duty to labour for a future which we may never see, and not merely to live on the wealth of accumulated experience, as the heir of riches does when he uses them for himself alone. This Association contains many missionaries for the propagation of sanitary knowledge. Their mission is to stand between the living and the dead, and bid the plague to cease. There have been times when a Scotch professor like myself dared not have preached such doctrines in Scotland; for his countrymen once hugged the belief that pestilences were divine judgments, which ought not to be interfered with by human agency. Even then they forgot that there is far more of mercy than of wrath in all divine arrangements. Undoubtedly, pestilences are warnings that man is transgressing the beneficent laws provided for his well-being. But a god of wrath and pestilence is now a god of the heathen, not of the Christian. That ought to have been understood long ago. The prophet heard the wind which clave the rocks, but the voice of God was not in the wind. He felt the earthquake which shook the world, but the voice of God was not in the earthquake. He saw the fire, as it pursued its track of desolation, but the voice of God was not in the fire. It was only after these terrors had passed away that the prophet heard the voice of God as a still small voice. That whispers to us still; not in plagues and pestilences, but, when these dangers have passed, as an ever-present voice in all the ordinary occurrences of our lives. It tells us of the beneficent wisdom which regulates all the laws of creation, made for our well-being, and not for our destruction. It is by disobedience to them that we are punished by 125,000 persons being unnecessarily cut off every year in this country. Our own acts produce those demons of destruction which the Jews of old credited with the slaughter of the people; and by our own acts we can convert them into preserving angels. I think it is in the epilogue to the *Honest Man of Fortune* that Beaumont and Fletcher thus describe our responsibilities for what befalls us:

"Our Acts our angels are, or good or ill,
Our fatal shadows that walk by us still."

The object of the health section of this Association is to show our countrymen how this sacrifice of preventable deaths may be avoided. That number of deaths imply more than four million two hundred thousand cases of preventable sickness. It is upon these that we must operate, by rooting out the causes which produce them. I began by drawing your attention to the death-rates of the country. These have been derived from the excellent system of death-registration which we now possess. But there is another system of registration which it would be important to add to our sanitary records—the registration of sickness. Registration of deaths represents the wrecks which strew the shore, while that of sickness would tell us of the coming storms and enable us to trim our vessels to meet them. Till we have such a system of disease-registration, public health cannot be administered with full intelligence. We must not forget that the function of the sanitarian is prevention. His function begins and ends before man reaches his final state of decay, "or ever the silver cord be loosed or the golden bowl broken...or the wheel be broken at the cistern". When this wheel, or circulation of the blood, is broken, a new and a great wheel begins, involving in its rotation all organic and inorganic matter. In this there is the highest example to us of hygienic organisation. You know how the waste of animals during life, and of their bodies after death, passes into the gaseous forms of carbonic acid, water, and ammonia. These substances form the aerial food of plants, which, in fixing and moulding some of their constituents into new forms of organic life, purify the atmosphere of its noxious products, and restore the life-giving oxygen abstracted in the respiration of animals. Thus plants convert the foul products of animals into new food necessary for their growth and development. The great and abounding air into which passes all the foulness of the living, and all the putrid products of the dead, becomes at once the grave of organic death and the cradle of organic life. In this wonderful circle death and life rapidly appear in correlation; and past generations of animals, by a process of dissolution, produce living generations by a process of evolution. All this is in the harmony of nature, without jar or disturbance. We should strive, in our hygienic efforts, to take part in this great circle, without vainly attempting either by ignorance or by design to mar such wonderfully conceived plans for preserving the world in purity and sanity.

PROMOTION IN THE INDIAN ARMY.—Under the authority of the Secretary of State for India, it is notified that, although a certain period of regimental service is not required by the Royal Warrant of July 1st, 1873, as a necessary qualification for promotion to the administrative grade of the Medical Department, it will still rest with the Government of India to select for promotion to that grade officers possessing sufficient regimental experience to enable them to exercise supervision over military hospitals and regimental military staffs.

INTRODUCTORY ADDRESS ON UNIVERSITY AND MEDICAL TEACHING.

*Delivered at the opening of the Medical Department of Owens
College, Manchester.*

By THOMAS H. HUXLEY, LL.D., F.R.S.,
Professor of Natural History in the Royal School of Mines.

