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confer perpetual youth upon its discoverer, and the philosopher's stone, by means of which the baser metals were to be transmuted into gold. The modern chemist, though he may still ridicule the idea of an elixir of youth, is not quite so positive as he was a few years ago as to the physical impossibility of finding a means for changing one metal into another, though possibly he may think its realization improbable by mere human agency. The doctrine that the atoms or small indivisible parts of which the various kinds of elementary matter, such as lead and gold, are believed to consist, are absolutely different and distinct entities, a doctrine to doubt which was heresy not many years ago, has been, like many other doctrines, rudely disturbed in recent years. It has been shown that highly complex groups containing several different elements can be transferred unbroken from one compound to another, in other words, that these groups, complex though they are, act in this respect as though they were simple or elementary substances; and, moreover, that some of these compounds are extremely like other known compounds in which simple substances take the place of these complex groupings. Again, the elements themselves are capable of being arranged in families which present many points of similarity to families of substances known to be compound. Again in one of the most brilliant investigations of modern times Mr. William Crookes has shown that one at least of the metals which has long been regarded as a simple substance, and which still when tested by all the generally accepted methods appears to be an element, can by special treatment be split up into at least five parts which are distinctly different when examined by the spectroscope. But if these substances so long regarded as simple be really compound what, it will be at once asked, are their constituent parts? There are not wanting theories as to one at least of the components. The phenomena of light, heat, and electricity have revealed the existence throughout space of a substance infinitely more attenuated than air, just as certainly as the winds and many other phenomena have revealed the existence of the atmosphere, and, by-the-way, this 'ether,' as it is called, is now recognised as playing an all-important part in the phenomena of electricity. Is it likely that this 'ether' is a substance distinct from all other kinds of matter and taking no part at all in their composition? Is it not more likely that it forms an essential part of all matter? Proceeding upon this idea, and assuming the known laws of chemical combination, endeavours have been made to show that the so-called atoms of the elements can be represented as a series of compounds of this 'ether' with other known forms of matter. Lord Kelvin, better known till lately as Sir W. Thompson, has gone much further, and has shown that if little pieces of the 'ether' were, so to speak, cut out and set rotating at enormous velocities they would have conferred on them, in virtue of this rotation, properties closely resembling those believed to be possessed by the atoms of the elements, and he has, in fact, propounded the theory that these 'atoms' are nothing more nor less than little masses of "ether" rotating at enormous velocities. He has arrived at this conclusion by means of higher mathematics in regions where but few ordinary mortals can follow him; but if any one here should wish to get some better idea of the extraordinary properties conferred upon matter by high speeds of rotation there is a charming little volume in the 'Romance of Science' series, entitled 'Spinning Tops,' which bears upon this subject, and which will amply repay any one who will take the trouble to read it. If any of these ideas are near the truth—if, for example, the atoms of lead and gold are not absolutely distinct forms of matter, but merely masses of the same 'ether,' rotating at different velocities or under different conditions, it follows at once that the problem of transmuting lead into gold, at which the alchemists toiled for so many years, does not appear so absolutely hopeless as it once did. Such is but one, though perhaps the most important, of the far-reaching problems with reference to matter with which chemistry has to deal. It is true that in this, as in many other investigations, chemistry and physics must work hand in hand. Nevertheless there is a wide field open for research in such directions for the chemist within his own peculiar sphere.

