity of seeing the work that is being done among the children of the great Metropolis in making their own scientific apparatus.



CONDUCTED BY B. FOULKES-WINKS, M.R.P.S.

EXPOSURE TABLE FOR NOVEMBER.

The figures in the following table are worked out for plates of about 100 Hurter & Driffield. For plates of lower speed number give more exposure in proportion. Thus plates of 50 H. & D. would require just double the exposure. In the same way, plates of a higher speed number will require proportionately less exposure.

Time, 11 a.m. to 1 p.m.

Between 9 and 11 a.m. and 1 and 3 p.m. double the required exposure. Between 8 and 9 a.m. and 3 and 4 p.m. multiply by 4.

SUBJECT	F. 5·6	F. 8	F. 11	F. 16	F. 22	F. 32	F. 45	F. 64
Sea and Sky..	1/125	1/60	1/32	1/16	1/8	1/4	1/2	1
Open Landscape and Shipping	1/30	1/15	1/8	1/4	1/2	1	2	4
Landscape, with dark foreground, Street Scenes, and Groups ..	1/15	1/8	1/4	1/2	1	2	4	8
Portraits in Rooms ..	8	16	32	1	2	4	—	—
Light Interiors	30	1	2	4	8	16	32	60
Dark Interiors	2	4	8	16	32	60	120	240

The small figures represent seconds, large figures minutes. The exposures are calculated for sunshine. If the weather is cloudy, increase the exposure by half as much again ; if gloomy double the exposure.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN.—The annual exhibition of this Society was opened on September 20th and will remain so until November 2nd. On the Saturday evening, before the public were admitted, the Society's soirée took place, the visitors being received by Mr. Thomas R. Dallmeyer, F.R.A.S., the President. A most enjoyable evening followed, and it is evident that the Society's soirée each year becomes more popular, and forms the occasion for members from all parts of the country to reunite and gossip over their achievements in the past and their hopes for the future. Judging from the attendance, few of our old friends lost this opportunity of again meeting. The exhibition is held in the New Gallery, Regent Street, London. On entering, the Fountain Court is devoted to professional exhibits, there being stalls managed by manufacturers and dealers. The first to attract attention is that of Messrs. Wellington & Ward, of Elstree, Herts, the chief features being enlargements in bromide process on their various papers, such as smooth, rough, and cream crayon-platino-matt surface. Some very pleasing effects are attained by the hot hypo and alum process. Most of the exhibits are made from films manufactured by the firm. There is also an exhibit of their film negatives. The stall of Messrs. J. H. Dallmeyer, Ltd., contains a fine exhibit of their lenses and cameras, also of work produced by means of that firm's apparatus. Considering the excellent results to be obtained by the Dallmeyer Stigmatic Lens and the possible advantages of the three foci principle, it has always been a source of surprise to us that the Stigmatic Lens is not in more general use. It is equal to any of the German two or three foci lenses and much less in price; yet we meet with a far greater number of German lenses in everyday use. We cannot imagine that the German lenses are more frequently recommended by dealers, to the exclusion of those of British manufacture. The next stand to attract our attention is one brilliant in colour, being that of the Sanger Shepherd Company, of London. It is a fine show, with some very pleasing effects by Mr. Sanger Shepherd's process of colour photography by the aid of light filters, described some little time ago in this magazine. This stall forms one of the most interesting corners of the whole exhibition. Messrs. Ross, Limited, of New Bond Street, London, have a most elaborate show, consisting, not only of articles of their own manufacture, but also apparatus made by Messrs. Newman & Guardia, Adams & Co., and Kodak Co., all these being fitted with lenses of Ross-Zeiss, Ross-Goerz, and Ross types of lenses, making admirable combinations of apparatus. Another Ross exhibit is their celebrated Twin-lens Camera, that is now fitted with a focal plane shutter for high-speed work. Their projection lanterns and arc lights for projection or laboratory work, also the Ross new pattern prism binoculars, form an important feature. Adjoining we find the stall of Messrs. C. P. Goerz, who show cameras, lenses, shutters, binocular glasses, and specimens of work achieved with the Goerz-Anschutz apparatus. Messrs. Watson & Sons, of High Holborn, London, exhibit a fine 12 in. × 10 in. studio camera and stand, also examples of their "Acme" and "Premier" field cameras, with the new Holostigmatic lenses and the new Leitz Periplan lenses and enlargers for Kodak pictures. There are further special ½-plate enlargers, a newly invented attachment for enlargers for the use of magnesium ribbon, the Watson-Bichrom Lamp apparatus for developing films, a quickly set tripod, stereoscopic binocular camera, and examples of the various kinds of hand cameras supplied by the firm. Messrs. Burroughs, Wellcome & Co. have an artistic display of the advantages of tabloid manipulation. One of the most interesting exhibits in the gallery is that of the Platinotype Company. The stall is decorated with some beautiful examples of this charming process. We then find the remaining exhibit in the Fountain Court is that of the Kodak Company, where visitors are introduced to all its latest productions. With regard to the general exhibition we may say that it contains many beautiful works of the art. It will be a revelation, with regard to the possibilities of photography, to those amateurs who have not seen one of these shows. It is a pity, however, that the Committee of Selection have admitted some of the exhibits. There are examples of work, the result of freely exposed and developed plates of uninteresting, and in some cases positively ugly, subjects, poorly printed and untastefully mounted, the whole showing a slovenliness unworthy of even careless amateurs.

CONDUCTED BY F. C. DENNETT.

	1901 Nov.	*Rises.* h.m.	*Sets.* h.m.	*Position at Noon.* R.A. h.m.s.	Dec. ° ′ ″
Sun ..	1 ..	6.55 a.m. ..	4.33 p.m. ..	14.23.59 ..	14.18.10 S.
	11 ..	7.12 a.m. ..	4.16 p.m. ..	15. 3.48 ..	17.18.58 S.
	21 ..	7.29 a.m. ..	4. 3 p.m. ..	15.45. 1 ..	19.50. 3 S.

	Nov.	*Rises.* h.m.	*Souths.* h.m.	*Sets.* h.m.	*Age at Noon.* d. h.m.
Moon ..	1 ..	9.18 p.m. ..	4. 7 a.m. ..	11.58 a.m. ..	19 22.49
	11 ..	7.16 a.m. ..	11.53 a.m. ..	4.25 p.m. ..	0 4.26
	21 ..	1.33 p.m ..	7.55 p.m. ..	1 13 a.m. ..	10 4.26

	Nov.	*Souths.* h.m.	*Semi-diameter.* h.m.s.	*Position at Noon.* R.A. h.m.s.	Dec. ° ′ ″
Mercury ..	1 ..	0.10·9 p.m. ..	4·9″ ..	14.51.17 ..	17.52.58 S.
	11 ..	10.53·5 a.m. ..	4·4″ ..	14.12.59 ..	11.35.13 S.
	21 ..	10.30·1 a.m. ..	3·3″ ..	14.29.14 ..	12.14.27 S.
Venus ..	1 ..	2.48·0 p.m. ..	9·1″ ..	17.28. 9 ..	25.53.35 S.
	11 ..	2.58·9 p.m. ..	9·9″ ..	18.18.30 ..	26.16.39 S.
	21 ..	3. 8·4 p.m. ..	10·9″ ..	19. 7.25 ..	25.31.18 S.
Mars ..	11 ..	1.58·3 p.m. ..	2·2″ ..	17.18. 6 ..	24. 4.47 S.
Jupiter ..	11 ..	3.26·1 p.m. ..	16·0″ ..	18.46.19 ..	23.13.39 S.
Saturn ..	11 ..	3.33·5 p.m. ..	7·3″ ..	18.53.47 ..	22.37.55 S.
Uranus ..	11 ..	1.36·7 p.m. ..	1·8″ ..	16.56.42 ..	22.41.39 S.
Neptune ..	11 ..	2.46·7 a.m. ..	1·2″ ..	6. 4.18 ..	22.15. 7 N.

MOON'S PHASES.

3rd Qr. ..	Nov.	3 ..	7.24 a.m.	*New* ..	Nov.	11 ..	7.34 a.m.
1st Qr. ..	„	19 ..	8.23 a.m.	*Full* ..	„	26 ..	1.18 a.m.

In apogee on November 11th, at noon; and in perigee on 25th, at 4 a.m.

METEORS.

			h.m.	°
Nov. 2 to 3 ..	ϵ Taurids	Radiant	R.A. 3.40	Dec. 9 N.
„ 10 to 23 ..	ν Cancrids	„	„ 8.52	„ 31 N.
„ 13 to 15 ..	Leonids	„	„ 10.0	„ 23 N.
„ 13 to 28 ..	Leo Minorids	„	„ 10.20	„ 40 N.
„ 20 to 28 ..	ϵ Taurids	„	„ 4.12	„ 22 N.
„ 23 to 24 ..	Andromedids	„	„ 1.40	„ 43 N.

From the position of the radiant of the Leonids they cannot be observed until after midnight. Watch should be kept for them this year, the absence of the Moon making a favourable opportunity for seeing the meteors should they put in an appearance.

