

cholera); and inoculation with them or their toxins inures the individual so treated to resist the attacks of micro-organisms of the same species and of the normal degree of virulence. One way of attenuating or rendering less virulent the toxins is to inject them into an animal that does not easily perish of them (e.g. horse, as regards diphtheria), when they undergo partial intracellular digestion within his tissues. His blood serum then contains altered toxins (the so-called anti-toxins), experience of which inures the cells of an animal of a more susceptible species (e.g. man) to resist the attack of virulent micro-organisms with unaltered toxins. It is noteworthy that when toxins and anti-toxins are mixed the latter may inure the cells to the former before death occurs, for the reason that these do not under normal conditions cause immediate death. For this reason animals are able to withstand much more than a fatal dose of a toxin when it is mixed with the appropriate anti-toxin, and sometimes even to recover from a disease which would otherwise be fatal if during the course of it the anti-toxin is injected. But toxins and anti-toxins are not retained within the system. They are digested by the cells and excreted, and therefore enduring immunity is not conferred by their presence, but by the fact (in some diseases at least) that when the cells are once inured they remain so.

It is clear that the serum treatment can be useful only in diseases against which immunity may be acquired, if only for a short time. In other diseases (e.g. tuberculosis, malaria, leprosy) against which immunity cannot be acquired, which do not run a pretty definite course of limited duration, of which one attack does not protect against subsequent attacks, it is useless; for here training does not benefit the cells, or if in some cases it does benefit them, this benefit is of such limited duration as to be practically useless.

After this, from want of space, very dogmatic statement of the rationale of serum-therapeutics, let us inquire what may be hoped for from the ceremony of blood-brotherhood in its medical aspects. Clearly nothing. It will not, of course, endow the traveller with his blood-brother's powers of resisting hardship (heat, cold, hunger, &c.); it will not confer immunity or increased powers of resistance against that class (the most death-dealing class) of diseases against which immunity *cannot* be acquired; and lastly, it will not confer immunity or increased powers of resistance against that class of diseases against which immunity *can* be acquired, unless there is present in the blood-brother this or that micro-organism in an attenuated form, or unless antitoxins are present in him to an inconceivable degree of concentration—very remote possibilities, or rather impossibilities, on which the traveller were wise not to count. On the other hand the blood-brother may communicate actual virulent disease, for instance syphilis and malaria.

G. ARCHDALL REID.

#### Remarkable Sounds.

IN a Japanese work, "Hokuetsu Kidan," by Tachibana no Mochiyo (published *circa* 1800, tom. ii., fol. 5, *seqq.*), I have found some remarkable sounds described. Among the details given therein of the "Seven Marvels of the Province of Echigo," we read: "The fifth marvel, the Dônari [literally *Body Sounds*, or *Temple Sounds*], is a noise certain to be heard in the autumnal days, just before a fine weather turns to stormy, it being sounded as if the thunder falls from the cloud, or the snow slides down a mountain. Where it originates is quite uncertain, as there are in the counties several mountains assigned therefor. The sounds are heard of same intensity in variously distant places." Further, the author recites a folk-tale current in his time among the villagers of Kurotori, in Co. Kambara, which attributes these sounds to the head and body of a hero, Kurotori Hyôe [killed in 1062?]; separately interred under a Shintoist temple in this village, they ever strive to unite once more. "The marvel, it is said, is now seldom met with; still it occurs frequently within two or three miles of the village, proceeding doubtless from the precinct of the temple. And the fact is more wonderful that the inhabitants of Kurotori themselves never hear the sounds unless they go out of the village." Concluding the narrative, the author, from his personal observation, argues the action of the tide-waves upon the earth to be the real cause of these curious sounds.

May 18.

KUMAGUSU MINAKATA.

