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Note

CHARACTERISATION OF APICAL GRANULOMAS BY DIFFERENTIAL SCANNING CALORIMETRY

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Anatomical pathology can sometimes give doubtful results especially when uncommon kinds of tumours are examined and when the pathologist lacks wide experience.

If it were possible to have an instrumental signal (NMR, EPR, DSC ...) corresponding to each kind of tumour, reproducible and well-differentiated for each tumour, it would be possible to avoid all those problems that can arise from an incorrect diagnosis.

The cell modification that allows the pathologist to diagnose a tumour is the reflex of a different organisation and interaction of the constituents of the membrane bilayers; now the cellular modification, neoformation induced, can be reflected in the structural modifications and originate similar configurations which are hard to distinguish.

Now, different structural arrangements are characterized by different interactions between the species that constitute the bilayers and different DSC curves will be obtained for healthy cells and for neoformed cells.

DSC studies have been carried out on lipidic bilayers (see, for example, ref. 1) and Oldfield and Chapman [2] reviewed the thermal studies of the lipidic membranes. Other studies have been carried out on live cells of *Myroplasma Laidlawii* [3] and on the ghosts of human erythrocytes (see, for example, ref. 4).

On this bases, as a first approach we tried to see if an inflammed tissue such as a granuloma and healthy tissue such as the surrounding gum gave different DSC curves and if the identical curves are obtained with granulomas from different patients.

EXPERIMENTAL

A DuPont 990 differential scanning calorimeter was used with an atmosphere of air and a heating rate of $10°C\ min^{-1}$.

Procedure

The sample (granuloma) and the control (healthy gum) were obtained and were immediately carefully washed with a physiological solution. When all the blood had been removed, they were washed with a little distilled water, dried with a filter paper and then analysed immediately to avoid any possible change. When the granuloma was analysed first, the control was kept in a refrigerator during the analysis and analysed immediately after the granuloma.

Figures 1 and 2 show the curves obtained for two different granulomas and the two corresponding healthy gums. The curves for the granulomas differ from those for the healthy gums: in fact, there are two endothermic peaks in the curve for the healthy tissues while there is just one peak in the curves for the granulomas. This process probably corresponds to the loss of the water. To confirm this hypothesis, a sample of one granuloma was dried under vacuum at 0°C to eliminate water without causing any change by increasing the temperature. The DSC curve for the granuloma treated in this way is shown in Fig. 3. It is possible to see that the first peak disappears so confirming that water is lost in this temperature interval.

In the case of the healthy tissue, an endothermic peak appears at 230°C that does not appear in the granuloma curve.

The temperature range in which the difference is most evident is 300—500°C. Here, the granulomas show an exothermic peak starting at about 300°C with a maximum at 350°C. This exothermic peak is not present in the healthy tissue curve where another exothermic peak appears starting at 485°C.

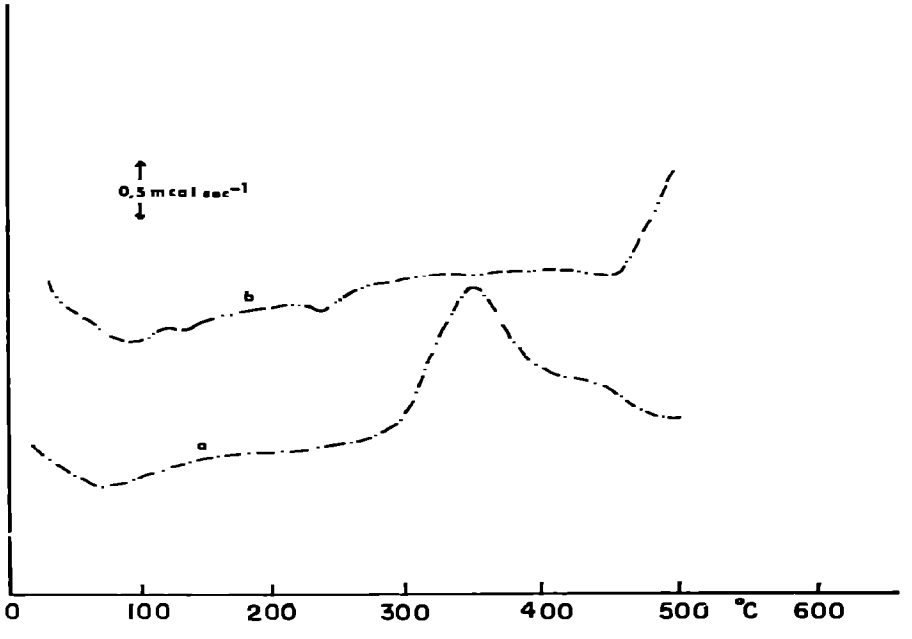

Fig. 1. DSC curves. (a) Granuloma No. 1 (male); (b) corresponding healthy gum. Heating rate, 10°C min^{-1} ; atmosphere, air.

