being more orbicular, 8 lines long, 7 lines broad, on a channeled petiole 2 lines in length, the older ones being always incano-velutinous, the younger of a deep ochreous colour; the branchlets are very much crowded, and not longer than 1 or 2 inches; the axils much closer, with more copious foliage, hence the flowers appear densely crowded: the corolla is of a deep violet-blue, 7 or 8 lines in length, broader in proportion; its border is somewhat oblique, with five rounded lobes, the anterior one more reflected, the two posterior lobes more erect; it is nearly smooth outside, and very pilose within. Another characteristic feature is, that the upper moiety of the ovarium, and the lower portion of the style, are densely covered with white hairs, the basal gland being smooth; it has constantly five stamens, of which the three anterior are somewhat shorter. The hairs of the corolla and pistillum are simple and articulated, those of the calyx stellately plumose, as in the rest of the plant*.

XXIV.—*Heights of some points of the Cotswold Hills, with some experiments with the Aneroid Barometer.* By W. Henry Hyett, Esq., F.R.S.†

A few months ago, in a formal Report, an Inspector under the Board of Health stated that "Cheltenham has been estimated to stand 200 ft. above the level of the sea, and the height of the Cotswold Hills above the same level is about 300 ft.:"—he meant probably to say "above the level of Cheltenham;" thus making the absolute height of these hills 500 feet above the sea—still an estimate rather wide of the mark when given under the nose of Cleeve Cloud, which exceeds 1000.

It is true the case required no accuracy, but such a degree of *in*accuracy could scarcely have appeared had a more general knowledge of the truth prevailed in this part of the country. Indeed it has been for years matter of complaint that even the relative heights of the several remarkable points of our Cotswolds were unknown—Painswick, Birdlip, Leckhampton and Cleeve Cloud each having their respective champions, but with no authority to quote, nor umpire to determine between them.

Having consulted some of the scientific Members of the Cotswold Club on the point without success, I ventured to suggest that they at least should try to set it at rest. The coincidence of the present Ordnance Survey for the improvement of the river Severn, having their signal staffs actually standing on the very

* A drawing of this plant with sectional details will be shown in plate 58 of the 'Illustr. South Amer. Plants.'

† Read to the Cotswold Nat. Hist. Club, Sept. 27, 1849.

eminences in question, offered an opportunity not to be lost of having measurements made.

I therefore proposed to our excellent President to get (as best I could) a list of the heights of those hills from which we derive our name, and which in the course of our excursions we so frequently climb;—a subject of peculiar interest therefore to ourselves, and not without importance to all who study the geology, botany, &c. of this range. Immediately on receiving his concurrence I wrote to Capt. Yolland, R.E., who has the mapping department of the Ordnance under his direction, and the command of the parties now executing the survey of the Severn. Observing that the signal staffs of their present Trigonometrical Survey afforded the easy means of taking the vertical as well as the horizontal angles, and of acquiring all the information which the public needed, I ventured to express a hope to that officer that he would afford it.

In reply he promised to communicate the information requested, and has since most obligingly supplied the approximate heights above the mean level of the sea of sixteen remarkable points in our vicinity which I shall presently read to you, together with other data which I have myself obtained by the aid of the aneroid barometer lately invented in France, and much vaunted as applicable to the measurements of heights. I then procured one of these instruments from Dent, with his pamphlet upon it, and will now give the results of its comparison with the measurements received from Capt. Yolland.

It may be as well however first to make a few remarks on this new instrument, with a view to show how far it may be applicable in its present state to the purpose of measuring altitudes. It is probably known to most of you, that in carrying a mercurial barometer to the top of a high mountain, the mercury sinks from two causes, the one purely barometric, the other thermometric. Whilst for every 850 feet of perpendicular ascent the weight of the air decreases so as to show a fall, in its counterpoise the quicksilver, of about an inch—for every 300 feet of ascent there is also a decrease in the temperature of 1° Fahrenheit, occasioning a proportional contraction in the quicksilver in the tube, making it stand so much lower than it ought to do were its descent due to the diminished pressure of the air alone. To calculate therefore correctly the height indicated by the mercurial barometer, allowance is always made for decreasing temperature, and tables have been compiled for this purpose from the known rate at which mercury contracts by cold.

The same double effect is doubtless produced in the aneroid barometer, which Mr. Dent says is compensated by means of gas

in the "vacuum-vase" of the instrument. This however is, I believe, a mistake*.

In its present form, then, I conclude that a correction for temperature is needed for the exact measurement of heights. There are also two palpable defects, one of which is that the hand or index is frequently so far from the face of the dial, that its parallax leads to error in reading off the scale, which may easily amount to 20 feet in height. This however may be somewhat corrected by bending the hand so as to make it nearly touch the face of the dial. The other fault is that the inch is subdivided into only forty parts, one of which corresponds to 22 feet in height. It would be better to have it graduated to hundredths —so that the actual reading off should tally at once with the barometric tables now in use—or if the size of the dial will not admit of this, to subdivide the inch into fifty instead of forty parts, so that each division should be ·02 of an inch. At present, in order to use the tables, it is necessary in reading off to change the vulgar fractions into decimals, which, in jotting down, frequently leads to troublesome mistakes.

