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Some Investigations concerning the Glands associated
with the Skin of the Mollusc, *Arion hortensis* (Fér.).

Volume I : Text

Volume II : Figures & Plates

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for the degree of

Doctor of Philosophy, Keele, 1972

Vol. II

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LIST OF ABBREVIATIONS FOR FIGURES AND PLATES

<u>Abbreviation</u>	<u>Interpretation</u>
A	<u>A</u> mucous gland cell of sole.
A.D	Area of discharge.
B	<u>B</u> mucous gland cell of sole.
Bas.	Basal body.
Bb.	Blebs.
BL	Basal lamina.
C	<u>C</u> gland cell of sole.
Ch.	Chromatin.
Ci.	Cilium.
Ci.H.	Ciliated 'Hump'.
Ci.R.	Cilium rootlet.
Col.	Collagen.
Col.S.	Collagen Sheath.
Co.S.	Coalescing Sacs.
Cr.	Cristae.
CTC	Connective Tissue Cells.
Cy.	Cytoplasm.
D	Duct.
De.	Desmosome.
EC	Epidermal Cells.
ER	Endoplasmic Reticulum.
ER Dd.	ER, Damaged.
ER Dis.	ER, Disorganised.
ER Ram.pl.	ER, ramifying plates.
ER Tan.	ER, tangential section of.
FC	"Fuzzy Coat."
F	Fibroblasts.

List of Abbreviations used on figures and plates.

<u>Abbreviation</u>	<u>Interpretation</u>
FF	Forming face of Golgi complex.
Gly.	Glycogen.
GC	Golgi Complex.
GS	Golgi Sacs.
GV	Golgi Vesicles.
ICB	Intercellular Bridges.
IMG	Intramitochondrial Granules.
LE	Lower Epidermis.
LM	Lateral Mucocyte.
Lu.	Lumen.
M	Large mucous gland cell of mantle.
m	Small mucous gland cell of mantle.
Me.	Melanocyte.
Me. Cond.	Melanin, condensing.
Me. Gr.	Melanin granules.
MF	Mature face of Golgi Complex.
Mi.	Mitochondrion.
Mi. DP	Mitochondrion, Dividing Phase?
Mt.	Microtubules (of Epidermis).
Mus.	Muscle fibres.
Mv.	Microvilli.
My.	Myoblast.
Mye.	Myelin figure.
N	Nucleus.
NM	Nuclear membrane.
NP	Nuclear pore.
N pl.	Nucleoplasm.
Nu.	Nucleolus.
Nuc.	Nucleonema (of nucleolus).

<u>-Abbreviation</u>	<u>Interpretation</u>
PA	Pars amorpha (of nucleolus).
PG	Pedal Gland.
P/P	Pigment / Protein cell.
Pr.	Projection.
Pre. Me.	Premelanin.
R	Ribosomes.
R.A.	Ribosomes absent.
Ram.	Ramifications.
RER	Rough Endoplasmic Reticulum.
S	Secretion.
Sp. (B.C.)	Spaces between cells.
SS	Secretion sacs.
SV	Synaptic vesicles.
T	Tubules.
T.W.	Terminal web.
T (WH.)	Tubules (whole).
Un. C	Unknown Cell.
U.E.	Upper Epidermis.
UM	Unit membrane.
V	Vesicles.
(X)	Unknown cell in blastema.
Z.A.	Zonula adhaerens.
Z.S.	Zonula septata.