NO. 1387, VOL. 54]

#### BOSNIA-HERZEGOVINA AND DALMATIA.

THE progress of prehistoric archaeology, the youngest of the inductive sciences, is one of the more important facts in the history of the intellectual development of the latter half of the nineteenth century. Up to 1870, attention was chiefly directed to the antiquity of man and his place in the geological record, and to the classification of his advance in the Neolithic, Bronze, and Iron ages in Europe. Man was proved to have lived in a remote past, not to be measured by years and under climatal and geographical conditions totally different to those now met with in Europe. The next ten years were chiefly spent in elaborating the details as to the range of Palæolithic man, and in working out the sequence of events, separating the Pleistocene period from the dawn of history. The Neolithic, Bronze, and Prehistoric Iron ages of human progress were traced far and wide over nearly the whole of the old and the greater part of the new worlds. In the last decade the centre of archaeological interest has shifted slowly in the direction of the frontier of history. On the one hand the researches of Flinders Petrie have revealed the close connection of ancient Egypt with the nations of the Mediterranean long before the rise of the Greeks, and have rendered it possible for us to use the Egyptian chronology as the standard to fix the date of prehistoric events in Southern Europe and in Asia Minor. On the other, in these latter areas, many workers, among whom Schlieman stands foremost, have revealed the manners and customs, the daily life, the modes of warfare, the habitations, fortresses and tombs of the very peoples who were in touch with Egypt. We even know, thanks to Arthur Evans, that there was a system of writing in the Ægean area long before the introduction of the Phœnician alphabet, and we may look forward to his future researches to make it intelligible.

A valuable book<sup>1</sup> on Bosnia-Herzegovina and Dalmatia is the last contribution to the subject. Under the modest title of "Rambles and Studies," it might very well be taken for the usual book of travels in a land of wonderful beauty, till now practically closed to the ordinary traveller. Under the Austro-Hungarian dominion, now some twenty years old, good roads have replaced the old tracks, and law and order reign instead of the brigandage of the past. New lines of railway and of steamers connect the chief centres, manufactures are encouraged, and schools for the education of both Christian and Moslem are in full swing. There are luxurious hotels in place of the old caravanserais, and the records of the past are being carefully preserved in museums, under the charge of competent scientific men, instead of being ruthlessly destroyed, as they were under the old *régime*. There are snow-covered mountains, great rivers and waterfalls, like those at Ottawa, and lakes embosomed in trees. There are ravines, like those of Miller's Dale, only larger, and caverns, and all the characteristic scenery of the limestone forms the surface of the country. The interest, however, chiefly centres in the inhabitants. The present phase of transition from Eastern to Western ideas is of special value at this time, when the cry of oppressed lands is ringing in the ears of the Western nations, because it shows with what extraordinary rapidity a people ground down to the dust for centuries by the Turk, may become happy and prosperous under a good system of local self-government. What the Austro-Hungarians have done in the Bosnia-Herzegovina, may be done by the Powers in Asia Minor and in the islands of the Ægean Sea. From this point of view Dr. Munro's well-written book is worthy of the attention of our rulers. Dr. Munro has dealt with all these things with a light and pleasant

<sup>1</sup>"Rambles and Studies in Bosnia-Herzegovina and Dalmatia." By Robert Munro, M.A., M.D., F.R.S.E. 8vo. (Blackwood, 1895.)

hand. He, accompanied by Mrs. Munro, travelled under great advantages. He went in 1894, at the invitation of the Austro-Hungarian Government, to attend an archaeological congress, and he has made the most of his opportunities.

It is not, however, the traveller's side of the book which more immediately concerns us. It is rather with it as a contribution to archaeological literature, in which the author brings to bear, on the discoveries made in those lands by others, the scientific method which he had already used so well in carrying out his investigations into Lake-dwellings in Britain and on the continent. We shall review in their chronological order the more important of the discoveries, now laid before English readers, in a quarter of Europe shut off by lofty mountain ranges from the pathways of the nations.

