common attributes; for, if we regard the invariable concomitance of certain qualities with certain other marks as proof of a common origin in the objects possessing those marks, there is no reason for setting any limit to the number of ways in which that common origin will be betrayed.

It is not meant to be implied in the foregoing, that in the case of all "Natural Kinds" community of origin has been the actual ground of classification, or even a subsequently found character. To take what seems, in some respects, the simplest possible instance, the chemical elements, there is not, within the present writers' knowledge, any external evidence that all the sodium, for example, in the universe was derived from a common stock; but it seems highly probable that either this is the case or else that all the properties of sodium are deducible by general laws from a few of them. In other words, the fact that all portions of matter which possess a few of the properties of sodium do actually possess all the other properties of sodium forces upon us the conviction that either the qualities or the objects have a real connexion with each other. If the former is the case, the properties of sodium are deductions from its molecular constitution; if the latter, then sodium is in a very valid sense a Natural Kind—something very different from an arbitrary and "merely intellectual" class: and this, whether one agrees or does not agree with the present writers in regarding the connexion between the objects to reside in a certain community of origin. In the case of the animals forming a species, it would be preposterous to suppose that all the common qualities might be explained deductively from a few of them. These, then, form a Natural Kind, in the sense in which we have used the term; and, in this case, community of origin has been sufficiently shown to be the true ground of the classification. It is a matter of course that such classes are not more but less rigidly marked off than arbitrary classes. The quality of "naturalness" is attributed to them, not in virtue of their boundaries being clearly marked out by nature, but because, however indistinct the actual boundary may turn out to be, the principle on which it is drawn points to a natural and not a merely intellectual connexion among the objects it includes.

THE AIM OF INDUCTIVE REASONING.

By Joseph Solomon.

Inductive Logic seems to me to be in a state of some confusion at the present time. There is not perhaps much to be added in the way of statement or elucidation to the general description of the processes by which natural truths, other than mere facts of observation, are attained to; but there seems still to be much

indistinctness in the logician's conceptions of the nature of the truths the men of science aim at discovering. The current description is that science aims at the discovery of Causes. Why I consider this description unsatisfactory, and what I desire to replace it by, I will shortly endeavour to show.

Cause is commonly understood to be prior to effect; the popular name of a well-known fallacy ('*Post hoc, ergo propter hoc*') reminds us of our common tendency to treat the earlier of two incidents affecting the same material as the cause of the later. Recent discussion of this assumed priority of cause to effect has elicited many true ideas, but has also tended to produce some degree of mental unsettlement. It is allowed we can constantly point to incidents without which later incidents would not have occurred; but we are reminded that much else also has to occur before the later incident is matured, that the striking earlier incident which we called the 'cause' is but a co-operating factor towards the evolution of the effect and would be better described as a 'condition,' to which other conditions must add themselves. But when all these conditions are once simultaneously realised, is not the result also realised coincidently with them? So that it would seem that the only true 'cause,' the 'assemblage of conditions,' was not prior to the effect but contemporaneous with it: and indeed, once this idea is broached, it seems to fall in with, and be a necessary corollary to, our idea of Cause; for how can a cause which does not produce its effect be called the cause of that effect at all? But if again the idea in question be adopted, what becomes of the current conception that a cause is prior to its effect, or of the scholastic transmutation of this, that the relation of cause and effect is nothing but a relation of invariable antecedence and sequence?

The drift of the above remarks is that it would seem more correct to describe science as the ascertainment of invariable *coincidences* than as the ascertainment of invariable sequences. But before saying more to justify this point of view, I wish to call attention to a class of discovered scientific truths which it seems still more difficult to range under the head of invariable sequences or even to describe as laws of causation at all.

When we say that the detached apple falls to the ground because the earth attracts it or that the heavenly bodies pursue their orbits because they attract one another, no one doubts that we here state a most profound and important discovery of the human intellect; vulgarly it is even supposed that we have attained in this case pre-eminently to the discovery of a cause, of an efficient cause, that actually brings about its own result (like the prophecies of Curran's criminal, who himself took in hand their execution) and is not merely followed by it (like the prophecies of other men). Science, however, deprecates any such conception as anthropomorphic or worse than anthropomorphic, as intending to attribute to the sun or earth the action of a man

and in effect attributing to them something quite impossible to man, namely, mechanical action at a distance. We have then to say that, in assigning the attraction of the earth as the cause of the fall of the apple, we are not merely restating the phenomenon itself, but giving in our restatement a general view of it, a view of it applicable to a vast variety of phenomena superficially quite dissimilar to it, to which it is thus for the first time, and most usefully, assimilated. We have found a Law of Nature, the attraction of all bodies to one another, but a law of which the phenomena in question are not effects but exemplifications. I want now to ask, Would it not be best to say that all discoveries of this class are discoveries of Laws of Nature, the character of which is, that they are endlessly and in endless forms exemplified in incidents?

