LETTERS TO THE EDITOR.

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Average Number of Kinsfolk in each Degree.

As Dr. Galton has completely misunderstood the point of my last remark, I fear it will be necessary again to re-open a discussion which I had thought was satisfactorily closed.

My point is this: If we take a large number n of families containing in the aggregate nd sons and nd daughters, and remove on an average one child *of specified sex* from each family, we shall have a preponderance of the opposite sex in those that remain. The *average* numbers under this condition will be d and $d-1$, and not $d-\frac{1}{2}$ and $d-\frac{1}{2}$, and this was how I was originally led to my first conclusion.

If, however, we wish to test the question whether a girl has the same average number of brothers as sisters, we are only concerned with families containing at least one girl, and therefore families containing only boys must be left out of account, as I stated. When these have been removed there will be a preponderance of girls in the families that are left. It is this cause which enables us to reconcile the fact that, while the probable total numbers of girls and boys in any family may be equal, the probable numbers of brothers and sisters of a single individual of specified sex, say a girl, may still be equal. This may not be such a rigorous method as Dr. Galton employs, but it at least shows that the result is not necessarily opposed to what one would naturally infer from general considerations.

G. H. BRYAN.

Compound Singularities of Curves.

THE compound singularities of algebraic curves may be divided into three *primary* species. First, *point singularities*, or multiple points, which are exclusively composed of nodes and cusps; secondly, *line singularities*, which are exclusively composed of double and stationary tangents; thirdly, *mixed singularities*, which are composed of a combination of simple point and line singularities. Amongst compound line singularities may be mentioned (α) a double tangent which osculates a curve at one of its points of contact, the constituents of which are one stationary and two *ordinary* double tangents; (β) a tangent having a contact of the fourth order with a curve, the constituents of which are three double and three stationary tangents.

The third species comprises the majority of compound singularities, and may be divided into the following subsidiary ones:—

(1) Nodes and multiple points, any tangent at which has a contact of a higher order than the first with its own branch, and does not touch the curve elsewhere. The flecnode and biflecnode are the most familiar examples of this species.

(2) Nodes, cusps, and multiple points, any tangent at which has a contact of the first or some higher order at some other point or points on the curve. For example, it is possible for each of the six nodal tangents of a trinodal quintic to touch the curve elsewhere, and it can be shown that the six points of contact lie on a conic.

(3) Two or more nodes, cusps or multiple points may have a common tangent. Thus the reciprocal of a biflecnode is a pair of cusps having a common cuspidal tangent, whilst a septimic curve may possess a node and a rhamphoid cusp having a common tangent.

(4) Singularities of the tacnode and oscnode type. When the number of constituent double points is unequal to $\frac{1}{2}n(n-1)$, where n is a positive integer, the singularity cannot be a multiple point, but must be of the tacnode type; and since the constituents of a tacnode are two nodes and two double tangents, every singularity of this species must contain double or stationary tangents, or both. When the number of double points is equal to $\frac{1}{2}n(n-1)$, the singularity *may* be a multiple point, but when it contains line as well as point singularities, it is of the same type as the oscnode, which is composed of three nodes and three double tangents.

(5) A tangent at a node or a multiple point, which has a contact of a higher order than the first with its own branch, may coincide with some other tangent at the singularity. When both tangents at a flecnode coincide, the resulting singularity is a tacnode; but the coincidence of two or more tangents at a multiple point, any of which possess this property, gives rise to a variety of peculiar singularities which do not appear to have been completely examined.

It is also possible for a mixed singularity to be formed in more than one manner; in other words, it may possess more than one penultimate form. Thus an oscnode may be formed by the union of two cusps and two stationary tangents, and additional singularities of this character are possessed by quintic and sextic curves.

To call a cissoid or a cardioid a *nodal* curve appears to me a glaring misuse of language, since both curves are *nodeless*.

A. B. BASSET.

November 18.

The Origin of Life.

No doubt "Geologist" points out a literal flaw in my statement, but I thought it would be obvious that by the "potentiality of life," which would be destroyed by heat, I meant potentiality of life, appearing within the time of the experiment. Given countless ages, then, on the evolution hypothesis, the potentiality of life, as of the rest of nature as we know it, existed in the fluid mass of the uncooled earth, and I did not mean to say anything inconsistent with this. Nor, on the other hand, did I mean to say that by the heat applied the potentiality of life in the matter under test would be destroyed for all time. I meant potentiality of appearing within a given time, the time of the experiment, and I cannot help thinking this was the natural sense of my words.

In asking me to explain the introduction of life or its potentiality into this planet, "Geologist" shows that he has entirely mistaken the purport of my letter. My aim was only logical, not constructive. If I could explain how life first appeared on the earth, I should probably be able to suggest a more promising line of experiment than that hitherto followed, which I find myself unable to do. My sole object was to point out a logical error, as it seemed to me, in the view commonly taken by men of science of the results of these experiments, an error, if my memory serves me, fully shared by Huxley—in admiration for whom, I hasten to say, I yield to no one. Huxley, if I remember rightly, was so impressed with the strength of the evidence against the contemporary origination of life that he practically gave up the idea, and put the date back. In this, I am venturing to suggest, he was illogical; through having overlooked the fact that in all the experiments the agent, which was used to destroy actual life and its germs, would probably be efficacious in destroying the potentiality of life in non-living matter on the point of assuming life, if any such there were, and, consequently, the positive result having artificially been made impossible, the negative result meant nothing, and should not be allowed to influence opinion.

GEORGE HOOKHAM.

Change in Colour of Moss Agates.

THE following observations may perhaps throw light on the colour changes in moss agate and flint noted by Messrs. Whitton and Simmonds in your issues of November 10 and 17. Specimens of the flints from Bournemouth referred to by Mr. Simmonds were brought to this laboratory some months ago, and, though they were not submitted to any very searching examination, it was found that the colouring matter could be removed on boiling a fragment with hydrochloric acid, while the solution gave well marked reactions for iron and phosphoric acid. Now the compound $Fe_3(PO_4)_2.8H_2O$, whether prepared in the laboratory or occurring as the mineral vivianite, is colourless when pure, but becomes oxidised to ferrosoferric orthophosphate, and turns blue, when exposed to the atmosphere. It seems probable, then, that the change of colour of these flints is due to a layer of vivianite which alters on exposure.

In considering the case of the agate penholder, it should be noted that such objects are but rarely made of agate in its natural condition, it being the practice of