The group of Neolithic remains at Butmir gave rise to much difference of opinion at the congress. According to Mr. Radimsky, they were deposits of refuse round ancient huts on the land, and the irregular amœba-like hollows in the clay were taken to be the bases of huts. In Dr. Munro's opinion these hollows were made by the extraction of the clay for the covering of the wattles of the huts, as well as for the large amount of pottery and terra-cotta found on the site. He points out that they have been filled up by the deposit of silt under water, as well as by human débris, and concludes that the whole accumulation was formed in and round pile-dwellings like those of Switzerland, the piles of which, as well as all the other woodwork, have wholly rotted away. We agree with this view; and would advance a further argument in its favour, that a settlement on a clay soil liable to floods is unknown in the history of Neolithic dwellings. On that spot pile-dwellings would be the only habitations possible. The inhabitants were skilful potters, and their vessels made by hand were in some cases ornamented by spirals. They also manufactured stone implements, polished axes, spears, arrows, and the like. They were also spinners and weavers; they had herds of pigs, domestic oxen, among which we may note the short-horned ox (*Bos longifrons*), and flocks of sheep and goats. In their fields they grew wheat and barley, and carried on a trade by barter with other communities. The rude terra-cotta idols imply that they had some kind of religion. Their burial-places have not yet been discovered. Among the purely Neolithic remains are twenty-seven perforated axe-hammers of a type found in the Bronze age elsewhere, and made of a stone which does not exist in the district. With the exception of three, all the rest of the implements amounting to 5118, are of native stone. It is probable that in this out-of-the-way place the Neolithic civilisation lingered long after the Bronze age had begun in the more accessible surrounding districts. We may accept Dr. Munro's conclusion, that the settlement of Butmir "is one of the side eddies of the early stream of immigrants who found their way into Europe by the Danubian valley from the regions to the south and east of the Black Sea," in the Neolithic age, and who lived on into the Bronze age—an age which in Bosnia is not so well defined and conspicuous as it is in Germany, Scandinavia, and Western Europe generally.

While bronze implements and weapons were gradually finding their way into Bosnia-Herzegovina, a new civilisation appeared at the head of the Adriatic, and extended over the southern watershed of the Danube, Northern Italy, the Tyrol and the adjacent regions, known, from the principal site of the discoveries, as that of Hallstadt. From this centre the characteristic products were scattered far and wide over Europe by means of commerce, marking the close of the Bronze and the beginning of the Iron age. The tumuli on the plateau of Glasinac, more than 20,000 in number, mark this age in Bosnia. Of these about one thousand have been explored, proving

that both inhumation and cremation were practised. The articles buried with the dead consist of iron knives, swords, spear-heads and axes, some double-edged, others in the shape of socketed celts. Bronze vessels, pendants, bracelets, finger-rings, and brooches, were discovered in great variety. The brooches are of great interest as indices to the age of the tumuli. This is marked by the stage presented in the evolution of the brooch from a straight pin. The first stage is presented by the bending of the pin; the second, by its being twisted round so that the point is brought to rest on a development of the head specially made to receive it; the third, by the development of one or more twists, so as to form an elastic spring or springs—the safety-pin type. From those of one spring, the Greek and Roman fibulæ are descended. At Glasinac about 44 per cent. were those with two springs, or of the Hallstadt type. Those with one are more closely allied to the Greek, while others are purely Roman. A helmet from a tumulus at Arareva is of pure Greek type and similar to one found at Olympia, bearing an inscription that it was dedicated by the Argives to Zeus out of the spoils of Corinth. It is also identical with the helmet on a warrior carved on the Harpy Tomb, Xanthos, Lycia, in the British Museum. Both these belong to about the middle of the sixth century before Christ. These things were found along with an infinite variety of ornaments and implements of bronze, iron and silver, of glass and amber and bone, together with fragments of pottery. It is obvious that these tumuli were used from the remote Hallstadt time down to the days of the Roman dominion. It is not a little remarkable that there is no mention of coins in the three elaborate volumes recording these discoveries, published by the scientific staff of the Public Museum in Sarajevo. Coins had not then found their way into the country, or if they had, were not buried with the dead.

