Anopheles vectors in Mauritius, *A. funestus* and *A. gambiæ*, are domestic species, their numbers can be demonstrated by catches in human dwelling places, on the walls and ceilings of which the mosquitoes rest after feeding. To establish a satisfactory check it was necessary to set up a large number of 'catching stations', nearly 3,500 in all, scattered evenly throughout the island. These stations were normal dwellings, representative in type of other houses in the area in which they stood. 'Flitted' regularly once a month by trained 'mosquito boys', these catching stations provide a clear index of the effect of residual insecticide on the domestic mosquito species. At the same time a detailed search has been carried out regularly both by whole-time skilled personnel and also, in inter-spraying periods, by district staffs, for the breeding places of anopheline larvæ. Catches of adult mosquitoes in houses by the routine method mentioned above and also by large-scale 'massed' catching during the year 1949 and the first half of 1950 show a very obvious reduction in numbers after spraying of the two *Anopheles* vector mosquitoes and also of *Aedes ægypti*.

Table 7

	Number of houses 'flitted'	*Anopheles gambiæ*	*Anopheles funestus*	*Aedes ægypti*
Before spraying	7,767	2,486	31,196	1,716
After spraying	76,246	703	474	1
Reduction (%)		97·12	99·85	99·94

Considering these figures with the larval and adult findings during the first five months of 1950, two important facts come to light. First, *A. funestus*, without doubt the most important carrier of malaria in Mauritius, especially in that it breeds all the year round, has been virtually eliminated since June 1949. With the exception of two small, sparsely populated areas on the coast, this previously very common mosquito can no longer be found, either in adult or larval form. A similar effect has been observed on the potential yellow fever vector, *A. ægypti*. Both these mosquitoes tend to be exclusively domestic in their habits and are apparently not in any way repelled by the residual insecticide on wall surfaces.

The second fact of importance is that *A. gambiæ*, although apparently (see Table 7) very markedly reduced in numbers by residual spraying, has been breeding profusely all over the island after the heavy rains in March and April 1950. It has already been remarked that malaria transmission is of a very low order; indeed, during the epidemic months of 1950, the number of cases of the disease notified monthly has continued to fall, in spite of the large population of *A. gambiæ*. A likely explanation of this interesting problem is that *A. gambiæ*, repelled by the insecticide deposits on the walls of dwelling-houses and cowsheds, has altered its feeding habits and elected to find outside resting-places. A small-scale experiment to illustrate the fact that DDT acts as a repellent to this mosquito was recently carried out. Unsprayed houses and cowsheds were not easily available in the coastal area; but one new house and two new cowsheds provided some useful information. These were 'flitted' at dawn, and sprayed buildings (DDT wettable powder) nearby were 'flitted' at the same time to act as a control. The results are tabulated in Table 8.

Table 8

Type of building	Number of buildings	Mosquito caught	
		A. gambiæ	Culicines
I. Dwelling-houses (sprayed 8 month previously)	20	1	70
Dwelling-house (new unsprayed)	1	98	59
II. Cowsheds (sprayed 6 months previously)	64	6	12
Cowsheds (new unsprayed)	2	531	152

These figures, of course, refer only to a very small number of buildings, and by themselves are of no value. Taken in conjunction with the general malaria and entomological situation in Mauritius, however, they are sufficiently striking to warrant further investigation. This is now being carried out on a large scale, in order to demonstrate the present feeding habits and resting places of adult *A. gambiæ*, and a full report will be published at a later date.

SWISS SOCIETY OF NATURAL SCIENCES

ANNUAL MEETING

THE Société helvétique des Sciences naturelles held its 130th meeting at Davos during August 26–28. The Society has met there twice before—in 1890, when Davos was becoming one of the great health resorts of Europe, and in 1929, when it was also one of the great sport centres. Between 1929 and 1950, Davos has acquired its third role, as a highly active and important contributor to science, beginning with the opening of the Physical-Meteorological Observatory, the present director of which, Dr. W. Mörikofer, was the president of the Society for the year and secretary of the meeting. In spite of the competition of other conferences, the keenness, high standards and undefeatable industry of Swiss men of science was again remarkably manifest, as was their informed interest in subjects outside their own fields.

