ISOTOPES IN SHANGRI-LA

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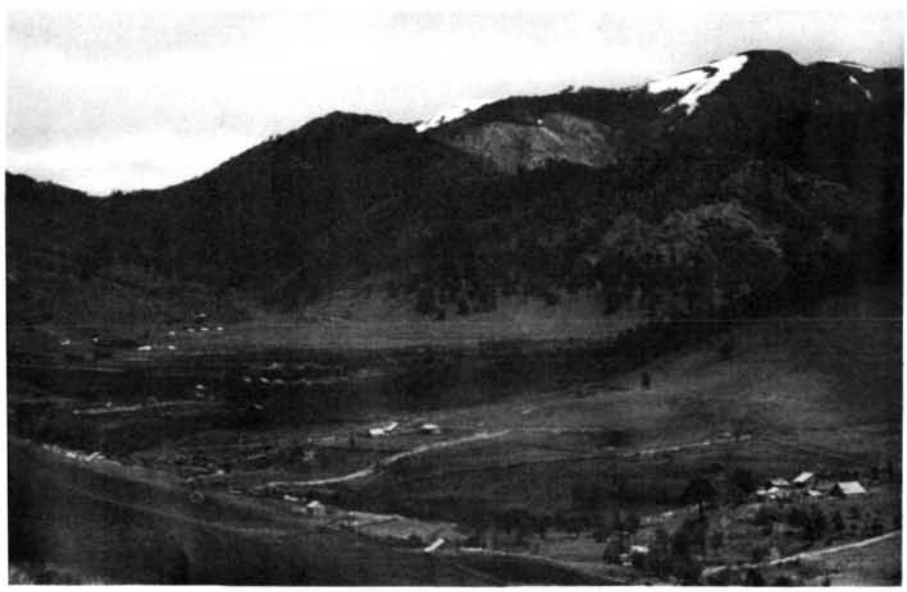
In a remote valley of the Andes, snow-bound for half the year, a small community of Pewenche Indians lives in almost complete isolation. Among these people there is a high degree of consanguinity, and most of them suffer from endemic goitre. These conditions offered an opportunity of studying the part played by congenital defects in the prevalence of the disease. With the support of IAEA, an expedition was sent to the place in November 1963 to study goitre with the help of radioisotopes.

In the last few years the University of Chile has undertaken a research programme designed to investigate the 3000 indigenous communities of the country, which together account for a population of over 300000. The purpose of this work is not only to evaluate and try to solve the immediate demographic problems, but also to study and gain some understanding of the culture of these communities with a view to enabling them – without disrupting their way of life – to reach a higher stage of development within the framework of the general efforts being made in this direction in Chile.

In 1960 haematological experts from the Medical Faculty of the University of Chile and a member of the Genetics Department of the Medical School



went on two expeditions to various reservations in the south of the central part of Chile. Their immediate purpose was to determine the incidence of the various types of blood group and other haematological characteristics and also to investigate the incidence of other features of anthropological and genetical interest, e.g. colour vision, sensitivity of taste to phenylthiocarbamide, etc. They also took the opportunity of surveying the incidence of goitre in these communities. These studies revealed that the greater the distance from the larger towns, and the greater the difficulty of access, the less the degree of racial intermixture with the rest of the population of Chile. The extreme case is in the Pedregoso Reservation, situated right in the Andean Cordillera, near the Argentine frontier, in the small valley of Lonquimay which is snowbound for about six months of the year. The nearest town, Villa Portales, is situated 30 kilometers away and is linked to Pedregoso by a road which is impassable to all forms of traffic for most of the year. Villa Portales in turn is about 30 kilometres away from a tunnel which is the railway terminus and serves as the only means of communication with the rest of Chile during the winter. Of all the reservations investigated, Pedregoso appeared to exhibit the minimum of racial intermixture, the highest percentage of consanguinity and the peak rate of endemic goitre.