CONJUNCTIONS OF PLANETS WITH THE MOON.

			° ′
Nov. 6	Juno† ..	1 a.m. ..	Planet 0.26 S.
„ 10	Mercury† ..	7 a.m. ..	„ 2.12 N.
„ 14	Mars† ..	5 a.m. ..	„ 4.19 S.
„ 15	Venus* ..	2 p.m. ..	„ 7.20 S.
„ 15	Jupiter† ..	8 p.m. ..	„ 4.44 S.
„ 15	Saturn† ..	10 p.m. ..	„ 4.21 S.

* Daylight. † Below English horizon.

OCCULTATIONS AND NEAR APPROACHES.

Nov.	*Star.*	*Magnitude.*	*Disappears.* h.m.	*Angle from Vertex.* °	*Reappears.* h.m.	*Angle from Vertex.* °
4 ..	ω Leonis	5·6 ..	0. 4 a.m. ..	79 ..	0.30 a.m. ..	27
6 ..	p^5 „	5·5 ..	5.29 a.m. ..	358 ..	near approach.	
22 ..	δ Piscium	4·6 ..	4.30 p.m. ..	14 ..	„ „	
27 ..	71 Orionis	5·1 ..	10.41 p.m. ..	49 ..	10.54 p.m. ..	26
28 ..	λ Geminorum	3·6 ..	11.39 p.m. ..	223 ..	near approach.	
29 ..	68 „	5·0 ..	7.18 a.m. ..	102 ..	8. 6 a.m. ..	210
30 ..	κ Cancri	5·0 ..	9.54 p.m. ..	84 ..	10.24 p.m. ..	20

ANNULAR ECLIPSE OF THE SUN, NOVEMBER 10TH.—This is unfortunately quite invisible in the British Islands, as it ends before sunrise. The path of the central eclipse is from a point very near to Malta, across the Sinaitic Peninsula, through Arabia, Ceylon, and Siam to the Philippine Isles. The partial phase is visible over a great part of Asia, Eastern Europe, North-East Africa, and the Northern Indian Ocean.

THE SUN still maintains quiescence with little break.

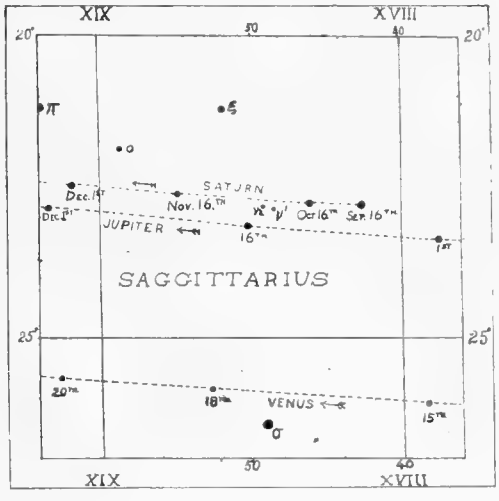
MERCURY is in inferior conjunction with the Sun at 6 p.m. on November 4th, but by 5 a.m. on 21st will have reached its greatest elongation, 19° 42′ west. At this time it rises in the east about two hours before the Sun, in the western part of Libra, a little north-west of the 3rd magnitude star α. The last half of the month will be a favourable opportunity for observing the rosy planet.

VENUS, although nearing elongation, is very unfavourably situated for observation in northern latitudes, but will be a beautiful object in the southern hemisphere, from its proximity to Jupiter and Saturn, with which planets it is in conjunction at 6 a.m. on the 18th and 7 a.m. on the 19th, 2° 45′ south of Jupiter and 3° 12′ south of Jupiter.

MARS and URANUS are too close to the Sun for observation.

JUPITER sets at 7.57 p.m. on November 1st, and at 6.28 on the 30th. At 6 a.m. on the 28th it is in conjunction with Saturn, passing only 27′ to the south. If the planet can be seen before 6 o'clock on November 2nd, it will be found with only Satellite IV. visible, II. and III. being in transit. Also on the 9th, as early as the planet can be seen, all four moons will be grouped very closely round.

SATURN.—The accompanying diagram, only 7° square, shows the relative positions of the three



planets during the latter part of the month better than it is possible to describe them in writing.

NEPTUNE will be found closely west-south-west of the third magnitude variable red star η Geminorum.

GRESHAM COLLEGE LECTURES.—The Rev. Professor Edmund Ledger will deliver lectures on the constellations of the Zodiac and the new star

in Perseus at the above College on November 12th, 13th, 14th, and 15th. They will be well illustrated and likely to be very helpful. The hour of commencement, 6 p.m., is perhaps a trifle too early.

A Parhelion or Mock Sun.—This phenomenon appears to have been seen for nearly ten minutes at Cushendun, Co. Antrim, about September 3rd. It is said to have been of a blood-red colour.

Encke's Comet, 1901, will be near Antares, α Scorpii, at the beginning of November, according to Herr Thonberg's ephemeris.

New Variable in Cygnus. a little south-west of W. Mr. Stanley Williams, of Hove, has discovered a tenth magnitude star, which after 3 d. 2 h. decreases for 3 h. 30 m. to twelfth magnitude; after thus remaining for 50 m. it again increases during 4 h. 10 m. to its normal magnitude. This is, of course, of similar type to Algol.

Star Atlas. — The Society for Promoting Christian Knowledge has published a third edition, revised and enlarged, of Klein's Star Atlas, with a translation of the explanatory text by Mr. Edmund McClure. This atlas is too well known to amateur astronomers to require a very extended notice, but we may mention that the positions of the stars have been corrected to 1900. The notation of nebulae comprises not only the Herschel Catalogue, but also the New General Catalogue. There are eighteen maps, some printed in colour. The size of the book is 12½ inches by 9 inches, and its price is 10s.

Nova Persei. 1901.—The Rev. Walter Sidgreaves, of the Stonyhurst College Observatory, has communicated some important notes on the spectrum of this star to the *Astronomische Nachrichten*, No. 3.741. All the hydrogen lines are now relatively weak, excepting the one apparently identical with Hε. These lines were altogether the brightest ones in the early days of the star's apparition, and are well shown in the photograph reproduced on p. 323, vol. vii., of Science-Gossip. Now. some of them are barely traceable. whilst lines unnoticeable in the older photograph are quite conspicuous. Father Sidgreaves has kindly sent us beautiful prints of the photographs taken on August 27th and September 5th, but they are too delicate for reproduction; the contrast between them and that of March 3rd is most noticeable. Three bright bands at wave-lengths 436·4, 396·9, and 386·9 are each crossed by four strong lines of the same relative intensities and at the same intervals. The line 436·4 is now very prominent, considerably stronger than Hγ. its near neighbour. Where these two overlap there is a line brighter than the sum of the two bands. On August 27th the spectrum consisted of bright bands at wave-length 500·7, 495·8, Hβ, 471·3, 467·9, 464·0, 436·3, Hγ, Hδ barely traceable. Hε ? brighter than all the other hydrogen lines together situate at wave-length 396·9, and 386·9. In the note on p. 124 of Science-Gossip the line spoken of as F (Hβ) was probably the one at wave-length 471·3 due to helium. The star is now in splendid position for observation, and when it has been focussed with a telescope of 3 inches over a prism, or diffraction grating, will show it not as a line, but as having a set of bright images of varying intensity, each image occupying the place of a bright line.

CHAPTERS FOR YOUNG ASTRONOMERS.

By Frank C. Dennett.

(*Continued from page* 60.)

SATURN'S SYSTEM (*continued*).

The rings thus nearly or entirely disappear at intervals of about fifteen years, the last time having been in October, 1891, when the ring was lost even with the 36-inch Lick telescope. Since that time the northern side of the rings has been presented towards us, and it will be so until 1907, when the southern side will become visible, and remain so for another fifteen years. The rings, therefore, disappear when Saturn reaches that part of its orbit situate where the constellations Leo and Virgo are conterminate, and again just after it attains the constellation Pisces. At each of these points the ring seems to disappear twice; once when the plane of the rings passes through the Sun, and again when the same plane passes through the Earth. When the planet reaches the portions of its orbit midway between these points, at the eastern border of the Taurus, and between Ophiuchus and Sagittarius, the rings are seen widely open, as shown in the accompanying drawing by Mr. Scriven Bolton, who used a 4⅛-inch achromatic. The ring was discovered by Cassini in 1675 to be double. The black line can sometimes be seen with a telescope as small as 2¼ inches in aperture, with a power of 120. The outer ring is usually not so bright as the inner, and is known as A. Telescopes above 4 inches aperture will sometimes show this ring divided into two portions by what is known as Encke's division. This division does not always preserve the same position on the ring, and is frequently more visible on one side of the planet than the other. Glimpses have sometimes been obtained of other divisions. The inner ring, "B," is much the brighter, gradually fading inwards; the process is usually gradual. but is sometimes apparently in steps, as in the accompanying drawing by M. E. Antoniadi. More than this was not seen even with the giant reflectors of the Herschels and Schröter, until in 1828 a shading was observed between the edge of "B" and the planet at the Roman observatory; but no particular notice was taken of it. In 1838 Galle of Berlin, with a 9·6-inch achromatic, saw, measured, and published the observations of this shading. Notwithstanding, it was not until November, 1850. that attention became attracted to it, when it was independently discovered by G. P. Bond at Harvard, and Dawes at Wateringbury, near Maidstone. It was found to be a third inner dusky ring, semitransparent, the limb of the planet being traceable through it. This ring is properly known as "C," but is frequently called the "crape veil." It is visible under favourable conditions with any good telescope above 3½ inches aperture. It is probable that the Cassini division of the ring is filled with the same material as "C," because from time to time it is noticed to be not black. If the planet travelled over a bright star it would be interesting to watch its appearance in passing these divisions of the ring, and also its visibility when covered by the "crape veil."