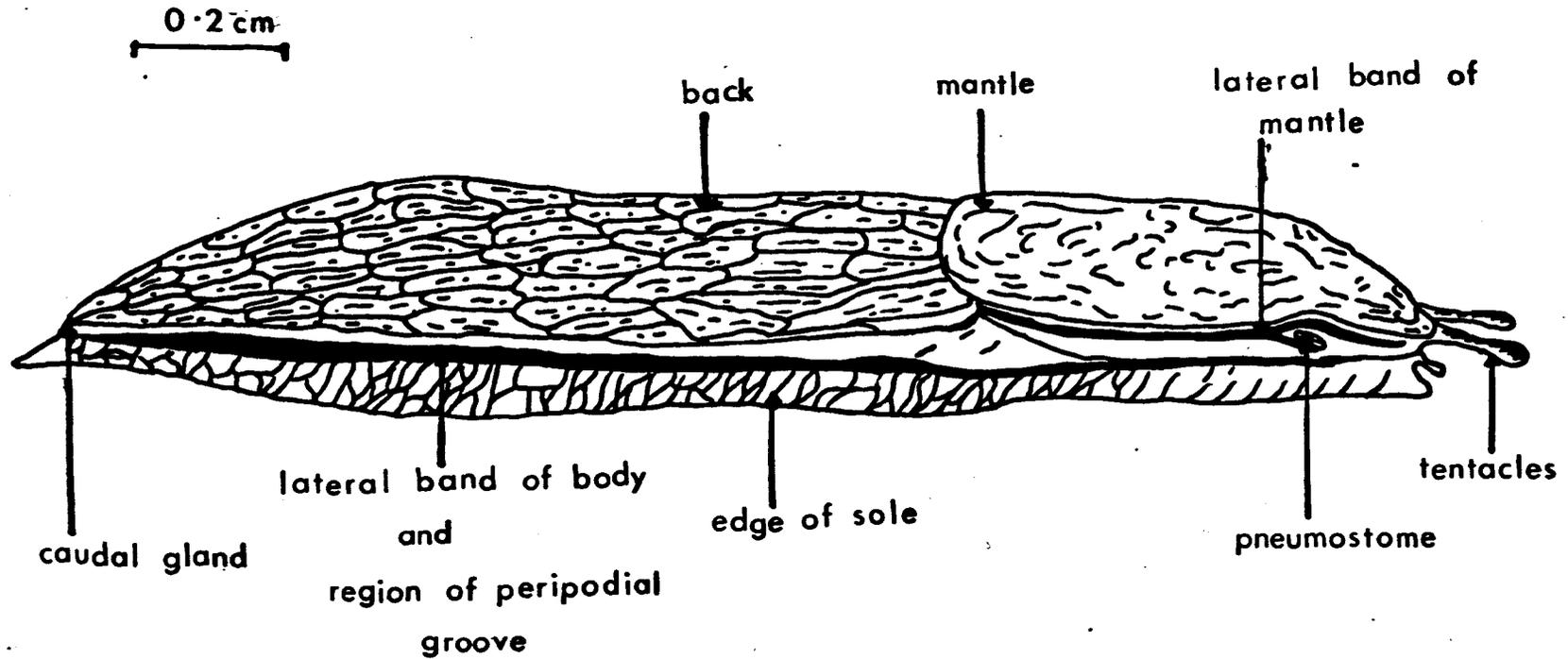


Fig 1 ARION HORTENSIS, right side, fully extended

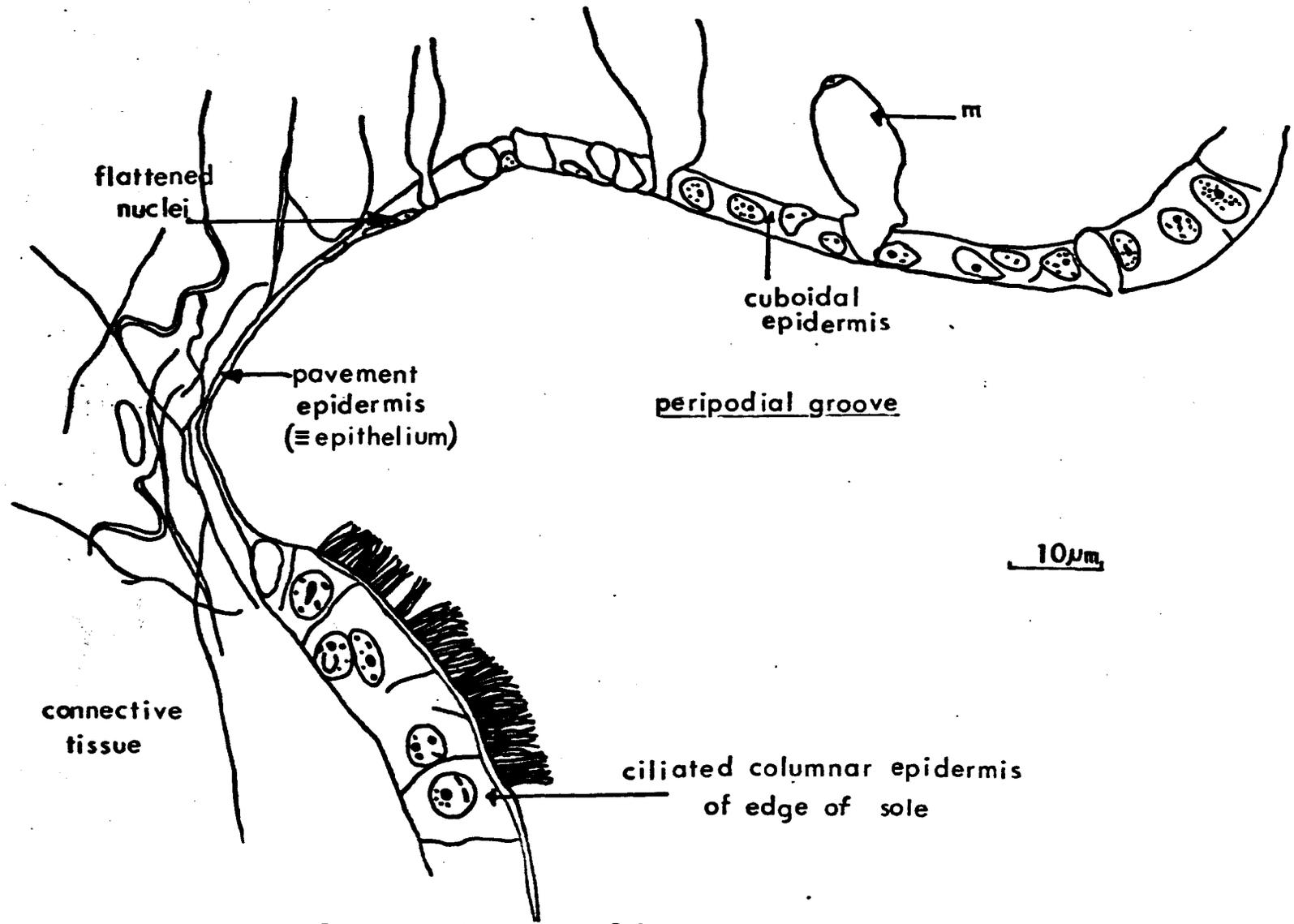


Fig 2.TS.PERIPODIAL GROOVE SHOWING VARIETY OF EPIDERMAL CELL TYPES

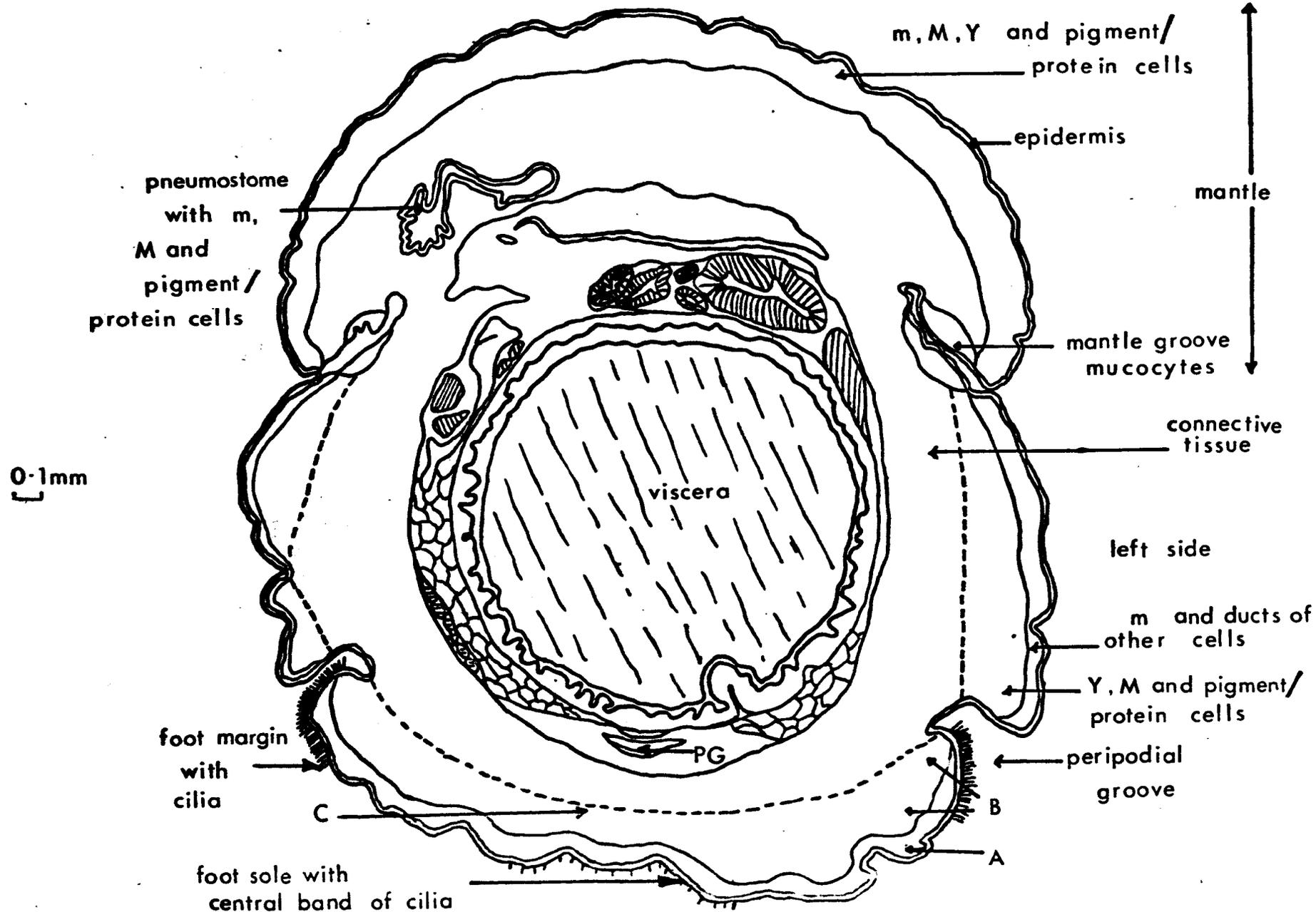


Fig.3 TS DISTRIBUTION of GLAND CELL TYPES (PNEUMOSTOME REGION)

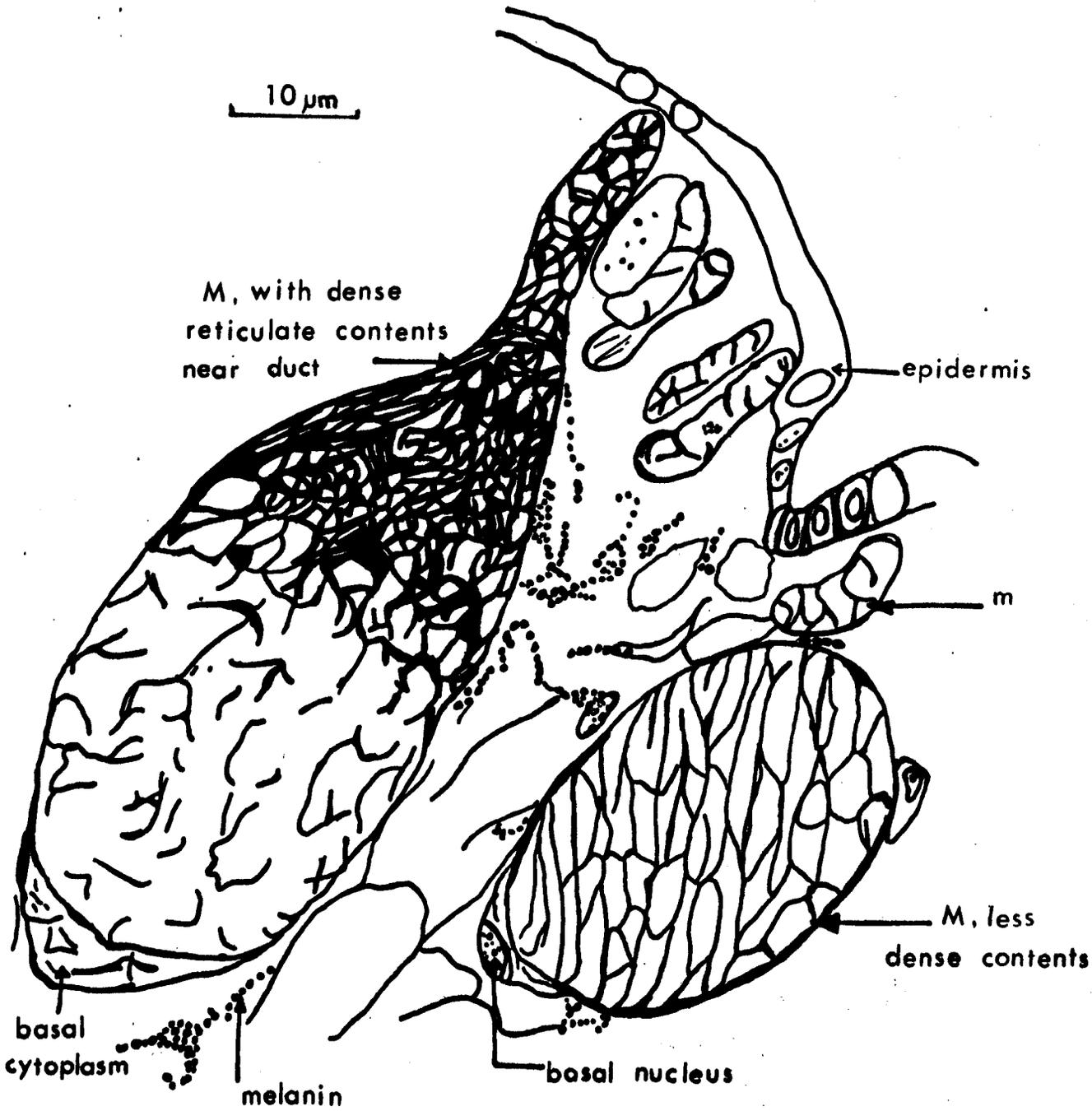


Fig 4. TS. M GLAND CELL, CHEMICAL FIXATION

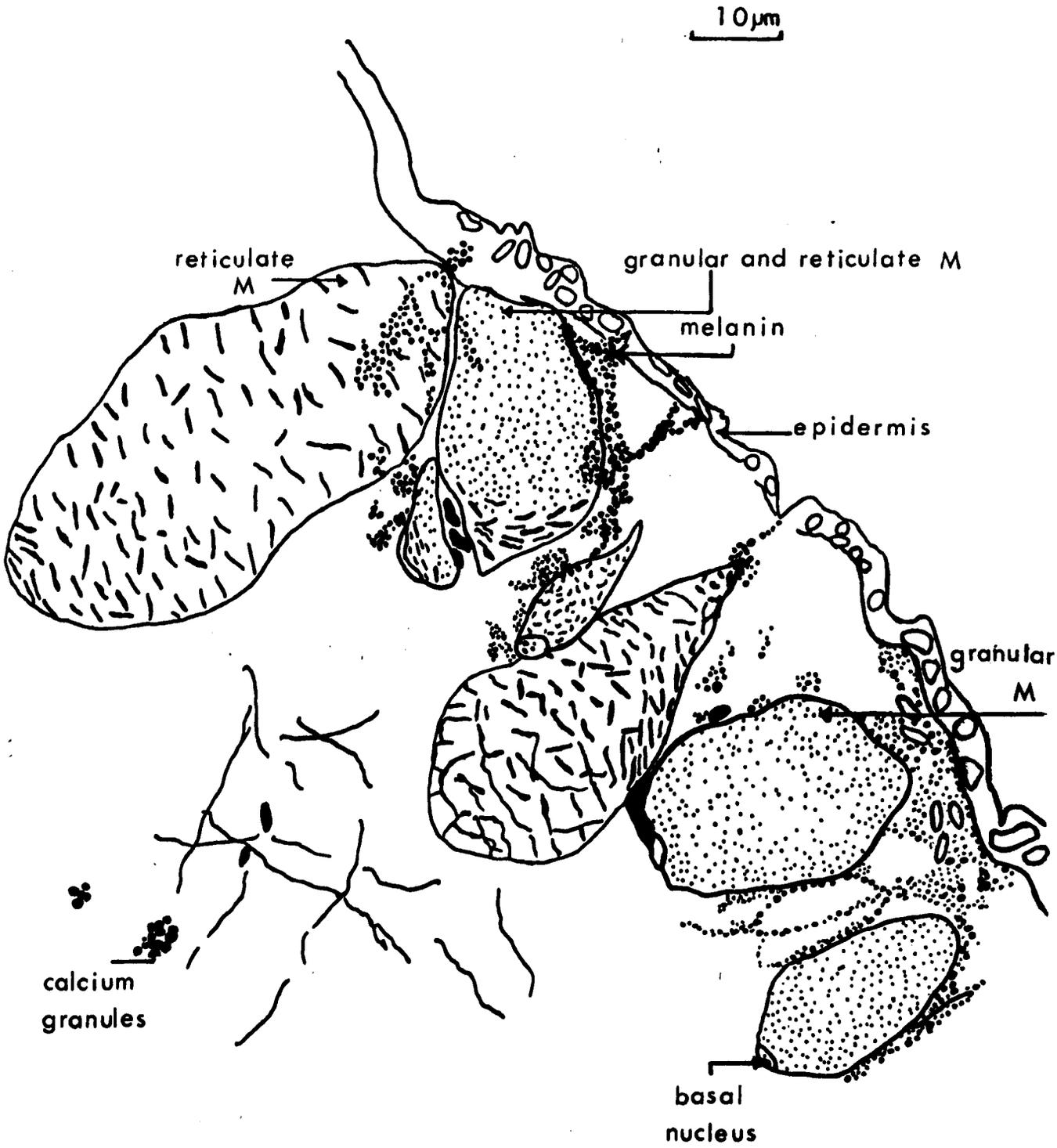


Fig 5 M GLAND CELL in MANTLE after FREEZING (TS)

