rate of diabetics appears to be about one-sixth of that prevailing among Indians in Durban, yet 24 of 289 diabetics were in diabetic coma when they were admitted to hospital (Director, Indian Council of Medical Research, 1956, personal communication). Freedom from ketosis is therefore not peculiar to the whole Indian race. In Ceylon, however, ketosis is rare (DeZoysa, 1951).

If an environmental factor is to be incriminated we are fortunate in being able to compare the incidence and nature of diabetes among the three racial groups in Natal: Bantu, Indian, and European. Among the latter diabetes resembles that of white races elsewhere. In the Bantu diabetes is relatively uncommon, but severe ketosis is not unusual. These facts allow one to exclude climatic conditions and certain dietary factors. The basic dietary constituents among the poorer of both non-European races are similar. Malnutrition occurs in both races. In the search for an environmental factor which is peculiar to Indians the most obvious finding is the large variety of herbs consumed as food or flavouring, or occasionally for therapeutic purposes. At least six species of indigenous herbs are eaten by almost all Indians, but not by the Europeans or the Bantu in any quantity.

The striking similarity between diabetes in Jamaica and that of Natal Indians leads one to look for common environmental factors in these two races. The two communities are as widely separated ethnologically as they are geographically. Hugh-Jones (1955) comments on the variety of herbs which are used by Jamaicans as bush teas, and mentions the possibility of these causing diabetes. Is it possible that among these herbs is one, or more, common to certain areas of India, Ceylon, Jamaica, and Natal that interferes with carbohydrate and fat metabolism to produce a diabetic syndrome? Alternatively, a dietary factor may modify diabetes in such a way that it becomes insulin-resistant and not apt to produce ketosis. This reasoning may be facile, and it leaves other aspects unexplained. It does, however, show the need for more detailed clinical, epidemiological, and botanical study in these countries.

Summary

Diabetes mellitus is exceptionally common among Natal Indians. In the course of an analysis of 207 diabetics in hospital the disease has been found to show certain peculiarities, some of which have been described in other tropical and subtropical countries. The diabetes of young people which is associated with liability to ketosis and sensitivity to insulin (type 1) is very uncommon. Instead there occurs a form of juvenile diabetes which is characterized by insulin resistance and freedom from ketosis (type J). Between 20 and 40 years of age there is a group of overweight diabetics, mostly women, who are more sensitive to insulin. Beyond the age of 40 years insulin requirements vary, but patients are more often underweight than overweight. Ketosis is rare among Natal Indians, but infections and vascular complications of diabetes are common.

In several respects there is a resemblance between the types of diabetes occurring among Natal Indians and those described in Jamaica. These findings are discussed in relation to peculiar forms of diabetes reported in other tropical countries.

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CARBON MONOXIDE HAZARD IN ANTARCTICA

BY

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Carbon monoxide poisoning is an important hazard in polar exploration. Amundsen, Byrd, and Stefansson have each described narrow escapes from fatal asphyxiation by CO, and Stefansson (1940) focused attention on the subject in his book *Unsolved Mysteries of the Arctic*. Henderson and McCullough Turner (1940) described experiments with the Nansen cooker showing that under certain conditions dangerous amounts of CO might be given off.

The Nansen stove introduced by Fridtjof Nansen in 1890, and used by Shackleton and Scott on their Antarctic expeditions, had a "primus" stove as its heating unit and was popular with explorers because of its lightness and high thermal efficiency. This amounted to 80–90% (Henderson and McCullough Turner, 1940), compared with 40–50% for a primus stove used with an ordinary cooking-pot (unpublished data). Unfortunately Henderson and McCullough Turner found that when the Nansen stove was used for melting snow or ice CO was produced in the highly dangerous concentration of 0.08 to 0.1%, and this may be one reason why the Nansen stove is no longer used.

Irving, Scholander, and Edwards (1942) studied the uptake of CO in persons using primus stoves in tents and snow-shelters, and reported blood COHb levels of 15–18% saturation after one to three hours. Among the tents tested, significant absorption of CO occurred only in those constructed of plastic-treated fabric which were more or less airtight.

