India now finds herself. No one who has visited Bangalore can have failed to recognise the great pioneering work which Dr. Travers did there; but the fact that he was unable to carry through does not necessarily mean that, under different conditions, possibly determined by past experience, the outcome might not be different. JOCELYN THORPE.

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Some Poetic Allusions to Phenomena of Plant Biology.

IT is with a peculiar pleasure that one finds observations, ordinarily recorded in the precise words of scientific usage, appearing in the beautiful and fanciful diction of the poets. The following examples may be familiar to many, but I have not seen them mentioned elsewhere in this connexion.

It has been shown by A. R. C. Haas that the soluble pigments in many flowers act as indicators, and give a measure of the hydrogen ion concentration of the sap, which in some flowers becomes less as the petals age and wither. This colour change has been noted by Edmund Spenser, and in recent times by A. E. as follows:

Astrophel.

Transformed them, there lying on the field
Into one floure that is both red and blew;
It first grows red, and then to blew doth fade,
Like Astrophel, which thereinto was made.

The Great Breath.

Its edges foamed with amethyst and rose,
Withers once more the old blue flower of day:
There where the ether like a diamond glows
Its petals fade away.

The first is the imagery of mythology, the second uses the same illustration to contrast the brief life of a flower with the unending procession of days.

Again Tennyson gives us a description of the yew tree in stanza 2 of "In Memoriam," which contains these lines:

O not for thee the glow, the bloom,
Who changest not in any gale,
Nor branding summer suns avail
To touch thy thousand years of gloom.

Beyond this stanza the early edition makes no further detailed reference to the yew. Later editions, however, provide one additional stanza, a new thirty-ninth being intercalated.

Old warder of these buried bones,
And answering now my random stroke
With fruitful cloud and living smoke,
Dark yew, that graspest at the stones

And dippest toward the dreamless head,
To thee too comes the golden hour
When flower is feeling after flower;
But Sorrow—fixt upon the dead,

And darkening the dark graves of men,—
What whisper'd from her lying lips?
Thy gloom is kindled at the tips,
And passes into gloom again.

Here Tennyson guards against the too literal interpretation of "who changest not in any gale," and gives a wonderful description of the liberation of the pollen and its result of many months later, the formation of the red berry, red as a glowing tip on a piece of wood kindled by fire. The berry falls, the glow is quenched, and gloom follows. This natural sequence of pollen and berry, coupled with the use of the word "kindled," so suggestive of a fiery hue, makes it seem impossible that Tennyson can have intended to allude to the lighter green of the young leaves—an explanation which, I believe, has been put forward.

To A. E. again we are indebted for the description of the recovery of turgor in plants wilted by the heat of day, which is contained in "A Summer Night":

The falling of innumerable dew,
Lifts with grey fingers all the leaves that lay
Burned in the heat of the consuming day.

We have all seen the "grey fingers," but it takes a poet to stamp the picture in an untarnishable phrase.

Finally, in "Prometheus Unbound," Shelley alludes to the liberation of oxygen in photosynthesis, imagining that the spirits "Which make such delicate music in the woods" dwell in bubbles, thus:

The bubbles, which the enchantment of the sun
Sucks from the pale faint water-flowers that pave
The cozy bottom of clear lakes and pools,
Are the pavilions where such dwell and float
Under the green and golden atmosphere
Which noon-tide kindles thro' the woven leaves;
And when these burst, and the thin fiery air, . . .

Have we as yet got so very far beyond "the enchantment of the sun" as an explanation?

W. R. G. ATKINS.

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July 17.

Electrical Properties of Thin Films.

THE mechanical properties of thin films on the surface of water have been the subject of many investigations; yet little is known of their electrical properties. Whilst the electrical properties of those films which are formed on the surface of soluble capillary active substances can be readily investigated, using a method elaborated by Kenrick (*Zeitschr. f. physik. Chem.*, xix. 625), no method, so far as I know, has yet been described which can be applied to

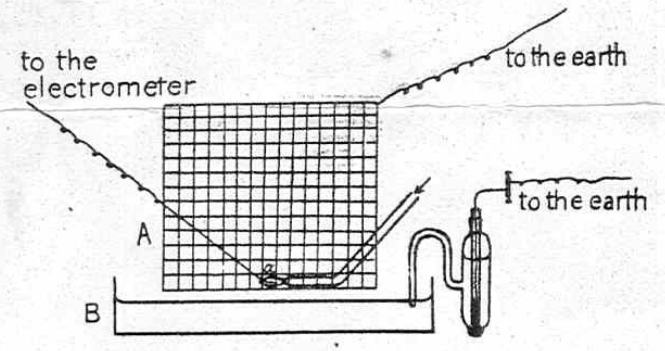

FIG. 1.

films formed by insoluble substances. The following simple arrangement has been designed which has given quite satisfactory results in this case.

A thin platinum wire *a* was heated to white-heat by a minute gas flame in an earthed Faraday cage *A* hung over the surface of water in the vessel *B* (Fig. 1). The platinum wire was connected with a quadrant electrometer, and the water in the vessel with the earth through a decinormal calomel electrode. Between the earth and the electrode, a variable electromotive force could be inserted. The experiments have shown that the potential of the wire follows closely the variations of the potential of the water surface when the distance between the platinum wire and the water surface does not exceed 7-8 m.m.