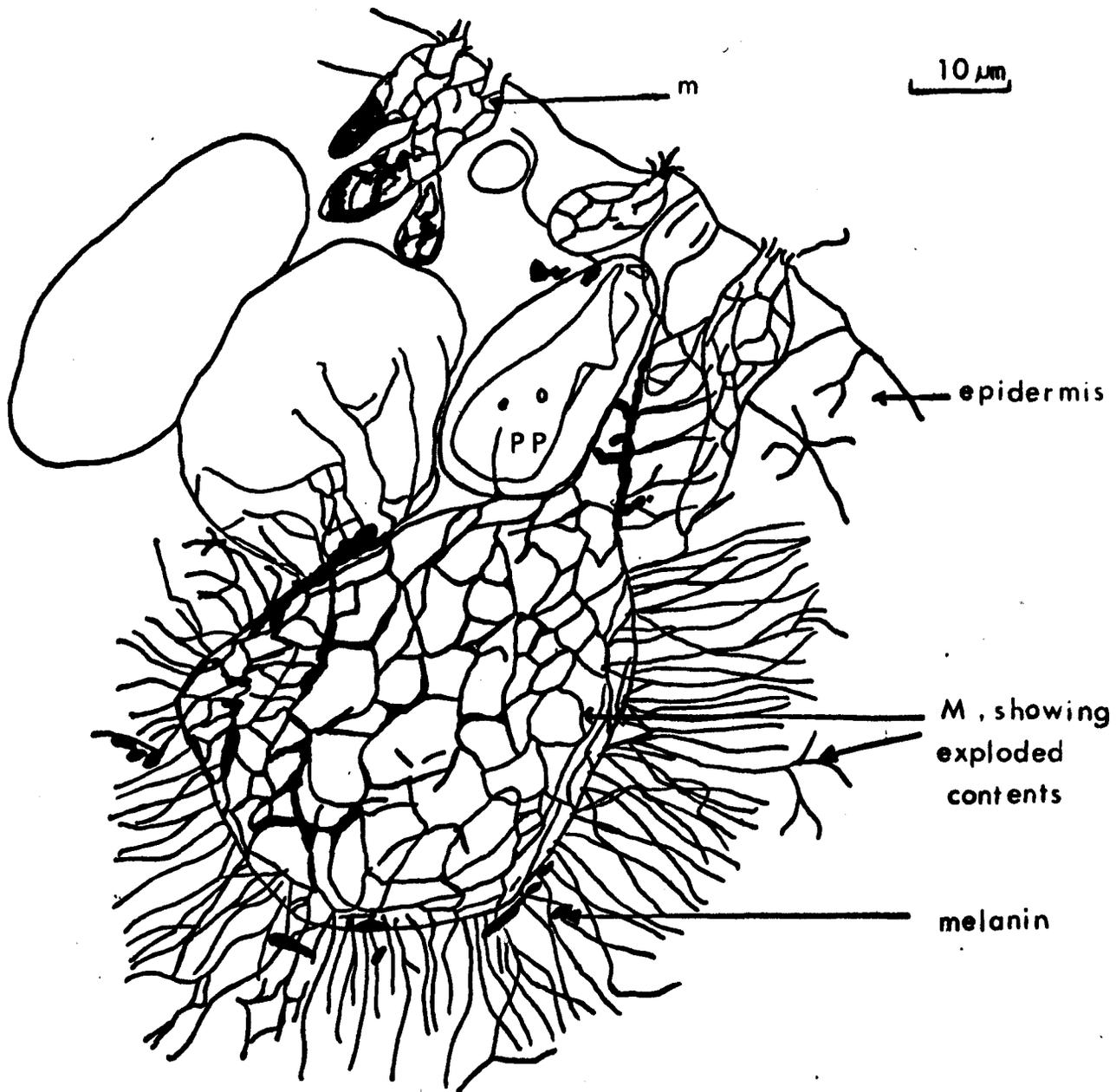


Fig 6.TS.M GLAND CELL, showing
EXPLODED CONTENTS,
CHEMICAL FIXATION

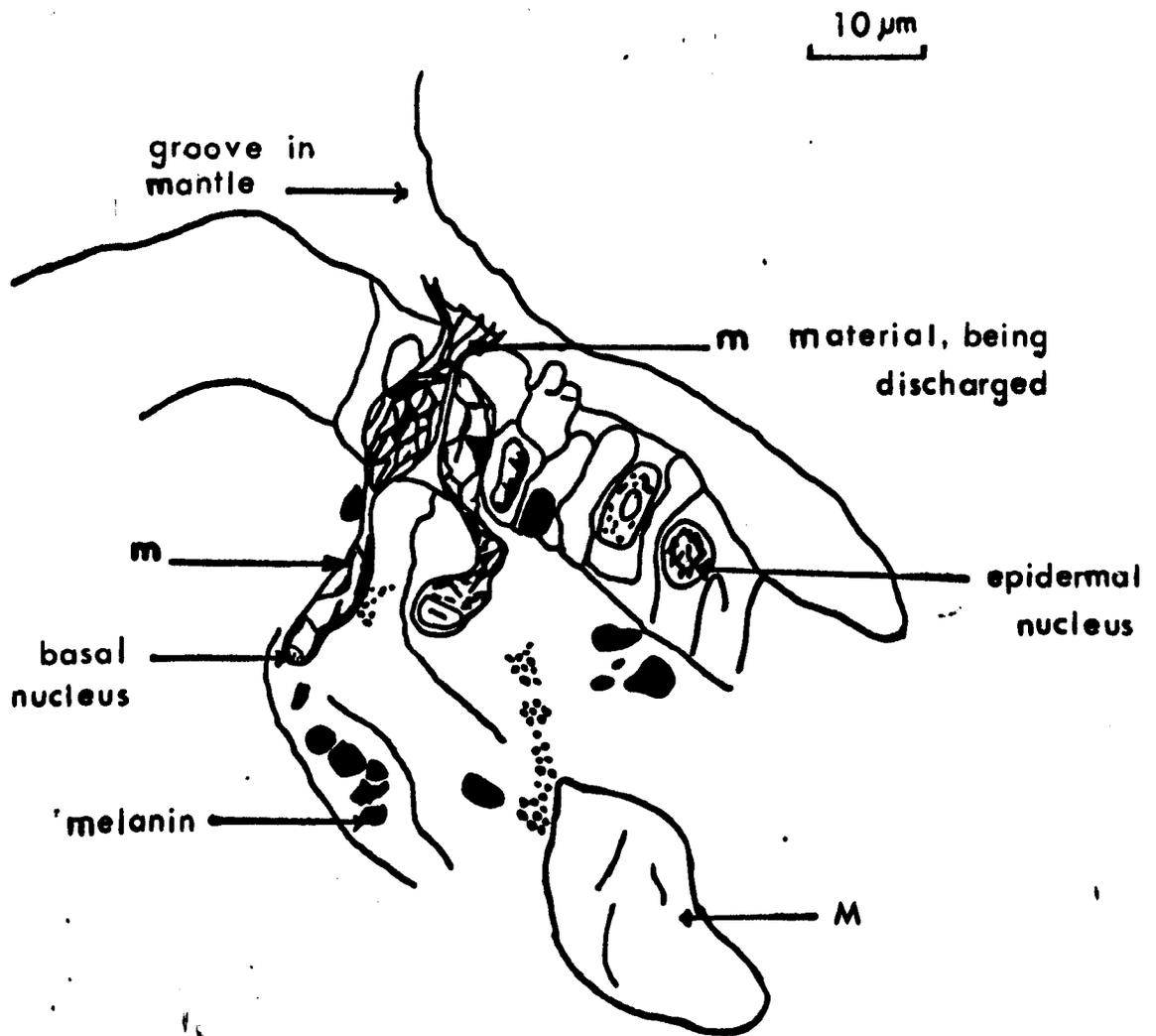


Fig 7: SMALL MUCOUS GLAND CELL, m.(TS).