In Antarctic exploration, where mechanized transport is rapidly replacing dog sledges for long-distance travel, there is the additional risk of CO poisoning from exhaust fumes. The importance of this hazard has been brought to light by the experience of the Commonwealth Trans-Antarctic Expedition. Both the British and the New Zealand parties were affected at times by

symptoms resembling those of CO poisoning during the crossing of the Antarctic plateau. The circumstances are described in this paper, together with some experimental observations carried out by the Anglo-American physiological team at Scott Base (Pugh, 1957). Also presented are the results of experiments carried out in London on the CO output from primus stoves, as used on the Trans-Antarctic Expedition.

CO Poisoning on the Commonwealth Trans-Antarctic Expedition New Zealand Team

The New Zealand party of five men led by Sir Edmund Hillary travelled in modified Ferguson tractors, one of which towed a small caravan or caboose containing the radio equipment. The caboose was heated by a radiator connected to the exhaust pipe of the vehicle ahead, and was equipped with two primus stoves for cooking. The tractor drivers took it in turns to rest and warm up in the caboose while travelling, and the party forgathered in it at halts. Hillary and the radio-operator, P. Mulgrew, slept in it, while the others slept in tents. Primus stoves were kept going in both the tents and the caboose for four to five hours a day. At sea-level all went well, but on the way up the Skelton Glacier symptoms consistent with CO poisoning began to appear and grew worse as the party ascended. The symptoms were most severe at the plateau depot at 8,000 ft. (2,440 m.) during a spell of unusually calm cold weather with temperatures of -35 to -38° F. (-37 to -39° C.). Those who spent much time in the caboose, in particular Hillary and Mulgrew, were affected on and off by the following symptoms, in various combinations: loss of appetite, severe headaches, weakness, shortness of breath on exertion—and occasionally even at rest—and a feeling of constriction in the chest. Mulgrew also complained of attacks of dizziness, buzzing in the ears, and precordial pain. Hillary on one occasion collapsed on leaving the caboose.

At first the symptoms were either disregarded or attributed to altitude; but, when it became obvious that something else was wrong, the air over the primus stoves in the caboose was tested with a CO detector, which gave a weakly positive result (0.005% CO). A small leak in the exhaust heater which had been causing fumes was repaired, and later a draught chimney was fitted up over the primus stoves. After this the symptoms improved, only to return when the chimney was blocked up because of the cold. Hillary and other members of the party, however, stated that they never really became acclimatized to the altitude on their journey to the South Pole, although they were never more than 10,000 ft. (3,050 m.) above sea-level. At the plateau depot Hillary said he felt very much as he had done in the Himalayas on camping for the first time at 16,000 ft. (4,875 m.). He and Mulgrew had occasion to return to Scott Base from the plateau depot, and they found it took them nearly a week to recover their normal health.

The British Crossing Party.—Similar symptoms were noticed by some members of Sir Vivian Fuchs's team after leaving the South Pole station, when the onset of low temperatures caused them to travel with the windows of their vehicles closed. There was one acute episode which will be described elsewhere by the expedition's medical officer, Dr. Allan Rogers. After this accident they took care to keep the windows of their vehicles open, and had no further trouble.

The British Advance Party (1956-7).—The following account of symptoms on the Trans-Antarctic Expedition advance party has been given by Dr. Rainer Goldsmith (personal communication).

In the crate in which the T.A.E. advance party spent the winter at Vahsel Bay, ventilation was rudimentary. The size of the crate was 20 ft. by 7 ft. 6 in. by 3 ft. (6 by 2.3 by 0.9 m.). It served as mess, kitchen, and recreation room, and for all other functions which required shelter for their performance. The drift snow after a few months reached roof level. Cooking was done on three primus stoves, and on a number of occasions the atmosphere was so foul that matches would not remain alight nor the stoves burn with a blue flame. Symptoms of CO poisoning were not uncommon. Men suffered from violent frontal and vertical headaches, relieved after a night in the tent, and on two occasions nausea and vomiting were experienced. The symptoms usually followed a prolonged stay in the crate.

