Letters to the Editor.

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The Optical Spectrum of Hafnium.

DURING the progress of the work of Coster and Hevesy on the concentration and isolation of the new element hafnium (atomic number 72), the discovery of which was announced in NATURE of January 20, p. 79, we have examined spectroscopically a large number of their preparations in order to establish the optical spectrum of hafnium, and at the same time to assist in the chemical work on its isolation. In all our exposures we have for the sake of comparison also photographed the spectrum of a specimen of very pure zirconium prepared by Coster and Hevesy from commercial zirconium by removing the hafnium content.

The spectra were photographed with a Hilger quartz spectrograph of largest size, and in our preliminary work we have confined ourselves to the spectral region between 2500-3500 Å.U., which could be exposed in a single setting of the spectrograph. The spectra were produced in an ordinary carbon arc, the salts being placed on the cathode. The lines which are given in the table below as the most prominent hafnium lines in the region mentioned, are all lines which were not visible in an intense spectrum of the purified zirconium, while their intensity increased gradually in the preparations which by X-ray analysis were found to contain hafnium in increasing amounts. In the last specimens prepared by Coster and Hevesy, and estimated to contain about 90 per cent. hafnium, the lines ascribed to hafnium were among the most intense lines in the spectrum. In the table is given the wave-length λ in international Å.U. in air, measured against iron normals, and an estimation of the relative intensity I in the usual scale (strongest lines denoted by 6).

λ.	I.	λ.	I.	λ.	I.	λ.	I.
2559·05	3	2845·75	5	2954·20	5	3181·00	3
2637·00	4	2851·00	4½	2964·85*	5	3189·65	2½
2638·70*	4	2866·35*	6	3016·65	5	3206·10	3
2668·25	3	2887·15	4	3018·25	4½	3249·70	3½
2705·60	5	2889·60	5	3050·75	4	3291·10	3
2713·80	4	2898·30*	6	3056·95	4½	3309·55	2½
2718·50	4	2904·40*	4	3072·90	5	3310·35	4
2761·65	6	2904·75*	4	3080·50	4	3312·82	5
2766·90	3½	2916·50*	6	3097·75	3	3332·70	5
2773·05	4	2918·50	4	3156·65	4	3358·90	3
2779·35	4	2924·55*	3	3159·80	4	3373·95	2
2817·70	3	2929·90	4	3162·60	4½	3472·45	4
2833·30	3	2940·80*	6	3172·05	5	3497·40	4½

We have examined the hafnium preparations for the presence of the lines belonging to the characteristic spectrum ascribed by Urbain (*Comptes rendus*, t. 152, 1911, p. 141) to an element celtium belonging to the family of rare earths, and the discovery of which was announced by him several years ago. By Dauvillier and Urbain (*Comptes rendus*, t. 174, 1922, pp. 1347 and 1349; NATURE, February 17, p. 218) this element was assumed to possess the atomic number 72. Not the slightest trace, however, of any of Urbain's lines appeared on our plates. Although the minerals used as starting-point for the work of Coster and Hevesy contained rare earth elements in considerable amount, the only elements besides hafnium which could be detected spectroscopically in their preparations were zirconium and titanium. It is interesting to notice that some of the most prominent hafnium lines have been present as weak lines in zirconium spectra measured by earlier investigators. Thus Bachem (Diss., Bonn, 1910) states the presence in his zirconium spectrum of the lines marked in the above table with an asterisk, and in several places he states without giving any measurements the presence of weak lines, which probably are identical with other of our hafnium lines.

A fuller account of the hafnium spectrum, with measurements of the wave-lengths of the characteristic lines throughout the region which is obtainable photographically, will appear shortly.

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Echinoderm Larvæ and their Bearing on Classification.

THE object of my reply to Prof. MacBride (NATURE, December 16, 1922, p. 806) was not to discuss the classification of Asteroids, but to protest against the character of his unprovoked attack on me. An adequate discussion of the question which group of starfishes is the more primitive, the Phanerozonia or the Spinulosa, requires very much more space than that allotted to a correspondence in NATURE. What I wanted to prove—and, I think, did prove—was the want of foundation in Prof. MacBride's sweeping statement that all admit the Spinulosa to be the more primitive group, tending to represent my view as to this point as perfectly absurd.

Prof. MacBride now states (NATURE, January 13, p. 47) that in my original work I "forgot that the Brachiolaria larva was found in Spinulosa but referred it to Forcipulata only." It is difficult to understand how I could have forgotten this, seeing that I have myself reared the larva of *Asterina pectinifera* and found it to be a Brachiolaria; moreover, in the very place (p. 220) where I arrive at the objectionable conclusion that the Brachiolaria is a specialised, not a primitive larval form, I begin with this statement: "While it would thus appear to be a rule that the larvæ of the Phanerozonia have no Brachiolaria-stage, the facts known of the development of the Spinulosa and the Forcipulata (Cryptozonia) seem to indicate that their larvæ are characteristic through having a Brachiolaria-stage." Is it too much to ask that, before thus criticising my work and accusing me of omissions, of which I am not guilty, or of absurd opinions (*e.g.* of regarding the metamorphosis of Echinoderms as metagenesis), which I have never set forth, Prof. MacBride would, at least, read the questionable paragraphs in that work? I have never stated that the case of the regenerating larva, *Ophiopluteus opulentus*, even if it undergoes complete metamorphosis a second time, must alter our views as to the signification of Echinoderm larvæ in general, only that this would represent a quite exceptional and unique case of metagenesis among Echinoderms.

Regarding the classification of Asteroids I will say only that the physiological and anatomical reasons given by Prof. MacBride for regarding the Astropectinids "as Asteroids secondarily modified for a life on sand" would scarcely be accepted as a sound basis for classification by any modern specialist on Asteroids, those "students of the external features of preserved specimens only," as Prof. MacBride rather contemptuously characterises them. May I only direct Prof. MacBride's attention to the fact that