"But, turning now to the relations of chemistry to medicine and life, and first as regards its relations to medicine, more especially with reference to substances useful for medicinal purposes or dangerous on account of their poisonous characteristics. Medicine is indebted to chemistry for the discovery and investigation of the extremely active substances, so many of which now in use are derived from the vegetable kingdom. To the scientific chemist the medical man owes the preparation, *in the pure state*, of such useful and well-known drugs as morphia and strychnine and others too numerous to mention. I emphasize the words, 'in a pure state,' because it is a matter of the greatest importance to obtain a pure drug, so that its physiological effects may be studied in an exact manner, and so that it may be thereafter used with a thorough knowledge of the results it will produce. But although in some cases the chemist can with comparative ease extract and examine an active substance existing say in a given plant, in other cases the investigation is surrounded by great difficulties, the nature of which it would not be easy to explain without introducing too great technicality. A new chemistry is, in fact, wanted for such cases, a chemistry which will probably not be welcomed by the average medical student, but which will be capable of dealing with more complex substances than can at present be brought within the pale of exact experiment. In consequence of this there is often a good deal of misconception as to the power of the chemist to deal with certain problems set before him. People are often disappointed when after taking the trouble to bring or send a handful of dried leaves from a long distance in the interior ('to be analysed for poison' as they term it) they are informed that instead of handfuls hundredweights of material may be required, and that the 'analysis' may occupy months instead of minutes to complete. In fact such statements are often received with ill-disguised scepticism. In spite of all this, however, much has been done towards the examination of medicinal substances to be found in Australian plants, but much remains to be accomplished. A few words now as to the relations of chemistry to vegetable and animal life, and to medicine with special reference to disease. A little more than seventy years ago it was believed that no product of animal or vegetable life could be formed artificially from inorganic or dead materials. Hence the distinction which arose between organic and inorganic chemistry, a distinction now more convenient than scientific. In 1821 a German chemist, Wöhler by name, succeeded in producing one of the waste products of the animal system out of purely inorganic or dead materials. Since that time the list of such substances has gone on steadily increasing until to-day a very large number of compounds, formerly known only as products of animal or vegetable life, can be artificially prepared. Many of these are of great industrial or medicinal importance, and efforts are being constantly made to increase their number, so as to produce at a cheaper rate many substances which are at present expensive and difficult to procure on account either of the rarity of the plants in which they are to be found or of difficulties in the way of their extraction. In the course of investigations such as these there have been indications of an approach to the discovery of the series of changes through which comparatively simple substances pass in their transformation into the more complex materials of the animal or vegetable system. Such changes are, for obvious reasons, much more easily observed in the plant than in the animal. Almost every schoolboy, and I might add schoolgirl, knows that the green parts of plants are able by the aid of sunlight to obtain a very large part of their nutriment from the substance in the air popularly known as carbonic acid. It is almost certain that the first stage in the process whereby this is effected results in the formation of comparatively simple substances, which are familiar enough to the organic chemist, but which are known to him as rapidly and easily, and often spontaneously undergoing conversion into more complex materials. Starting from these very substances Emil Fischer, in a marvellous series of chemical investigations, has recently produced by highly artificial methods several of the sugars (for there are many sugars) and allied substances known to exist in many plants: and these sugars, be it remembered, are most intimately connected with starch and cellulose, which are the most important plant constituents. Again there are some points connected with the chemical changes due to the life of plants which are of the greatest practical importance as well as scientific interest. It is well known, for instance, that plants as well as animals require nitrogen in considerable quantities for their life and growth. One of the questions which has been discussed for some time past is whether plants in general, or any special kinds of plants, are able to take up nitrogen direct from the atmosphere, it being an ascertained fact that they can take up nitrogen from certain substances naturally present in or artificially supplied to the soil. Some practical agriculturists had for a long time asserted that the growth of certain kinds of crops, peas for instance, improved the soil in some respects for other crops such as wheat, &c. Of late years chemists have shown that some leguminous plants at any rate, such as peas, do absorb and utilize the nitrogen of the air. The process is not a purely chemical one, it is true, but it was reserved for chemical science to demonstrate the fact and to place what had long been a mere suspicion on a sound scientific basis.

"In studying the transformations which go on within the animal system the chemist is met with many and great obstacles, partly in consequence of difficulties in the way of observation, and partly in consequence of the great complexity for the most part of the substances with which he has to deal. In fact some of these substances are so complex that here again a new chemistry needs to be developed for their thorough investigation. Still some progress has been made, and a closer insight into the nature of such materials is gradually being obtained by the study of the simpler forms into which they break up under various conditions of decomposition. Perhaps the most interesting and important result in this direction is the discovery that animal substances by their decay and putrefication give rise to the formation of poisons which, chemically speaking, belong to much the same class