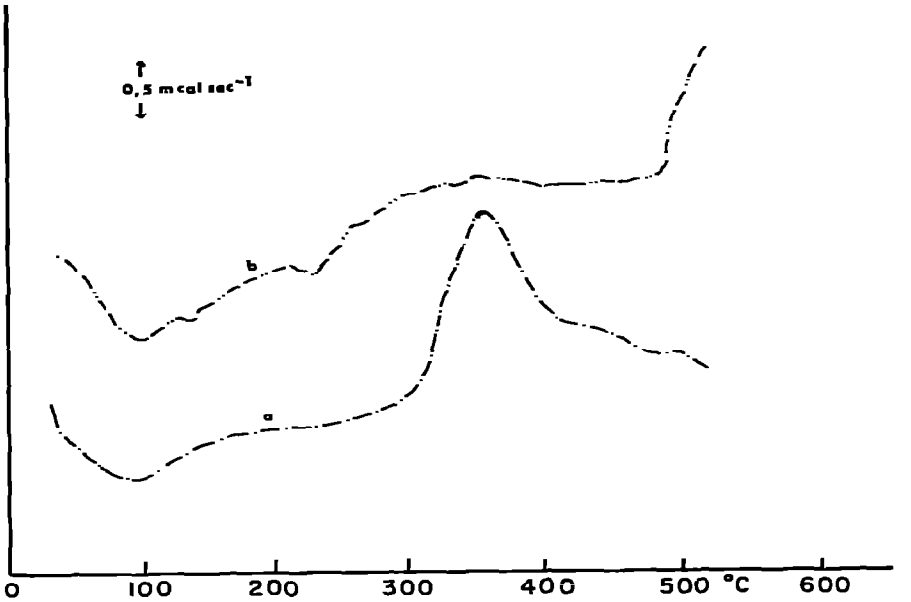

Fig. 2. DSC curves. (a) Granuloma No. 2 (female); (b) corresponding healthy gum. Heating rate, 10°C min^{-1} ; atmosphere, air.

To confirm these data, many other granulomas and the corresponding healthy gums, obtained from both male and female patients, were analysed and on each occasion the same behaviour was observed.

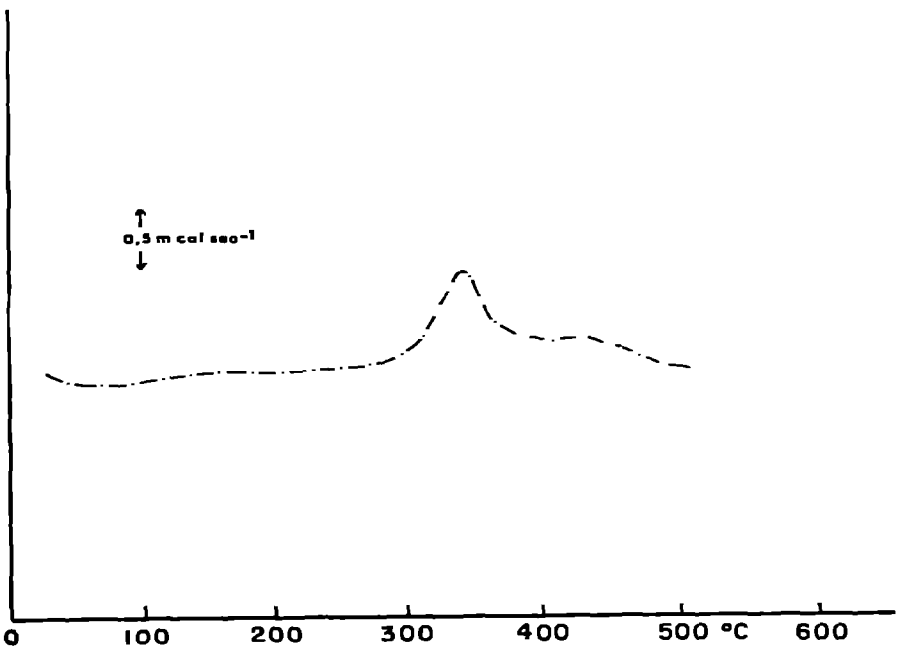

Fig. 3. DSC curve. Granuloma No. 1 dried under vacuum at 0°C. Heating rate, 10°C min^{-1} ; atmosphere, air.

CONCLUSIONS

From the data obtained it is possible to see that differential scanning calorimetry provides curves which are significantly different for the granulomas and the healthy surrounding tissues. Particularly, it can be seen that healthy tissue shows a double peak corresponding to water loss, which means that the bound water is, in healthy tissue, of two different types, while in the case of the granuloma there is just one type of bound water.

Another characteristic is that the endothermic process localised at 230°C in the healthy tissue curve disappears in the case of the granuloma.

Finally, the behaviour of the curve changes dramatically in the temperature range 300—500°C where the granuloma curve shows an exothermic peak starting at 300°C with a maximum at 350°C that is shifted to about 485°C in the case of healthy tissue. This shift should be because the oxidative degradation of the cells is easier in the case of granuloma where the tissues have a lower organisation with respect to the healthy gum tissues.

In the case of the granulomas and of the surrounding healthy gums, the instrumental signals are characteristic and the reproducibility is so good that the DSC curve appears as a finger print for these inflammed tissues.

If this phenomenon proves to be the same for tumours, it will be possible, obviously after a long period of research, to characterize the different types of tumour.

ACKNOWLEDGEMENT

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