

The Glaciers of Dauphiné.¹

IN NATURE of Mar. 27, 1926 (vol. 117, p. 456), an account was given of the important glaciological work carried on by the French Direction Générale des Eaux et Forêts on the principal glaciers of the chain of Mont Blanc. A further volume of results has now been published relating to similar work on the glaciers of the Alps of Dauphiné, those descending from the great peaks of la Meije, les Écrins, and Mont Pelvoux. It will be remembered that the principal glaciers in question are as follows: On the north of the Meije group of peaks, facing the Romanche valley, in which is situated La Grave, there are the glaciers de la Meije, de Tabuchet, de l'Homme, de Râteau, du Lac, de la Girose, and du Mont-de-Lans; on the south side, facing the valley of Vénécion, is the glacier de la Selle; from the north-east and north-west flanks of les Écrins respectively descend the glaciers Blanc and de la Bonne Pierre, and between les Écrins and Mont Pelvoux, north of the latter, the glacier Noir; while from Mont Pelvoux and its flanking companion peak the Ailefroide descends on the west the glacier de la Pilatte.

All these glaciers have been under observation, survey, and accurate measurement since the year 1911, and some of them since 1909, with the exception of the two first War years, 1914 and 1915, right up to the present time, the report giving the results up to 1924. In addition, the glaciers of the Grandes Rousses group, north-west of the Meije-Écrins-Pelvoux chain, those of Saint Sorlin, des Quirliès, des Malâtres, du Grand Sablat, de Sarnnes, and des Rousses, have also been observed.

From the commencement in 1909, when the glaciers de la Selle, de la Girose, and du Mont-de-Lans were studied, it was obvious that the period of retrogression, hitherto for many years so obvious, was coming to an end, if it had not actually terminated, so that the time chosen for this great survey of glaciological movement was most propitious. The official observers of the Département des Eaux et Forêts had the advantage of the collaboration of Profs. Blanchard and Flusin of the University of Grenoble, and of Prof. Bénévent of the École Supérieure.

The first results obtained in 1909 showed that while the glacier de la Selle was still very slightly in retreat, the Girose and Mont-de-Lans glaciers had really begun to advance, the snout of the last-mentioned glacier being thrust forward nine metres beyond its position in 1908. Moreover, the general appearance of both glaciers had changed enormously, much of the ground hitherto left bare at the sides during the retreat having been recovered. When observed again in the summer of 1910, a very stormy year of great snow blizzards, all three glaciers showed a clear advance.

In 1911 the observations were extended to the glaciers de la Meije, du Lac, du Râteau, and the six

glaciers already named of the Grandes Rousses, and the advance found to be general, a clear frontal (snout) advance of all the glaciers being revealed by the measurements, together with a great augmentation of the upper snowfields and névé. The next summer, 1912, was very wet and cold, and avalanche residues persisted to quite an unusual extent, so that the snow augmentation above, on, and about the glaciers was very remarkable.

In 1913 the observations were further extended so as to include the glaciers de la Pilatte (the Refuge Carrelet above La Berarde being the base of operations) and de la Bonne Pierre, and similar advances with all were observed, except in the case of the last-mentioned glacier, which still showed a slight retreat.

The War at first prevented the regular continuance of the work, but happily means were found in 1916 to recommence the observations. By this time all the Dauphiné glaciers had advanced considerably, even the Bonne Pierre having thrust its snout forwards by ten metres. The glacier de la Selle had so greatly enlarged that all the stakes (jalons), ladder-scales, and other fiducial marks were totally buried and lost; and the avalanche snow from the Col de la Lauze (the well-known glacier pass at the head of the Girose glacier, by which one passes over from La Grave to St. Christophe on the Le Berarde road) had so accumulated on the St. Christophe side over against the de la Selle glacier as to have obliterated completely the medial moraine of the latter. The 1917 observations also afforded similar results, but without the exceptional snow deposits.

The general advance of the Dauphiné glaciers at this time is more remarkable than that referred to in the previous report on the Mont Blanc glaciers, inasmuch as the precipitation is much less than that occurring in the Chamonix district. At La Berarde, for example, the average is only half what it is at La Tour at the northern end of the Chamonix valley. In the summer of 1918, however, it began to look as if the advance were only a secondary one, and not to be compared with the great advance of the seventeenth century, which began in 1580, or the later one which showed its maximum in the beginning of the nineteenth century. For the growth had slackened or ceased in many cases by 1918, although some of the glaciers still showed a clear advance, for example, the glacier de la Bonne Pierre and the glaciers Blanc and Noir, which had now come under observation and had exhibited a thrust of snout forwards by so much as ten metres each. The year 1919 was a great snow year, so much so that the glaciers and their moraines were too much snow encumbered to enable any valuable conclusions to be drawn. There were two exceptions, however, for the glaciers de la Meije and Tabuchet showed very clearly increases in length of no less than seventy and thirty-five metres respectively, and the Meije had also thrown up a new moraine ten metres high. By 1921, nevertheless,

¹ "Ministère de l'Agriculture: Direction générale des Eaux et Forêts." 2^e partie: Eaux et Génie rural. Service des Forces hydrauliques. Études glaciologiques. Tome 6. Pp. ii + 179 + 16 planches. (Paris: Ministère de l'Agriculture, 1927.)

retrogression was manifested, the Girose glacier having retreated six metres since 1919, the Meije nine metres on one tongue of its snout and thirty on the other, the Rateau by two metres, and the Tabuchet by twelve and twenty-five metres on its two fronts.

