

with a little finely divided iron as catalyst, heated at about 950° , when sodium cyanide and carbon monoxide are produced; the sodium cyanide is then decomposed by steam yielding sodium formate and ammonia. Partington and Parker ("The Nitrogen Industry," 1922) state that the United States Government made careful investigations of this process, and that a large plant was said to be ready to begin operations in 1918.

However, the direct catalytic synthesis of ammonia is probably to be regarded as providing the key to the world problem of nitrogen supplies. The atmosphere contains enough—some 4×10^{15} tons, it is said—and to spare; Haber's process makes no excessive demands as regards power or fuel, and it now holds a pre-eminent position in the

field of nitrogen fixation. In view of its proved success and its established position in Germany under conditions both of war and of peace—manufacture there having been proceeding since 1913, and production in Germany to-day being of the order of 600,000 tons per annum of nitrogen—it is not surprising that in the development of the nitrogen fixation industry, which continues to extend rapidly in most European countries, as well as in the United States of America and in Japan, new plants should envisage the application of this process almost exclusively. The advantages which direct synthesis of ammonia offers are, in fact, such as to introduce the method into Norway, the home of the arc process.

(To be continued.)

The Skull of Lord Darnley.¹

IN the year 1869 Mr. J. W. Belt presented to the Royal College of Surgeons a skull—minus a mandible—and a thigh bone, believed by the donor to be those of Lord Darnley. He had obtained them from Mr. Grimshaw, a dealer, who had bought them four years earlier at a sale by Messrs. Sotheby and Co. of certain effects belonging to the Hon. Archibald Fraser of Lovat. The Conservator of the Museum, looking the gift horse in the mouth, entered the bones in the Museum catalogue, with the remark that "the internal evidence afforded by both bones conclusively negatives their authenticity. Darnley at the time of his death in 1567 was about 22 years old, and the bones are those of a man considerably more advanced in life and of great muscular development. The almost complete absence of frontal elevation, which is one of the most striking features in the skull, finds no corroboration in any of the known portraits and descriptions of the young Earl, and the femur could not be that of a person invariably described as 'tall' or 'long,' as calculating at the usual ratio of 27·5 to 100 it would give a height of only 5 feet 2·2 inches." So adverse a decision would be sufficient to deter most from further inquiry, but not Prof. Karl Pearson, who has attempted, with what success we shall see, to establish the authenticity of the more important of the relics, namely, the skull.

In 1880 Mr. T. M. Grimshaw—presumably the same man from whom Mr. Belt obtained the bones mentioned above—offered the Conservator of the Museum of the Royal College of Surgeons a femur bearing a manuscript label to the effect that it was "the thigh bone of Lord Darnley, husband of Mary Queen of Scots, murdered and blown up, February 10th, 1567." This, he stated, had been bought at a sale at Sotheby and Wilkinson's, together with two other bones, "the thigh bone of Little John, the companion of Robin Hood, and the shin bone of Humphrey, Duke of Gloster"; no mention is given of the date of this sale. The femur was purchased and entered in the Museum

catalogue as "that of a very tall man, probably the real thigh bone belonging to the skull," presented eleven years earlier by Mr. Belt, an assumption which is almost certainly correct, for skull and femur exhibit the same peculiar coloration, "such as usually obtains," to quote the new catalogue, "in bones that have lain long in a peat bed."

If we accept, as we think we safely may, the single origin of the two relics, namely, the skull presented in 1869, and the femur purchased in 1880, then clearly, from the point of view of authenticity, they must stand or fall together. The authenticity of the femur gains support from the manuscript label, but suffers from the strange company in which the bone appears, company for which Prof. Pearson has no use, dismissing them summarily as "bones of most absurd attribution." In this we think Prof. Pearson has done wrong, for a little inquiry would have shown that the bones might very well be those of the more or less venerable Englishmen to whom they were ascribed. 'Little John'—or such part of him as was not apocryphal—was a big, stalwart man, whose grave is still to be seen in Hathersage churchyard. The grave was rifled, we are told, in 1782, and again in the early years of last century, when a thigh bone, measuring, it is said, 32 inches, was taken from it.²