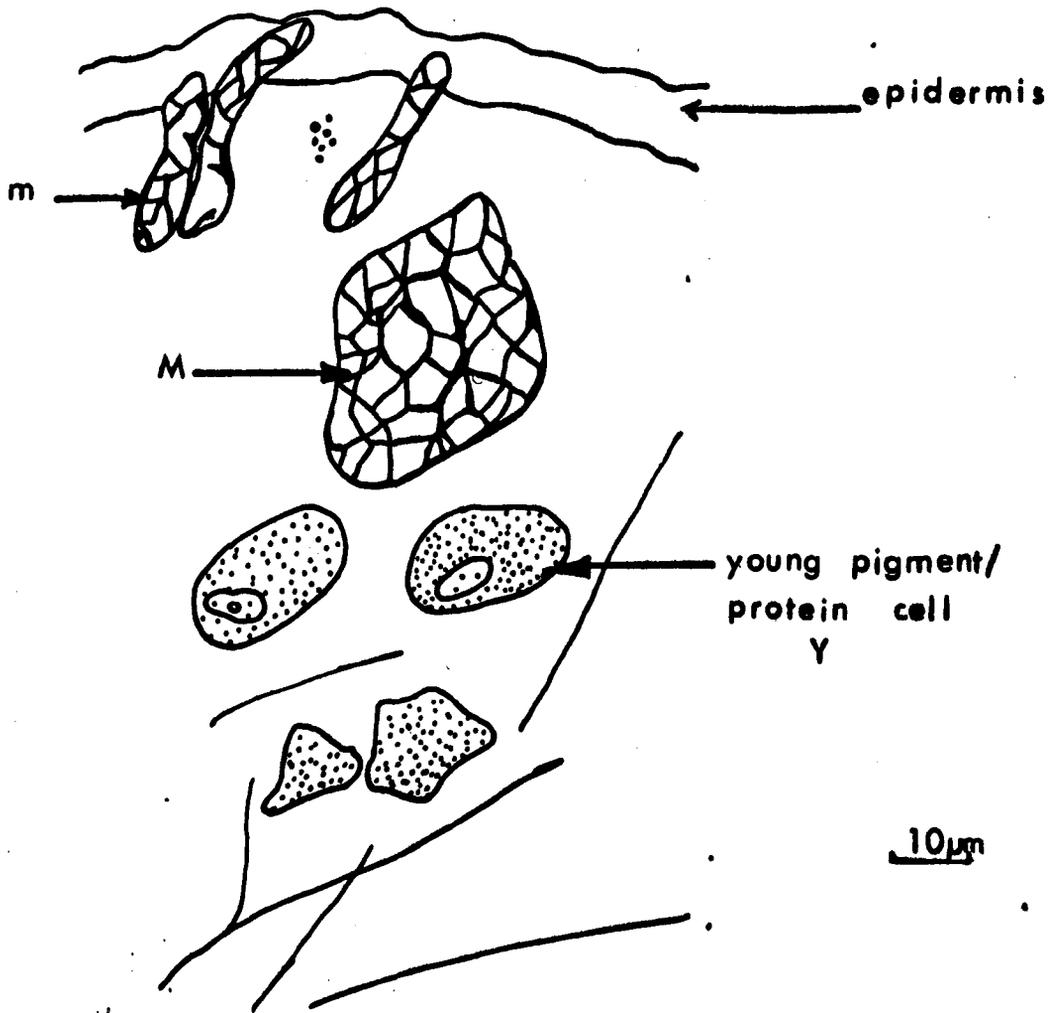


Fig 8.T.S.SHOWING RELATIONSHIP OF DORSAL SURFACE GLAND CELLS AND YOUNG PIGMENT/ PROTEIN CELLS AFTER FREEZING

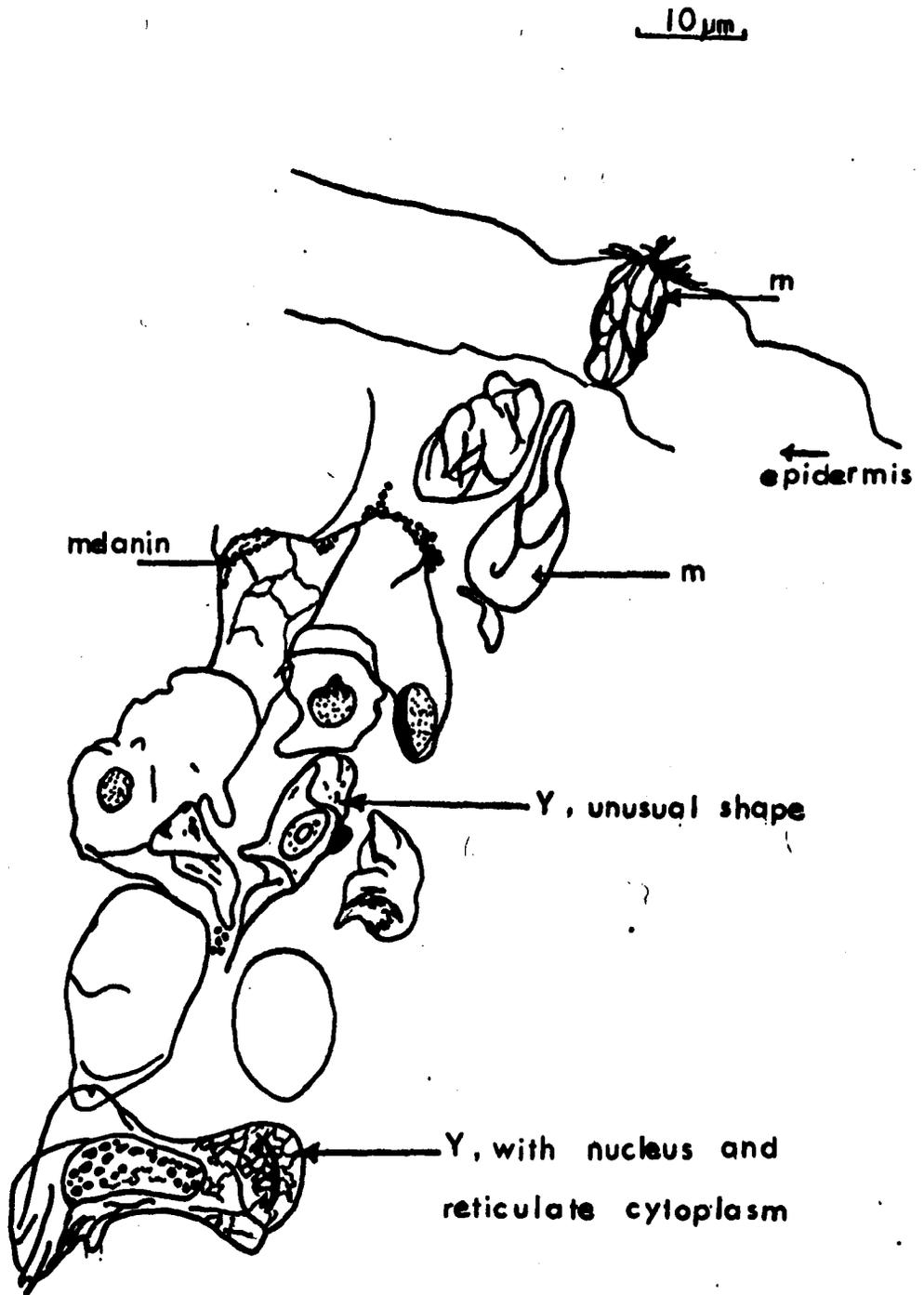


Fig 9: YOUNG CELL, Y, of PIGMENT/
PROTEIN CELL.
CHEMICAL FIXATION. (TS)

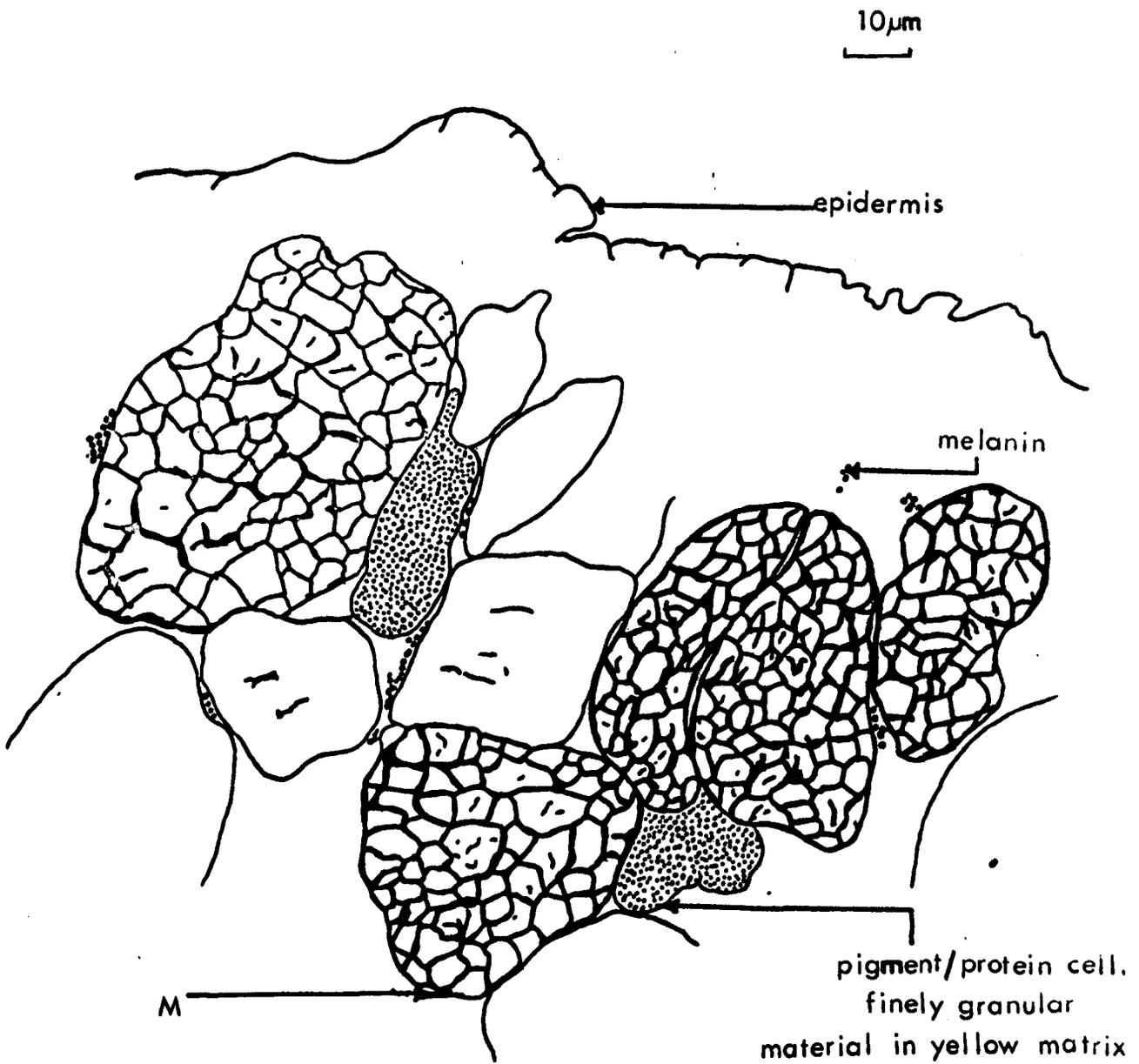
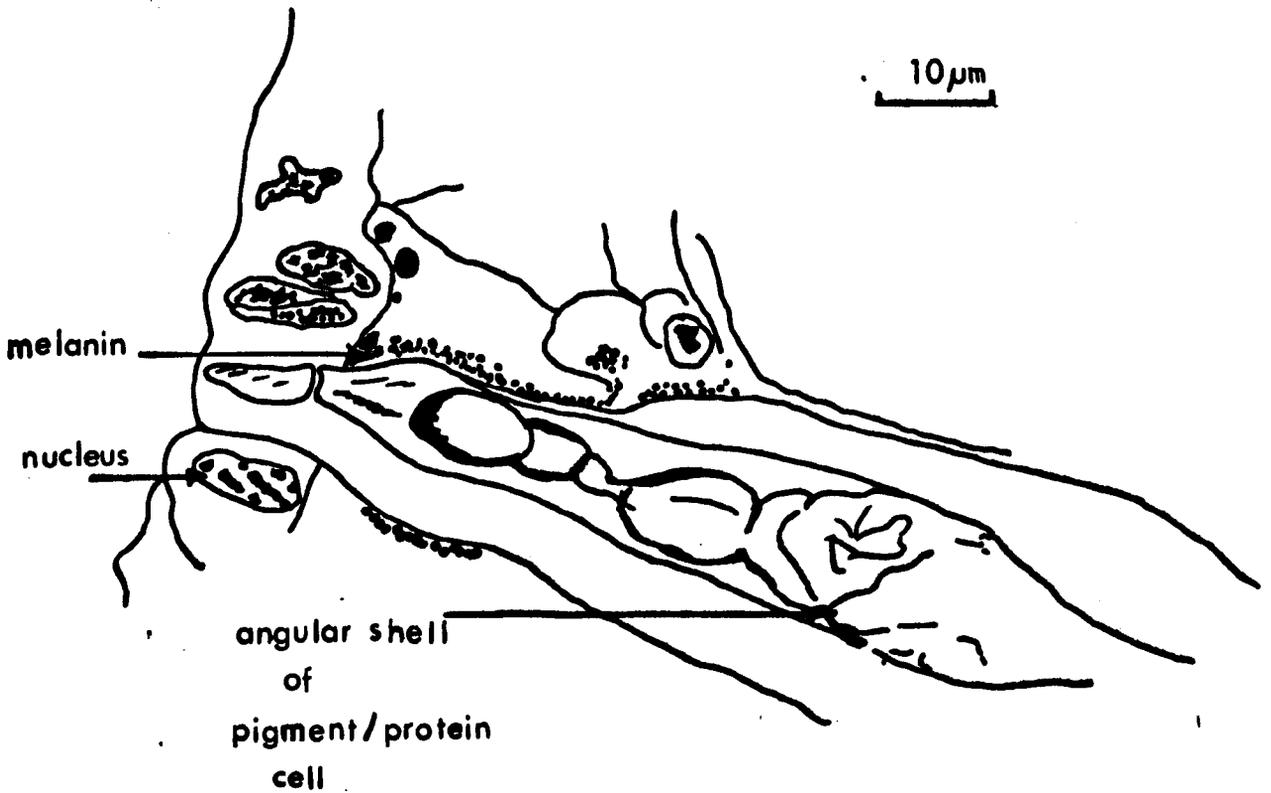