The Department of Endocrinology of the Hospital del Salvador had been interested in the study of endemic goitre in Chile, particularly since 1954, when it acquired a radioisotope laboratory. It was natural, therefore, to be interested in investigating the pathogenesis of endemic goitre in this isolated community of Pedregoso. A particular attraction was the prospect of perhaps finding evidence for the existence of a genetic factor in the pathogenesis of this disorder. With this aim in view, an application was made for a research contract from the IAEA, and this was granted in 1963.

SETTING UP THE BASE

At the same time, the Pan-American Health Organization set up a study group to encourage research on endemic goitre in Latin America. An invitation was sent to Chile to take part in the work of this group, and the Chilean team was able to extend and plan its activities accordingly.

In November 1963 the first expedition to Pedregoso was organized. The worst problems at this initial stage were the transport and installation of the equipment, but these difficulties were overcome thanks to the cooperation of the army authorities, who provided the necessary vehicles, and also of the School of Engineering of Chile University, which provided the services of the head of its Electronics Laboratory. His assistance was extremely useful. Five tons of equipment were transported; this included radioisotope-counting equipment, a refrigerator, chromatography apparatus, etc. The bulk of the equipment was set up at a hospital under construction at Villa Portales, which had to be supplied with water and electricity. The soldiers who had accompanied the expedition started to dig a small trench across the main street for a plastic water pipe between the hotel and the hospital – it was a sight not easily forgotten. The soldiers also laid electricity cables between the two buildings, the hotel possessing a diesel generator which could be operated throughout the day. In Villa Portales electricity is only available

from dusk to midnight. At Pedregoso, another diesel generator, supplied by the army, was set up and for the first time in the history of the Reservation electric lights went on in one of the local buildings. This was at the Protestant Mission School where equipment for *in vivo* radioisotope measurements was installed.

To reach our place of work we left Santiago by train, approaching the snowy ridges of the Andes through alternating rain and snow.*) After having covered a distance of 800 km, we arrived in the valley of Lonquimay at nightfall and during a hailstorm. We climbed into our army jeep which was waiting for us and bumped through the night to Villa Portales, the largest town in the area (population 7000). There we were surprised to find that a succulent barbecue had been prepared in our honour by some of the local inhabitants. It was served to us in a smoke-filled shed beneath a torrential downpour.

Next morning dazzling sunshine and a cloudless sky transformed the whole surroundings, enhancing the beauty of the fertile valley of Lonquimay with its backdrop of mountains covered with snow-laden pines. We embarked on what was to become our routine day's work over the next month: an hour's ride by jeep to the Pedregoso Reservation 30 km away, 4-7 hours' work among the indigenous population, return to Villa Portales to work in our laboratory in the partly-finished hospital. Time was divided between the research programme and care of the genuine and imaginary invalids of all ages who came in dozens as soon as they heard that doctors had arrived in their isolated region. Thanks to the friendship and sense of humour of a group of friends, this task was transformed into a pleasant and valuable human experience.

*) *This was on the arrival of Dr. Beckers from Vienna.*

Our main problem at the beginning of the expedition was to know how we would be received by the indigenous population. It so happened that our arrival coincided with an influenza epidemie, so that our stock of aspirin and penicillin turned out to be the best possible introduction to the local inhabitants. The doors of their homes were opened to us and there was no hesitation about accepting our invitations to come to the Mission School. The inhabitants of the Reservation saw that we were trying to help them and they reciprocated generously by allowing us to carry out all our investigations. Their friendly and cheerful collaboration contributed substantially to the success of our expedition and, on the whole, they were co-operative and kept the appointments we regularly made with them from week to week.

A HARSH EXISTENCE

Language difficulties were overcome with the help of teachers from the Mission and Government Schools and of various young men from the Reservation, who spoke Spanish as well as the vernacular. We were thus able to gain some insight into the culture of the inhabitants, so different from our own in so many respects and yet possessing fundamental links with the traditions of most other societies. A remarkable feature was the exaggerated sexual modesty of the men and women – a considerable handicap when it came to carrying out our physical examinations. We were also struck by the uninhibited acknowledgement of bigamy and trigamy once it became clear that we were not interested in condemning anybody on legal or religous grounds.

