education authorities in establishing and administering schemes for the advancement of apprentices.

Perhaps the most important feature of the Memorandum is the distinction which it draws between the major and the minor course. Industrial training has suffered hitherto from a lack of proper appreciation of the differences between the training required by the future artisan (or "tradesman") on the one hand, and the future "technical" man (whether designer, manager, or commercial representative) on the other. The distinction now drawn does not, however, go deep enough. The Memorandum does not sufficiently discourage the prevailing notion that the ideal evening student first enters evening classes at fourteen, and continues to attend such classes for seven years. Thus, instead of insisting that the technical student should remain at a secondary school until he is at least sixteen, and then, perhaps, enter his major (senior) course when he enters works, the Memorandum contemplates that the technical student and the trade student shall both follow the same junior (evening) course from fourteen to sixteen. It would surely be better that the trade student's own minor course should begin at fourteen instead of at sixteen, and attract him, by its special adaptation to the circumstances of his particular trade, from the moment when he leaves his day school. Moreover, since the trade student will as a rule have less opportunity for general reading in later life, his minor course might well include some "citizenship" subjects, such as industrial history considered at first from the point of view of his particular trade.

More than half of the Memorandum is devoted to "outlines of work" for various recommended courses. This portion is full of most useful suggestions. Some, however, are open to objection, or, at least, to criticism. Thus there is a curious confusion between *weight* and *mass* on page 20 ("$g \times$ force = mass $\times$ linear acceleration," which would make g a pure number, independent of the system of units employed). It is also doubtful whether the conception of "work" is really so difficult as to justify the suggested postponement of its introduction until the second year of the senior course. Again, the four years' (major) course in mathematics outlined in the Memorandum might with advantage be less "practical" in its first two years, during which some time might well be found for geometry.

ENGLISH MATHEMATICS.

THE *Mathematical Gazette* has recently published a translation of an address delivered by Prof. Gino Loria to the International Congress of Historical Studies. This is a well-proportioned and detached estimate of the main contributions of England to the body of mathematical science, from the earliest available records to the present time. An important suggestion is made that it may be possible to find in some of our libraries manuscript works by some of those early writers who, unlike ourselves, did not hasten to publish their discoveries, and were often surprised by death. In this connection the names of Bradwardine, Richard of Wallingford, John Maudith, and Tonstall are mentioned. Another note is that James Gregory made lengthy stays in Italy, and was therefore probably acquainted with the work of Galileo; so the question arises how far Newton may have been influenced by the achievements of the great Italian philosopher. Prof. Loria suggests inquiry about this as an important piece of research.

Prof. Loria emphasises, with justice, the fact that the renascence of English mathematics in the nineteenth century coincided with a better knowledge and appreciation of work being done abroad. The greatness of Newton, like that of Euclid and Archimedes, had a sort of benumbing effect upon his successors, and even contemporaries; although, of course, there are exceptions, like Maclaurin and Brook Taylor and Waring. It is also pointed out that even now there are certain branches of mathematics which Englishmen persistently ignore, or else treat by obsolete and clumsy methods. The example given is descriptive geometry; and it is noted that Brook Taylor laid down the principles of this subject in a way perfectly analogous to that adopted long afterwards, and independently, by Fiedler. It is not stated by Prof. Loria, but it is a fact that most of our text-books on descriptive geometry are simply contemptible, from a scientific point of view, and not to be compared with Fiedler's treatise, or the classic work of Monge, which does in the main follow the lines of what we call descriptive geometry, in the restricted sense of orthogonal projection.

Even able students who use these books, and attain great practical efficiency, have no conception at all of the subject as a whole, and are baffled by the simplest problems about traces of lines and planes. So far as we know, there is only one good treatise on descriptive geometry in the English language, and that is in the "Penny Cyclopædia," where so many other treasures have been buried and forgotten. This leads to the remark that Prof. Loria has a proper appreciation of the works of De Morgan, and laments that they are so inaccessible; with this sentiment we cordially agree.

An Italian is as likely as anyone to sympathise with English modes of thought; so any conclusion drawn from this address is likely to be flattering rather than the reverse. We must remember, too, that, when we speak of English mathematicians, we are apt to include such men as Maclaurin, Rowan Hamilton, and Sylvester, who were not Englishmen at all. But even in this inclusive sense of the term "English" one cannot but feel that Continental opinion about English mathematics is almost bound to be analogous to that about English literature in general. Newton *is* English, and, like Shakespeare, or Dante, or Goethe, incomparable; but we have lesser men, of a more distinctly national type, who may, perhaps, be more justly appreciated at home than abroad. As an example, we may instance W. H. Fox Talbot, now only vaguely remembered in connection with photography. As a mathematician he is, of course, not to be compared with Abel; nevertheless he did investigate some cases of Abel's theorem in a very instructive and fundamental way, implicitly showing that the theorem is really a deduction from the known facts about symmetric functions of the roots of an equation, and the elementary theory of partial fractions. We are inclined to believe that the simplest proof of Abel's theorem will ultimately follow the lines that Talbot has indicated.

There are many points in the address to which we cannot refer; but one that deserves mention is that Newton is reported to have said that the style of the ancient geometers is the only one appropriate to any mathematical treatise worthy of the name. Judging by the "Principia," it is probable that this story is authentic.

G. B. M.

PUBLIC HEALTH.