Fig10 POSITION and APPEARANCE
of PIGMENT/PROTEIN CELL,
AFTER FREEZING. (TS).



**Fig 11. EFFECT of CHEMICAL FIXATION
on PIGMENT/ PROTEIN CELL (TS)**

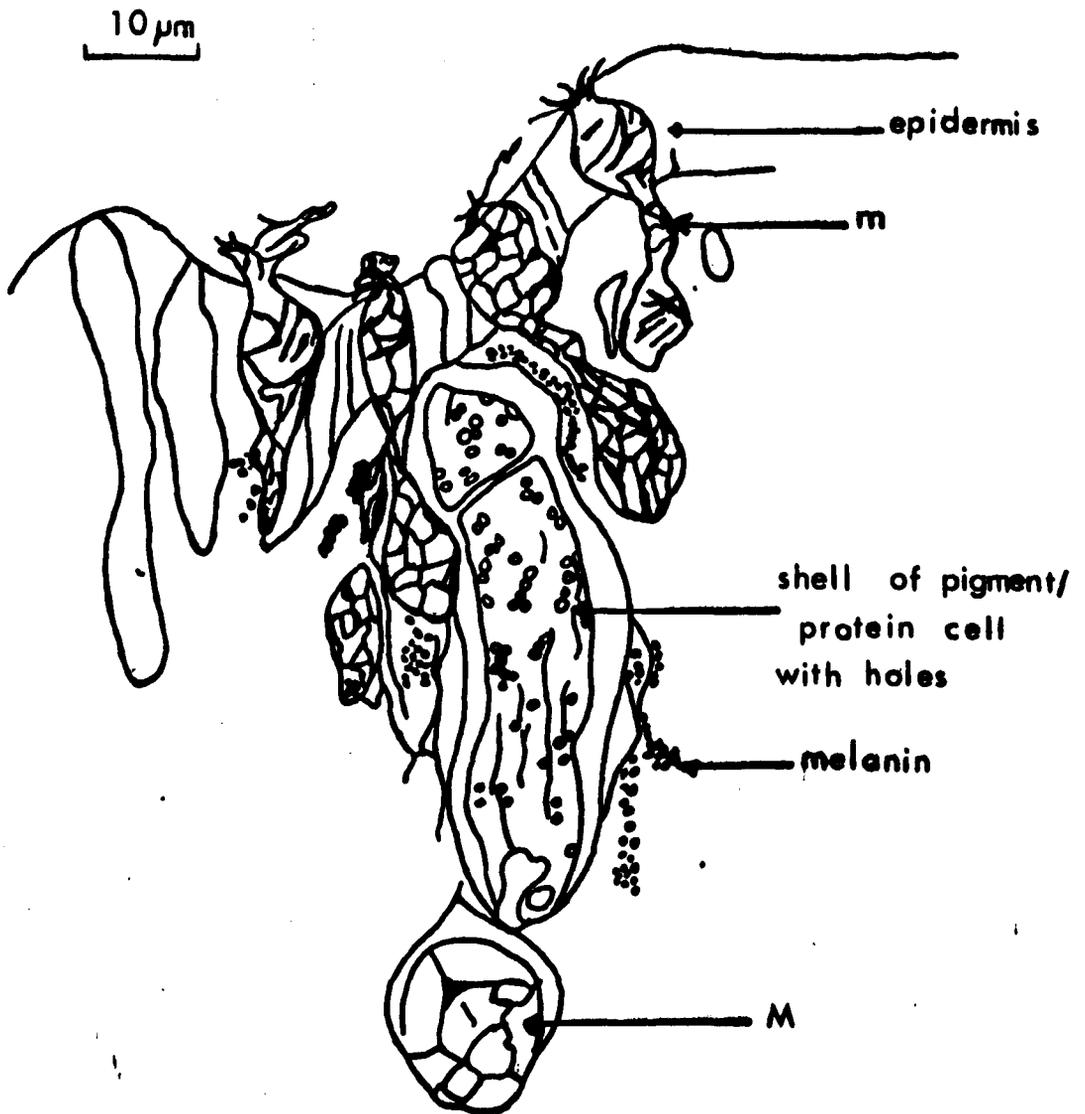


Fig 12: EFFECT of CHEMICAL FIXATION on PIGMENT/PROTEIN CELL.(TS).

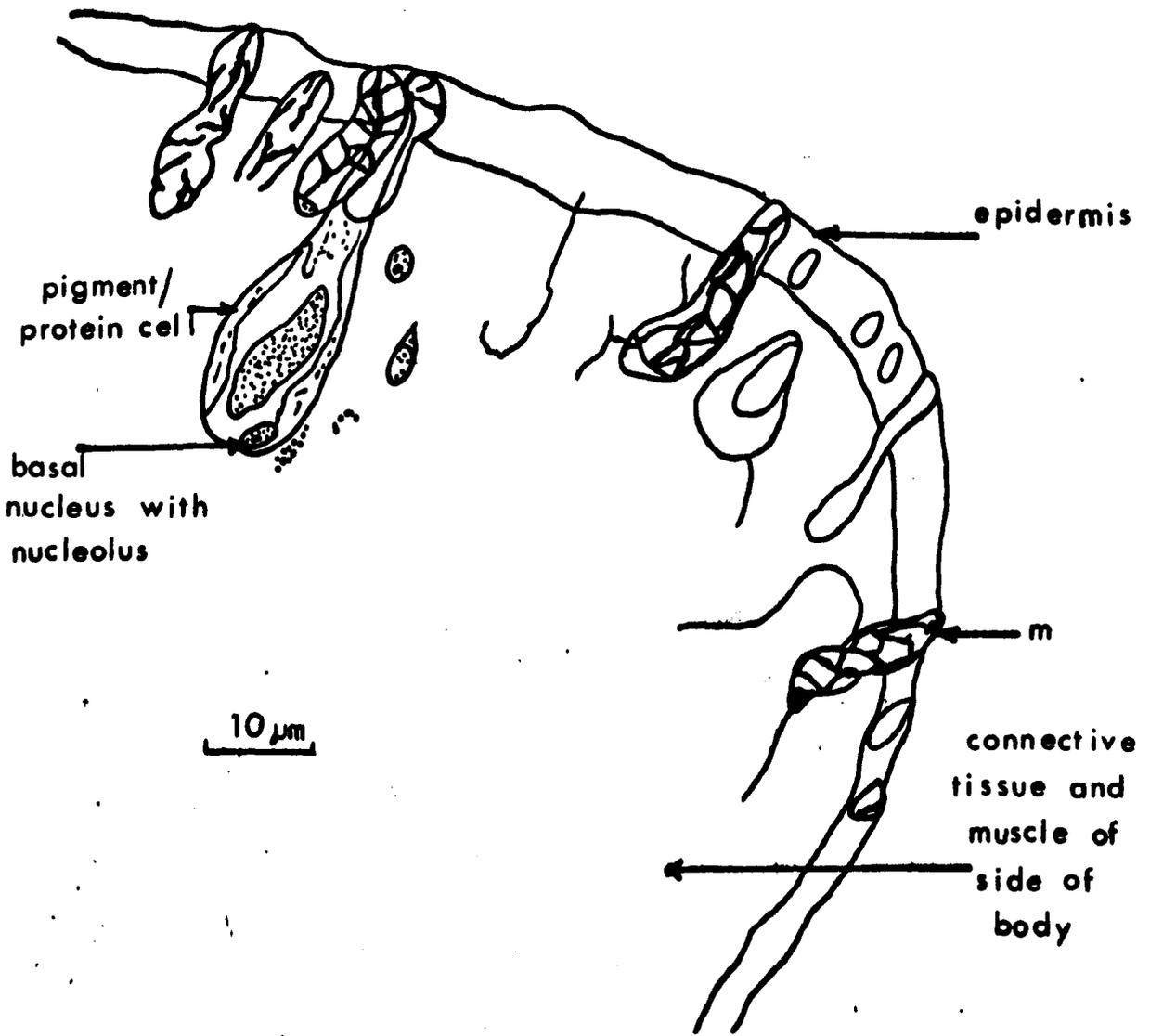


Fig13 PIGMENT/PROTEIN GLAND CELL,
with basal nucleus .
CHEMICAL FIXATION. (TS).