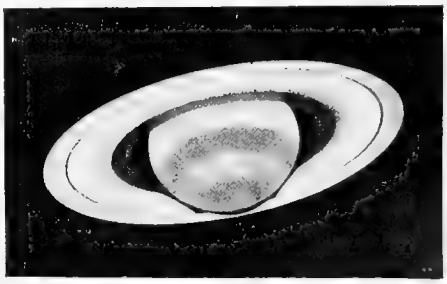
This wonderful ring system, the only large flat surface known. was at one time thought to be solid, and even to support mountains, but this has been quite disproved. It was found, by the spectroscopic observations of the late J. E. Keeler, that the outer edge of the ring rotated more slowly than

the inner. It is usually believed the rings are really composed of an immense multitude of tiny satellites, each travelling in its orbit around its primary. It really seems, too, that the rings are not quite so flat as some have supposed. The shadow of the planet on the rings has often appeared to be notched, as will be noticed on Mr. Bolton's drawing. This gentleman has given what seems to be a plausible explanation. He considers that "B" slightly thickens toward its outer edge, whilst the inner edge of "A" is nearly twice the thickness of the outer edge of "B," and then rapidly thins towards its outer edge. This may explain the peculiar distortion of the shadow.

The dimensions of this ring system are such that a train travelling fifty miles an hour would take a year and ten weeks to travel round the outer border of "A." Professor T. J. J. See, from measures with the 26-inch Washington achromatic in 1900, makes the greatest diameter of "A" 173,115 miles, with a breadth of 11,846 miles; the greatest diameter of "B" 145,828 miles, and its width 17,181 miles. The "crape veil" has a width of 11,533 miles, whilst its inner edge is only separated by 6,730 miles from the surface of the planet. A comparison of the measures taken from time to time makes it evident that the dimensions of the system are slowly but surely changing.

Huyghens so early as 1655 discovered Titan, Saturn's largest satellite, and later Cassini added four other members to the system, named Japetus, Rhea, Tethys, and Dione. All these, except Tethys, may at times be seen with a 3-inch achromatic; but to reach Mimas and Enceladus, discovered by Sir W. Herschel in 1789, an aperture of from 6 to 8 inches at least is required, and Hyperion, which was discovered simultaneously by W. C. Bond and Lassell in September 1848, needs even greater instrumental power. Titan is easily seen with a 1-inch telescope, but Japetus is variable, being much brighter near the western elongation than in any other part of its orbit. The other satellites were thought by Schröter to be brighter in the eastern sections of their orbits. These variations make it probable that Saturn's moons, like our own, revolve on their axes once in the course of their revolution round the planet, always presenting the same face to their primary. With the exception of Japetus they all revolve in the same plane as the rings, but that satellite's orbit is inclined about 10°.

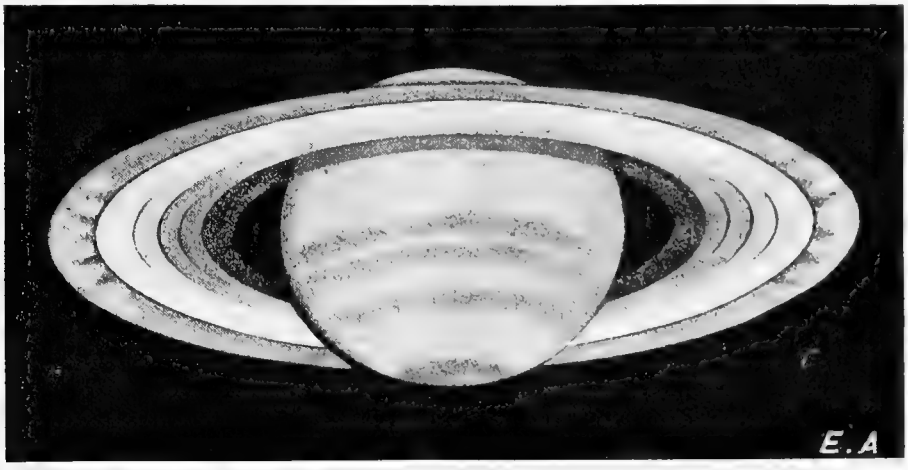
From time to time, as already mentioned, Titan may be seen in transit the shadow may also be seen with even a 3-inch aperture nearly as easily as the shadow transit of Jupiter's first satellite. A similar instrument is also sufficient to show the eclipse of Titan.



SATURN AS SEEN BY MR. SCRIVEN BOLTON, July 3rd, 1901.
(*By permission from the "Cambrian Natural Observer."*)

The distance, period, diameter, and apparent star magnitudes of the satellites are:—

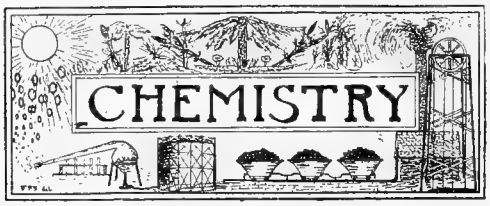
	Miles	d. h. m.	Miles	Mag.
Mimas ..	115,000 ..	0.22.37 ..	1,000 ..	17
Enceladus	147,000 ..	1. 8.53 ..	? ..	15
Tethys ..	183,000 ..	1.21.18 ..	500 ..	13
Dione ..	234,000 ..	2.17.41 ..	500 ..	12
Rhea ..	327,000 ..	4.12.25 ..	1,200 ..	10
Titan ..	758,000 ..	15.22.41 ..	2,092 ..	8
Hyperion	916,000 ..	21. 7. 7 ..	? ..	17
Japetus ..	2,221,000 ..	79. 7.53 ..	1,800 ..	9



PLANET SATURN'S RINGS. (*Drawn by E. Antoniadi.*)

Sir John Herschel pointed out a singular relationship between the periods of the four inner satellites. If the periods of Mimas and Enceladus are doubled you get almost exactly the periods of Tethys and Dione. The orbit of Mimas is less than 30,000 miles from the outer edge of the rings.

(*To be continued.*)



CONDUCTED BY C. AINSWORTH MITCHELL, B.A.OXON., F.I.C., F.C.S.

GREEN AND BLUE MODIFICATIONS OF SULPHUR. When certain sulphides, such as those of bismuth, zinc, or cadmium, are heated with a solution of sulphur chloride in benzene, a green powder, consisting of almost pure sulphur, is obtained. The product formed in the case of cadmium chloride also contains blue granules; and Orlow, who has recently studied the phenomenon, suggests that the blue variety of sulphur stands in the same relationship to ordinary sulphur as ozone does to ordinary oxygen.

OCCURRENCE OF ZINC IN PLANTS.—A series of interesting experiments have been carried out by L. Laband to determine the proportion of zinc which plants are capable of absorbing. The plants were grown in a soil containing a large amount of zinc salts, and at the close of the experiments appeared perfectly healthy. When dried they were found to contain on the average 0·2 per cent. of zinc.

ARSENIC-FREE BEER.—The Royal Commission appointed last February to investigate the causes of the arsenical poisoning epidemic has issued the first part of its report, in which the causes of the outbreak are dealt with, and methods of prevention discussed. In the main the report confirms the conclusions that had previously been arrived at by independent authorities. As regards the complete elimination of arsenic from beer, it is pointed out that certain tests are so delicate that any beer, however carefully prepared, would show minute traces if examined in sufficient quantity. At the same time the Report says, "in the absence of fuller knowledge than is at present available as to the possible effects of consumption of mere traces of arsenic, we are not prepared to allow that it would be right to declare any quantity of arsenic, however small, as admissible in beer or in any food, and we think it should be the aim of the manufacturer to exclude arsenic altogether." Recognising the practical difficulty that has arisen through the use of different tests for arsenic, the Commission proposes eventually to prescribe a standard test for beer, fixing a maximum limit, above which there shall be no discussion.

THE BLOOD OF INVERTEBRATE ANIMALS.—In worms and most molluscs the liquid corresponding to the blood of higher animals has received the name of haemolymph. It contains white corpuscles, and more rarely red corpuscles, though free oxyhaemoglobin is not infrequently found in solution taking the place of the latter. In certain arthropoda and molluscs, such as crabs, oysters, and snails, the haemolymph is of a bright blue colour. This is due to the presence of an albuminous colouring matter which takes the place of the oxyhaemoglobin in red blood. This pigment, known as oxyhaemocyanin, contains copper instead of iron. It can be partially separated from the haemolymph, but readily dissolves in a dilute solution of common salt. It plays a considerable part in the process of respiration, and when the respiratory oxygen is withdrawn from it, a colourless compound remains, known as haemocyanin, which rapidly becomes blue again on exposure to the air.