Prominent among the sectional work was the very full programme organized by the Société suisse de Minéralogie et de Pétrographie to celebrate the twenty-fifth anniversary of its foundation. A number of foreign scientific workers were invited, and four excursions, each lasting a week, took place before and after the meeting. Prof. P. Niggli of Berne, in his lecture on "Probleme der alpinen Gesteinsmetamorphose", explained the need for more precise data from geologists and geophysicists on the timing and sequence of events implicated in alpine rock metamorphosis. He characterized the effect of variations in these data by means of a precise technical vocabulary, which was circulated round the large audience in French and German versions, as the present state of the nomenclature appears to be chaotic.

This lecture by Prof. Niggli was the real start of the meeting, which was officially opened later in the day by Dr. Mörikofer in his address "Zur Meteorologie und Meteorobiologie des Alpenföhns". The actual physical course of the Föhn phenomenon is now known with fair accuracy, and it is also known that the physiological disturbances so familiar in a large area of Switzerland, and specially marked in Canton

Glaris, are caused not directly by the Föhn itself, but during the preparatory stage, when it blows as a rapid dry wind at mountain-top level, and has not yet been sucked down and become hot by loss of potential energy. But much still remains baffling; for example, why the physiological effects are unaffected by obstacles that would screen disturbances in ordinary conditions of pressure, humidity, dust content or electrical state of the atmosphere. High-frequency vibrations, such as investigated by Dr. Jean Lugeon, might provide an explanation, as they are much more penetrative, but could also be screened by suitable structures. Future progress in research on the Föhn requires much closer collaboration between medical and meteorological experts, and much more precise statistical data in both domains.

In the section for geophysics, meteorology and astronomy, Dr. Lugeon, who is director of the Swiss Weather Bureau, gave a report, entitled "L'espéranto de la stratosphere", of the important international *radio-sonde* trials held at Payerne last May[1]. At the same hour, the Swiss Mathematical Society, the Swiss Physical Society and the Swiss Society for the History of Medicine and Natural Science held a joint meeting in honour of the three hundredth anniversary of the death of Descartes. On the whole, the occasion was used for stressing Descartes's failure rather than his greatness. Dr. J. O. Fleckenstein, of Basle, speaking on "Cartesianische Erkenntnistheorie und mathematische Physik des 17. Jahrhunderts", made clear, above all, Descartes's great mistake in eliminating the time-element from his mechanics.

The mathematical section met on its own on the morning of August 27 and began by paying tribute to the memory of Prof. R. Fueter. Dr. A. Challand, of Berne, in connexion with the problem of bringing sociology into the realm of applied mathematics, suggested extending to sports and examination results a probability technique hitherto applied exclusively to speculations on stock exchanges. E. Bareiss gave a generalization of Fueter's integral theorem in hypergeometric function theory. Mlle. Sophie Piccard, of Neuchâtel, summarized her latest discoveries in the search for the bases of the symmetric and alternate groups. She was able to enumerate all possible groups generated by a pair of cycles of order 8 forming a connex primitive system, and deduced that a pair of cycles of order 8 is a basis of the symmetric group of order $n > 10$ if, and only if, the pair is connex and primitive. The corresponding technique for order 9 and for $n > 9$ gives as a necessary and sufficient condition in that case that the pair be connex. A technique for analysing imprimitive systems was then outlined. J. de Siebenthal added to his published joint work, which extends to non-Abelian subgroups of a compact Lie group, Elie Cartan's theory of the Abelian ones. The new work tackles the omitted case of rank 1. Dr. L. Locher-Ernst established an interpolation formula providing a continuous transition between two correlations in projective geometry. Prof. H. Hadwiger sketched a postulational definition of volume for polytopes, presupposing, as the chairman, Prof. F. Gonseth, pointed out, a prior definition of translation. To conclude, Dr. R. C. H. Young spoke on fashions in mathematics, stressing their serious side in research.