If we put now a droplet of oil on the water surface, the electrometer shows instantly a change of the potential of the wire. In order to compensate this

change a definite electromotive force has to be inserted between the calomel electrode and the earth. In this way it can easily be shown that a monomolecular layer of oleic acid makes the water surface more positive by 0·22 volt, whereas the same effect for lauric acid amounts to 0·27 volt and for olive oil to 0·32 volt. On replacing the water in the vessel by a solution of a capillary active substance, data are obtained which can be compared with those given by the Kenrick method. In this way I have found a positive effect equal to 0·27 volt for 50 per cent. acetic acid and a negative one equal to 0·38 volt for a molar solution of chloral hydrate, whereas the Kenrick method gave for the same solutions in a fair agreement +0·285 and −0·365 volt respectively (*Zeitschr. f. physik. Chem.*, in press).

The experiments are to be continued, and a detailed account will be published in the *Zeitschr. f. physik. Chem.*

A. FRUMKIN.

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Moscow, July 3.

The Oogenesis of Lithobius.

MISS S. D. KING in her note on the oogenesis of Lithobius published in NATURE of July 12, p. 52, says:

"Yolk formation is from nucleolar extrusion, of which two phases can be distinguished; first, an early extrusion of particles budded off from the large central nucleolus, which retains its individuality, and, secondly, an extrusion of particles derived from the fragmentation of this nucleolus."

In a paper on the oogenesis of Lithobius now in the press (Proceedings Cambridge Philosophical Society), I have shown that there is no fragmentation of the nucleolus. It can be seen in the most highly developed oocytes obtainable from the ovary as a completely acidophil structure with prominent vacuoles. The nucleus at this stage lies just below the chorion. As to budding of the nucleolus, there are two kinds of nucleolar extrusions: small circular bodies, which generally form the secondary nucleoli, and large irregular bodies, which are first plastered round the nuclear membrane, where they may bud off smaller pieces, and are later detached and lie in the cytoplasm.

Nor is there any direct evidence for the statement that "the later extrusions enlarge after proliferation to form the definitive yolk spheres." All that can be said with certainty is that the nucleolar extrusions precede yolk formation, although a few may exist side by side with yolk spheres.

With regard to the Golgi apparatus, I have definitely established that during fragmentation it undergoes fatty degeneration, and gives rise to fatty yolk, which forms the uppermost area in the centrifuged egg, whereas the true vitelline yolk is thrown down. Both direct and indirect evidence has been adduced in favour of this statement. The fatty yolk is intensely blackened by chrome-osmium alone; with Da Fano it turns brownish. The mitochondria, the nucleus, and a few unchanged Golgi elements form the central area of the centrifuged egg.

In view of the remarkable transformation of the Golgi elements in the oocytes of Lithobius, which is paralleled only in Saccocirrus (Gatenby), and also in view of the egg-like giant spermatocytes of Lithobius, it was considered desirable to extend the investigations to the Golgi apparatus in the male germ cells. No fatty degeneration of the apparatus takes place in these cells. In the spermatogonia the apparatus consists of at least one circular element, in the centre of which is a definite archoplasm. During the remarkable growth phase the circular element proliferates profusely, so that the spermatocytes are full of such elements. Each circular element may also divide in such a manner as to form two very regular crescents, each with an archoplasm. During meiosis the distribution of the Golgi elements is quite haphazard. During spermateleosis all the mitochondria and the majority of the Golgi elements form the tail sheath, but a few Golgi elements are plastered round the anterior face of the nucleus, and probably give rise to the acrosome.

VISHWA NATH.

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Cambridge, July 14.

Approximate Rectification of the Parabola.

RECENTLY I had to ascertain with some precision the length of the curved path of a shot in air at elevations up to 40° as compared with the horizontal range.

The material available was a quantity of trajectories worked out in full detail by "small arcs." The error in summing these small arcs and considering the result to be the length of the curved path was within ±0·10 per cent. The greatest heights were also contained in the calculations.

Assuming the parabola of equal angle of projection and of equal height as standard and comparing the actual length, the length of a similar circular arc and the "fudge" formula $L = R \sec E$ to this standard, the result is surprising, and is as follows in parts *per thousand*:

Elevation in Degrees.	10	20	30	35	40
Parabolic error	0	0	0	0	0
Actual length	+1·0	+4·5	+7·0	+ 8·5	+ 8·5
R sec E . .	0	0	0	+ 0·8	+ 4·5
Circular arc .	0	+2·0	+10·0	+18·0	+31·0

On comparing notes with professional ballisticians, I cannot find that the "fudge" R sec E was known to Tartaglia, Galileo, Newton, or Benjamin Robins, nor has it yet been found in any modern book on ballistics or geometry. I hit on it myself by pure chance. Can any reader of NATURE supply a reference?

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Electric Charges by Friction.

THE following quotations from a book printed nearly one hundred years ago (Murray's "Elements of Chemistry." Sixth edition, Edinburgh, 1828) bear on the observations of an anomaly in frictional electricity referred to recently in NATURE (June 21, p. 914). "A white silk ribbon rubbed against a black one becomes positively electrified; but if the black ribbon be worn so that the colour is faded, and if the white ribbon be heated, the latter will be found to be negative, and the black positive."

As a result of consideration of a large number of such experiments, M. Coulomb inferred "that where the particles suffered a transient compression, they would be more disposed to become positive; where they suffered dilatation, the tendency would be to the reverse state."

This inference seems to receive support in the recent experiments with rough and smooth ebonite rods.

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July 4.