THE Medical Officer's Supplement to the forty-third Annual Report of the Local Government Board for 1913–14 (Cd. 7612, price 1*s.* 11*d.*), while it deals mainly with matters primarily of medical interest, of necessity includes within its scope much that is of value to all scientific minds.

The question of infant mortality occupies a pro-

minent place, and one notes with satisfaction that the general trend of the curve continues in a downward direction. Greater provision is likely to be made in the near future for the care of expectant mothers, and the official recognition of an ante-natal state, though somewhat belated, is none the less welcome. Much good work has been done by voluntary agencies in the past, and the linking up of this with the various organisations dealing with child welfare must inevitably tend to a healthier future race.

Some interesting figures are given regarding vaccination returns. It appears that in England and Wales as a whole one-half of the children whose births were registered in 1912 have been vaccinated, and nearly one-third have been exempted from vaccination by statutory declaration of conscientious objection. When compared with the returns for 1911, these figures show a percentage reduction of 52·3 to 50·1 in the proportion of children born who are vaccinated. The percentage of children born who were exempted under certificate of conscientious objection increased from 28·5 to 32·1.

Inquiries have been made regarding certain outbreaks of enteric fever supposedly due to the consumption of infected shell-fish. The medical officer of health of a seaport town has repeatedly referred to the danger incurred by persons in collecting shellfish of all sorts from areas obviously contaminated with sewage. While it is difficult in most cases to prove conclusively that an epidemic owes its origin to such a practice, yet, when local authorities have acted as if such were undoubtedly the case, the wisdom of such action has been abundantly shown by the non-recurrence of the disease.

Progress is constantly being made towards securing purer and more wholesome food for consumption in this country. A careful watch has to be kept at the various ports of entry to prevent so far as possible the import of unsound and even poisonous material. As an instance of what is continually happening it will suffice to quote the following occurrence. During the unloading of a cargo of sugar in the Port of London it was noticed that some of the bags containing the sugar were covered with borax, which had been carried in the same hold and had become loose during the voyage. Samples of this powder were taken, and analysis showed them to contain arsenic in considerable quantities. The whole of the sugar was rebagged, and that portion of it that had already been sent out was recalled for suitable treatment under supervision.

The effect of certain types of waters on lead has again been brought into prominence by an outbreak, extensive though mild, of lead poisoning in an urban district in Yorkshire. The waters most liable to act in this way are acid, peaty supplies, and it is even asserted as conceivable that the treatment applied with a view of destroying the plumbo-solvent properties of the water may tend in some way to increase the ability of the water to erode the lead. At all events, further investigation is being made, as the case in point has proved a very difficult one to deal with.

More research has been conducted on the subject of ferro-silicon with special reference to possible danger arising from its transport and storage. This substance, of certain percentage compositions, is liable to disintegration in the presence of moisture, and poisonous gases are given off in quantity sufficient to produce fatal results in human beings. It is suggested that liability to spontaneous disintegration with evolution of poisonous gases may be related to the amount of aluminium present in the ferro-silicon. Further reports are now issued on ferro-chrome and other ferro-alloys, with special reference to aluminium content.

The work of Prof. Leonard Hill on the effect of open-air and wind in the metabolism of man is referred to. He points out that the physical qualities of the air—heat, moisture, and movement—are of paramount importance to health. The stimulating effect of cool and variable breezes acting on the skin leads to improved health, while a stagnant, windless, over-warm atmosphere tends to depression and diminished vitality. Two new instruments are described—the kata-thermometer and the caleometer—which enable the rate of cooling of the body and the variability of the rate to be measured (see p. 205 of this issue of NATURE). Prof. Hill's researches on the physical condition of the atmosphere have done much to elucidate the problem of "stuffiness," to which so many ailments are undoubtedly due.

THE CARNEGIE INSTITUTION OF WASHINGTON AND SCIENTIFIC RESEARCH.

THE Carnegie Institution of Washington was founded by Mr. Carnegie in 1902, when he gave to a board of trustees an endowment of 2,000,000*l*., to which he added 400,000*l*. in 1907, and a further 2,000,000*l*. in 1911. The articles of incorporation of the institution declare "that the objects of the corporation shall be to encourage, in the broadest and most liberal manner, investigation, research, and discovery, and the application of knowledge to the improvement of mankind," and already, as the annual reports of the president and the directors of the various departments show, the objects of the institution are being fulfilled admirably.

The trustees have inaugurated and developed three principal agencies to forward the aims of the institution. In the first place, the departments of research attack problems requiring the collaboration of several investigators, special equipment, and continuous effort. A second agency provides means to enable individuals to complete investigations requiring less collaboration and simpler apparatus; while a third division deals with the publication of the results obtained as the result of the work of the first two agencies.

The reports by the president, the directors of the various departments of research, and the executive committee, contained in the 1914 Year Book, recently received, give full particulars of the financial resources of the institution, and of the activities of its different departments, during the year under review. The Year Book provides convincing evidence of the success of the trustees of the institution in their endeavours to encourage and advance scientific research.

The following table shows the amounts of the grants made by the trustees for the current year, and the purposes to which they are being devoted :—

	£
Administration	10,000
Publication	12,000
Division of Publications	2,000
Departments of Research	138,462
Minor Grants	21,860
Index Medicus	2,700
Insurance Fund	5,000
Reserve Fund	50,000
Total	242,022

The next table shows the departments of scientific investigation to which the larger grants were made for the financial year 1913–14, and the amounts of these grants :—