Experimental Studies

Blood CO Levels

Samples of venous blood for CO determination were taken from members of Sir Vivian Fuchs's party at the South Pole and at Scott Base. Blood CO levels were also determined on members of a sledging team who had been in the field for four months, and on other personnel at Scott Base who were non-smokers. The analyses were performed by the special method for small quantities of COHb described by Scholander and Roughton (1943). Haematocrit values were also determined. The blood samples taken at the South Pole were obtained almost seven hours after the party arrived

TABLE I.—*Blood CO Contents (Vols. % STPD) and Percentage Hb Saturation (Figures in Parentheses) in Members of the British Trans-Antarctic Party, New Zealand Dog-sledge Teams, and Others at Scott Base*

Smokers	Non-smokers; or No Smoking for 24 Hours*
<i>British Trans-Antarctic Party</i>	
J.S.: 0.37 (1.5) South Pole	H. Le G.: 0.92 (3.4) Scott Base
H.L.: 0.55 (2.3) " "	R.H.*: 1.27 (5.5) " "
D.S.: 1.02 (4.3) " "	G.P.: 0.67 (3.9) " "
A.R.: 0.55 (2.3) " "	K.B.: 0.90 (3.7) " "
V.E.: 0.57 (2.3) Scott Base	
J.S.: 0.70 (2.8) " "	
<i>New Zealand Dog-sledge Teams</i>	
G.M.: 0.38 (1.8)	R.B.*: 0.15 (0.7)
	B.G.: 0.17 (0.8)
	R.M.: 0.10 (0.4)
<i>Others at Scott Base</i>	
B.D.: 0.64 (3.0) Before tractor driving	E.P.H.: 0.12 (0.6)
0.90 (4.2) After 40 min. tractor driving	F.C.: 0.15 (0.7)
	G.M.: 0.15 (0.7)
	A.P.: 0.13 (0.6)

there; those taken at Scott Base were obtained within an hour of arrival. None of the men concerned were actually suffering from symptoms at the time of taking blood.

The results (Table I) did not show any evidence of undue accumulation of CO; the blood levels in the crossing Antarctic party were comparable to the values found in smokers in London, which in this laboratory vary from 0.3 to 1.3 vols. %. However, on comparing members of the crossing party, who either did not smoke at all or who had not smoked that day, with non-smoking base personnel, it is seen that the CO levels in the former range from 0.67 to 1.27 vols. %, compared with 0.12 to 0.15 vols. % in the latter. Evidently, therefore, the crossing party were absorbing CO from some external source apart from smoking. Their experience after leaving the South Pole—when they had

symptoms consistent with CO poisoning which cleared up after attending to the ventilation of their vehicles, as well as the low CO levels observed in the dog-sledging team, who, like the crossing party, slept in tents—suggest that absorption of CO was taking place in the vehicles and not in the tents. The COHb levels before and after tractor-driving are of interest in that the subject had been driving an open tractor with a vertical exhaust pipe opening at head level. They show that a measurable rise in blood CO can occur even in a vehicle without a cabin if the exhaust pipe is so placed that fumes can be blown in the direction of the driver's face.

Absorption of CO in Tents

No opportunity presented itself of investigating the uptake of CO in the Trans-Antarctic parties' Sno-cats, but blood CO levels were investigated in one of the expedition's tents on a subject using a primus stove (a) for heating purposes alone, and (b) for melting snow. The experiments were performed on two successive days under comparable weather conditions, the outside temperature being 27° F. (−3° C.) and the wind velocity 3–5 m.p.h. The tent was a double-walled pyramid tent of rather heavy cotton fabric with a separate ground sheet, the inside volume being approximately 2.5 cubic metres. The sleeve entrance was kept closed, but the ventilating tube at the apex was left open to simulate ordinary conditions of use.

In the first experiment the stove burnt continuously for over three hours. In the second it went out several times after two hours, and the experiment was discontinued. In this experiment the subject melted snow in an open container, pouring away the water and starting afresh as the container filled with water.

The results (Fig. 1) show a progressive increase in blood CO which was more than twice as rapid when the stove was used for melting snow as it was when used for heating alone; but in neither experiment was a

FIG. 1.—Blood carbon monoxide in a subject using a primus stove in an Antarctic tent.

dangerous level reached, and the subject experienced no ill effect apart from the heat. In a subsequent experiment in London, in which the CO concentration inside a light-weight single-walled pyramid tent, set up in a laboratory, was followed over three hours while ice was being melted over a primus stove, the CO content did not rise above 0.003 vol. %, which corresponds to a blood COHb level of less than 5% saturation. This tent was constructed of a light-weight nylon-cotton fabric ("wincol") as used on the 1953 Mount Everest expedition. The results indicate that with such a tent dangerous accumulation of CO is unlikely to occur, even in still air, owing to diffusion of air through the fabric.