MY first business to-day is to declare that the medical school which has now for some years been in course of erection, is formally opened, and ready for the work which will, I hope, for a very long series of years be successfully continued in it. I am very proud to be made the medium of this declaration to-day, and I might, perhaps, express my regret that official engagements, from which I could not free myself, prevented me from being present this time last year, when the magnificent buildings which I have seen to-day for the first time were formally opened by his Grace the Duke of Devonshire. Indeed, an occasion of that kind, and an inauguration such as took place last October, was one at which any man having the interests of so great a section of Her Majesty's dominions as Lancashire at heart might have been glad to be present; for although in name you professed only to have established a College, that which you practically did then was to lay the foundation of a great university for Lancashire. If you look into the origin of universities, you will find that it was no part of the original constitution of an university to be endowed with rich fellowships, or even the possession and power of granting degrees. Those admirable men originally associated themselves together for the purpose of forming corporations which were called universities, and they were impelled by a desire to learn and to teach, without caring more for the future fate of their learning and teaching than what might be necessary for securing the full efficiency of that learning and teaching. It was only subsequently that the power of granting degrees became conferred upon them, or, perhaps I should more accurately say, at first associated with them.

I find that, like the older universities, this body has practically divided itself into departments, which in the case of the older universities were true faculties, but are here known by the more modest name of departments. You have a department of arts, a department of law, a department of science, and a department of medicine; and this classification of the departments into which you have spontaneously divided yourselves, when contrasted with that which existed early in the history of the older universities, is in itself a striking indication of the times; and the present state of affairs differed from what would naturally have arisen in older times by the absence of something and by the presence of something. It would be wholly needless and undesirable for me to dilate upon the reasons which have led to this remarkable difference; they are patent and obvious to everybody; nor will I for a moment dwell upon what considerations might be urged to show that the difference which now exists is possibly not an essential and not a desirable one. On that point ideas vary. But I congratulate you upon having made this great step, and I congratulate Lancashire upon having seen that her highest interests are bound up not only with the elementary education of the people, but with the higher education of the upper and those classes which are more accustomed to depend upon their intellectual and less upon their manual labour. And I congratulate you upon having done so great a work and by your own spontaneous efforts. The sum that has been raised for the establishment of this College is perhaps not vast in relation to the enormous wealth of Lancashire, but it is a great sum; and let us hope that those who possessed that enormous wealth, when they considered what this College is doing, what a great work it is performing, what most beneficial results will certainly accrue from its efforts in the future, that they would understand that, although they were giving liberally, it is only a forecast of that which is to come.

I notice in these donations, and in these sums of money subscribed for the purpose of building and endowing and providing with scholarships this great institution, what appears to me to be a peculiar fea-

ture; at least I know nothing exactly like it anywhere else; and, as it appears to me to be a feature of great importance and one which is desirable to be imitated as fast as possible by other educational bodies, you will pardon me if I dilate upon it for a short time. You have two scholarships which differ from the ordinary scholarships in this, that they are rewards not merely for learning, and not merely for careful attention and diligent study of that which the student may learn in the lecture-room or from books, but they are rewards which are given to those who exhibit in some degree that most valuable and most important of all intellectual gifts, the power of advancing truth by the pursuit of original research. I refer to the Dalton scholarship and the Platt scholarship. I can conceive no object more important at the present time than that of encouraging original research in science; and the way of doing it, without at the same time doing more harm than good, is one which has come very seriously under my consideration as one of the royal commissioners for the advancement of science. I earnestly wish that we could look elsewhere to the solution of that problem by means analogous to those adopted here—I mean to say by private benefactors coming forward with their endowments, which endowments should benefit those only who are engaged in original research. But the introduction of scholarships of that kind into the early life of young men, when it is so important that their attention should be directed to original research, is a new feature in this institution; and permit me to say, however important in other respects, I am not sure that it is not one of the most important of its features.