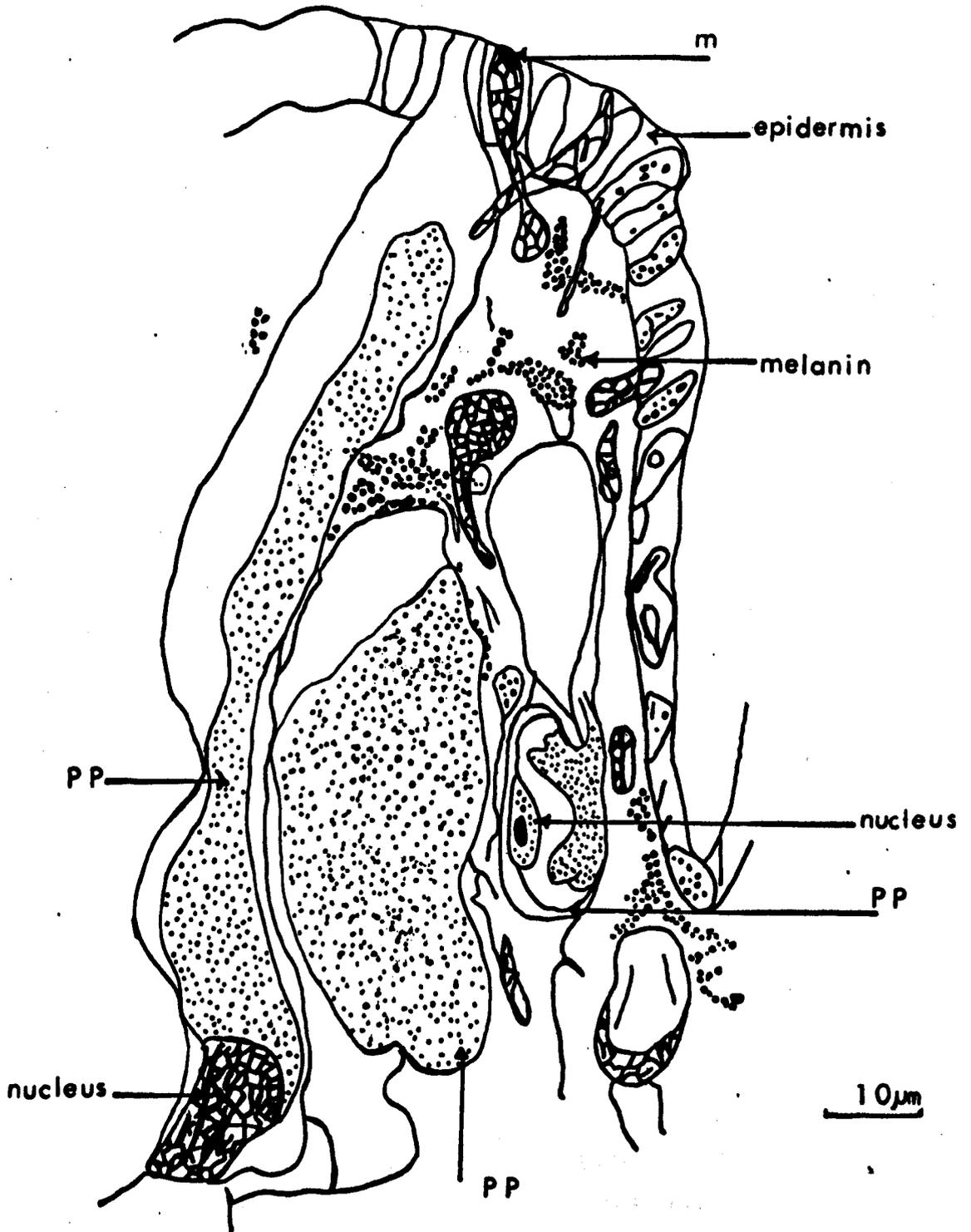


Fig14: TS. PIGMENT / PROTEIN CELLS
CHEMICAL FIXATION

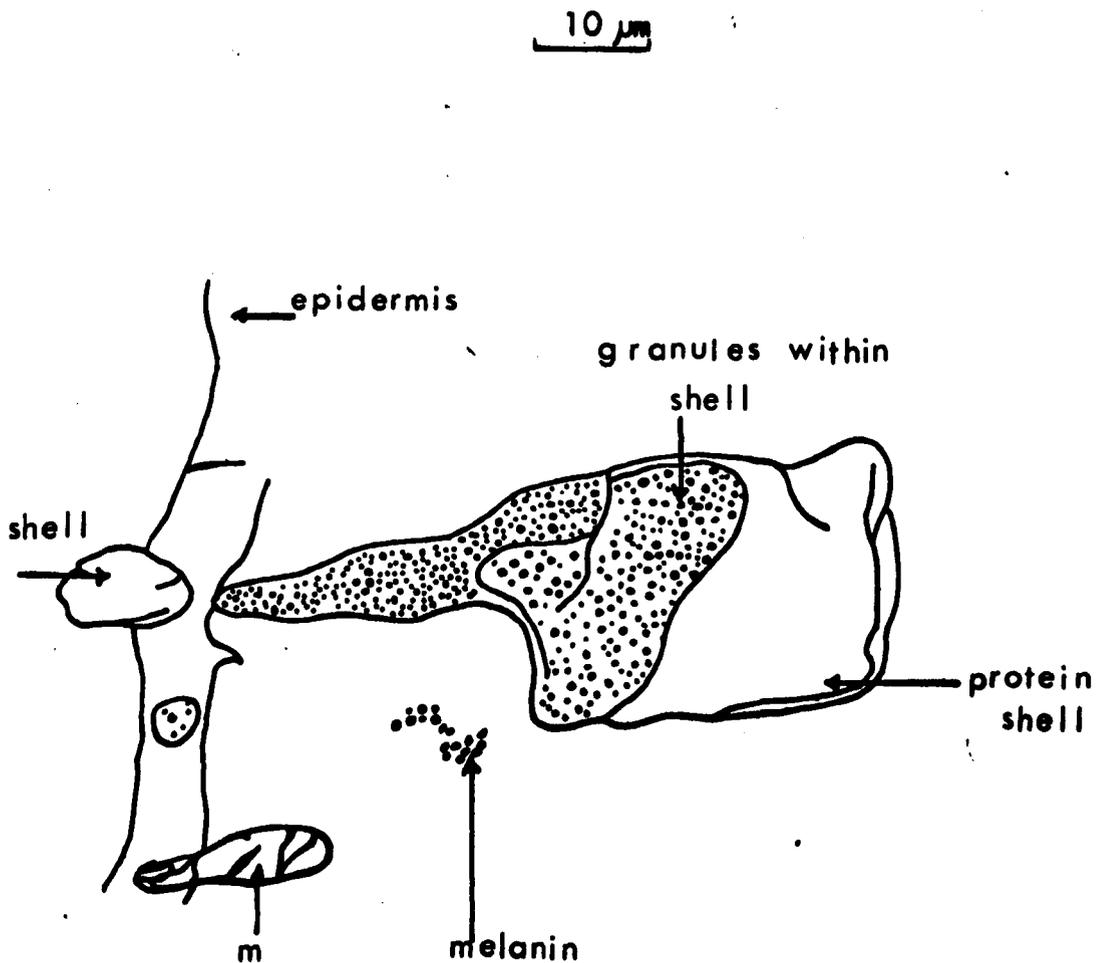


Fig 15: PIGMENT/ PROTEIN CELL
AFTER CHEMICAL FIXATION. (TS).