Output of CO from Primus Stoves

A lighted primus stove was placed in an upright metal drum of approximately 100-litre capacity. The opening at the top was closed with a well-fitting lid provided with a central outlet pipe. Air was admitted at the bottom

by an inlet pipe. In the initial experiments the combustion gases were simply aspirated into a Tissot spirometer by suction at a measured rate of approximately 100 l./min. The spirometer was filled and emptied twice before gas samples were taken. With this arrangement it was found that the flame went out in two to three minutes whenever a container full of ice was placed on the stove. In order to improve the air supply a pump was attached to the inlet pipe and air was forced in at a rate of 300 l./min.: the combustion gases were pumped into a large Douglas bag via a dry gas meter.

The gases collected in the spirometer or in the Douglas bag were analysed for O₂, CO₂, and CO. O₂ and CO₂ were measured on a Scholander gas analyser; CO was determined on an infra-red apparatus after removal of water-vapour and CO₂. Separate experiments were carried out with two well-used primus stoves. The stoves were pumped up until a maximum flame was obtained, but, apart from this, no attempt was made to secure a constant size or colour of flame. The stoves were used (a) alone, and (b) with a cooking-vessel filled with ice chips. The effect of air-nitrogen mixtures was also studied; but under these conditions results could be obtained only with the bare flame, because the flame went out too quickly when the cooking-vessel was placed on the stove.

When the primus stoves were used without the cooking-vessel the concentration of CO in the aspirated gas mixture varied from 0.002 to 0.005 vol. %, and the volume of CO produced per minute varied from 2 to 5 ml. The oxygen consumption was 2.2 to 3.7 l./min. with a CO₂/O₂ ratio of 0.53 to 0.63. The volume of CO per litre of O₂ consumed was 0.7 to 2.2 ml. With O₂-deficient gas mixtures, it was found that the flame went out when the O₂ content of the combustion gases fell to 13–14%. With the O₂ below 17% the CO concentration rose to 0.01–0.015%.

When the cooking-vessel full of ice chips was placed on the stove the concentration of CO rose to 0.023–0.060%, and the CO output rose to 50–70 ml./min. or 10.2–26.8 ml./l. O₂. It was found that the stove would burn only as long as the aspirated gas contained 18% O₂ or over; and just before the flame was extinguished the CO concentration sometimes rose as high as 0.165%. The production of CO was not appreciably reduced by allowing the ice to melt and bringing the water to near boiling-point, but was prevented by interposing an asbestos mat between the flame and the cooking-vessel.

The results of these experiments are in general agreement with those obtained by Henderson and McCullough Turner (1940) with the Nansen cooker. These workers also found that the evolution of CO from a primus stove burning freely under good conditions of air supply was negligible, but that dangerous amounts of CO were given off when cooking-vessels filled with ice were used, especially when the air supply was restricted.

Discussion

Absorption and Physiological Effect of CO

The rate of absorption of CO at various concentrations of CO in the air breathed and the permissible concentrations of CO in the blood are shown in Fig. 2 (Forbes, Sargent, and Roughton, 1945; Henderson *et al.*, 1921; Drinker, 1938).

In experimental studies in which the desired blood level of COHb is reached rapidly and maintained only

for a short period of time, partial saturations up to 20–30% are tolerated without symptoms by healthy adults during rest or moderate physical exertion (Haldane and Priestley, 1935; Asmussen and Chiodi, 1941; Apthorp *et al.*, 1958); but, as Haldane emphasized, such exposures may be followed by tiresome headaches coming on some hours later. At saturations between 40 and 50% there is impairment of mental function and ataxia, and collapse may occur on exertion. Few investigators have exposed themselves to levels above 50%. Haldane once reached 56% saturation, at which level he was completely incapacitated and in imminent danger of collapse.

In experiments designed to study the effects of long exposures to low concentrations of CO, Sayers, Merewether, and Yant (1922) found that the symptoms of CO poisoning developed at lower blood concentrations and were more severe at any given blood concentration than in short experiments. These investigators reported tightness across the forehead or slight headache at COHb saturations of 16–20%, which were reached in six hours of breathing 0.02% (2 parts in 10,000 of air). COHb saturations of 22–28% were associated with moderate to severe headache, with or without dizziness and nausea. In a later investigation, however, three out of six subjects remained free of symptoms at these COHb levels even after six hours' exposure (Sayers *et al.*, 1929).