I may now pass on to say a few words respecting the organisation of the several departments of instruction and learning into which the working power and teaching power of your institution has separated itself; and here allow me to say, that I do not propose to step for one instant beyond my last. Your Faculty of Arts speaks for itself; the distinction of many of its members, and the fact that they are authors of works well known and esteemed all over England and wherever the English language is read, is sufficient to give that faculty a high position. It certainly would not become me to speak of its operations as if I were a judge of them in any way whatever; but I may be allowed, as a person whose pursuits lie elsewhere, and who has the misfortune to be accused sometimes of seeing no merit and desert in anything but his own pursuits—allow me to say, that I trust that the position of the Arts Faculty in this institution will never, by a hair's breadth or shadow, be diminished; but that a sound and thorough training in literature and general knowledge will be regarded henceforward, as very properly it is now, as the essential foundation in the intellectual life of every educated man; and let me say, that to no person is such education and such training of greater importance than to us who are called men of science. Our occupations are very engrossing, and they can be pursued with success only by the intensest stress and attention; and we are obliged even to limit ourselves to particular fractions and particular portions of our own study if we are to make any advance therein; and, unless we have the good fortune to be trained in early youth to take a broad and general view of the interests of human nature, unless our tastes are disciplined and refined, and unless we are led to see that we are citizens and men before anything else, I say it will go very hardly indeed with men of science in future generations, and they will run the risk of becoming scientific pedants when they should be men, philosophers, and good citizens. Still less, if possible, can I have anything to say respecting the Faculty of Law; but, as regards that of Science, by which, of course, is understood physical science, I can only express my unmeasured satisfaction at the completeness—I may almost say magnificence—of the arrangements provided for the teaching of this subject in this institution. The laboratory of my friend the professor of Chemistry has, I take it, few parallels; and, if the laboratory of my friend the professor of Physics be not so complete, I am sure it is far better than nine-tenths of such laboratories, and I am certain that those benefactions at which I was looking just now will before long enable him to put his establishment on the same footing as to completeness and magnificence as that of his colleague of Chemistry. I understand—indeed, I know very well, knowing how much my distinguished friend Professor Roscoe has been in this institution—that he had, I believe, the advantage of being on the spot when the building went on; and, although I am sure he is the last man to take any more than his own share, somehow he has got a good deal.

But now I come to that which is my proper subject to-day, and that is our medical school. I have not seen, in the course of my experience—I say it deliberately—I have not met with any more efficiently organised institution than you have within the four walls of that medical school. I have some acquaintance with such institutions and their interests; and I undertake to say, that you will not find better constructed appliances for the teaching of those branches of science which relate to medicine than you will find in that school. Everything has been very

carefully considered, and everything has been done which the idea of convenience could suggest, or which the notion of efficiency requires to have carried out; and I should like particularly to address myself to that particular corner over there, and to say to those gentlemen, whose strong lungs I admire much, that, if they do not apply those equally strong Lancashire brains in becoming first-rate medical men, it will not be the fault of the institution or the fault of their teachers, but their own most assuredly. I recollect in former days, when I was an examiner in the University of London, the Manchester medical school of that day used to send up exceedingly well prepared men; and, if that was done with the means and appliances then existing, although no longer an examiner, I expect to see the list of the University of London crowded with successful men from Manchester in future times. I am sure, addressing myself rather to the lay portion of my audience, it may astonish many, and puzzle them somewhat, to know why so elaborate an apparatus is needed for the teaching of medicine, and why men require to spend so long a period of arduous study in that most important of pursuits. I believe this surprise arises from the prevalence in the general mind of the notion which was once exceedingly common in the philosophical mind—I mean this, that the human body in general is dependent upon forces and powers which were altogether different from those we find working in other kinds of matter. It is not two hundred years since the notion existed that the vital processes of the body were subject to some demon who kept the body straight, I suppose when in good temper, and let it go wrong when out of sorts; and, when it was gravely supposed that there was a broad gulf between the phenomena of inorganic nature and those of life. Now let me say this, that the whole of our modern scientific study of medicine depends upon precisely the contrary assumption—upon the assumption that the living body is a mechanism infinitely more refined, and infinitely more difficult to understand, than our coarse human machinery; but still the mechanism of it is governed by rules and laws which can be discovered, and which can be applied and reasoned from, in order to understand its processes. Modern medicine, in fact, is a kind of engineering. It is the attempt to understand the machinery of the body, for the purpose of being able to put it right when it goes wrong. I have seen in your great factories in Manchester some of those astonishing complicated pieces of machinery which seem almost endowed with life, by which the products which make Manchester so famous are produced. Let me put before you the case of the possessor of one of those machines, who, finding that it has gone wrong and that it will not work properly, finds himself, as Sir Robert Peel would say, with three courses open to him: either that he might sit down and hope that it would get better, and, perhaps, even offer up his prayers that it might get better; or that he should send to the nearest blacksmith and tell him to bring his hammer and bottle of oil, and tap here, or oil there, in the chance of setting the machine right; or should, thirdly, send for some skilled and experienced mechanic who, from long study and familiarity with it, would be able to judge by the mode of action where it was wrong, and be able to put his finger on the part which was broken or injured, and thus be able to set it right. Now the human body is a machinery which, in complexity, stands to the spinning-jenny in the same relation as the spinning-jenny stands to a child's windmill. But it stands by the same laws, and those who have to deal with it must be guided by the same reasoning. Sickness is the going wrong of the machinery. Death is the destruction of part of the machinery; and the only way in which that machinery can be set right, if it go wrong, is not by sitting down and hoping for it, is not by sending for the first blacksmith, who will administer his purge here and his bleeding there, and who is what we call a "quack"; I mean a person who is really ignorant of that with which he is dealing, and who yet, nevertheless, presumes to meddle with it. That is the essence of quackery. Or, thirdly, we must send our skilled engineer, who, by the help of what he calls symptoms, finds out what wheel is out of place, what cog is broken, and, by his previous knowledge of therapeutics and remedies, knows in what way it is possible to get this erring wheel or broken pinion into its place again. And it is in order that we may have such skilled engineers to the body that all this great apparatus, which you see erected here, and all this long period of study is carried out.