In the afternoon, all sections joined up for the funicular railway ascent of the Weissfluhjoch. The very complex geological panorama was elucidated by Prof. J. Cadisch, of Berne. The Federal Institute for Research on Snow and Avalanches was inspected, with its low-temperature rooms, its thermically tested snowball of about a foot diameter and its stereoscopic microscope showing, in all its perfection, the scintillating branched symmetry of a crystal of snow. Afterwards, a film lecture on "Die Metamorphose des Schneekristalls", by Dr. M. de Quervain, added the dynamic to the static picture, a striking feature being the spontaneous passage to a less symmetrical form with the effect of reducing the surface area. Avalanche research was also illustrated by a film, which by a tragic coincidence had caught a skier being engulfed.

A symposium was held on "Theorie und Erfahrung" under the chairmanship of Dr. M. Altwegg, of Zurich. It was led by a physicist, Prof. M. Fierz, of Basle, a psychologist, Dr. H. Biäsch, of Zurich, and the mathematical philosopher, Prof. Gonseth. The vague word "Erfahrung" (experience) was criticized; no one suggested a definition of the word "Theorie". A sharp difference of opinion showed itself on the question whether mathematics is a science, Prof. André Mercier, of Berne, denying this and defining mathematics as the system of all mutually consistent propositions. Prof. Gonseth and Prof. Fierz opposed him, with the logical proof that such a system does not exist and the practical view that a mathematical theory, like any other scientific theory, is valid only as long as it is not contradicted by 'experience'.

At the closing banquet, Dr. Mörikofer announced that a Swiss scientific research fund, the first of its kind, is being started under the president of the Société helvétique, Prof. A. von Muralt.

To a small group of members from all sections, perhaps the most interesting experience was the excursion after the meeting to the Swiss National Park in the Engadine, organized by Prof. J. de Beaumont, president of the Scientific Commission of the National Park and director of the Zoological Museum at Lausanne. The Park, which was first instituted in 1929, is now showing results of preservation from human interference not all as expected. Gloomier forecasts, in particular, have proved quite wrong: there have been no epidemics either in the animal or in the vegetable world. The deer have increased to about the limit appropriate to the region, and will presumably be maintained as an equilibrium state by migration across the frontier into Italy, where there is no protection. The effect of unrestricted cropping by deer and other wild animals has been to encourage the growth of young trees, by allowing the spread of the fungi that live in symbiosis with them, so that the forest is slowly invading the open spaces. Another gradual change, which in some parts may be complete in fifty years time, is the appearance of the Arollo pine wherever humus can settle, supplanting the mountain pine, which grows where the soil is practically absent because of continual shifting of the crumbling dolomite stone. Expeditions were curtailed by rain, and only a few animals were seen through binoculars, including, however, some chamois and a magnificently outlined stag on the mountain crest. The party also visited the Laboratory of the Scientific Commission of the National Park, built in 1947 at Il Fuorn, at an altitude of more than 6,000 ft., close to the only hotel and private domain in the region.

It is fitting to conclude with a few words on the work of the Physical-Meteorological Observatory at Davos, which was on view during the meeting. Three main lines of research are of interest: first, the

absolute measurement of solar radiation has now reached an accuracy hitherto impossible to achieve, with important results which so far are largely unpublished; secondly, much progress has been made in overcoming the obstacles to the measurement of black-body absorption of solar radiation, notably in estimating or eliminating the adventitious effects of the wind-tunnel installation, set up to counteract the equilibrium disturbances due to small breezes by superposing a known steady wind; thirdly, the energy required to keep a black sphere at 36½° C. at atmospheric conditions throughout the day and night is now recorded automatically by an instrument that adds up the hourly totals, and the unexpectedly low average obtained goes some way towards explaining the comparative immunity to chills shown by consumptive patients while they remain at Davos, in spite of the severe winters. R. C. H. Young

[1] See Painter, H. E., *Weather*, **5**, 307 (1950).