In life situations, where a given blood level is reached slowly or is maintained for a long period of time, the first symptom is usually headache, followed by dizziness

FIG. 2.—Absorption of CO by man in light activity (ventilation 9.5 l./min.) (after Forbes *et al.*, 1945).

and nausea, and a tendency to collapse on exertion. With rapid poisoning, the victims may become paralysed before they realize that anything is wrong. In cases of fatal poisoning blood COHb levels of 60–80% saturation are the rule, but fatalities have occurred at much lower levels. In a series of 68 fatal cases reported by Gettler (1943), 25% had less than 60% of COHb, and 4.5% of cases had levels between 30 and 40% saturation.

CO and Altitude

When persons at high altitude are exposed to low concentrations of CO symptoms are experienced at much lower blood concentrations and the effects are more severe. In aviation the assumption has been that, for practical purposes, the effect of a given blood level of COHb is the same as that of an equivalent degree of arterial O₂ unsaturation due to reduced barometric pressure (Heim, 1939; Armstrong, 1952). Experimental justification for this assumption has been provided by visual sensitivity tests (McFarland, 1946). On this basis,

an altitude of 10,000 ft. (3,050 m.), which reduces the arterial O₂ saturation to about 85% (Luft, 1956), is equivalent to a COHb saturation of 97–85=12%; and 12% COHb at 10,000 ft. (3,050 m.) is equivalent to a height corresponding to an arterial O₂ saturation of 85–12=73%, or 16,000 ft. (4,875 m.). Altitude has no significant effect on the rate of CO absorption in

TABLE II.—COHb Content of Blood as Percentage Hb Saturation, in the Presence of Various Partial Pressures of CO at Sea-level and at 10,000 ft. (3,050 m.), Calculated from a Standard O₂ Dissociation Curve by the Method of Roughton and Darling (1944), Assuming the Arterial pO₂ at 10,000 ft. to be 63 mm. Hg and the Relative Affinity of CO for Hb to be 238 Times that of O₂ (Joels and Pugh, 1958)

CO% (Dry Gas at Sea Level)	pCO mm. Hg	COHb	
		Percentage Sea-level	Saturation 10,000 ft. (3,050 m.)
0.005	0.04	8.5	11.6
0.010	0.25	15.6	20.7
0.020	1.50	27.0	35.2
0.030	2.25	36.1	46.2
0.040	3.00	44.8	52.4

man (Forbes, Sargent, and Roughton, 1945; Lilienthal and Pine, 1946), but it does influence the final concentration reached in the blood after many hours of exposure, because of the change in the partition of Hb between CO and O₂ at low O₂ tension (Table II).

CO from Primus Stoves

Reference to Fig. 2 shows that the concentration of CO produced by the naked flame of a primus stove is negligible so far as symptoms are concerned: the concentrations observed during cooking or snow-melting would be unlikely to cause symptoms in under an hour; and even the high concentrations just before the stove went out would be tolerated for half an hour. However, the O₂ consumption and rate of CO production is such that in a confined space, like Hillary's caboose or the advance party's crate, a considerable deficiency of O₂ and accumulation of CO would gradually develop in the absence of ventilation with fresh air.

The blood concentrations of COHb observed in tents by Irving *et al.* (1942) and by ourselves at Scott Base were not sufficient to cause symptoms at sea-level, although they would do so at 10,000 ft. (3,050 m.). Irving and his associates used tents made of impervious material in their experiments, pointing out that, although tents are not normally made of impervious fabric, diffusion of air through the wall of a tent in cold weather may be practically abolished by accumulation of snow and ice, and the condensation of moisture on the inside. That such a condition may in practice be realized is shown by the fact that, just as in the T.A.E. advance party's crate, the air in a tent may become so vitiated that the primus stove goes out and it becomes difficult to light a match. Instances of this are given by Irving *et al.* (1942), and the same thing has been described to me by Sir Vivian Fuchs and other members of his party. Irving and his colleagues did not melt ice in their experiments, and had they done so their COHb figures would no doubt have been higher.

Fortunately, explorers are protected from CO poisoning in such circumstances by two factors: (1) the time spent in melting snow and preparing food is always kept to a minimum—usually about half an hour; and (2) during the dangerous period when a cooking-vessel is being used the stove tends to go out at a relatively high oxygen concentration—namely, 17–18% compared

with 13–14% with the stove used for heating alone. This happened in the second experiment at Scott Base, causing the experiment to be given up after two instead of three hours when the subject's blood COHb, though beginning to rise steeply, was still at a comparatively safe level of 15%.