DUST IN FACTORIES.—The principle of filtration through cotton wool which Arens used in his method of estimating the amount of dust in the air (*ante*, p. 151) has been adapted to the prevention of the distribution of dust in factories. The apparatus devised by Arens and Lamb consists essentially of a box with an inlet and outlet. It contains rough moistened flannel, so arranged as to catch the dust carried by the air which passes through. In this way dust is readily prevented from entering a room, and dust in factories from passing into the exterior air.

JUBILEE OF M. BERTHELOT.—This month M. Berthelot, who is seventy-three years of age, celebrates the fiftieth anniversary of his career as a chemist, in which he has attained a world-wide reputation, particularly by his brilliant researches on the phenomena of explosion. A plate designed by M. Chaplin will be presented to M. Berthelot by the other members of the Institute of France to commemorate the occasion. This plate has a profile portrait of the distinguished chemist on one side, and on the other a design representing him in his laboratory illuminated by Truth holding a torch, while France presents to him a crown and waves a flag above his head. It will be remembered that M. Berthelot has also taken a prominent part in politics, and that for some time he was Secretary for Foreign Affairs in France.

THERMAL DEATH-POINTS OF BACTERIA.—Different species of bacteria vary greatly in their powers of resisting the action of heat. Speaking generally, pathogenic micro-organisms perish at a much lower temperature than non-pathogenic bacteria. Thus the well-known *B. prodigiosus*, which forms a beautiful blood-red colony when grown on moist bread, cannot withstand a temperature of 58° C. for more than ten minutes, whereas the tetanus bacillus only perishes after six hours at 80° C. The bacillus of tuberculosis is rapidly destroyed in cultivations at 70° to 80° C.; but, according to Welch, it can resist in the dry state a temperature of 100° C. for three hours. In milk it has been found to perish after four hours at 55° C.; one hour, at 60° C.; five minutes, at 80° C.; and one minute, at 95° C. (Forster). The spores of bacteria can withstand far higher temperatures than the bacteria themselves. Thus the spores of the tetanus and anthrax bacilli are both extremely resistant to heat, though the latter are destroyed by moist heat at 90° to 95° C. This fact is recognised in the sterilisation of food products, which are first heated to a sufficient temperature to destroy the parent bacteria, then left for the spores to develop, and again heated to kill the newly-formed bacteria. As regards the action of heat upon the toxic products of different bacteria, it has been found that some, like the toxin of tetanus, are decomposed and rendered harmless after a short exposure to a comparatively low temperature; whilst others, like the toxine of anthrax, are only weakened and not destroyed at the temperature of boiling water.

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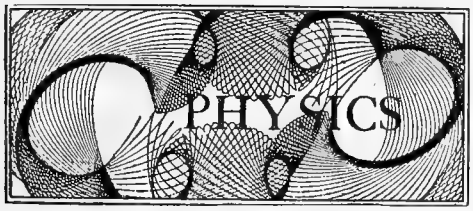
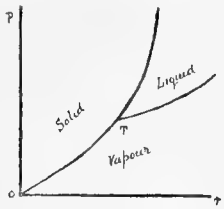


CONTRIBUTED BY W. H. CADMAN.

THE TRIPLE POINT.—The only point at which the three conditions, solid, liquid, and vapour, can exist together is called the "triple point." This point becomes quite intelligible when we consider the curves with reference to these three conditions indicated on the diagram below. Looking at the boundary lines between solid and liquid, liquid and vapour, and vapour and solid, it will be seen that they all start from one point. This represents the melting-point under maximum vapour pressure, the customary melting-point under atmospheric pressure being slightly higher, though the difference is practically unnoticeable.

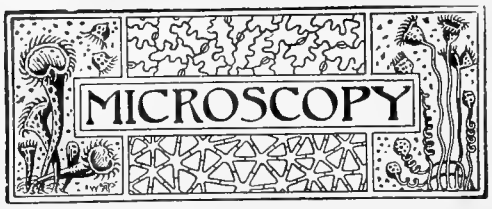


In the diagram pressure P is taken as ordinate, and temperature T as abscissa. T is the triple point.

The graphic figure of these states is very instructive. It consists of (1) areas, (2) lines that bound these areas, and (3) a point in which the lines meet. The areas indicate the conditions under which the substance is present only in one state, whether solid, liquid, or vaporous; the lines indicate those in which two states are possible; finally, under the conditions indicated by the point of intersection all three states, solid, liquid, and vapour, can exist side by side. The boundary between liquid and vapour vanishes at the critical point. If we prolong the rising curve between solid and liquid it is possible that at some temperature and pressure solid and liquid also lose their sharp distinction, and we should then have an amorphous half-liquid, half-solid state. Spring appears to have passed this point. He prepared "Lehmann's flowing crystals" by exposing powder of solid metals to a pressure of more than 1,000 atmospheres. This gave, by its homogeneity and crystalline structure, the impression of having been melted. When these facts and their graphical representation are treated from the thermo-dynamical relation the well-known reversible cycle process applied to evaporation is available, and we get a thermo-dynamic expression regulating the three curves.

AN APPARENT PARADOX EXPLAINED BY ELECTRICAL OSCILLATIONS.—The result of an experiment by M. Pellat appears at first sight paradoxical, but is easily explained by electrical oscillations. Two condensers of very unequal capacity (a battery of six large jars and a small Leyden jar, for example) have their armatures connected through an invertor which enables the communication to be alternated. Two discharging tongs are placed near the small condenser, and they allow a spark to pass as soon as the difference of potential between the armatures is sufficient. If the two condensers are then charged with only half the charge necessary to produce a spark, or even a little less, and if the communications of the armatures be inverted by working the invertor, then the spark passes between the discharging tongs. Now, it might be supposed that, if the spark did not pass after the inversion and the state of equilibrium had been attained, the difference of potential between the armatures would be diminished, since the inversion put the positive armature of one of the condensors into connection with the negative armature of the other, and *vice versâ*. As a matter of fact, the difference of potential of the armatures of the small condenser has more than doubled at a certain instant by following electrical oscillations.

THUNDER AND LIGHTNING.—Lightning is caused by the equalisation of potential in the clouds, where the electrical spark produces the lightning, and the accompanying sound appears as thunder. There are three forms of lightning—fork lightning, sheet lightning, and ball lightning. Sheet lightning may be regarded as brush-like discharges from cloud to cloud. Fork lightning may be considered as a spark with ramifications. The quantity of electricity contained in a cloud depends upon its capacity and potential. The difference of potential between two clouds, or between the cloud and the earth, may become so great that the intervening medium of air gives way under the strain, and a flash of lightning is the result. The reader will see how closely this resembles the oscillatory discharge of a Leyden jar having a thin glass dielectric between the two coatings. When the jar is charged sufficiently the difference of potential between the outer and inner coatings becomes so great that the thin glass medium is unable to bear the strain, the glass is pierced, and a spark passes between the two coatings. Lightning invariably traverses the path of least resistance. Hence the great value of metallic lightning conductors for the protection of buildings. The lower end of a lightning conductor should not merely pass into the ground. It should, if possible, be connected with water-pipes, or else pass into a specially prepared bed at some distance from the building. Ball lightning, a phenomenon rarely met with, consists of balls of fire visible for about ten seconds and then bursting with a loud explosion. Lightning without thunder may be a quiet flowing-out of electricity from the clouds, or possibly a reflection of a far-distant thunderstorm. The time between the flash of lightning and the accompanying thunder enables us to approximately determine the distance of the thunderstorm. Sound travels about 1,100 feet per second. Light from that distance reaches us in such a small time that we may neglect it. The thunderstorm will therefore be at a distance of 1,100 feet × the number of seconds between the time of seeing the flash and hearing the report. With some practice and a clearly indicating seconds-hand on a watch it should be found easy to estimate the distance between the cloud originating the flash and the observer.



CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

COLOURING OF WATER BY MICRO-ORGANISMS. Much curiosity and speculation have been aroused in the neighbourhood of Stoke Bridge, Ipswich, by the turbidity and deep chocolate colour of the river Orwell, reaching for some little distance from each side of the bridge. This appearance has been ascribed by some to the scourings of the maltings, by others to spawn, also to the sun, or to the remains of star and jelly fish. This remarkable coloration of the river is in streaks of a greater or less width, and extends but a few inches beneath the surface, whilst on the decline of the sun the colour wholly disappears. This phenomenon is caused by countless myriads of beautifully marked plants of a deep chocolate shade. This colouring matter can readily be discharged by chemical reagents and the green structure of the plant rendered apparent, or by the action of iodine the presence of starch can readily be determined. These plants bear a striking similarity in their movements and power of contractility to the fresh-water Euglena, but in form they resemble a bicuspid tooth, with a deep cleft on each side of the axis. The two fangs might be taken to represent the head, and the crown the base; each plant being about the $\frac{1}{3000}$th of an inch in diameter. Some hundreds of these organisms may be seen gaily disporting themselves in a drop of water scarcely exceeding in size a pin's head, the whole being in a rapid state of motion. These brackish water organisms are delicate, breaking up a few hours after being removed from their habitat. The plants appear to come up with the tide, and are not due to the presence of sewage or other preventable matter.—*Alfred Martinelli, Ipswich.*

[See an article on the "Colouring of Water by Micro-organisms," by Mr. James Burton, which appeared in SCIENCE-GOSSIP, vol. vii., pp. 332, 333.—ED. Microscopy, S.-G.]