I do not know anything which strikes me more forcibly than the progress which this kind of knowledge has made within the last thirty or forty years. I find that your medical school in Manchester was first founded mainly, I understand, by the zeal and energy of a memorable man now no more—Mr. Turner—whose acquaintance I had the pleasure of making many years ago, aided by his *fidus Achates*, Mr. Hunt, who is also, I believe, deceased. I understand the first medical school in Manchester was founded in the year 1824. I happen to remember that date for a very simple reason, that, inasmuch as the school was

founded in 1824, it is as nearly as possible six months older than I am. It is something astounding to know what progress has been made since that time. I happened to take up to-day the syllabus of your sessional work here, and I turn, not unnaturally, to the class of Practical Physiology and Histology, and, on looking over the various doings of this course of instruction, it struck me that, thirty years ago, when I began my medical studies, there certainly was nobody in London—nay, nobody in the world—who could have given you this course of instruction. We had not the instruments which are requisite to carry it out. The whole course of medical study since that time has been completely changed—by, in the first place, discoveries made by the use of the microscope, and, in the second place, by that application of delicate instruments to the illustration of the mechanism of the body, which is the very essence and a great part of modern physiology. At that time, even organic chemistry was hardly in existence. We used to use, when I was a student, what was called Turner's *Chemistry*. It is this recognition of the fact, that the study of life is essentially a question of applied physics and chemistry. That is what has changed the whole course of our medical studies. It is that which makes that elaborate appliance necessary, and that you who commence your medical studies should come prepared with the outlines of physics and chemistry as your foundations. One of the greatest reasons of the backwardness in medical study is, that those who come to study are, by reason of the lamentable defects of their common school education, utterly unprovided with a knowledge of what those physical studies mean.

I do not think it would be needful for me to detain you longer. The subject is a tempting one, and I might be disposed to enlarge still more upon the advantages which you who are now commencing your career have over those who are thirty or forty years older than yourselves. Though not enlarging upon these advantages at still greater length, if it were possible that I could stamp upon your minds as firmly and as strongly as it is burnt into my own, that all these appliances, and all these mechanical aids for the study of medicine, are simply thrown away unless they have the foundation of human hard work and clear-headedness to go upon. You have before you probably that which is the most responsible of all human careers. It is hard for you not to realise that. It is hard for you, curbing the hot blood of youth, to understand what issues may depend upon your present career; but depend upon it, exactly in proportion as you make use of these advantages, as you feel the burden of your responsibilities, as you acquire that knowledge which was essential for you, so will your lives in the future be passed in the satisfaction of well merited renown, or in the misery of a violated conscience.

A CASE OF POISONING BY MUSHROOMS.

By JAMES SEDGWICK, M.R.C.S., Boroughbridge.

THE following case of poisoning by mushrooms appears sufficiently severe, and probably rare, in the early advent of tetanic muscular spasm, as to demand a short notice from me, more especially as such symptoms, I find, have only been very seldom seen, and then in fatal cases.

About 6.15 P.M. one day in August 1874, T. F., when in perfect health, partook of about eight or ten carefully chosen small young mushrooms; after which, he took a walk round his farm, retired to bed about 11 P.M., feeling perfectly well, and not in the slightest degree suspicious that the mushrooms could be poisonous, and entirely ignorant of any of the symptoms of poisoning by fungi.

About 1.30 A.M., when I first saw my patient, I found him supported by his nurses, walking in the open air. He said he felt so sleepy, and had been obliged to leave his bed and room, because he could only breathe with very great difficulty. He added that, after sleeping until 12.15, he awoke suddenly with spasmodic twitching in his hands and arms, soon followed by a suffocative feeling; so much so, that he felt he should die from it. This necessitated his removal to the open air; and a glass of brandy and water was given.

