tied to his back, marching cheerfully to his appointed place of study. After 8 o'clock no children of school age are to be found away from their classes. Each parish of a town must have at least one primary or elementary school, and most towns, in addition to these elementary schools, have at least one upper or burgher school, as it is called.

The German children at school all appear neatly dressed, and, what I am sorry to say is not always true in my own country, these children are trained to good manners. When a stranger enters a school room, the children all rise and remain standing until the stranger is seated, or until they are invited to be seated; and when the visitor leaves, the children all rise and remain standing until he has closed the door behind him. This practice is observed in all the grades of schools, from the first primary up to the senior class in the university.

If a parent is not able to clothe his child properly for school, then he is clothed at the public expense. The children of the rich are found sitting on the same seat with those of the poor, and the nobles do not hesitate to allow their children to receive their elementary training in the same classes in which the children of the humble are trained, and the boy who has the most brains and explains his lessons best, is the best fellow while his young school days last, whatever distinctions may be made in after life. After leaving the common school the German youth can enter upon the duties of active life, or they may enter the trade school, where they remain three years, and prepare for the various trades they may choose to follow.

Then he can follow his trade, or he can enter the industrial school and in two years graduate an architect, an engineer, a chemist, etc., or, if he wishes, he can pass from the industrial school to the polytechnic school, and prepare to take a high position in the mechanical arts. The student may leave the common schools also and enter the gymnasium, where Latin, Greek, mathematics, rhetoric, history and chemistry are taught. From the gymnasium the student can take up the study of a profession, or he can go thence to a university, where he can fit himself to take the highest position in any profession he chooses, and where he can know all the subjects of his study as sciences.

In the gymnasium the students are required to study and recite thirty-two hours per week, and before graduating to pass over a course of study which requires nine years to complete. The German teachers, as a class, are better prepared for their work than the teachers of any other country. They are encouraged to fit themselves for a high excellence in their profession by the preference which is always given to teachers who have a professional training, and by the honor which is everywhere accorded to teaching as a profession.—*Dresden Correspondence of the Springfield Republican.*

SCIENTIFIC EDUCATION IN SCHOOLS.

I HOPE you will consider that the arguments I have now stated, even if there were no better ones, constitute a sufficient apology for urging the introduction of science into schools. The next question to which I have to address myself is, What sciences ought to be thus taught? And this is one of the most important of questions, because my side (I am afraid I am a terribly candid friend) sometimes spoils its cause by going in for too much. There are other forms of culture besides physical science, and I should be profoundedly sorry to see the fact forgotten, or even to observe a tendency to starve or cripple literary or æsthetic culture for the sake of science.

Such a narrow view of education has nothing to do with my firm conviction that a complete and thorough scientific culture ought to be introduced into all schools. By this, however, I do not mean that every school boy should be taught every thing in science. That would be a very absurd thing to conceive, and a very mischievous thing to attempt. What I mean is, that no boy nor girl should leave school without possessing a grasp of the general character of education, and without having been disciplined, more or less, in the methods of all sciences; so that, when turned into the world to make their own way, they shall be prepared to face scientific discussions and scientific problems, not by knowing at once the conditions of every problem, or by being able at once to solve it, but by being familiar with the general current of scientific thought, and being able to apply the methods of science in the proper way, when they have acquainted themselves with the conditions of the special problem.

That is what I understand by scientific education. To furnish a boy with such an education, it is by no means necessary that he should devote his whole school existence to physical science; in fact, no one would lament so one-sided a proceeding more than I. Nay, more, it is necessary for him to give up more than a moderate share of his time to such studies, if they be properly selected and arranged, and if he be trained in them in a fitting manner.

I conceive the proper course to be somewhat as follows: To begin with, let every child be instructed in those general views of the phenomena of nature for which we have no exact English name. The nearest approximation to a name for what I mean, which we possess, is "physical geography." The Germans have a better, *Erdkunde*, ("earth-knowledge," or "geology," in its etymological sense), that is to say, a general knowledge of the earth, and what is on it, in it, and about it.