In reality, however, this retrogression was but temporary, caused mainly by the rarity of snow in the winter of 1920-21 and the relative dryness of 1921. For when the summer of 1922 came round the glaciers had all again clearly advanced, or had at least formed a front of clear blue ice as if the minimum were passed and advance were looming ahead again. That this view was correct has since been clearly proved by the measurements made during the summers of 1923 and 1924. In 1923, for example, the Grandes Rousses glaciers showed unmistakable frontal advances since their last measurement; for example, the glaciers des Rousses and des Quirliés had each elongated by three metres, and the Saint Sorlin by fourteen metres. In 1924 the glacier du Mont-de-Lans exhibited an advance of sixteen metres since 1921, the glacier du Lac ten metres, the glacier de la Meije seven metres, the glacier du Tabuchet thirteen metres, and

the glacier de l'Homme five metres. The positions of 1919 have thus not only been recovered but also passed, and the fronts were all of clear, beautifully clean ice, while a considerable increase of superficial rapidity of movement was also observed, a sure sign of advance.

Hence it seems certain that we are now really in a period of true advance of the glaciers of the Dauphiné Alps, a result in line with that derived from the Mont Blanc glaciological survey. The work on these Dauphiné glaciers has been much more arduous, however, as the writer can testify from having actually seen some of the observers at work. On one occasion a number of them were lost for five hours in a terrific snow blizzard on one of the Meije glaciers, and only reached the refuge hut when frost-bitten and on the point of exhaustion. Such accurate work as is recorded in this report, carried out under such conditions, will be appreciated by all who read it, and most of all by those who know the ground, and the danger and tragic history of this group of mountains, the terrible Meije and its sister peaks, the last of the great Alpine peaks to be trodden by the foot of man.

A. E. H. TUTTON.

The Development of Human Physiology.¹

By Dr. C. G. DOUGLAS, C.M.G., F.R.S.

IN physiology our task is to study the nature of the phenomena which characterise normal life, as shown in the individual organism. At the outset it would perhaps seem presumption on our part to turn our attention to what we must admit to be the most complicated and highly-developed organism, namely, man, before we have been able to elucidate at least the main features of the life-process of more lowly forms; should we not do better to argue from the simple to the complex?

In the last fifty years we have seen the wide extension of what I may term the analytical method of physiological investigation, the attempt to differentiate the various components in the complex system which we call life, and to study in detail each of these components in turn and to render clear the phenomena peculiar to each. The organism is in this method treated as a series of systems—we speak, for example, of the nervous system, the circulatory, the respiratory, and the excretory systems—which, though no doubt but parts of a whole, are yet capable of being treated within limits as independent. In pursuing this method we have a perfectly definite aim, for we are trying to establish elementary facts about the different parts of the body without some knowledge of which we feel, and feel rightly, that a general conception of the whole is impossible. No one can deny that we have acquired in this way a mass of information which is essential to the whole study of physiology, nor is there any reason to suppose that the future will witness any diminution either in number or importance of the contributions thus made to knowledge.

The bulk of this information has been attained by the deliberate and careful investigation of animals by experimental methods, and as I am going to plead the cause of human physiology, may I say at once, lest any one should misconceive my purpose, that I do not believe that progress in physiology and in medical science to the lasting benefit of mankind is possible without employing such methods. But, while acknowledging the great debt which we already owe to these investigations, and my firm conviction that their further prosecution will be fully justified in the future, I have to face the question whether the method has not in reality some limitations.

We are bound, I think, to admit frankly that direct observation by methods involving operative procedure on the anæsthetised animal cannot by itself give us the full answer that we require. I have defined physiology as the study of the nature of the phenomena which characterise normal life, and normal life involves constantly varying activity of all the different organs of the body. Under the influence of an anæsthetic our subject is no longer normal, and we have perforce deliberately to close our eyes to that fundamental aspect of life—ceaselessly varying natural activity. We are forced to adopt methods of investigation which are essentially highly artificial; the stimuli which we employ are usually coarse, and the changes to which we subject the organs gross, compared with the delicate alterations to which these same organs respond in natural life.

If we are to understand life we must ultimately adopt methods of investigation which do not interfere with the normality of the organism or its power of self-maintenance; and clearly, so long as

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