Humphrey, Duke of Gloucester, murdered at Bury St. Edmunds, was buried in St. Albans Cathedral. The leaden coffin containing his body, and "full of pickle," was opened in the reign of Queen Anne; the body was taken out of the preserving fluid, and "reduced to a skeleton, the smaller bones of which the vergers permitted visitors, for a due consideration, to carry away."³ If, then, the two bones can scarcely be described as Daniels come to judgment, they are nevertheless not the guys which at first sight they appeared. They further serve the useful purpose of restoring our confidence in the good faith of Sotheby and Grimshaw, a not unimportant matter, seeing that they are among the sponsors for the relics. Sir Arthur Keith⁴ thinks it "most probable" that

¹ Biometrika : a Journal for the Statistical Study of Biological Problems. Edited by Karl Pearson, assisted by Egon S. Pearson. Vol. 20 B, Part 1, July. Pp. 104+46 plates. (London : Biometric Laboratory, University College, 1928.) 21s. 6d. net.

² "Guide to Buxton, the Peak, Dovedale, etc." (London : Ward, Lock and Co.)

³ "Saint Albans" (Bell's Cathedral Series).

⁴ British Medical Journal, Sept. 8, 1928.

the femur presented by Mr. Belt with Darnley's skull was the femur of 'Little John.' This can scarcely be, but, granted a certain confusion, and such appears to have occurred, and was not unlikely in a saleroom, where such objects as bones can be so easily mislaid, forgotten, and wrongly ascribed, it is not impossible that the femur in question is that of Humphrey, a man of no little importance in his day, own brother as he was of Harry of England.

It is now time to record certain strange events which followed on the death of Darnley. His body, blown up by the explosion at Kirk o' Field on the morning of Feb. 10, 1567, was bowelled and embalmed with perfumes and spices, and four days later buried in the Royal Vault in the south-east corner of the Abbey Church at Holyrood. There the body lay in undisturbed privacy until January 1683, when, in the removal of certain seats, the Royal Vault was discovered and found to contain six leaden coffins. Of these, two contained the bodies of children, the infant sons of James V.; three bore on them, or near them, inscriptions indicating that they contained the bodies of James V., his first Queen, Magdalen, and his illegitimate daughter, the Countess of Argyll. James's body was coloured black with the balsam which preserved it, which was like melted pitch. The sixth and largest coffin contained a body not so long as that of James V., with the muscles of the thigh seemingly entire, and with balsam stagnating in some quantity at the foot of the coffin : it bore no inscription, but it was generally and confidently supposed to be that of Lord Darnley.

In 1688 the 'Glencairn purging' included the violation of the Royal Vault, but apparently the bodies were left more or less intact, for in 1735—*incredible though it seems*—they were seen "lying open to the view," the coffins having been broken into by the mob in 1688. Still later, in 1776, they were seen by Arnot, "the head of Queen Magdalen being entire and even beautiful." In 1778 the same antiquary reports that both the Queen's head and Darnley's skull had vanished. It will be noticed that references are to Darnley's skull, not to his head, from which we may presume that the embalming, always "an hazardous piece of art," had not been so successful in his case as in that of Queen Magdalen. No mention is made of the colour of his skull, but it seems not unreasonable to assume that it was like that of James V., black.

We next hear of the skull through Alexander Campbell, who wrote that it "is preserved among the curiosities of the Antiquarian Society of Scotland, exhibiting melancholy proof of the effects of his incontinence"—a significant remark, for it implies that some part or parts of the skull had been eaten away, the popular and not unscientific conception of the effects of syphilis, and further explains the relative ease and confidence with which the relic was followed in its subsequent wanderings. In spite of Campbell's statement, no mention of the skull has been found in any of the catalogues of the Scottish Society of Antiquarians, an omission attributed with some reason to its being the per-

sonal property of James Cummyng, the secretary of the Society, who would naturally hesitate to make it publicly known that he was in possession of so important a relic, obviously nefariously acquired. At his death it is believed it was sold by his executors with other of his effects, passed into the hands of an Edinburgh sculptor, and finally into those of Archibald Fraser of Lovat. No mention, it will be noted, is made of the thigh bone until it appeared with the skull in Sotheby's catalogue.