PREPARING CRYSTALS FOR THE MICROSCOPE.—The "American Monthly Microscopical Journal" reprints an article by Mr. S. E. Dowdy that originally appeared in the "Pharmaceutical Journal." The article deals with the preparation of crystals as microscopic objects, and we summarise it as follows. The slides and cover-glasses must be carefully cleaned before starting work, so as to ensure their freedom for use. This may be secured by washing them with ammonia or other solvents, rinsing with distilled water, drying with a clean rag, and finally polishing with chamois leather. One of three methods can then be adopted for preparing the slide. The first consists of evaporating down a saturated solution of the salt until enough moisture has been driven off to enable the crystals to rapidly form on cooling. Make a saturated solution of the salt in distilled water, and with a pipette deposit a drop in the centre of the slide; slope the slide to make the liquid spread in a film, and absorb the superfluous moisture from the side of the slip with blotting-paper. Then hold the slide, with the wet side uppermost, over the flame of a Bunsen or spirit lamp at such a distance that the liquid just steams. Continue this until a thin film of the salt forms at the edges; then withdraw; allow to cool, and examine under the microscope. If satisfactory, mount permanently by depositing a drop of cold xylol balsam over the film, and covering with a clean cover-glass. If the salt be insoluble in water, a suitable solvent, such as alcohol, chloroform, &c., may be employed; in which case rapid evaporation will, of course, take place without the aid of heat. These crystals will probably require a different mounting medium, such as castor-oil, or one in which they are not soluble. Dr. Lankester recommends dissolving a little gelatin or gum acacia in distilled water, and adding to this a few drops of a saturated aqueous solution of the salt. A drop of the warm mixture is then deposited on a slip, superfluous moisture drained off, and the slide allowed to cool. With some salts—*i.e.* copper sulphate, iron sulphate, &c.—remarkably beautiful crystalline forms make their appearance, often in flower- or fern-like patterns, the forms varying according to the temperature, and consequently upon the loss of varying proportions of water of crystallisation. Epsom salts, potassium chlorate, potassium bichromate, or in fact any salt soluble in water, will lend itself to the above process.

The second principal method is by fusion, a more restricted, but not less effective method than the foregoing. Though equally simple, the process is not, however, as uniformly successful. Salicine is a good substance with which to experiment. Place a small quantity on the centre of a *thin* slip and heat over a flame until it just fuses; withdraw from the heat before it chars, and allow to cool gradually. If successful, small circular plates or rosettes will appear on the film, which may then be mounted as usual in cold xylol balsam. Good slides of this description make beautiful objects for dark-ground illuminations or for polarised light. This method is useful in enabling one to prepare totally different physical forms from the same salt. With salicine, for instance, an aqueous solution deposits needle-shaped crystals, quite distinct from the circular form obtained by fusion. Too much salt on the slip must be avoided, as on cooling the film would thus have a tendency to star and crack. If the film should be too thick to be viewed as a transparent object, it will often make a good opaque object by pasting a circle of black paper on the under side of the slide. Crystals of fatty substances—spermaceti, hard paraffin, etc.—are prepared in a similar way. It is only necessary to place a small piece on a slide, warm it, and when melted press a cover-glass on it; the crystals form as the mass cools. Such crystals have an added interest in that by simply warming the slide before viewing it the actual formation of the crystals can be watched under the microscope any number of times. The third principal method is still more limited in application, being confined to those substances which are easily volatilised, and crystallise on cooling. Preparation of slides by sublimation is as follows. A suitable chemical—benzoic acid, for instance—is placed in a dry narrow test-tube, and the latter is then held over the flame until the acid volatilises, the tube being then inverted and stood on a cold slide. The characteristic crystals will

form on the part of the slide covered by the tube, and, if satisfactory, can be mounted in the usual way. Camphor, arsenic, and many others will suggest themselves as suitable for this method. These three methods practically cover the whole ground of preparing crystals for the microscope, and, if mounted in a suitable medium and preserved from undue heat and light, these slides will be permanent; any change which may take place in the forms of the crystals may be put down to the solvent action of an unsuitable medium.

MEETINGS OF MICROSCOPICAL SOCIETIES.

Royal Microscopical Society.—20 Hanover Square, November 20th, 8 p.m.

Quekett Microscopical Club.—20 Hanover Square, November 1st, 7 p.m.; November 15th, 8 p.m.

Manchester Microscopical Society.—Mounting Section, Grand Hotel, November 21st, 7 p.m. "Life History of Fucus Vesiculosus" (Mr. Cottam); and Practical Demonstration of the Various Methods of Microscopic Illumination.

[For further articles in this number on Microscopic subjects, see pp. 173 and 189.]

EXTRACTS FROM POSTAL MICROSCOPICAL SOCIETY'S NOTEBOOKS.

[Beyond necessary editorial revision these extracts are printed as written by the various members.—Ed. Microscopy, S.-G.]

Insect Anatomy.

(*Continued from page* 156.)

Proboscis of Butterfly.—The tongue, or proboscis, is a cartilaginous substance, and owes its great flexibility to being formed in rings, which give it a finely-engraved appearance under the microscope. It is formed of two pieces that can be separated through its whole length, and each being grooved on the inner side they fit together perfectly air-tight; this is effected by an infinite number of fillets resembling the laminae of a feather which interlace and adhere to each other. Between this groove and the outer skin is a space occupied by tracheae or breathing tubes. The proboscis is always carried coiled, but can be uncoiled in a moment. It is perfectly suited to the work of

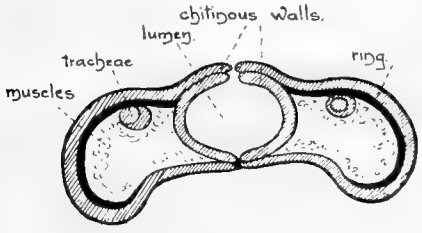


Fig. 1. Section through Proboscis of Cabbage Butterfly.

penetrating to the honey of flowers. We know how butterflies close their wings as they alight on a flower, when the insect makes a powerful expiratory effort by which the air is expelled from all tracheae. At the moment of applying its proboscis to the food it makes an inspiratory effort by which the tube of the proboscis is dilated and the food ascends at the same moment to fill the vacuum produced, thus passing to mouth and stomach, being further assisted thereto by the muscles of the proboscis.—[*Mrs.*] *W. Major.*

The function ascribed above to the tracheae is a novel one, and it is difficult to understand how a vacuum can be produced in the oesophagus and its connections by driving the air out of them, even if it were possible. In insects the mouth can only be considered as connected with respiration in the most indirect manner, if at all; for, although in certain acari the air-tubes open at the base of the mouth, there seems to be nothing analogous in insects. Respiration in insects is effected by means of two large canals, called "tracheae," running along the sides of the body underneath the outer surface, which communicate with the air by short tubes called spiracles situate along the sides. I take it that these tubes can never be exhausted

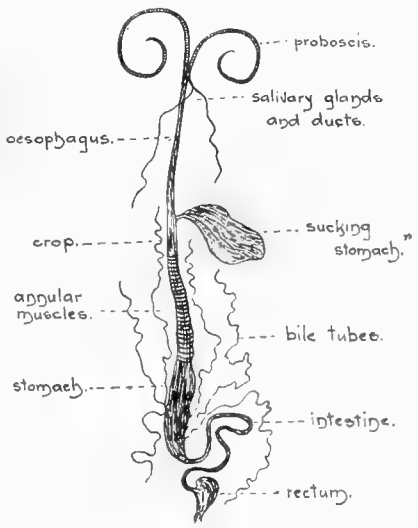


Fig. 2. Alimentary Canal of Pieris brassicæ.

of the air they contain, seeing the walls are supported by spirally convoluted fibres, which impart great strength and prevent collapse; and that the air is changed within them, according to the necessity of the creature, by the closing or opening of the spiracles and the continuous rhythmic movement of the body. It may be well to say a few words with respect to the means by which in the Proboscidea the food is drawn up into the stomach. The Hymenoptera, Lepidoptera, and Diptera are provided with a bladder-shaped distension of the oesophagus which would appear to be a modification of the crop, and is called a "sucking stomach." This is not a receptacle for food, but by its distension and the consequent rarefaction of the air contained therein it promotes suction of the same and facilitates the rising of fluids in the proboscis and the oesophagus, and it is by this means these insects rifle the flowers of their contents.—*E. Bostock.*

