

INTRODUCTION

THE USE of the scanning electron microscope (SEM) in ENT surgery as a diagnostic and research method is relatively new and, as such, has been applied enthusiastically. In this paper the uses, scope and limitations of the SEM will be reviewed.

TECHNIQUES & RESULTS

The SEM provides a clear and highly magnified view of the surface of many objects including

The Use of Scanning Electron Microscopy in ENT Surgery

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glutaraldehyde at room temperature and then transferred to an ordinary refrigerator until processing is possible.

The SEM gives remarkable resolution and the clarity of image of the surface of tissues allows for careful study. Submucosal tissue is not seen but some tissues, normally deeply situated, may be studied after surgical removal and appropriate dissection, e.g. the lateral semi-circular canal (Figure 3).

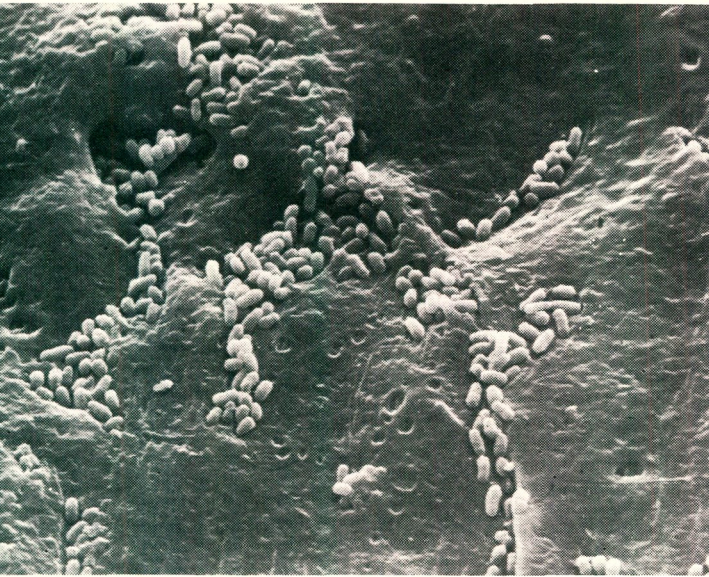


Fig. 1 x 5000 Commensal skin bacteria



Fig. 2 x 5000 Red blood cell on nasal mucosa

human tissues. Magnifications of up to 7500 are obtained and the images may be readily photographed. Commonplace objects such as commensal skin bacteria (Figure 1) or a red blood cell on nasal mucosa (Figure 2) may appear startling at these high magnifications.

We have used the SEM extensively to study the surface morphology of nasal mucosa in a variety of conditions. Biopsy specimens are taken either by dissection with a scalpel blade or with sharp punch forceps. It is important to avoid crushing the specimen and

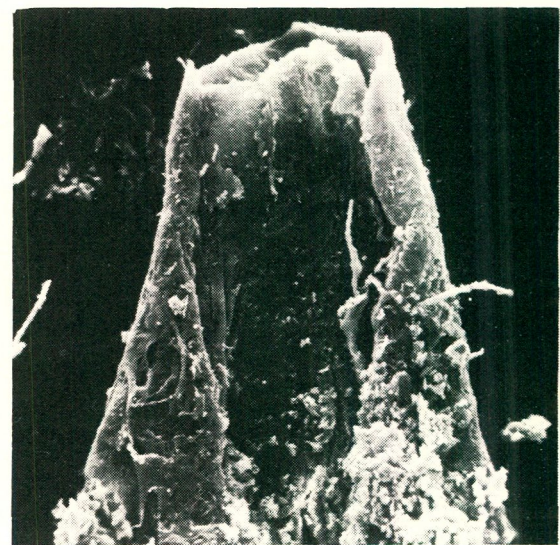
blood should be rinsed off in normal saline. The specimen is fixed immediately in 3% buffered

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Fig. 3 x 3000 Ampulla of lateral semi-circular canal