Such, then, is the historical evidence—not, it is true, absolutely convincing, and yet not, we think, to be lightly set aside in view of the general and confident identification of the body in the large coffin, of the early recognition of distinctive marks on the skull, and of the reputation of the various witnesses. The chain of evidence is complete, but not all the links are strong.

We now pass to a consideration of the actual relics, for confirmatory or rebutting evidence. First, as regards their colour: this varies from a light brown to a blue-black. Dr. H. A. Harris, in a recent article,⁵ attributes both the colour and the polish, here and there apparent, to the bones having been painted with shellac. Prof. Pearson attributes them to the body having been embalmed, to the "stagnating balsam," to which reference has already been made. The question cannot, we infer, be decided by the chemist, as both shellac and balsam are resinous substances. Of the two explanations, we are inclined to accept that of Prof. Pearson. The extreme variations in colour, thickness, polish,—the patchy distribution are all against the coating being due to the undiscriminating 'dead' hand of man working with a uniform medium, and in favour of the more or less natural 'wash' of a solution of varying composition, picking out for different treatment different anatomical areas. We would particularly instance the appearance of the posterior surface of the neck of the femur, there being a sharp distinction between the colour and patina of the upper and lower parts, the line of separation agreeing exactly with the line of attachment of the capsule of the joint. It is difficult, again, to explain on Dr. Harris's hypothesis why the interior of the cranium is similarly coloured to the exterior.

If, then, we are inclined to accept Prof. Pearson's explanation, we might hope to find some evidence of embalming, in clinging remains of soft tissues: these we find in the interior of the cranium, for not only is part of the general dura mater still evident, but we can actually see on the left side of the mid-line the lacunæ laterales stretching from frontal to occipital region—a piece of evidence not available to Prof. Pearson when he wrote his monograph, for at that time the skull had not been opened. That the skull was never buried in the usual way is almost certain. Sir Arthur Keith has shown that there is an entire absence of earth in any of the natural cavities, such as the cranial cavity, external auditory meatus, tympanum, sphenoidal sinus. It may, however, be argued that

⁵ *British Medical Journal*, Sept. 15, 1928.

the skull was that of a criminal whose body had been handed over to an anatomical department. This might be so, but in such case we should expect the calvaria to have been removed, and the bones, if kept, completely macerated. The evidence for the belief that the skull and femur are from an embalmed body is, in our opinion, strong. The description of the appearance of the body of James V., and the statement that Humphrey's coffin was full of pickle, will convey some idea as to what the results of embalming in certain circumstances might be.

We now come to the strangest of all the features of the skull, the presence of a large number of more or less circular pits on the vault—"the melancholy proof of the effects of his incontinence," to quote again Alexander Campbell. These, by many, if not by most, have been attributed to syphilis, and Prof. Pearson is at great pains to prove that Darnley suffered from this complaint, which, presumably, had reached the tertiary stage at the time of his death. We do not propose to enter into the arguments for this opinion, for we are convinced that the pits are not due to disease, the complete absence of all signs of inflammatory reaction, as both Dr. Harris and Sir Arthur Keith have pointed out, definitely negativing such a theory. If, then, as Prof. Pearson asks, they are not due to syphilis, to what are they due? Dr. Harris confidently dismisses them as artefacts made with some such instrument as a bradawl. He gives no reason for so singular a procedure on the part of an 'unknown,' but no doubt the idea of faking evidence might be advanced. Dr. Harris's theory leaves unexplained the inequality in the size of the pits, the singular manner in which they are grouped, and their confinement to, practically, one side.

