LETTERS TO THE EDITOR.

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The Red (C) Line of Hydrogen and the Zeeman Effect.

FOR some months we have been engaged in an investigation of the effect of a magnetic field on the more conspicuous lines of certain elementary gases, including the case of helium referred to by Prof. Gray and Dr. Stewart in your issue of November 21. We have employed a very fine echelon grating of twenty-six plates by Hilger. One observation that we have already made is, perhaps, of sufficient interest to deserve mention in your columns. The red (C) line of hydrogen was unmistakably divided before the application of the magnetic field. A reference to Michelson's papers on the application of interference methods to spectroscopic measurements showed that he had announced the red hydrogen line to be a very close double as long ago as 1887. A more detailed examination of the visibility curve is given in the *Philosophical Magazine* for September, 1892, from which it appears that the curve is practically the same as that due to a double source, whose components have the intensity ratio 7 : 10, and in each of which the light is distributed according to the exponential law resulting from Maxwell's theory of velocities. The distance between the components is given as $1{\cdot}4 \times 10^{-3}$ millim., so that it should be well within the power of the echelon as at present constructed to resolve the line.

Under the influence of the magnetic field each component is widened, and by using a double-image prism as recommended by the late Prof. Preston to separate the constituents, is seen to give rise to the normal triplet.

It is necessary for these observations to use a vacuum tube giving a bright crimson light in the capillary portion, and it is an advantage to have the tube in connection with the pump and a supply of hydrogen while under observation.

We hope to be able to publish quantitative results regarding this and other lines when our researches are further advanced.

BLYTHSWOOD,
H. S. ALLEN.

Blythswood Laboratory, Renfrew, N.B., November 25.

On the Probability that the Son of a very highly-gifted Father will be no less Gifted.

AN abstract was presented last Thursday to the Royal Society by Prof. Karl Pearson of results that apparently showed in a most conclusive way "that the mental characters in man are inherited in precisely the same manner as the physical." His data and work have yet to be communicated, but the figures, which were given separately, for four physical characters in from 800 to 1000 pairs of brothers, and for seven mental characters in another equally large set, are closely the same in all eleven instances, and they seem to substantiate his conclusion up to the hilt.

As the question of inherited ability may thus be brought again to the front, perhaps you will allow me space to refute a specious objection which is likely to be adduced, as it has already been urged with wearisome iteration, namely, that the sons of those intellectual giants whom history records, have rarely equalled or surpassed their fathers. In reply, I will confine myself to a single consideration and, ignoring what Lombroso and his school might urge in explanation, will now show what would be expected if these great men were as fertile and as healthy as the rest of mankind.

The objectors fail to appreciate the magnitude of the drop in the scale of intelligence, from the position occupied by the highly exceptional father down to the level of his *genetic* focus (as I have called it), that is to the point from which his offspring deviate, some upwards, some downwards. They do not seem to understand that only those sons whose upward deviation exceeds the downward drop can attain to or surpass the paternal level of intelligence, and how rare those wide deviations must be.

The exceptional quality of the father is only one of four elements that contribute in apparently equal shares to determine the position of the genetic focus. The other three are (1) the quality of the mother, (2) that of the paternal ancestry, (3) that of the maternal ancestry. In the case we are supposing the mother may occupy a high, though almost necessarily a lower, position on the scale of intelligence than the father. Where, for instance, could an intellectual giant like Napoleon find an equal mate? The average ancestry, whether of the father or of the mother, are always more or less mediocre, some ancestors being above and others below the general level of intelligence. Consequently the exceptional quality of the father, considered apart from his ancestry, is not likely to raise the position of the joint genetic focus of himself and the mother by more than a quarter of its amount. Let us consider the far from overstrained case of a father whose intelligence exceeds mediocrity by an amount that lies between seven and eight times that of the "probable error" of the distribution of racial intelligence. Extending the nomenclature employed in my lecture, which you published on October 31, his class would be Y. I will suppose his wife to be a woman of such ability that her equal is only to be found once in every fifty persons, that is of class U. Then the class of the mid-parent would be half-way between Y and U, or W. Regression which is due to the joint ancestral influences would degrade W by at least two classes, that is from W to U, which makes a total drop of four classes from the Y from which we started. Only those children who deviate upwards to that large extent can equal their father. But the conditions are still harder than they appear, because of the closeness with which the sons are clustered round the common filial (or genetic) centre. Their modulus of deviation is less than that of racial deviation, so that it would need fully five steps of filial deviation to reach the required level, and hardly one in 300 deviates do that. He might have many sons more or less distinguished, sons classifiable as W, X, or V, as experience shows to be the case, but the probability of a Y father having a Y son is remote. All the same, a Y father is more likely than any one man of a lower class than his own to have such offspring, but as the latter are very numerous the supply of Y men comes chiefly from them.

I have looked again at my "Hereditary Genius," written many years ago, under the light of newer knowledge, and feel that the evidence there recorded of the inheritance of ability is quite as strong as theory would lead us to expect.

I must not trespass further on your space, though the subject tempts one to go far into details. FRANCIS GALTON.

Pigments of Nudibranchiate Mollusca.

LAST summer, on the coast of California, I had occasion to study three species of the beautiful genus Chromodoris, all of them hitherto undescribed. Technical descriptions have been sent for publication elsewhere, but the purpose of the present note is to call attention to the interesting pigments possessed by these animals. *C. universitatis* (so called because it bears the colours of the University of California) is a large species, more than 2½ inches in length, of a rich dark ultramarine blue, the edges of the mantle and foot bright cobalt blue. The mantle has two longitudinal series of oblong very bright orange spots, about seven in a series; there are also five orange spots on the anterior part of the mantle. The sides of the foot also exhibit a row of orange spots.

When the animal is placed in formalin (4 per cent.) it immediately gives into solution a strong blue colour. This colour is even dissolved out, though more slowly, by sea water after the death of the animal. The blue solution is bleached by caustic potash, and is immediately turned pink (about the colour of apricot flowers) by hydrochloric acid.

The orange spots are not affected by formalin, but, curiously, when seen through the blue solution, they appear bright red. *C. porterae* (from La Jolla) is a small species, about 11 mm. long, blue as in the first species, with two rather broad longitudinal stripes of bright orange on the mantle. There is an inconspicuous median line of a lighter blue. After death the blue (evidently the same pigment as that of *C. universitatis*) dissolves out, and the body becomes a sort of pale greenish, with the dorsal stripe on the mantle very white. The orange bands are not affected.

The third species, *C. mcfarlandi* (from La Jolla and San Pedro), is about 35 mm. long, the mantle brilliant purple with a yellow margin and three longitudinal yellow stripes. The end