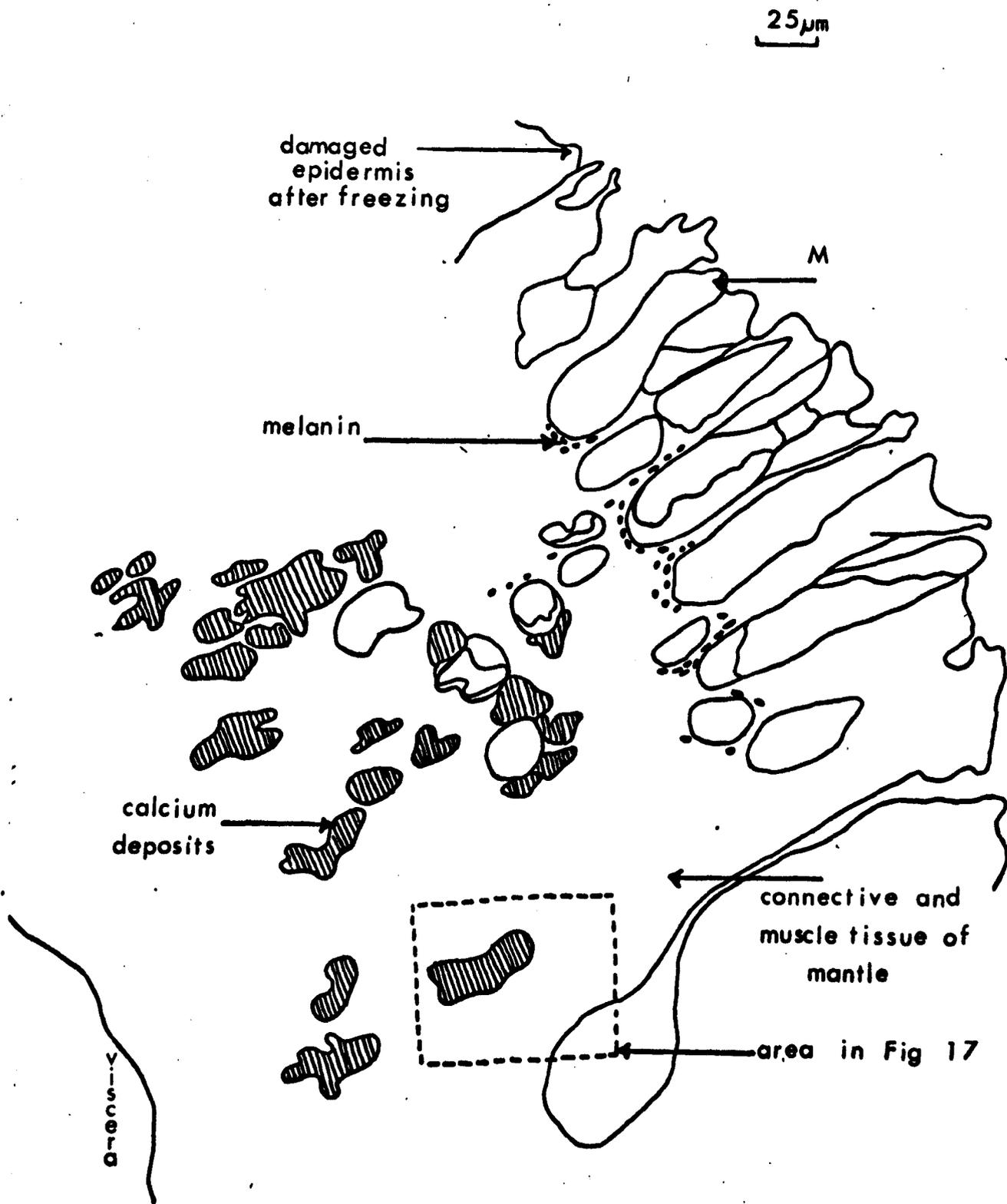
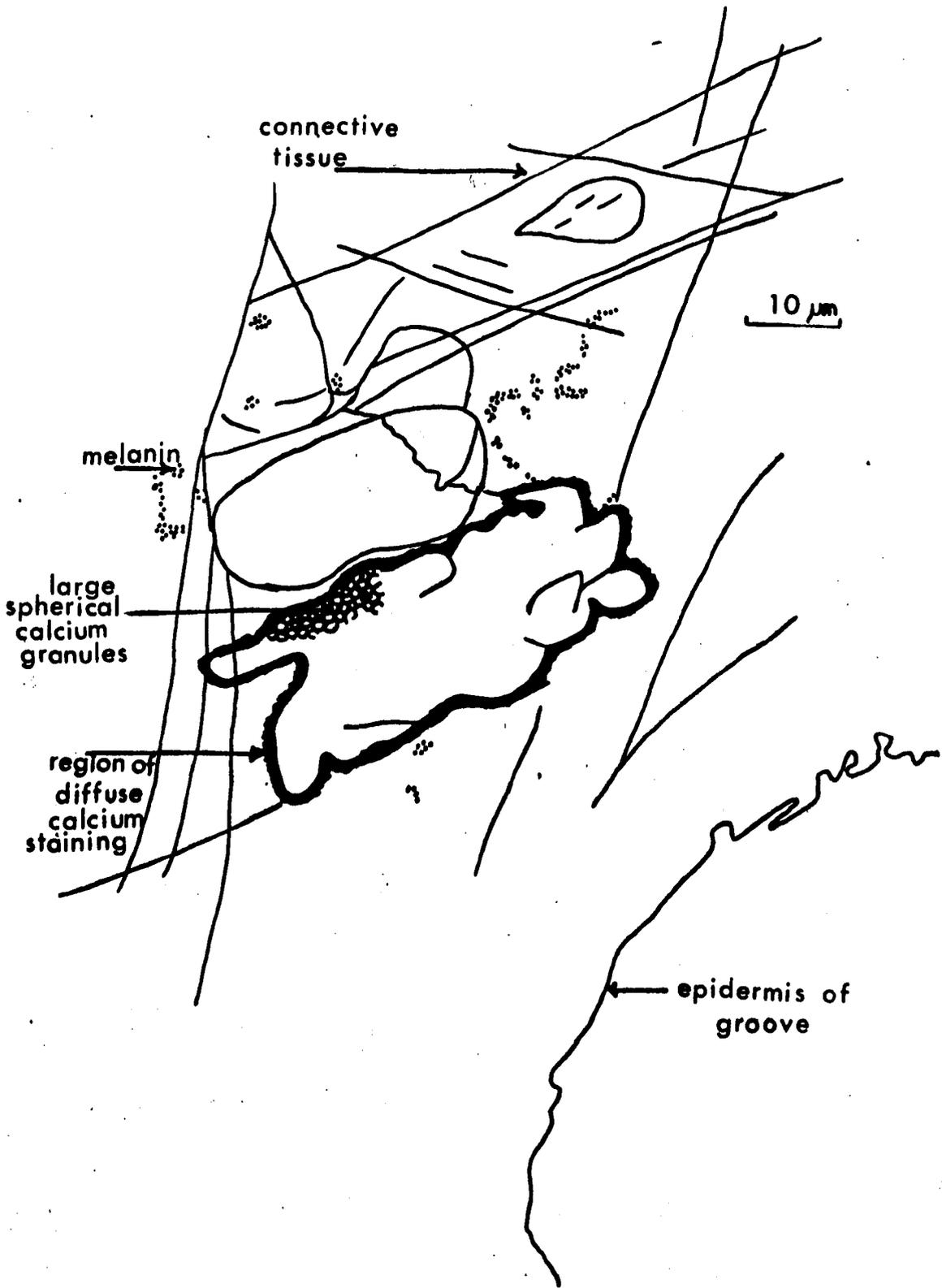


Fig 16: DIAGRAM OF DISTRIBUTION OF CALCIUM IN MANTLE. (TS).



