mankind in central Germany in post-Pleistocene times; Dr. Pfeiffer's inquiry covers both periods.

The tumulus explored by Dr. Möller (he had great difficulty in obtaining permission to undertake the work) lies about twenty miles north of Weimar, on a slight elevation among the flat fields which border the Unstrut—a tributary of the Saale. Interments were discovered which date from the early part of the Neolithic period down to mediæval times—roughly speaking, from 3-4000 B.C. to 1000 A.D. A section of the tumulus—oval in shape and measuring 30 metres in its longest diameter—revealed within it a small tumulus, covering a single interment, of the early Neolithic period. On the southern margin of the smaller and older tumulus were three intrusive burials—in the contracted posture—also Neolithic in date. At the southern base of the tumulus, at a still later Neolithic date, there had been placed a cyst, or slab tomb, flanked with altar floors. The larger tumulus, which covers the older and smaller one, had been thrown up over a fourth interment, a cyst burial, covered with a cairn of stones, which is ascribed to the close of the Neolithic period.

These four burials of the Neolithic period were accompanied by such evidence that their sequence and date could be determined with a fair degree of accuracy. The Bronze period is represented by only one interment, the body having been entombed within a dug-out canoe. The pre-Christian period was represented by three urn-burials; the tomb of a warrior of the fifth or sixth century marked the Merovingian age; lastly, numerous graves of people buried in early Christian times (ninth and tenth centuries) occurred all over the large tumulus. Dr. Möller's attention was more particularly directed to the pottery and other accompanying evidences of civilisation, which gave him a clue to the dates of the various interments. The skeletal remains of the men, women, and children buried in the tumulus, often reduced to little more than dust, are only incidentally touched upon. It will be thus seen that, in expert hands, tumuli become the most valuable of prehistoric documents.

In Dr. Soergel's memoir a most useful contribution is made to the systematisation of our knowledge of the larger mammals which became extinct towards the end of the Pleistocene period. Every palæontologist has observed that the extinction of these great animals is coincident with the progress and distribution of human races in the Pleistocene period. Indeed, Dr. Steinmann (*Die geologischen Grundlagen der Abstammungslehre*, 1908) came to the conclusion that their extinction took place at the hands of man. Dr. Soergel does not agree with that view; he holds that the frequent changes of climate in the Pleistocene epoch led to a manifestation of a high degree of variability amongst certain of the mammalian genera, and that the forms which became most highly specialised—such as the Irish elk—in contradistinction to the less specialised form—*Cervus dama*—became extinct because of their highly specialised characters. An unprejudiced survey of the evidence inclines

the reviewer to regard Dr. Steinmann's conclusion as the nearer approximation to the truth.

Dr. Pfeiffer's memoir—by far the more important of the three—is an honest attempt to lay archæology, so far as it is concerned in investigating the evolution and history of human handicraft, on a firm foundation. His work is beautifully illustrated, and he has spared no pains to obtain evidence by experiment and by direct observation. The scope of his memoir will be best indicated by giving the titles of its seven chapters: i., the technique employed in fashioning stone implements during the periods of stone; ii., the physical conditions determining the various forms of technique employed; iii., various forms of fashioned stones; iv., the bone implements of the Stone periods; v., wood implements of the Stone periods; vi., the utilisation of the products of the chase; vii., the extinction of the industries of the Stone periods. Dr. Pfeiffer does not touch on the evidence of a high surgical technique amongst the people of the Neolithic period. The ancient skulls with clear signs on them of extensive operations and limb-bones with well-healed fractures show that there were daring and successful surgeons amongst the Europeans of the Neolithic period.

THE PASTEURISATION OF MILK.

IN a former article on "Tuberculosis and the Milk Supply" (*NATURE*, November 7, 1912, p. 281), reference was made to pasteurisation as one of the means suggested for the provision of a pure milk supply.

Pasteurisation, as applied to milk, is a process of somewhat indeterminate nature. It denotes the heating of milk to a temperature which may range between 140° F. and 165° F. in "bulk" pasteurisers, in which the milk remains, and is maintained at the temperature employed during the whole period of treatment—some 20-30 minutes—or up to 180° F. in "flash" pasteurisers, in which the milk flows continuously through the apparatus and the period of heating is a brief one. In both cases the milk is immediately run on to coolers. Either method fulfils more or less completely the objects for which pasteurisation is carried out, which are (1) to destroy pathogenic micro-organisms, such as tubercle, typhoid, and diphtheria, that may have gained access to the milk; (2) to reduce the bacterial content of the milk, and, as a consequence, (3) to enhance the keeping qualities of the milk, and to allow its distribution in a merchantable condition. The treatment undoubtedly effects these objects more or less efficiently, but it remains to consider in what manner the after-condition of the milk may be influenced thereby.