At 1.30 A.M., he was drowsy, and not quite collected; said he felt as if he should soon be delirious; but both tetanic muscular spasm and dyspnoea had subsided. Pupils somewhat inactive; pulse regular. I at once emptied the stomach twice by emetics, and then gave an aperient. The vomited matter contained several mushrooms, very probably all that had been taken; and, though six hours had elapsed since the meal of mushrooms had been eaten, very little could have passed the stomach. Great relief followed the action of the emetics. He had no return of discomfort, except a feeble digestion, and for a few days a feeling in his arms which he described as similar to that caused by riding an unruly pulling horse for a day.

REPORT

OF THE COMMITTEE OF THE BRITISH MEDICAL ASSOCIATION TO INVESTIGATE THE ANTAGONISM OF MEDICINES.

By JOHN HUGHES BENNETT, M.D., F.R.S.E.,
Chairman and Reporter.

II.—ANTAGONISM BETWEEN SULPHATE OF ATROPIA AND CALABAR BEAN.

WHEN the Committee commenced their investigations into this subject, the antagonism had already been indicated by Dr. Fraser. It was resolved, however, to determine the question with exactitude. Subsequently, a very lengthened inquiry was published by Dr. Fraser,* with whose general results those of the Committee coincide.

The preparation of Calabar bean employed was in the form of an alcoholic extract made by Dr. Cook, formerly of the firm of Messrs. T. and H. Smith of Edinburgh, now residing in Liverpool. It was prepared as follows. The powdered beans were acted upon with spirit of specific gravity .830, at 60 deg. Fahr., until the powder was exhausted. The clear solution thus obtained was evaporated in a vacuum of twenty-six inches until the spirit was entirely removed. To the residue thus prepared, three ounces of water were added, and the whole was heated gently. The residue was partly dissolved, leaving some oily matter floating on the surface. This mixture was filtered, and a fluid obtained, one ounce of which represented four ounces and a half of Calabar bean; or, in other words, twenty eight grains of the extract free from oil were present in each ounce.

Numerous experiments were made on rabbits and on rats.

A. Experiments on Rabbits.

TABLE IX.—Showing Effects of a Minimum Fatal Dose of the Extract of Calabar Bean on Rabbits.

No.	Weight of Rabbit.	Dose of grains.	Result.
116	3 lbs. 8 oz.	$\frac{1}{2}$	Died in 1 hour 40 minutes
117	3 lbs. 8 oz.	$\frac{1}{2}$	Died in 12 minutes
118	3 lbs. 12 oz.	$\frac{1}{2}$	Recovered; ill nearly 24 hours
119	3 lbs. 12 oz.	$1\frac{1}{2}$	Died in 7 minutes
120	4 lbs.	$1\frac{1}{2}$	Died in 19 minutes
121	4 lbs. 1 oz.	$1\frac{1}{2}$	Died in 8 minutes
122	4 lbs. 2 oz.	$1\frac{1}{2}$	Recovered; very ill 6 hours
123	4 lbs. 4 oz.	$1\frac{1}{2}$	Died in 6 minutes
124	3 lbs. 6 oz.	$1\frac{1}{2}$	Died in 29 minutes
125	4 lbs.	$1\frac{1}{2}$	Recovered after severe illness
126	3 lbs. 8 oz.	$1\frac{1}{2}$	Died in 31 minutes
127	3 lbs. 7½ oz.	$1\frac{1}{2}$	Recovered after severe illness

Taking into account the relative weights of these rabbits, it was concluded that three-quarters of a grain of extract of Calabar bean for every three pounds weight of rabbit was the minimum fatal dose of the extract employed; and it is so understood in all the investigations on the supposed antagonistic properties of other substances to Calabar bean. The minimum fatal dose of the extract prepared by Dr. Fraser was 1.2 grains for every three pounds weight of animal; but he states (p. 575) "that the lethal activity of this extract" [the extract given him by Dr. Cook] "is considerably greater than that of the extract prepared by myself".

The symptoms following the subcutaneous injection of three-quarters of a grain of this extract into a rabbit were as follows.

Experiment 126.—Male rabbit, weighing 3 lbs. 8 ounces. Three-fourths of a grain of extract of Calabar bean, dissolved in ten minims of water, were injected under the skin of the back. In a minute and a half, there were slight twitchings of the skin. In three minutes, the breathing became very hurried, and the animal seemed to be distressed. Saliva now accumulated profusely in the mouth. In two minutes more, the animal rested on its abdomen and chest, and spread out its legs, which were stiff. It attempted to regain its natural posi-

* *Proceedings of the Royal Society of Edinburgh*, 1868-69, pp. 587-590. See also the *Practitioner* for February 1870; and an elaborate paper in the *Transactions of the Royal Society of Edinburgh*, vol. xxvi, part iii, for the session 1870-71.