CO and the T.A.E.

Although confirmation by blood gas analysis was not obtained, there can be little doubt that both parties on the Antarctic plateau suffered at times from the effects of CO, or more correctly a combination of CO and altitude, for their story suggests that they might have escaped symptoms altogether had they been travelling at sea-level. The advance party kept three primus stoves going in a small crate with practically no ventilation, so it is not surprising that they should have had symptoms, even though they were at sea-level.

In Sir Vivian Fuchs's party the important factors were the long periods of travelling, which amounted to 10–16 hours a day, and the onset of extra cold weather which caused them to keep the windows of their vehicles closed. Since exhaust gas contains anything between 3% and 10% CO (Sayers and Davenport, 1937; Fitton, 1956) even a small leakage of fumes from the engine compartment into the cabin could be dangerous if inhaled over many hours. The New Zealand party were likely to have been exposed over shorter periods to higher concentrations of CO, since two primus stoves were used simultaneously for cooking and heating in a small caravan which lacked the safeguard of air-permeable walls.

The symptoms complained of by the parties on the plateau were a mixture of those characteristic of altitude and those of CO intoxication. Headache is, of course, an early symptom in both conditions: dizziness, precordial pain, and tinnitus are more typical of CO poisoning (Drinker, 1938). Hyperpnoea, anorexia, lassitude, and weakness are the characteristic effects of altitude as experienced on Himalayan expeditions, where the ascent is roughly comparable to that of Hillary's party on the Skelton Glacier. Altitude symptoms are not, however, encountered below 12,000 ft. (3,660 m.) in the Himalayas and are usually not severe below heights of 14,000–18,000 ft. (4,265–5,485 m.): even then they tend to pass off in a few days (Pugh and Ward, 1956).

According to Hillary the symptoms were very much like those he had experienced on first going to 16,000 ft. (4,875 m.), although the actual height was only 8,000 ft. (2,440 m.). This statement can be used as a basis for calculating the probable COHb content of his blood. The alveolar O_2 tension for a person living at 8,000 ft. (2,440 m.) who ascends rapidly to 16,000 ft. (4,875 m.) would be about 42 mm. Hg (Rahn and Otis, 1949). Subtracting 2 mm. Hg for the alveolar-arterial O_2 gradient at such an altitude gives an arterial O_2 tension of 42 mm. Hg, the corresponding O_2 Hb saturation being 75% (Luft, 1956). Since the arterial O_2 saturation for an acclimatized person at 8,000 ft. (2,440 m.) is about 90% the equivalent COHb would be only about 15% saturation, which at sea-level would be unlikely to cause symptoms.

Summary

Carbon monoxide poisoning on the Commonwealth Trans-Antarctic Expedition is described. The symptoms occurred mainly at 7,000–10,000 ft. (2,135–3,050 m.) and

represented a combination of the characteristic effects of altitude and CO. In the British party symptoms were associated with long hours of travelling in motorized vehicles with the cabin windows closed. In the New Zealand party symptoms were associated with shorter exposures in a small caravan provided with an exhaust heater and two primus stoves for cooking.

Symptoms of CO poisoning were also experienced by the T.A.E. advance party who spent the winter of 1956–7 in a crate, with three primus stoves for cooking and heating purposes.

The output of CO from primus stoves was investigated, and the absorption of CO was studied in a subject using a primus stove in an Antarctic pyramid tent.

The physiological effects of breathing low concentrations of CO at sea-level and at altitude are discussed.

I wish to thank the members of the Trans-Antarctic Expedition for their collaboration in this work.

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The executive board of W.H.O. began its 23rd session at Geneva on January 20 under the chairmanship of Dr. P. E. MOORE, director of Indian and Northern Health Services of Canada. The session is expected to last two or three weeks, and during it the board will review W.H.O.'s programme for 1960. The 18 members of the board, which is a technical non-political body, are health experts designated to act on behalf of the World Health Assembly. The present board is composed of members designated by the following countries: Afghanistan, Australia, Brazil, Canada, France, Guatemala, the Federal Republic of Germany, India, Iran, Italy, Liberia, Mexico, Tunisia, United Arab Republic, United Kingdom, United States of America, U.S.S.R., and Viet Nam.