Our own theory of the pits is that they are due to the action of some burrowing insect. We arrive at this partly because, excluding the two theories already mentioned, little else remains, partly because it is well known that an extensive fauna preys upon the bodies of the dead, but mainly because of certain positive reasons. A close scrutiny of the pits will show that their circumferences not infrequently intersect, that the pits often occur in pairs, that at times part of the circumference shelves, giving a pyriform outline to the pit, at times a shallow groove leads from one pit to another, producing a dumb-bell appearance. Such features are, we consider, in keeping with what we know of the action of burrowing larvæ, which, when they meet anything uncongenial, are in the habit of moving a little aside and then proceed to burrow afresh. The varying size and shape, the number, arrangement, and distribution of the pits, all lend support to such an explanation. Can we obtain any corroboration?

Sir Arthur Keith, when in Glasgow lately, observed certain skulls somewhat similarly pitted: two of these have now been lent by Prof. Bryce to the Royal College of Surgeons, where we have had an opportunity of examining them. They are from a medieval graveyard at Crosschurch, Peebles.

Although the pits on these skulls are not so numerous or so cleanly cut as those on the 'Darnley' skull, they are, in our opinion, essentially of the same character. Further, near a pit on one of the skulls we have noticed a collection of what appears to be bone debris and earth, stuck to the skull possibly through admixture with some animal excretion, reminding us forcibly of the description by Prof. Elliot Smith of the collections left by beetles on Egyptian skulls.⁶ Prof. Elliot Smith, however, is insistent on the fact that beetles only attack skulls which have been buried, a restriction with which of course the Crosschurch skulls conform, but not, if we are correct in our 'embalming' theory, Darnley's. Our ignorance, however, of the conditions within the large lead coffin both before and after the contents were exposed is such as to prevent us from offering any opinion as to whether they were more or less favourable to insect life. The pits do not appear to us to have any significant bearing on the question of the authenticity of the skull.

We have now to consider the form of the bones, and finally the age of the individual to whom they belonged. The femur clearly is that of a tall, spare individual of no marked muscular development. We are fortunate in knowing what Darnley's legs were like, for we have an admirable full-length portrait of him, aged seventeen, in doublet and hose, by Hans Eworth. Although, admittedly, there is little individuality in legs, those of the portrait are exactly those which we should expect the owner of the 'Darnley' femur to possess.

As to the skull, we fail to find those signs of great muscular development to which the Conservator of the Royal College of Surgeons in 1867—Sir William Flower—refers. We venture to think that if the skull were macerated and bleached, it would in a large measure lose such indications of muscular development as it may be thought to show. The outstanding feature of the skull is, however, as Sir William Flower pointed out, the absence of frontal elevation. Of this, it will be remembered, he found no corroboration in any of Darnley's portraits; on the other hand, we find no certain refutation. In considering this question we must remember that portraits in early life are misleading, for then the skull is naturally of a different shape from that which it ultimately attains, and in no region, unless it be in that of the jaws, is the difference greater than in the frontal region. All the portraits on canvas which we possess of Darnley are full-face, and hence any absence of frontal elevation is, or may be, relatively unapparent. The so-called Cenotaph portrait was painted some time after death, and is, for reasons which Prof. Pearson makes plain, entirely untrustworthy. There are, however, two portraits on medals commemorating the marriage of Darnley and Mary—a third is apparently a copy of one of the others—which show Darnley in profile. They are too crude to justify any confident expression of opinion, but they go some way towards corroborating the authenticity of the skull. By the use of Coradi's

⁶ *Lancet*, 1908.

pantograph, Prof. Pearson has superimposed skull on portrait, and brought out still more clearly the resemblance. We agree, too, with Prof. Pearson in finding more than a hint of a low, retreating forehead in the important full-face portrait belonging to the Duke of Devonshire, masked though it be by 'cap and hair.' On the whole, we consider the evidence of the portraits not antagonistic to the claim of authenticity.