In 1890 a cemetery was discovered at Jezerine, belonging to the same period as the tumuli of Glasinac, and containing the same types, but with fewer weapons. It is remarkable for the beautiful rings and beads made of blue, yellow, white and green glass. A gravestone with a figure of a warrior found here is assigned by Dr. Hoernes to the late Hallstadt period. The helmet with the lofty crest reaching far down the back is identical with that carved on the Harpy Tomb at Xanthos, and those on the heads of warriors, on painted early Greek vases. It may very well be of late Hallstadt age, as well as early Greek.

Besides burial-places such as the above, there are numerous forts belonging to this people, similar in construction to the hill-forts of Scotland, and built of rubble masonry without mortar.

Nor are we without evidence as to the physique of the people themselves. Of thirty-two human skulls from Glasinac, examined by Dr. Glück, 76 per cent. are either long or mesocephalic, while 24 per cent. are short; a fact of considerable interest when contrasted with the present roundness of head of the Bosnians. Out of 1500 natives examined by Dr. Weissbach, 7 per cent. only were long and 93 per cent. short.

The prehistoric inhabitants of Bosnia, like those of Hallstadt, were mainly long-headed, while the presence of the short-headed minority shows the existence of two races in both regions. The reversal of this in Bosnia in later times is due to the immigration of short-headed people, mostly Slavs, from the time of the tumuli down to the present day. It may be inferred that in Herzegovina and Bosnia, as in Western Europe, the aboriginal and Neolithic peoples were long-headed, and that they were invaded by a new race of round-headed conquerors. Whether this took place in the Bronze age must be left for future inquiry, and whether it took place from the line of the valley of the Danube, or, as Dr. Munro suggests, by the head of the Adriatic, must also be left an

open question in the present condition of the inquiry. The close connection with Hallstadt renders the latter view the more probable, although there is clear proof of the Greek influence from the south. This, however, it must be admitted, may belong to a later period.

In closing this review, we may congratulate Dr. Munro on his success in writing a book which is short, picturesque, and scientific; and we feel sure that he will gain his end, of attracting attention to the archæological treasures awaiting the explorer in this hitherto little-explored corner of Europe.

W. BOYD DAWKINS.

### EXPERIMENTS IN MECHANICAL FLIGHT.

I HAVE been for some years engaged in investigations connected with aerodromic problems, and particularly with the theoretical conditions of mechanical flight. A portion of these have been published by me under the titles "Experiments in Aerodynamics" and "The Internal Work of the Wind," but I have not hitherto at any time described any actual trials in artificial flight.

With regard to the latter, I have desired to experiment until I reached a solution of the mechanical difficulties of the problem, which consist, it must be understood, not only in sustaining a heavy body in the air by mechanical means (although this difficulty is alone great), but also in the automatic direction of it in a horizontal and rectilinear course. These difficulties have so delayed the work, that in view of the demands upon my time, which render it uncertain how far I can personally conduct these experiments to the complete conclusion I seek, I have been led to authorise some account of the degree of success which has actually been attained, more particularly at the kind request of my friend Mr. Alexander Graham Bell, who has shown me a letter which he will communicate to you. In acceding to his wish, and while I do not at present desire to enter into details, let me add that the aerodrome, or "flying-machine" in question, is built chiefly of steel, and that it is not supported by any gas, or by any means but by its steam-engine. This is of between one and two horse-power, and it weighs, including fire-grate, boilers, and every moving part, less than seven pounds. This engine is employed in turning aerial propellers which move the aerodrome forward, so that it is sustained by the reaction of the air under its supporting surfaces.