The most striking feature of this community – even more so than the dire poverty in which the people live – was perhaps the exiguous means of artistic expression available to the villagers. Artistic feeling was, in our view, expressed most clearly in woollen fabrics woven in complicated multicoloured patterns and used as articles of clothing or simply for decoration.

The women use roughly-wrought pieces of silver to fasten their capes ; these are passed on from generation to generation and are not made nowadays. They give one the impression of being specimens of some higher level of culture in the past. Generally speaking, the Indians seem to be resigned to their primitive and narrow existence, to living out their lives against a harsh and impressive background of high mountains and tall pines, exposed to the snows, the rains and the winds which wash and erode the soil and make the land arid and desolate. Only a few of the younger individuals exhibit any real desirs to improve their lot and dream of leaving the Reservation. It is interesting to note, however, that many of the older people who have worked away from the Reservation in their youth return to their small plot of land to marry and have children. It seems as though ownership lends them a dignity which they would not be able to find outside by trying to integrate themselves into our civilization.

The first week was mainly devoted to taking a census of the population. At the same time we provided a number of Indians with general medical treatment to the extent that we were able. That week was not always easy because the reconstruction of genealogical trees was made difficult, partly

through lack of knowledge of the language of these Pewenche Indians and partly because some of the circumstances concerning consanguinity could not be ascertained. It was possible, however, to collect genetic and demographic information in the case of about 600 Indians living in the Pedregoso Reservation. A certain degree of consanguinity was established in 25 per cent of the marriages, and 3.2 per cent were "non-tasters to phenylthiocarbamide". General living and food conditions were fairly uniform.

Of 173 adults subjected to a rather thorough examination, 84 per cent were clearly suffering from goitre, usually of moderate size. Clinically they were euthyroid types.

With these subjects we used – in accordance with various clearly defined research methods – radioactive tracers in the form of inorganic or organic iodine molecules, like thyroxine, tri-iodothyronine or di-iodotyrosine, labelled with iodine-131 or iodine-125. Repeated measurements were made either *in vivo* or on plasma or urine samples. The latter, combined with micro-measurements of stable iodine (iodine-127), made it possible to calculate various metabolic aspects of the iodine cycle and of thyroid hormone production in these patients.

A quantitative study of iodine metabolism was carried out on 77 subjects by observing the evolution of specific activities of circulating organic iodine before and after isotopic equilibrium or after stimulation by exogenous thyrotropic hormone. In some cases the thyroid seemed to function in a homogeneous manner while other patients showed a clear functional heterogeneity of the thyroid. While the adaptation of the thyroid gland seemed satisfactory in the cases of diffused goitre, it seemed incomplete in multinodular goitres.