We now come to the most critical of all the questions, for clearly, if it can be definitely shown that the bones are not compatible with their being those of a man of Darnley's age, $21\frac{1}{2}$ years, then the whole of the argument falls to the ground. To answer such a question we naturally turn to the epiphyseal lines of the femur, the spheno-occipital joint, the sutures of the cranium, and to the teeth—although all these last are missing, the empty sockets are available. We may say at once that an examination of these parts by the unaided eye gives no justification for denying the authenticity of the bones. Dr. Harris, who has paid much attention to these matters, studying them, moreover, with the aid of X-rays, thinks otherwise, and puts the age of the individual to whom the bones belonged at not less than twenty-five. He confirms his view by reference to the size of the diploic veins. Even if we accept, as with certain reservations we are disposed to do, Dr. Harris's generalisations, we would point out that the range of variation in all departments of human anatomy

is wide, and nowhere perhaps wider than in such matters as those under consideration, and that in these circumstances we must allow a corresponding latitude in judgment. Nor, we would add, are the results of X-ray photography as a rule only open to one reading and interpretation.

A review of the evidence, historical and anatomical, leaves us no option, we think, but to conclude that, while certainty is denied, there is very strong probability that the relics considered, once formed part of that young, proud prince who caught the eye and won—if only for a season—the heart of perhaps the most romantic figure of modern times—"red star of boyhood's fiery thought."

Although this is neither the time nor the place to enter into considerations of Mary's character and of the part she played in Darnley's murder, we cannot conclude without paying high tribute to the learning and eloquence of the latest of her apologists. We remain, however, unconvinced. "Has he shown," as David Hume was in the habit of asking, "that she didn't marry Bothwell?" Alternatively, what of Chastelard? It was her participation, active or passive, in the two tragedies of Darnley and Chastelard, which more than all else was responsible for the bitter and almost universal hatred of two great nations, neither notably lacking in generosity and sentiment, and which drove her, a fugitive queen, to seek refuge in a foreign land.

WILLIAM WRIGHT.

News and Views.

IN continuation of a practice that NATURE has pursued for the past four years, there is printed elsewhere in this issue the first instalment of a new calendar, which will be devoted to items of importance and interest from the records of British and other patents for inventions. No apology is needed to our readers for the choice of this subject, for it will be fully realised that the literature of patents (which now includes amongst a mass of other material upwards of four million separate specifications of inventions from all countries) forms a survey of the industrial progress of the world from the seventeenth century onwards that stands unrivalled. Not much of this literature, of course, is concerned with epoch-marking inventions, but a great deal of it refers to lesser-known patents which have had no little influence on subsequent developments. Some of these have made their contribution direct, whilst others, though not themselves put into practical use, have yet stimulated later inventors, and have often formed the basis on which the final success has been achieved; others, again, have had their day and (perhaps only for a time) have passed into oblivion. It is with this class rather than with the well-known inventions that the calendar is intended mainly to deal, whilst it is felt also that a few notes should be included on some of those fruitless and extravagant ideas that are scattered through the records and have resulted in nothing but the shattering of life-long ambitions. Of necessity, the bulk of the material will be taken from British records,

since these cover a longer period of time than any others, and are for the most part more easily accessible; but foreign dates of interest will also be included from time to time.

No part of Africa suffered more from the War than the Mandated Territory of Tanganyika, which comprises most of what was formerly German East Africa. From practically the beginning to the end it was a scene of conflict, with consequent breakdown of the administrative services, dislocation of its communications, interference with the normal occupations of the native inhabitants and the destruction of lives, their villages, crops, and domestic livestock. The task of repairing the havoc had to be undertaken by British officials who replaced the deported Germans. Most of these British officials were unfamiliar with the country and its peoples. They deserve the greatest credit, therefore, for the way they have coped with the difficulties of their situation. Their success can best be measured in terms of the trade of the country. The present exports and imports show a marked increase on those of pre-War years. New varieties of crops have been introduced, and the cattle industry is in a flourishing condition. The education and other social services have been greatly extended. Hundreds of miles of new railways have been constructed.

IN September next, under the presidency of the governor, Sir Donald Cameron, Tanganyika is to hold its first Agricultural and Industrial Exhibition,