I should, in further explanation of what Mr. Bell has said, add that owing to the small scale of construction, no means have been provided for condensing the steam after it has passed through the engine, and that owing to the consequent waste of water, the aerodrome has no means of sustaining itself in the air for more than a very short time—a difficulty which does not present itself in a larger construction where the water can be condensed and used over again. The flights described, therefore, were necessarily brief.

S. P. LANGLEY.

Through the courtesy of Mr. S. P. Langley, Secretary of the Smithsonian Institution, I have had on various occasions the privilege of witnessing his experiments with aerodromes, and especially the remarkable success attained by him in experiments made on the Potomac River on Wednesday, May 6, which led me to urge him to make public some of these results.

I had the pleasure of witnessing the successful flight of some of these aerodromes more than a year ago, but Prof. Langley's reluctance to make the results public at that time prevented me from asking him, as I have done since, to let me give an account of what I saw.

On the date named, two ascensions were made by the aerodrome, or so-called "flying machine," which I will not describe here further than to say that it appeared to me to be built almost entirely of metal, and driven by a

steam-engine which I have understood was carrying fuel and a water supply for a very brief period, and which was of extraordinary lightness.

The absolute weight of the aerodrome, including that of the engine and all appurtenances, was, as I was told, about 25 pounds, and the distance, from tip to tip, of the supporting surfaces was, as I observed, about 12 or 14 feet.

The method of propulsion was by aerial screw propellers, and there was no gas or other aid for lifting it in the air except its own internal energy.

On the occasion referred to, the aerodrome, at a given signal, started from a platform about 20 feet above the water, and rose at first directly in the face of the wind, moving at all times with remarkable steadiness, and subsequently swinging around in large curves of, perhaps, a hundred yards in diameter, and continually ascending until its steam was exhausted, when, at a lapse of about a minute and a half, and at a height which I judged to be between 80 and 100 feet in the air, the wheels ceased turning, and the machine, deprived of the aid of its propellers, to my surprise did not fall, but settled down so softly and gently that it touched the water without the least shock, and was in fact immediately ready for another trial.

In the second trial, which followed directly, it repeated in nearly every respect the actions of the first, except that the direction of its course was different. It ascended again in the face of the wind, afterwards moving steadily and continually in large curves accompanied with a rising motion and a lateral advance. Its motion was, in fact, so steady that I think a glass of water on its surface would have remained unspilled. When the steam gave out again, it repeated for a second time the experience of the first trial when the steam had ceased, and settled gently and easily down. What height it reached at this trial I cannot say, as I was not so favourably placed as in the first; but I had occasion to notice that this time its course took it over a wooded promontory, and I was relieved of some apprehension in seeing that it was already so high as to pass the tree-tops by twenty or thirty feet. It reached the water one minute and thirty-seconds from the time it started, at a measured distance of over 900 feet from the point at which it rose.

This, however, was by no means the length of its flight. I estimated from the diameter of the curve described, from the number of turns of the propellers as given by the automatic counter, after due allowance for slip, and from other measures, that the actual length of flight on each occasion was slightly over 3000 feet. It is at least safe to say that each exceeded half an English mile.

From the time and distance it will be noticed that the velocity was between twenty and twenty-five miles an hour, in a course which was constantly taking it "up hill." I may add that on a previous occasion I have seen a far higher velocity attained by the same aerodrome when its course was horizontal.

I have no desire to enter into detail further than I have done, but I cannot but add that it seems to me that no one who was present on this interesting occasion could have failed to recognise that the practicability of mechanical flight had been demonstrated.

ALEXANDER GRAHAM BELL.

### THE APPROACHING CELEBRATION OF THE KELVIN JUBILEE IN GLASGOW.

IT may interest our readers to state the programme of the approaching celebration of the jubilee of Lord Kelvin as Professor of Natural Philosophy in the University of Glasgow.

On the evening of Monday, June 15, at 8.30 p.m., the University will give a conversation, when there will be an