By heating milk above a temperature of 165° F. a more or less rapid destruction of the lactic-acid-producing organisms occurs, while the more resistant putrefactive forms largely survive the treatment, and it is owing to this change in the bacterial flora that danger arises should the milk subsequently be kept at temperatures favourable

to bacterial growth and development. It is true that Ayres and Johnson have stated, as a result of their experiments on milk pasteurised at 145° F. for 30 minutes or at 160° F. "flash," that the resultant milk sours similarly to raw milk, and that the relative numbers of the various organisms remain unchanged.

Apart from the fact that these temperatures are probably untrustworthy for killing the tubercle bacillus, it is necessary to point out that, though the relative proportions of the organisms may be unaltered by this treatment, it by no means follows that the actual species remain the same, for the predominant lactic-acid organism (*Streptococcus lacticus* or *Güntheri*) certainly succumbs at these temperatures. In any event, the subsequent bacterial content of pasteurised milk depends not only on the pasteurising temperature, but also on the temperature at which it is subsequently kept. Milk pasteurised at a temperature above 165° F. for any time, and afterwards kept at a temperature above 65° F., always undergoes what may be termed a "peptolytic" change, allied to putrefaction, and the latter may actually occur if pasteurisation has been conducted at 170°-175° F.

With pasteurisation at these higher temperatures, this "peptolytic" change may take place without at first apparent alteration in the milk. These changes, however, do not take place if the milk, after pasteurisation, be kept below 50° F., and this is the crux of the matter so far as the bacterial content is concerned. The real danger of pasteurised milk arises from the fact that the milk is stored by the consumer in warm pantries, or is purposely kept hot in vacuum flasks or food-warmers for infant or invalid feeding! A similar danger may ensue if, as is frequently done, the milk be boiled and allowed to cool spontaneously. It is notorious that summer diarrhoea in children coincides with the period when room-temperatures of 70° F. and upwards prevail, and when the necessity for boiling the milk is considered to be greatest, the proper cooling and protection of such boiled milk being completely overlooked and omitted! The work of Dr. Ralph Vincent in this connection is strongly confirmative of this view.

There can be no doubt that summer diarrhoea of children is not due to an excessive development of the true lactic-acid-producers, for the administration of soured milk or whey is often of service in the treatment of the condition, and soured milk containing vast numbers of these organisms is a valued article of diet in all parts of the world, including the tropics. When summer diarrhoea occurs after the use of raw uncooked milk, the explanation is that an initially dirty milk has been kept at such a temperature that the peptolytic bacteria have developed more vigorously than the lactic forms, and these organisms or their products induce the condition.

If raw and pasteurised milks be kept at blood-heat until curdling ensues, the character of the curd and the microscopical appearances therein will be found to be entirely different, despite the

fact that, even in the raw-milk sample, considerable proteolysis (though from a different cause) may have taken place.

If, then, pasteurised milk is to be taken in preference to raw milk, unless consumed at once there seems to be only two ways of safeguarding its use, either (1) to cool immediately and subsequently to keep it always at a temperature below 50° F., which in summer in the household is difficult to ensure, or (2) to add a sufficiency of an active culture of lactic-acid-producing organisms to reproduce the original condition of the raw milk, which may not be altogether practicable. Similar considerations affect the use of boiled milk. Unless safeguarded, pasteurisation may also lead to less care in the production and distribution of the milk, since obvious change in it occurs more slowly than in untreated milk. There will also be a tendency for the smaller and the less scrupulous dealers to treat dirty or returned milk, and thus to make sure of its ultimate disposal.

There is no need here to enter into the vexed question of the alteration and diminution in nutritive qualities which ensue from heating milk. The lower the temperature of heating the less the alteration, and in this respect pasteurised milk has the advantage over boiled or sterilised milk.

R. T. HEWLETT.

NOTES.

WE announce with regret the death on January 31, at sixty-five years of age, of the Earl of Crawford, F.R.S., president of the Royal Astronomical Society in 1878-79, and distinguished in the world of science by his work for astronomy.

A REUTER telegram from Stockholm announces the death, at sixty-seven years of age, of Dr. G. de Laval, the well-known inventor of the steam turbine which bears his name.

DR. W. CARTER, who for many years was professor of materia medica and therapeutics in the University of Liverpool, and took a large share in the initiation of the Liverpool School of Tropical Medicine, died on February 2 in his seventy-seventh year.

At the annual general meeting of the Royal Astronomical Society, to be held on Friday, February 14, the gold medal of the society will be awarded to M. H. A. Deslandres, for his investigations of solar phenomena and other spectroscopic work, and the Jackson-Gwilt medal and gift to the Rev. T. H. E. C. Espin, for his observations of the spectra of stars and his discovery of Nova Lacertæ.

THE annual meeting of the Iron and Steel Institute will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on Thursday and Friday, May 1 and 2. The Bessemer gold medal will be awarded to Mr. Adolphe Greiner, general director of the Société Cockerill, Seraing, vice-president of the institute. The autumn meeting will be held at Brussels, at a date to be announced later.