If any one who has had experience of the ways of young children will call to mind their questions, he will find that, so far as they can be put into any scientific category, they come under this head of *Erdkunde*. The child asks, "What is the moon, and why does it shine?" "What is this water, and where does it run?" "What makes the waves in the sea?" "Where does this animal live, and what is the use of that plant?" And, if not snubbed and stunted, by being told not to ask foolish questions, there is no limit to the intellectual craving of a young child, nor any bound to the slow but solid accretion of knowledge and developement of the thinking faculty in this way. To all such questions, answers which are necessarily incomplete, though true as far as they go, may be given by any teacher whose ideas represent real knowledge, and not mere book-learning; and a panoramic view of nature, accompanied by a strong infusion of the scientific habit of mind, may thus be placed within the reach of every child, of nine or ten.

After this preliminary opening of the eyes to the great spectacle of the daily progress of nature, as the reasoning faculties of the child grow, and he becomes familiar with the use of the tools of knowledge—reading, writing, and elementary mathematics—he should pass on to what is, in the more strict sense, physical science. Now, there are two kinds of physical science; the one regards form and the relation of forms to one another; the other deals with causes and effects. In many of what we term our sciences, these two kinds are mixed up together; but systematic botany is a pure example of the former kind, and physics of the latter kind of science. Every educational advantage which training in physical science can give is obtainable from the proper study of these two; and I should be contented, for the present, if they, added to *Erdkunde*, furnished the whole of the scientific curriculum of schools. Indeed, I conceive it would be one of the greatest boons which could be conferred upon England, if henceforward every child in the country were instructed in the general knowledge of the things about it—in the elements of physics and of botany. But I should be still better pleased if there could be added somewhat of chemistry, and an elementary acquaintance with human physiology.

So far as school education is concerned, I want to go no further just now; and I believe that such instruction would make an excellent introduction to that preparatory scientific training which, as I have indicated, is so essential for the successful pursuit of our most important professions. But this modicum of instruction must be so given as to insure real knowledge and practical discipline. If scientific education is to be dealt with as mere book work, it will be better not to attempt it, but to stick to the Latin grammar, which makes no pretence to be any thing but book-work.

If the great benefits of scientific training are sought, it is essential that such training should be real, that is to say, that the mind of the scholar should be brought in direct relation with fact, that he should not merely be told a thing, but made to see by the use of his own intellect and ability that the thing is so and not otherwise. The great peculiarity of scientific training, that in virtue of which it cannot be replaced by any other discipline whatsoever, is this bringing of the mind directly into contact with fact, and practising the intellect in the completest form of induction; that is to say, in drawing conclusions from particular facts made known by immediate observation of nature.

The other studies which enter into ordinary education do not discipline the mind in this way. Mathematical training is almost purely deductive. The mathematician starts with a few simple propositions, the proof of which is so obvious that they are called self-evident, and the rest of his work consists of subtle deductions from them. The teaching of languages, at any rate as ordinarily practised, is of the same general nature—authority and tradition furnish the data, and the mental operations of the scholar are deductive.

Again, if history be the subject of study, the facts are still taken upon the evidence of tradition and authority. You cannot make a boy see the battle of Thermopylæ for himself, or know of his own knowledge that Cromwell once ruled England. There is no getting into direct contact with natural fact by this road; there is no dispensing with authority, but rather a resting upon it.

In all these respects, science differs from other educational discipline, and prepares the scholar for common life. What have we to do in every-day life? Most of the business which demand our attention is matter of fact, which needs, in the first place, to be accurately observed or apprehended; in the second to be interpreted by inductive and deductive reasonings, which are altogether similar in their nature to those employed in science. In the one case, as in the other, whatever is taken for granted is so taken at one's own peril; fact and reason are the ultimate arbitrators, and patience and honesty are the great helpers out of difficulty.

But, if scientific training is to yield its most eminent results, it must, I repeat, be made practical. That is to say, in explaining to a child the general phenomena of nature, you must, as far