I happen to have some transverse sections of the so-called tongue of the Cabbage Butterfly. I have made a rough drawing (fig. 1) of one. This shows the organ to be composed of the two maxillae, the walls of which enclose a tracheal vessel, muscles,

and a fluid (the blood) in each maxilla. They are strengthened by numerous chitinous rings connected by flexible chitine. The nerves are not sufficiently differentiated in this section to be distinguished. If it were possible, which it really is not, for the insect to make such an "expiratory effort" as would remove the air from the tracheal vessels of the maxillae, it could not possibly have any effect upon the air in the lumen formed by the concave walls of the maxillae, because the walls are rigid in a transverse direction. The spiral fibres also in the large tracheal vessel keep them always distended; therefore I cannot support Mrs. Major's very pretty theory. Neither can I endorse that of Mr. Bostock. In the many dipterous insects that I have dissected the so-called "sucking stomach" has invariably contained more or less food; but supposing the sac not to be distended by food, and to be partially filled with air, how is the air to become rarefied? I can conceive of this being effected in only one of two ways. Either there are special muscles for enlarging the capacity of the sac, or otherwise expansion of the air is effected by heat. In the former case I have not met with any muscles that could perform such an act, and in the latter the temperature of the insect would have to be raised whenever it required to feed. It is generally admitted that the temperature of the individual animal is pretty constant, and such sudden changes could not take place. Doubtless Mr. Bostock has proofs to uphold his theory, and it would be interesting if he would give them. Is it not possible that in the alimentary canal itself this commonly called "sucking action" may originate? Not only the annular muscles of the pro-ventriculus or gizzard, but those of the crop and oesophagus, when frequently slightly contracted, would expel sufficient air to cause an intermittent inflow of fluid food. In the common Cabbage Butterfly the gizzard is absent, but, according to Newport, the crop is very richly supplied with annular muscles (compare fig. 2).—*Wm. Jenkinson.*

[The later explanations of the method by which Lepidopterous insects suck up their food may be briefly summarised as follows. The oesophagus is expanded just behind the mouth, so as to act as the actual means of suction; in fact, as a kind of sucking pump. The food being liquid, there is no need for a gizzard; and the oesophagus, though of considerable length, leads practically direct into the stomach. Mr. Jenkinson is correct in his deductions as to the so-called "sucking stomach," as it is now known to be a reservoir for food only.—Ed. Microscopy, S.-G.]

Sections of the Pulvilli of Sarcophaga carnaria (see pp. 121, 122).—I am not quite sure of the meaning of the term "semi- or half-tubes." The tubes seem to me to be separate. I do not see why the walls of the gland-case should not be porous, and the viscid fluid ooze through. I consider the suggestion that the viscid fluid takes up and retains disease germs for the benefit of man to be wholly inadmissible. I believe it to be an axiom in evolutionary science that no creature develops any organ or habit for the benefit of any others, unless it is itself benefited by benefiting the other, as in the case of the ants and the thorny Acacia of South America. The opinion of Mr. Newton as to the situation of the organ of memory in the head of the blow-fly seems very daring and entirely unverifiable.—*R. S. Pattrick.*

FIELD BOTANY.

CONDUCTED BY JAMES SAUNDERS, A.L.S.

Elecampane in Hampshire.—The New Forest district of Hampshire has been so thoroughly explored by botanists that it is not often one expects to find anything quite new, much less such a handsome and conspicuous plant as *Inula helenium*. I recognised the elecampane in a bunch of wild flowers at the Milford Show in August, and having tracked the young exhibitor with some difficulty was taken by her mother to see the growing plant, shorn of its blossoms, but apparently quite wild, in a low-lying meadow in that parish. It is known to grow in many parts of the Isle of Wight, but has hitherto been only once found on the Hampshire mainland, between Alresford and Basingstoke. The plant has a large fleshy root, formerly used in medicine.—*J. E. Kelsall, Milton.*

Elecampane in Bedfordshire.—In "Abbott's Flora," 1798, it is recorded for Beds, in "pastures, Ravensden, Stevington: rare." It has recently been found in this county by Mr. C. Crouch in an old pasture at Pullox Hill, apparently native, or at least perfectly naturalised. H. C. Watson found it impracticable to determine in which counties it is indigenous and in which it is an introduced plant. His remark with reference to its occurrence in the Isle of Wight is that "it seemed to be obviously an introduced plant."—*J. Saunders.*

The Moss Exchange Club Report.—There is evidence from the report for 1901 that good work is still being accomplished by this society in what is essentially field botany. One advantage that the study of mosses possesses is that they can be collected in every season of the year. Some species are at their best long after the summer flowers have gone. We notice that the distributor has issued during this season over three thousand authoritatively named specimens, a sufficiently onerous task, and of great value to the students of this group of plants. One noteworthy phase of the report is the prominence given to the Sphagnaceae, the nomenclature of which is evidently up to present date. The important alterations that have recently been made in the naming of these mosses will render many of the older records valueless with reference to the comital distribution of these plants. This will give agreeable occupation to enthusiasts on the subject. There is apparently a diminution in the interest taken in the Hepaticae, which it is to be hoped is only temporary, as there is still room for original work in that section. We wish the "Moss Exchange Club" continued and increasing success."—*J. S.*

Narcissus biflorus.—It is news to one man at least, who is "something of a botanist," but still a little outside the pale, to know that *Narcissus biflorus* Curtis was ever looked upon as a British plant (*ante*, p. 125). It is an alien, and mentioned

as such in "English Botany," 3rd edition, and the same in Hooker's "Flora." About John's book I know nothing, except the name "Flowers of the Field." Far better authorities are H. C. Watson and the last edition of the "London Catalogue." Both, of course, take the species as alien. Hybridity is a matter for growers.—*S. L. Petty, Ulverston.*

Variety of Lastrea pseudo-mas.—I found a new variety of the above on the Coreen Hills, alongside the Cotburn, Alford, Aberdeenshire, on August 21st, 1901. There are several crowns of the plant, and the fronds are variable over the whole, some being typical forms of *Lastrea pseudo-mas*, but most were departures from that in varying degrees. Some were beautifully branched and others forked. I found one several years ago; but the one under notice varies more from the normal type. The former was named *Lastrea pseudo-mas* var. *multiformis-wilsoni* by Mr. Wollaston, of Chiselhurst. This one might be called *Lastrea pseudo-mas* var *multiformis II. wilsoni*.—*W. Wilson, Alford, Aberdeen, Scotland.*

Educational Botany.—I am enclosing some notes on what I think would, if carried out, do more for the furtherance of a love of field botany than much writing. If plots could be set aside and planted in a rational manner with labels giving the common names as well as technical ones, so that "he who runs may read," there might perhaps be a chance that among the thousands who roam over our parks a few here and there would be attracted to use their eyes and brain in a science at once pleasant and health-giving. I daresay you know that here in Lancashire to be a botanist is no great distinction, as the place has always been the home of "herbalists" and their kindred, who amongst many good points have much to answer for in the depletion of our not too varied flora. I should be glad if you could get anyone to send us roots. Of course we should pay carriage, etc., and in case you know of anyone likely I would send a list marked with what we have.—*Thomas Midgley, Chadwick Museum, Bolton.*

Summer Flowers.—Spring flowers opened late this year. There was little sunshine and a prevalence of cold, ungenial east wind. The first hawthorn was noted on May 15th. With regard, however, to early summer flowers it is quite different. They are opening in quick succession. *Rosa canina* was first seen on May 30th, and is now abundant. The forcing sun heat of the last three weeks may be credited with this. During a riverside ramble in this country on June 3rd, scarcely more than a mile in length, we noted the following flowers:—*Rubus caesius*, *Digitalis purpurea*, *Lychnis diurna*, varying in shade from pale pink to deep rosy crimson, mingling with the amber shades of *Euphorbia amygdaloides*; *Viburnum opulus* in the hedges; *Polygala vulgaris*, blue, pink, and white in the grazed pastures; in the mowing-grass *Bromus mollis* and *Avena pubescens* and *Carex hirta* fruiting by the river. Where the parasitic *Rhinanthus crista-galli* was flourishing the grass was short and poor. In the damper spots of the meadows bordering the river Munnow were numerous orchids. *Listera ovata* in full flower; *Orchis morio*, purple, pink, and white, was nearly over; *O. maculata* and *O. incarnata* were abundant, accompanied by an interesting series of intermediate forms, hybrids between the two last. The leaves of the hybrid are well marked with small distinct spots. The flowers vary in tint, and are intermediate in the form and the marking of the labellum; the spikes are furnished with long coloured bracts. The individuals were mostly tall, well-developed specimens.—*E. Armitage, Dadnor, Herefordshire, June 4th*, 1901.

STRUCTURAL and PHYSIOLOGICAL BOTANY

conducted by harold a. haig.