Thus the functions of scientific discovery appear to be (1) pre-eminently *generalisation*, by which I understand the grouping of one sort of phenomenon with phenomena of (apparently) other sorts by the hypothetical or experimental detection of a common principle in them; (2) the ascertaining of invariable *coincidences*, *e.g.*, the occurrence of the electric spark, of explosion, &c., upon the assemblage of certain conditions. I say 'pre-eminently *generalisation*,' because the idea of generalisation must be the guide and inspirer even of efforts at discovery made in direction (2). And of course by generalisation I mean (as in fact I have already tried to state) something more than the bare assertion that what has happened now will always happen. It is matter of course, it is the postulate of all study of nature whatever, that what has happened now will always happen; whether the date be 1887 or 2887, what does that matter? No doubt, our experience often misleads us; no doubt, our memoranda of the past often lead us to expect something that does not happen: but that can only be from inaccuracy or incompleteness in those memoranda. We think we have reported accurately, we think we have reported fully what has happened, and we have not done so. If nature is uniform, if nature can be studied, then one instance is as good a proof as a thousand of the detailed phenomenon exhibited in that instance; and if we endeavour precisely to repeat the instance—as men of science constantly (one sometimes thinks needlessly) do—it is because of their diffidence as to the accuracy of their own narrative of what has occurred, especially when the matter to be observed is minute, subtle and easily misread. Therefore even in seeking new coincidences the student of nature always does so with the hope of establishing something wider and more general than the mere phenomenon he has observed or produced, even though that be in itself startling and unexpected. He seeks, we say, to discover its 'cause'; in fact he is trying to discover some wider coincidence, one less burdened with detail, of which the one before him may be regarded as an example, but of which there may be other examples lying perhaps in fields apparently widely separated from the present one.

It thus appears that if—as we, no doubt, commonly say—it is the function of inductive reasoning to discover 'causes,' the word 'cause' is here used in a sense widely different from the common one, even when that common one is refined and subtilised by being explained as 'assemblage of conditions'. There can be no doubt it is the function of science both to discover 'causes'—in the sense in which we have last used the word—and to discover 'assemblages of conditions' under which some new state or phenomenon is realised. I would suggest that the word 'cause' be used for neither of these objects of scientific discovery. The first kind of 'cause' we might call 'reason' or 'principle,' and say it is one function of science to discover the 'reasons' or 'principles' of phenomena: for the second kind of 'cause' we might keep the name 'assemblage of conditions,' and say that it is another function of science to discover such 'assemblages of conditions,' or—to use language previously employed—to discover natural or invariable 'coincidences'.

I have no such foolish wish as the desire to banish the word 'cause' from language altogether, though others have entertained that aspiration. My point is, that it is a word not for scientific but for practical use. The popular instinct seems to me most right in clinging to the idea that the cause is prior to the effect, most right in resisting, as bewildering and unsettling, the logician's theory that cause, when fully scrutinised, is coincident and contemporaneous with effect. For practical purposes the time-element is everything. We do not desire to state scientific 'coincidences'; we do not desire to state with scientific precision what *must* happen under certain circumstances. We desire to infer the future from the present—in particular to infer our own individual future from our present circumstances, and especially from our present actions. It is not less serviceable to point out that a certain explosion was 'caused' by a servant entering a gas-laden room with a candle; though science on the one hand would not stoop to particularise such a detail as the candle but would speak generally of 'flame,' and on the other hand would seek to register with a precision we do not aim at the whole set of circumstances with which an explosion is necessarily coincident, or to which it is necessarily annexed. We may serviceably warn a child against over-eating to-day because such over-eating will 'cause' indigestion to-morrow, without any theory as to the kind of physical distress of which indigestion is an expression, and without any kind of theory as to the connexion between such distress and overloading the stomach. Therefore, to us in the practical management of our lives, knowledge of 'causes,' in the old popular sense of 'cause,' is most important, and we may fairly, because serviceably, speak of that which was done in the morning as the 'cause' of that which happened in the evening. The man of science should not. What we call the 'cause' of the later incident is to him at once too full and not full enough: not full enough, because he

knows what a string of later circumstances and states must be added before the effect is realised—a string not complete till the effect is realised; too full, because to the man of science with his desire for the broadest, most general, most widely-applicable modes of expression, our minute recital is needlessly and unbearably involved in detail.

The conclusion is—let us keep the word 'Cause' for the use of practical, every-day life, and let the function of inductive science be described as has been suggested above.

ETHICS AND THE IDEAL.

By Rev. W. L. Davidson.

Ethics, taken in its proper signification, includes two things. On the one hand, it consists of an investigation into the nature and constitution of human character; and, on the other hand, it is concerned with the formulating and enunciating of rules for human conduct. In the first case, it is theoretical ethics; in the second, practical. The practical is necessarily dependent on the theoretical; for, in order to be a sure and trustworthy guide to conduct, ere ever it can lawfully claim the authority of a counsellor and help to man, Ethics must repose on a well-considered analysis and investigation of man's mental and moral nature, as well as of his social conditions. It is, therefore, in the closest manner allied with psychology and with sociology; and the methods of these two sciences are precisely those that stand us in good stead here.

As compared with allied sciences, however, Ethics has a complication peculiar to itself. It deals essentially with the 'ought' as distinguished from the 'is'; it is the science of human character and human conduct *as they should be*, and not simply as we actually find them. Nevertheless, as the ideal, in order to be of any true value, must be founded on the real, the starting-point for all ethical speculation must be human nature as it falls actually within our ken. We must analyse and study the 'is' before we can safely proceed to the 'ought to be'; and, however far forward our ideality may carry us, it must both begin from and return again to actual experience. The word 'ideality,' however, is here somewhat ambiguous. It may refer simply to an idea present in the mind, and not embodied in actuality; or it may signify a highest or best conceivable state of things, partly indeed realised but the full realisation of which is still future. It is in the second sense that the word is here employed; and, though this sense includes the other, it goes considerably beyond it. An ideal is also an idea, though an idea need not by any means be an ideal.