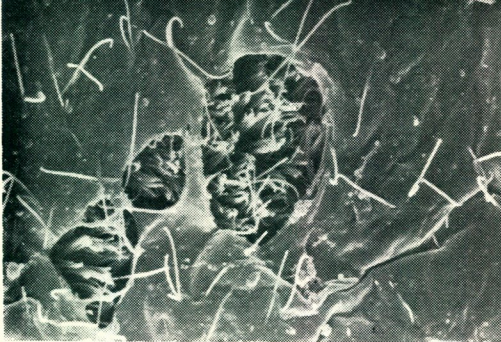


Fig. 4 x 5000 Normal cilia



Fig. 5 x 1500 Atrophic rhinitis

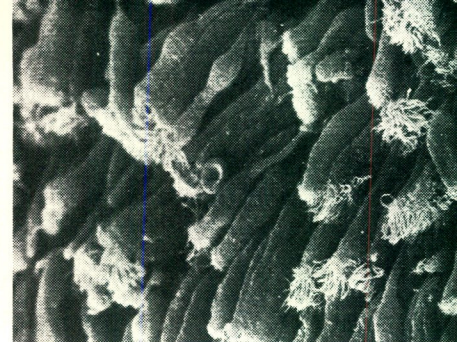


Fig. 6 x 3000 Atrophic rhinitis :crust Formation

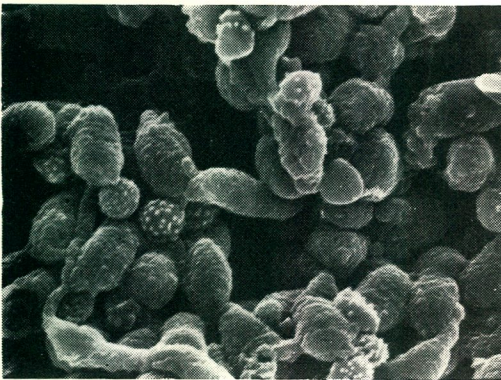


Fig. 7 x 5000 Atrophic rhinitis

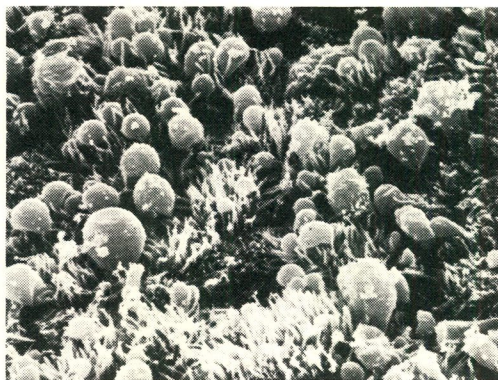


Fig. 8 x 5000 Atrophic rhinitis Non-coalescing mucus

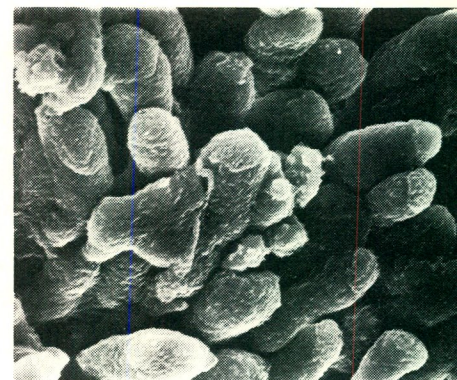


Fig. 9 x 5000 Atrophic rhinitis : Bare epithelial cells

DISCUSSION

The usefulness of the SEM will be considered under 4 headings.

i) Morphology of surface epithelium

Perhaps especially in the nose it is the pathological processes which occur on the very surface of the mucous membrane that make up a particular set of symptoms, which are then labelled as one particular disease.

Figure 5 — 8 show the typical SEM features of primary atrophic rhinitis and it is easy to appreciate how the morphological features are related to the classical symptoms of the condition.

The serried ranks of cilia in a normal nose showing through the mucous blanket (Figure 4) are indeed beautiful but, more important, they are a reminder that any medical or surgical treatment which we apply to the nose must not in any way compromise their integrity.

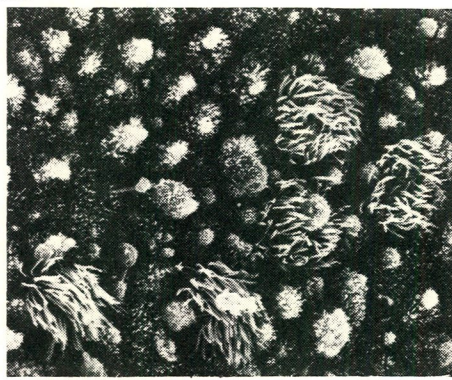


Fig. 10 x 5000 Atrophic rhinitis. Cilia regeneration

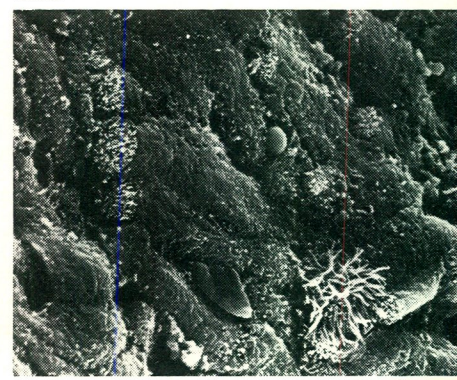


Fig. 11 x 5000 Pre-clinical atrophic rhinitis Minimal ciliation

ii) Understanding disease processes

The example of atrophic rhinitis has been discussed in the preceding paragraph. The formation of a crust in the nose — a seemingly mundane affair — may be dramatically illustrated by the SEM (Figures 5 — 7) when the dynamic nature of the process may be understood.

In certain circumstances the SEM may give a clue to subsurface pathology. Figure 8 shows mucus in atrophic rhinitis forming abnormal droplets rather than a coherent

mucous blanket. The implication is an abnormality in the mucous glands themselves.

iii) Monitoring the response to treatment

In non-malignant conditions the most important factor is normally the subjective feeling of the patient. However, it is always gratifying to receive objective confirmation that the treatment one has inflicted upon the patient is actually of benefit.

Figures 9 — 10 illustrate this clearly and show how ciliary regen-

eration takes place after surgical closure of the nostrils, for a period of several months, in atrophic rhinitis.

iv) *Diagnosis*

At present the SEM is in ways too slow and cumbersome to be of much value as a diagnostic tool. More conventional methods are quicker and cheaper. However, it is of interest to note that the SEM may on occasion be of value in diagnosis. In one case which we studied, a 13 years old girl was admitted for reduction of a nasal

fracture. An elective biopsy of an apparently normal and healthy nasal mucosa showed changes of early atrophic rhinitis (Figures 11). When she was seen 8 months later she had established atrophic rhinitis !

Summary

An introduction to the use of the SEM in ENT surgery and illustrations of the technique are presented. More detailed papers on some of the subjects covered have been prepared and are at present

“in press”. Interested readers should refer to future issues of the *Journal of Laryngology and Otolology*.

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H.E. Shaikh Hamad Bin Isa Al-Khalifa the Heir Apparent and Defence Minister visiting the Operation Theatre at the Military Hospital.