Bract and Fruit-scale in Coniferae.—The carpellary-scale in Pinus, or Larix, corresponds, as is well known, with a carpel in the Angiosperms, but differs in that it is not folded on itself, but is dorsi-ventrally flattened, and bears the ovules upon its upper surface. The bract is a scale-leaf, in the axil, and perhaps partly from the upper surface, of which the fruit-scale arises. The relative arrangement of the xylem and phloëm in these two structures is peculiar, and has a distinct physiological bearing upon the question. In the fruit-

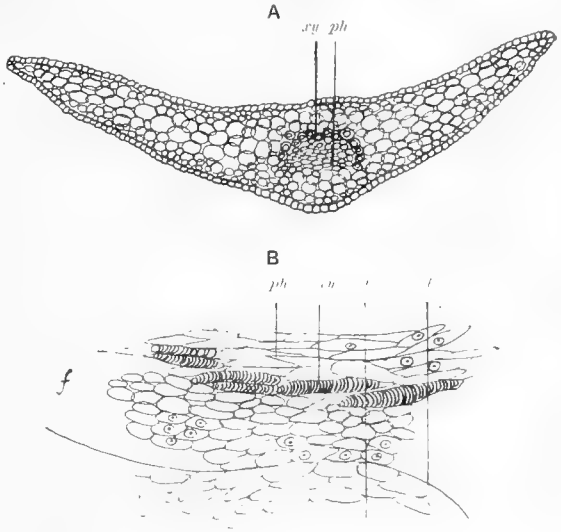


Fig. 1.

A. Transverse section of Bract (Larix).

xy. Xylem, nearest upper surface. *ph.* Phloëm.

B. Longitudinal Section of Bract (*b*) and Fruit-scale (*f*).

ph. Phloëm of fruit-scale nearest upper surface. *xy.* Xylem. *l.* Line of junction of bract and scale.

scale we find that the phloëm is uppermost, and adjacent to the under surface of the ovule, whilst the xylem is underneath. In the bract, on the other hand, the xylem is uppermost, lying adjacent to the under surface of the fruit-scale, the phloëm being underneath. In this structure, then, the constituents of the bundle have the same relative position as in an ordinary bifacial leaf, whereas in the fruit-scale they have received a "twist," whereby phloëm is brought uppermost. That the phloëm should lie next the ovules is of importance, for the elements of this tissue merge gradually into

those of the nucellus and seed-coat, and there is thus every facility for rapid diffusion of food material during the process of reproduction. Various views are held concerning the manner in which the altered relative position of xylem and phloëm is brought about, but these need not be here discussed.

Adaptability of Plants.—Prince Kropotkin, writing in the "Nineteenth Century" (September, pp. 423–431), reviews the work that has recently been done in establishing the fact that variability in plants is very largely determined by the surrounding conditions of moisture, warmth, light, etc. He points out that Alpine plants taken away from high altitudes and grown in a valley lose many of their Alpine characteristics, and vice versa; there is also a brief account of the work of the great botanist, De Vries, in this direction, with especial mention of the variations he produced in the poppy; for instance, the production of the many-headed variety by alterations of manure and other nutrition factors—a process De Vries called "nutrition-variation," for it depended chiefly upon the nature and quantity of the food-material supplied. There are other interesting notices concerning the variability of plants under changing conditions, and stress is laid upon the fact that in some plants (*Oenothera lamarckiana*) accidental variations have arisen that possessed the power of reproducing their kind exactly even for more than four or five generations.

The Structure of the Nucleolus.—The "definitive" nucleus of *Caltha palustris* offers many interesting points for observation. In the first place, its large size, relatively to the dimensions of the embryo-sac, renders great aid to investigation, as also does the comparative ease with which

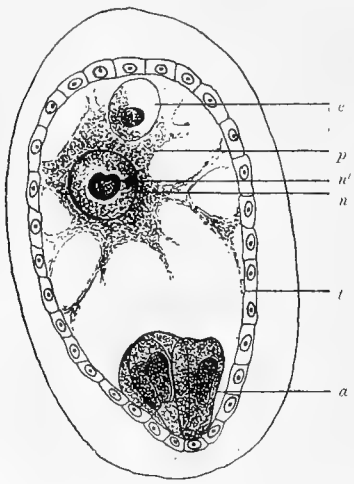


Fig. 2. Longitudinal Section through Embryo-sac of Caltha palustris.

(*Drawn under* $\frac{1}{10}$ *oil-immersion.*)

t. Tapetal layer. *a*. Antipodal cells. *p*. Mass of protoplasm. *n*. Nucleus of embryo-sac. *n'*. Nucleolus. *e*. Egg-cell (?).

sections may be made of the sac in the ovules. A longitudinal section of an ovule of *Caltha* at a certain stage prior to fertilisation will, if the section be successful and carefully stained with haematoxylin, safranin, and toluidin blue, show us all the structures contained in the embryo-sac. These are (*a*) the "definitive nucleus," (*b*) the "synergidae" and egg-cell at the micropylar end of the sac, and (*c*) the "antipodal cells," three in number, at the opposite end. (See fig. 2.) In the definitive nucleus we easily make out the nuclear membrane, the chromatin masses, and the large nucleolus. This latter has a well-defined border, and moreover this border is seen to be of fair thickness, and may at certain points be depressed towards the interior, which is clearer. Obviously in this case the nucleolus has the structure of a vesicle, and it is probable that all nucleoli are of this nature, being filled with a clear fluid of an oily consistency.

Partial Suppression of Phloëm in Wild Balsam.—It may interest botanical readers to investigate or discuss the reason why the ring of phloëm is to a great extent suppressed in the stem of the wild balsam (*Impatiens*). There are certain points of a transverse section where the large

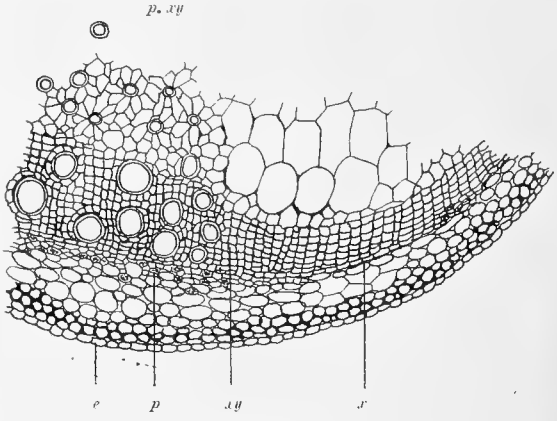


Fig. 3. Transverse Section through Stem of Impatiens Noli-me-tangere.

e. Epidermis. *p*. Phloëm. *xy*. Xylem. *x*. Part of interfascicular xylem outside which no phloëm has been developed. *p. xy*. Proto-xylem of primary bundle.

obviously primary bundles may be seen, the phloëm being outermost; but between these there is only a fully-formed ring of xylem, with a few cambial cells lying just outside it. The protoxylem is to be seen in the primary bundles, and radiating from each of the annular vessels of this primary xylem are cells of a peculiar shape, giving a sort of stellate appearance to the whole.

A Modified Form of Chalazogamy.—Dr. Longo employs the term "mesogamy" in cases where, as in certain of the Amentiferae, the pollen-tube traverses the tissues of the funiculus and the outer integument of the nucellus before entering the micropyle (*Rendiconti della R. acad. dei lincei*). With regard to the direction taken by pollen-tubes in their passage towards the embryo-sac, it has been noticed that in Gymnosperms it is by no means unusual to find that the tube, instead of passing to the upper end of any one of the canals of the archegonia, pierces the nucellar tissue, and so reaches the apex of the embryo-sac.

ISAAC TAYLOR.—The Rev. Isaac Taylor, LL.D., Litt.D., Rector of Setterington and Canon of York, died on October 18th, in his seventy-third year. An Essex man, son of Isaac Taylor, of Ongar, author of a "Natural History of Enthusiasm," he was a skilled entomologist and student of vegetable and animal physiology, and one of the founders of the Alpine Club.

WILLIAM WEST, JUNIOR.—By the unexpected death of Mr. William West, Junior, science has lost a promising devotee. This took place through an attack of cholera on September 14th last in India, where he was but a couple of weeks in his appointment as biologist to the Behar Indigo Planters' Association. After a bright scholastic period, including the winning of several scholarships, he gained the Forbes Medal for botany in the Royal College of Science, London. At the age of sixteen Mr. Forbes won a Foundation Scholarship at St. John's College, Cambridge, and later took a high place in the Natural Science Tripos. He then became a science demonstrator at Cambridge, and afterwards an extra-assistant in the South Kensington Museum of Natural History. He was born in 1875, son of William West, F.L.S., of Bradford, a celebrated botanist, who so well trained his sons William and G. S. West, F.L.S., that they long ago took places of authority among those studying this science, being authors of valuable papers on the lower forms of plant life. His loss to science is severe.