It is full time however to come to the table which I promised of the

Approximate altitudes above the mean level of the Sea supplied by Capt. Yolland, R.E.

	By Ordnance Survey. feet.	By Aneroid Barometer. feet.	Difference by Aneroid. feet.
Tewkesbury Church, surface of ground ...	47		
Gloucester Cathedral, surface of ground ...	56		
Barrow Hill, surface of ground	198		
Corse Hill	292		
Christ Church tower, Cheltenham (top)...	343		
Robin's Wood Hill	652	634·2	−17·8
Standish Hill.....	715	691·4	−23·6
Stinchcombe Hill	725	740·27	+15·27
Finger-post on top of Frocester Hill	.....	780	
Oxenton Hill.....	733		
Firs at Symond's Hall	.....	810	
Uley Hill	823	825·5	+2·5
Painswick Hill	929	935·9	+6·9
May Hill	966		
Birdlip Hill	969	960·5	−8·5
Leckhampton Hill	978	969·9	−8·1
Base of Bredon Hill tower	979		
Cleeve Hill or Cleeve Cloud	1081	1066·8	−14·2
Malvern	1396		

With the exception of Standish and Robin's Wood Hills, the

* I have since ascertained it to be one. M. Vidi himself informed me in November last, that although he at one time made some experiments on the use of gas in the "vacuum"—(qy.) "vase,"—he has now rejected it altogether.

height of each of which is the result of a single observation with the aneroid, the agreement of its indications with those of the Ordnance determinations is very remarkable, considering the errors to which the present construction of that instrument render it liable. I must observe, however, that they are brought nearer to the trigonometrical measurements by my having rejected some of my first attempts, in which I am almost certain that I made mistakes, and by subsequently adopting the mean of two or three observations, a process which always reduces the extremes of error. Thus for Painswick Hill I had three observations—

One giving it . . .	919 feet.
Another	934·8 „
The third	954 „

giving a mean result of 935·9 feet, which differs only 6·9 feet from Capt. Yolland's figures.

I am sorry that I have not had time to try more of our heights; but I thought it better to repeat the observations on the same hills in order to obtain mean results, and thus to sift my own probable errors, than to persevere in them undetected.

Throwing out of consideration, then, some of my first trials, before I was quite up to the use of the instrument and its tables, the results which I have just given are highly satisfactory. But on the other hand I tried it against the published sections of the Cheltenham and Great Western Railway with less success, as the following comparison will show:—

	By Company's sections. feet.	By Aneroid. feet.	Error. feet.
Stroud station above Gloucester station	116·3	124·75	+8·45
Summit-level at top of Saperton tunnel above Gloucester	352·2	413·7	+61·5

Now these were the means of two trials; in the latter case the discrepancy is greater than I can easily explain, unless the oscillations of the railway carriage have any effect on the instrument, which I can hardly suspect; for in all other cases, however carefully carried, it must have been exposed to rough shaking*. On the whole therefore I must suspend my opinion as to the merits of the aneroid for measuring heights till after further experiments, and at any rate would recommend the improvements in the construction, to which I have before alluded, to be effected, viz. the decimal graduation to be adopted, and the index to be placed closer to the face of the instrument.

P.S. Since the compilation of the above paper I have been

* The error may be this—that the Company's sections were published before the completion of their line, which was eventually carried at a rather higher level than these sections show.

fortunate enough, on a visit to Paris, to make the acquaintance of the ingenious inventor of the aneroid—which I find, in its present state, he regards as a domestic rather than a scientific instrument,—an estimate of its capabilities in which its continued use leads me very much to concur. Still, while I find it perfectly well adapted to the house purposes of a common weather-glass, I can say no less of it as an instrument for taking heights, than that it is far more commodious and much less likely to get out of order than a mercurial barometer—and when limited, as my trials were, to heights not exceeding 1200 feet, that it exhibits quite sufficient accuracy for general purposes—a power which I have no doubt in its present form may be extended to heights of some 2500, and were the index graduated to 24 or 25 inches of the mercurial barometer, probably to the height of any hills in Great Britain.

M. Vidi, however, has made some elaborate trials towards a more purely scientific instrument. If he persevere, I have no doubt he will succeed.

The grand Exhibition of Works of Art in London in 1851, offers him a good opportunity for submitting his invention to more general notice,—and, to the judges perhaps, a not inappropriate object for a premium.—W. H. H.

XXV.—*On the Embryogeny of* Hippuris vulgaris. By John Scott Sanderson, F.B.S.E., Member of the Royal Medical Society of Edinburgh*.

The subject of the origin and development of the embryo has been lately brought before botanical readers so frequently in the various journals appropriated to vegetable physiology, and so much has been done by so many observers in the elucidation of the subject, that it must appear somewhat uncalled for to occupy your time with facts and observations which are only repetitions of what has been much better detailed by others in regard to other species, and by which therefore these results can only be corroborated.

As however the observations referred to are contained in foreign journals, and may have escaped the notice of many members whose attention has not been directed to this particular branch of botanical science, I trust that the following details will not prove wholly unacceptable, more especially as they will enable me to lay before you some of those highly important generalizations, which are to be obtained from the splendid researches of Hofmeister, Unger, Tulasne, and others, on the subject of em-

* Read before the Botanical Society of Edinburgh, Feb. 14, 1850.