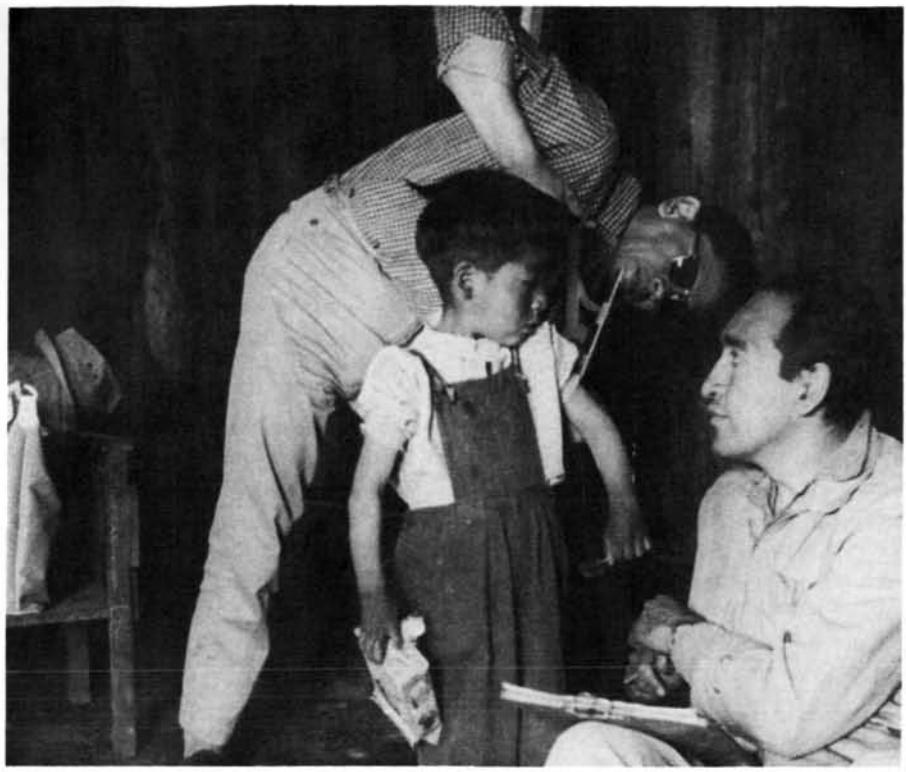
SOME VALUABLE RESULTS

Our first impression indicated the existence of iodine deficiency in these Indians. However, other goitrogenic factors must be taken into account, particularly the atmospheric conditions and the cold which increase thyroid hormone secretion, the diet as well as intrathyroid disorders of hormone synthesis connected with chronic stimulation of the thyroid gland.

One feature of the diet of the Pewenche Indians of Pedregoso struck us as being peculiar and led us to carry out a special study. We observed that the Indians eat the Araucaria nut, i.e. the fruit of the Araucaria tree, day in day out throughout the year. This suggested to us the possibility of an additional goitrogenic factor and we are now studying the behaviour of the thyroids of rats fed with this nut. The experiments carried out have indicated that the Araucaria nut is in fact goitrogenic. Consequently we now have to examine whether this is a significant factor in the pathogeny of endemic goitre among the inhabitants of Pedregoso.

DR. BARZELATTO'S CONCLUSIONS-

Over eighteen months we have carried out three expeditions to Pedregoso, spending a total of twelve weeks studying the indigenous popu'ation. During



this period we have visited all the homes in the Reservation and have examined over 80 per cent of the inhabitants. Our work has thus been a useful exercise in demographic research. We now know the name of each individual and his position in the complicated genealogical tree of the Reservation. We have made a careful study of the feeding habits of each family and of a sample group of individual cases. In one large group of individuals we have made chemical and radioactive measurements of iodine metabolism. We also investigated the effect of various hormones and drugs on iodine metabolism. In this way we have built up an extensive fund of information which when analysed will give us a better understanding of the pathogenesis of endemic goitre among the aborigines. It is too early to draw general conclusions but a few interesting points have already emerged. As in practically all areas where endemic goitre studies have been carried out, there is an iodine deficiency in the food consumed by the community. This would seem to be the fundamental cause of the disorder. Nevertheless 28 per cent of the adult males and 7 per cent of the females, who are exposed to exactly the same environmental conditions, do not suffer from goitre.

.....AND THOSE OF DR. BECKERS-

It is as yet premature to draw final conclusions from the results obtained. The metabolic calculations are in the process of completion. Nevertheless,

various facts are coming to light, in particular the existence of an iodine deficiency, as suggested by the remarkable avidity of the thyroid for radioactive iodine and a rather low (33 microgrammes per day) urinary excretion of stable iodine. On the other hand, some misuse of iodine by the goitrous gland reduces its efficiency in producing thyroid hormones.

Our sejourn in the Andes lasted six weeks. Towards the end the atmospheric conditions improved progressively and we experienced the joys of spring in a region which, though arid and barren, is truly majestic.

Our stay there was a success for more than one reason. First, from a scientific point of view, we believe various interesting metabolic data were obtained which clarify the problem of the pathogenesis of goitre. From the human point of view, we felt we had gained a better understanding of the health problems arising there and hence were in a better position to help the local people. Finally, as research workers, we had the pleasure of working together and pooling our results. Participating in this mission as an IAEA expert, I had the pleasant feeling of being perfectly at home among the Chileans I met every day. I admired the good qualities of these people, who welcomed me so warmheartedly and tried unflaggingly to resolve the thousand and one technical difficulties, which, though small, assume such importance when one is far away from everything. This gives proof of a desire for knowledge and scientific work which merits our highest esteem.