MARTIN FOUNTAIN WOODWARD.—We deeply sympathise, as do the rest of those interested in science in this country, with Dr. Henry Woodward, F.R.S., on the loss of his son, Martin F. Woodward, who was unfortunately drowned by the capsizing of a boat during a sudden squall off the Galway coast on September 15th last. The sadness of the event was the greater, as Mr. Woodward was a fair swimmer; but he appears to have received an injury by the accident, as he was not again seen until his remains were recovered nearly a fortnight later. Son of Dr. Woodward, the present Keeper of the Geological Department of Natural History, the subject of this notice was born on November 6th, 1865. After a brilliant career as a student, he was selected by the late Professor Huxley as personal Assistant and Demonstrator of Biology in the Royal College of Science, London. After Huxley's death he retained the position which he held until the unfortunate accident cut short so promising a career. During the whole of this period his labours were rewarded by a continued series of successes, and few men have made more friends than he whom we mourn. Always a hard worker and ardent naturalist, Mr. Woodward came to his unexpected end by undertaking another's duties when he might have indulged in the idleness of a vacation. He was Hon. Secretary of the Malacological Society of London. Science has lost one of her most promising votaries.

SPHINX CONVOLVULI.—During the past six weeks my boys have captured three *Sphinx convolvuli*—viz., one female at Blackgang and two males here. We have also found four *Colias edusa*. The convolvulus hawk-moth, according to my books, is very rare, so the captures may be of interest to your readers.—*George Irving, Camberley School, Surrey, October 1st.*

BALL LIGHTNING.—During the thunderstorm of July 25th last, about 58 minutes after noon, lightning of ball-like appearance fell into the garden at the rear of our house at this address, and then exploded with a terrific report, not unlike that of a firework shell. Although it appeared to fall into the middle of a flower-bed, not a stem or leaf seemed to have been moved by the explosion.—*F. C. Dennett, 60 Lenthall Road, Dalston, London.*

"CALEDONIA EVANSII" CB.—In reply to my inquiry respecting the occurrence of this spider (*ante*, p. 141), Mr. F. O. Pickard, Cambridge, informs me that my capture does not constitute a new record for England. He states that Mr. A. Randall Jackson found three adult males in the Grisedale Pass, Helvellyn, a year or two ago. I may mention that at the beginning of the present month I secured another male in the same locality where I made my other captures referred to above.—*William Falconer, Bank Field, Slaithwaite, Huddersfield, October 21st*, 1901.

ARTIFICIAL DENDRITES, as made and illustrated by Mr. E. Moor in the September issue of SCIENCE-GOSSIP, are interesting; but I should like to raise the question whether they ought to be classed under this heading, and also if he is correct in stating that the manganese, in the well-known braching forms, was in a plastic state, and the design resulted from the widening of a fissure which it had penetrated. To my mind and eye there is exceedingly little similarity between Mr. Moor's illustrations and those he refers to at South Kensington. The manganese growths are, I believe, deposited from aqueous solutions of the metal.—*G. Abbott, F.G.S., Tunbridge Wells.*

BEES AND AFRICAN MARIGOLDS.—I have recently heard from a friend in Devonshire as follows: "We have some African marigolds in our garden, and from about noon till four in the afternoon the bees, for some reason or other, get stuck on their flowers, kicking one hind leg in an idiotic manner; but they make no attempt to fly away. I assisted them off and placed them on the ground, where they crawled about in an aimless sort of way, finally recovering and flying off. One bee was very bad: he was right inside a flower and could not get back. I had nearly to destroy the flower to get him out. I should like this curious state of affairs explained." Can any of your readers throw any light upon this matter?—*Charles F. Thornewill, Calverhall Vicarage, Whitchurch, Salop.*

A Novel Spider-hunt.—On the evening of August 13th, having a few hours to spare, I decided to celebrate such an unusual condition of things by a spider foray. I therefore visited a hotel in City Road, E.C., and, accompanied by my friend, Mr. P. Couch, the son of the proprietor, descended into the vaults, with the intention of investigating the araneidan fauna of that dismal locality. The expedition was highly successful. From ceiling and wall were festooned enormous accumulations of webs formed by *Tegenaria domestica* Clk., and in the corners funnel-shaped tubes were formed, in which one could observe the forms of the watchful spiders. The specimens taken were all plump, although it is a mystery where the food supply could have been obtained. Intermixed with the larger webs were the fragile snares of *Lepthyphantes leprosus* Ohl. The owners were almost invariably beneath their webs, but their agility was so great that capture was a matter of some difficulty. Our attention was next called to some tiny lenticular egg-sacs upon the walls, and, after close search, the owners were found, and turned out to be the rare *Tapinocyba subitanea* Cb. The walls producing nothing further, our attention was bestowed upon the boards which were lying upon the ground. The first one we turned produced startling results, for no less than five specimens of *Amaurobius ferox* Wlk. were disturbed, their large size being exaggerated by the uncertain flicker of the candle-light. *Amaurobius similis* Bl. was also found in the same position. Turning as a final resource to boards standing against the wall, we were delighted to find a pretty slender-legged creature carrying a globular egg-sac, which was at once recognised as *Nesticus cellulanus* Clk. With several specimens of this prize, we again sought the upper world, a microscopical examination of our captures terminating a most enjoyable and profitable evening.—*Frank P. Smith*, 15 *Clarendon Place, Islington.*

NOTICES TO CORRESPONDENTS.

To Correspondents and Exchangers.—Science-Gossip is published on the 25th of each month. All notes or short communications should reach us not later than the 18th of the month for insertion in the following number. No communications can be inserted or noticed without full name and address of writer. Notices of changes of address admitted free.

Editorial Communications, articles, books for review, instruments for notice, specimens for identification, etc., to be addressed to John T. Carrington, 110 Strand, London, W.C.

Business Communications.—All business communications relating to Science-Gossip must be addressed to the Manager, Science-Gossip, 110 Strand, London.

Subscriptions.—The volumes of Science-Gossip begin with the June numbers, but Subscriptions may commence with any number, at the rate of 6s. 6d. for twelve months (including postage), and should be remitted to the Manager, Science-Gossip, 110 Strand, London, W.C.

The Editor will be pleased to answer questions and name specimens through the Correspondence column of the magazine. Specimens, in good condition, of not more than three species to be sent at one time, *carriage paid*. Duplicates only to be sent, which will not be returned. The specimens must have identifying numbers attached, together with locality, date, and particulars of capture.

The Editor is not responsible for unused MSS., neither can be undertake to return them unless accompanied with stamps for return postage.

ANSWERS TO CORRESPONDENTS.

C. H. M. (Stalybridge).—The four-winged flies are males of an homopterous insect of the family Aphidae or plant-lice. They are abundant in most places during dry weather in autumn, and fly in "swarms," probably on account of a sudden change of temperature.

NOTICES OF SOCIETIES.

Ordinary meetings are marked †, *excursions* * ; *names of persons following excursions are of Conductors. Lantern Illustrations* §.

Birkbeck Natural History Society.

Nov. 9.—* Hampstead Heath. H. W. Unthank, B.A., B.Sc.
„ „.—Annual General Meeting.

North London Natural History Society.

Nov. 12. - Pocket Box Exhibition.
„ 16.—* Museum of Practical Geology.
„ 26.—§ "More Pictures of Bird Life." O. G. Pike.

Lambeth Field Club and Scientific Society.

Nov. 4.—† "Fruits and Seeds." E. J. Davies.
„ 16.—* Natural History Museum—Botanical Gallery. E. J. Davies.
„ 18.—† "A Visit to Shakespeare's Birthplace." Miss A. Wall.

Selborne Society. Croydon and Norwood Branch.

Nov. 1.—† "A Demonstration on Fungi." Dr. Franklin Parsons.

City of London Entomological and Natural History Society.

Nov. 6.—† Discussion: "The British Species of the Genus Eurymus."
„ 20.—† Discussion: "Sugaring."

Hampstead Scientific Society.

Nov. 1.—Conversazione.
„ 4.—† Astronomical Section, "Light," Lecture I. P. E. Vizard.
„ 11.—† Ditto ditto Lecture II.
„ 13.—§ Photographic Section, "What can be done with a Hand Camera."
„ 18.—† Astronomical Section, "Light," Lecture III. P. E. Vizard.
„ 25.—† Ditto ditto Lecture IV.
„ 29.—Photographic Section. Annual Section.

Geologists' Association.

Nov. 1.—Conversazione.

EXCHANGES.

Notice.—Exchanges extending to thirty words (including name and address) admitted free; but additional words must be prepaid at the rate of threepence for every seven words or less.

Offered: Hesperia linoela from Essex. Wanted: Local butterflies.—W. R. Hayward, Sawbridgeworth, Herts.

Rock Specimens and Coal Measure Fossils, also thin slices of rocks for grinding for microscopic slides for geological specimens. Lists exchanged.—W. Hemingway, 170 Old Mill Lane, Barnsley.

Micro Material.—Wanted, strarches, diatoms, zoophytes, Coleoptera (good British or foreign), also sponge spicules or other interesting marine specimens. Must be correctly named. Send list and quantity. Liberal exchange given in either other material, mounted specimens, or microscopic apparatus.—R. Mason, 69 Park Road, Clapham, London, S.W.

Diatoms.—Having a considerable quantity of superfluous material, I should be pleased to hear from others studying the Diatomaceæ.—G. H. Bryan, Plas Gwyn, Bangor, N. Wales.

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