ANALYSIS OF HUMAN SKILLS

In an article in a recent issue of *Occupational Psychology* (14, No. 3; July 1950) Prof. C. A. Mace suggests that what may later be regarded as one of the characteristic features of the twentieth century will be the marked acceleration in the progress of social and human sciences. There have been, he says, significant advances in the plan to make a science and an art of human nature—in the growing understanding of basic human skills, of increasing control over human will and in the emergence of a general scientific approach to the study of human emotions and human relations.

A fair amount is now known about the basic human skills. What is called 'physical' skill, for example, is the ability to produce some required effect or group of effects through bodily movement guided by sensory and perceptual cues. There are also intellectual skills in which generalized knowledge and imagination play a more important part, and social skills in which subtle emotional reactions to personality and subtle expression of personality are the chief determinants of the required effect. A skill that is employed for æsthetic ends is called an art; one that is turned to industrial ends a craft. The clerical and allied occupations involve the practice of some of the simpler intellectual skills. The concept of a social skill enters into the analysis of the supervisory functions and into leadership in most of its forms. What are called the 'professions' are distinguished not merely by the factor of social prestige but also, as a rule, by a complex intermixture of various types of skill.

With the physical skills the apparent simplicity of a skilful movement is always deceptive. Many dexterities are dexterities of the hand, and, in consequence, one is apt to speak of skill in terms of co-ordination between hand and eye.

The natural tendency to the dominance of the hand is one of the things which needs to be corrected in the acquisition of skill. In the very simplest of skills the required effects can be produced only by a sequence of patterns of movements, the components of which are precisely timed and adjusted in relation not only to each other but also to a sequence of patterns in the perceptual cues; the skilled bricklayer invites one to admire not the tapping or the buttering of his bricks but the dance which he performs with his feet.

The exercise of skill may become automatic, but it never becomes unconscious. Action is always adjusted to perceived cues. Skill is at its simplest when signals that are easily perceived call for responses that are easily performed—as when, for example, the typist reads a clearly written script and taps the appropriate keys. In the vast majority of cases significant cues have to be singled out from a context of irrelevant information, and in response to these cues new and often difficult movements have to be made. In earlier days, even learning to drive a car was a task of this kind. Significant and possibly ominous sounds from the engine had to be distinguished from irrelevant 'body' noises, and complex cycles of movement carried out with clutch, gears and brake.

Between the physical and the intellectual skills no sharp line can be drawn. The greater the complexity of the skill the larger the part played by the higher cognitive functions. In all but the simplest skills we may distinguish two factors in cognitive control: (1) situational information and (2) general knowledge. The exercise of military skill by those at the higher command depends upon these two kinds of knowledge: a knowledge of what is happening in particular places at particular times and a knowledge of general principles such as those of strategy, tactics and logistics. So it is in all the crafts and the practical professions.

In the workshop the craftsman is taught, *inter alia*, to understand the sensory cues through which his movements are guided. In his lessons in the classroom he is taught the more general principles upon which the versatility of his skill will depend. Science has scarcely begun to explore the extremely complex problems that arise in connexion with the provision of general knowledge required in the exercise of a craft.

Leadership and supervision may be taken as convenient examples of the social skills, the work of the manager or supervisor being quite peculiar. Its essence is to know what requires to be done and then—not to do it—but to see to it that someone else does. The kind of self-control that is required in order not to do oneself what should be delegated is one of the primary virtues in the supervisory office.

On a systematic job-analysis of supervision or leadership, a primary and a secondary function can be distinguished. The primary function is to direct, that is, to give direction to, and to co-ordinate, the activities of others. This function is concerned with the job. The secondary function is to arouse and maintain the motives appropriate to the actions of those who are so directed.

Broadly speaking, the primary function is prominent at the higher levels of management or command, the secondary function more prominent at the lower levels. The supervisor must know what has to be done, decide who shall do it, when, and sometimes how, the thing shall be done. These decisions will find expression in the written or spoken word. Hence the vital importance to his supervisory function of verbal intelligence and special verbal skills.

Although much is not yet known, it is recognized that there is a common structure in the physical, the intellectual and the social skills. In every case skill consists in the ability to produce required effects by executive action guided by relevant information. In the rest of his article Prof. Mace indicates the conditions through which all potential skills issue in performance. T. H. Hawkins