**Fig 17 TS CALCIUM DEPOSITS
OF MANTLE**

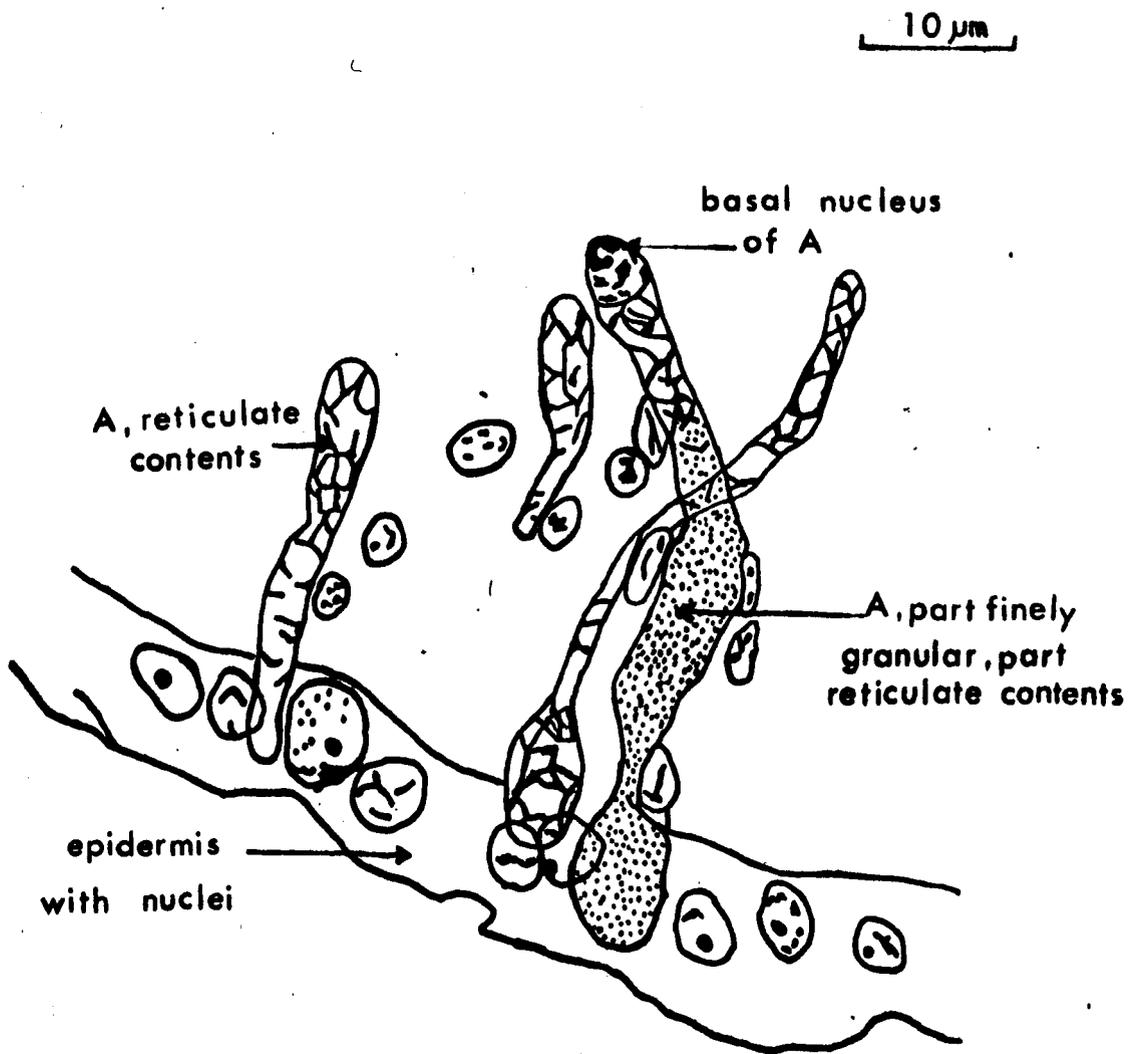


Fig 18 TS A, MUCOUS GLAND
OF SOLE

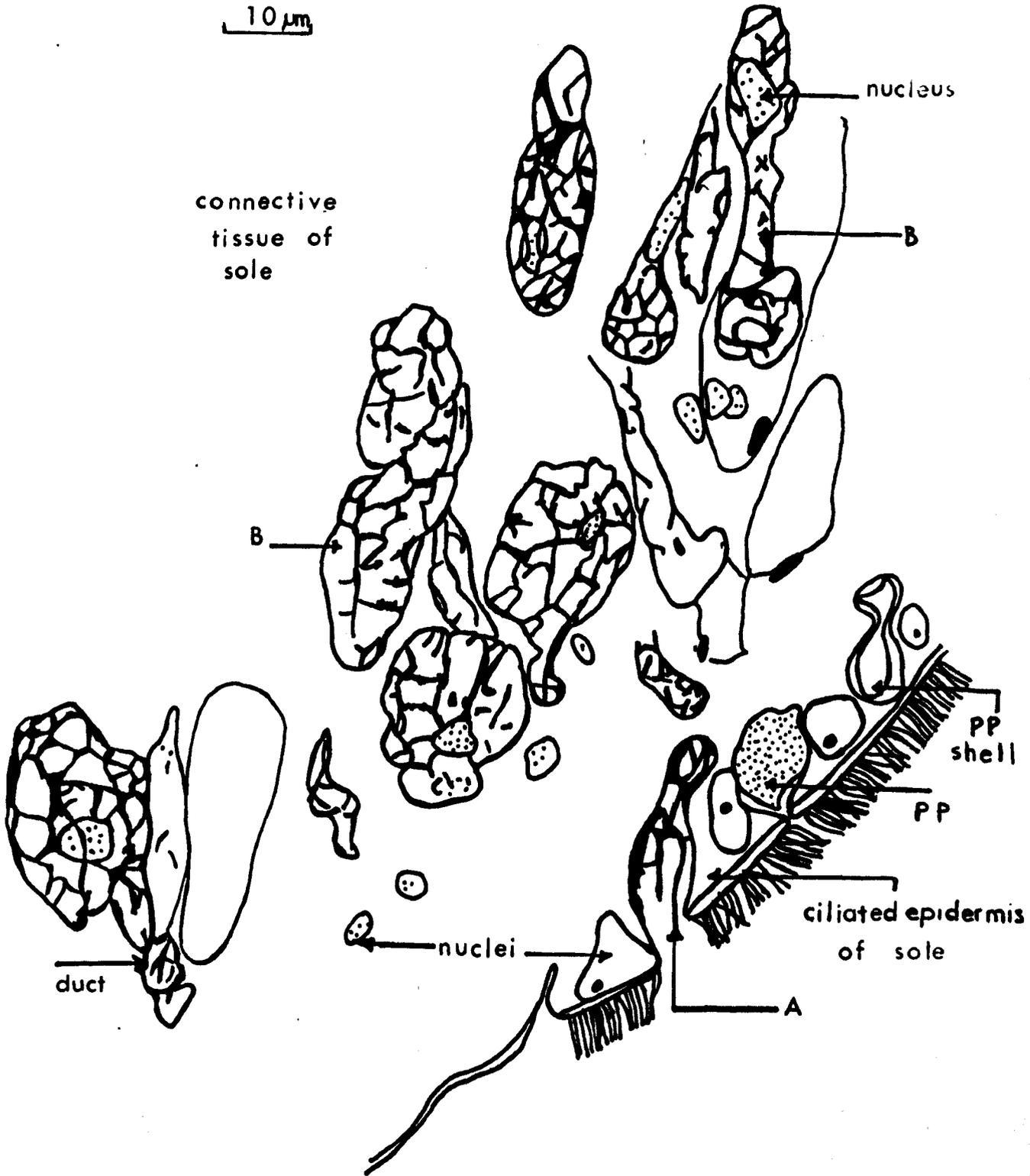


Fig19: B, MUCOUS GLAND CELL in REGION of PERIPODIAL GROOVE . (TS).

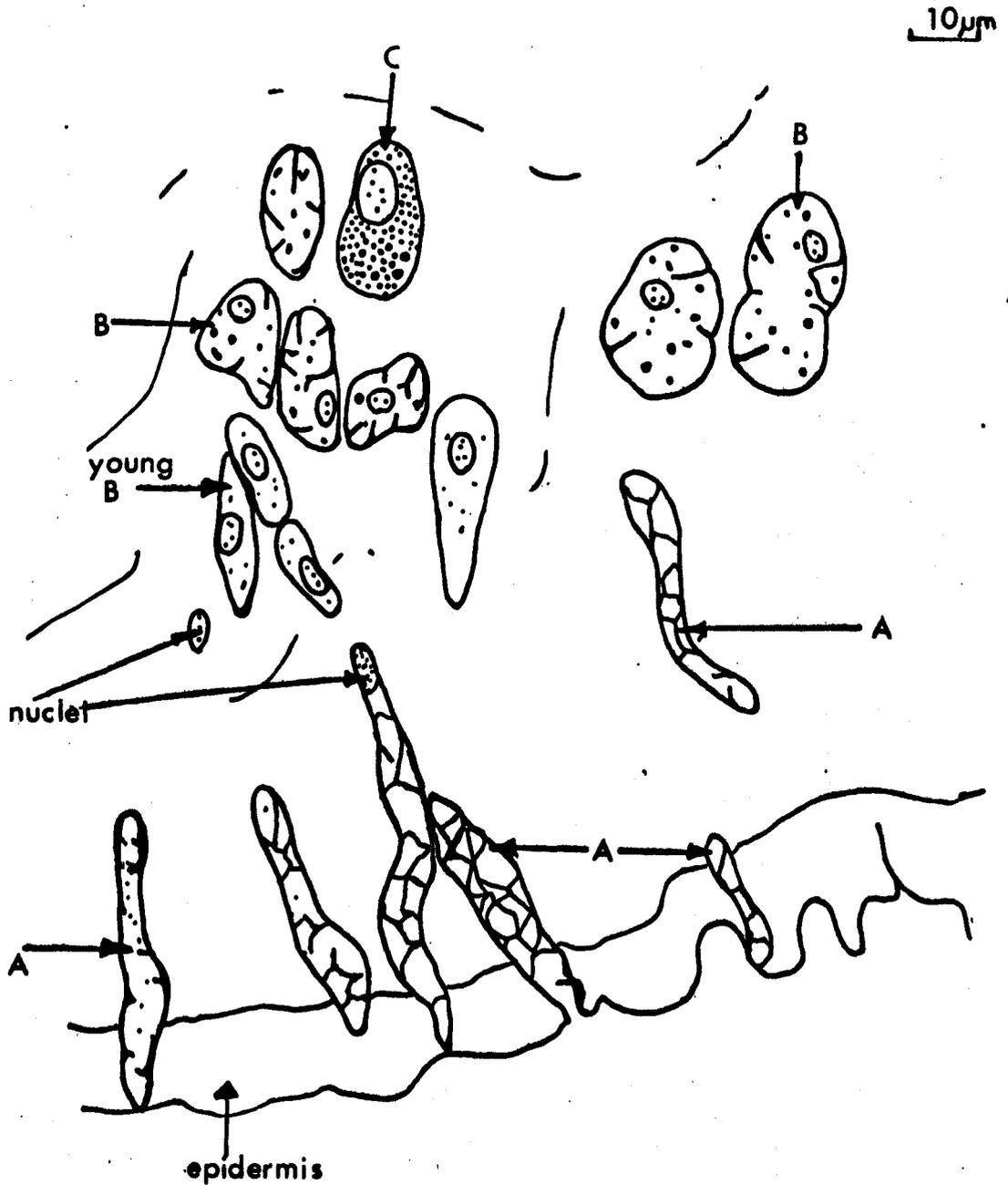


Fig 20 TS SHOWING RELATIONSHIP OF GLAND CELLS IN SOLE AND YOUNG B CELLS.

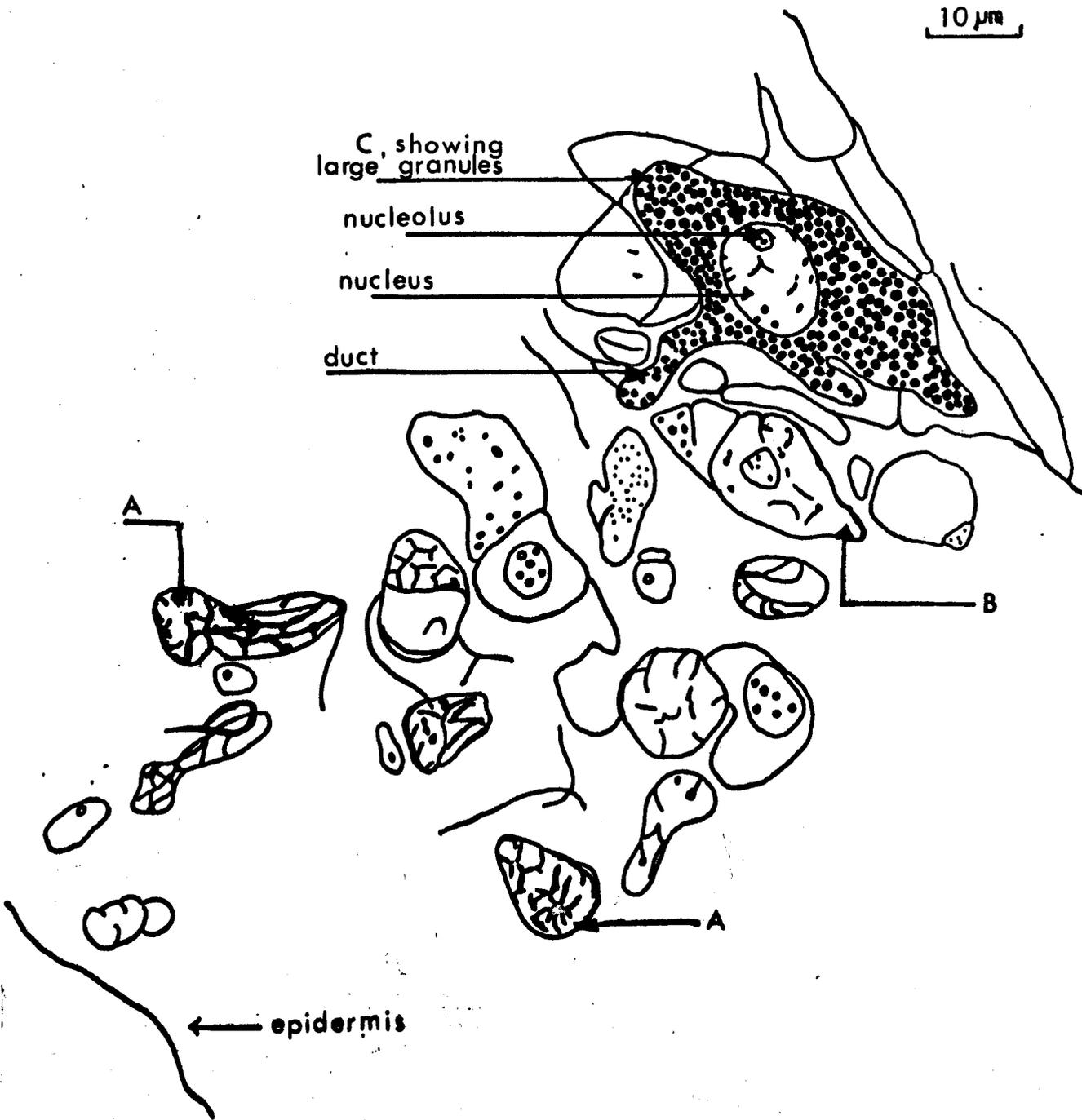


Fig 21 TS GLAND CELL C OF SOLE

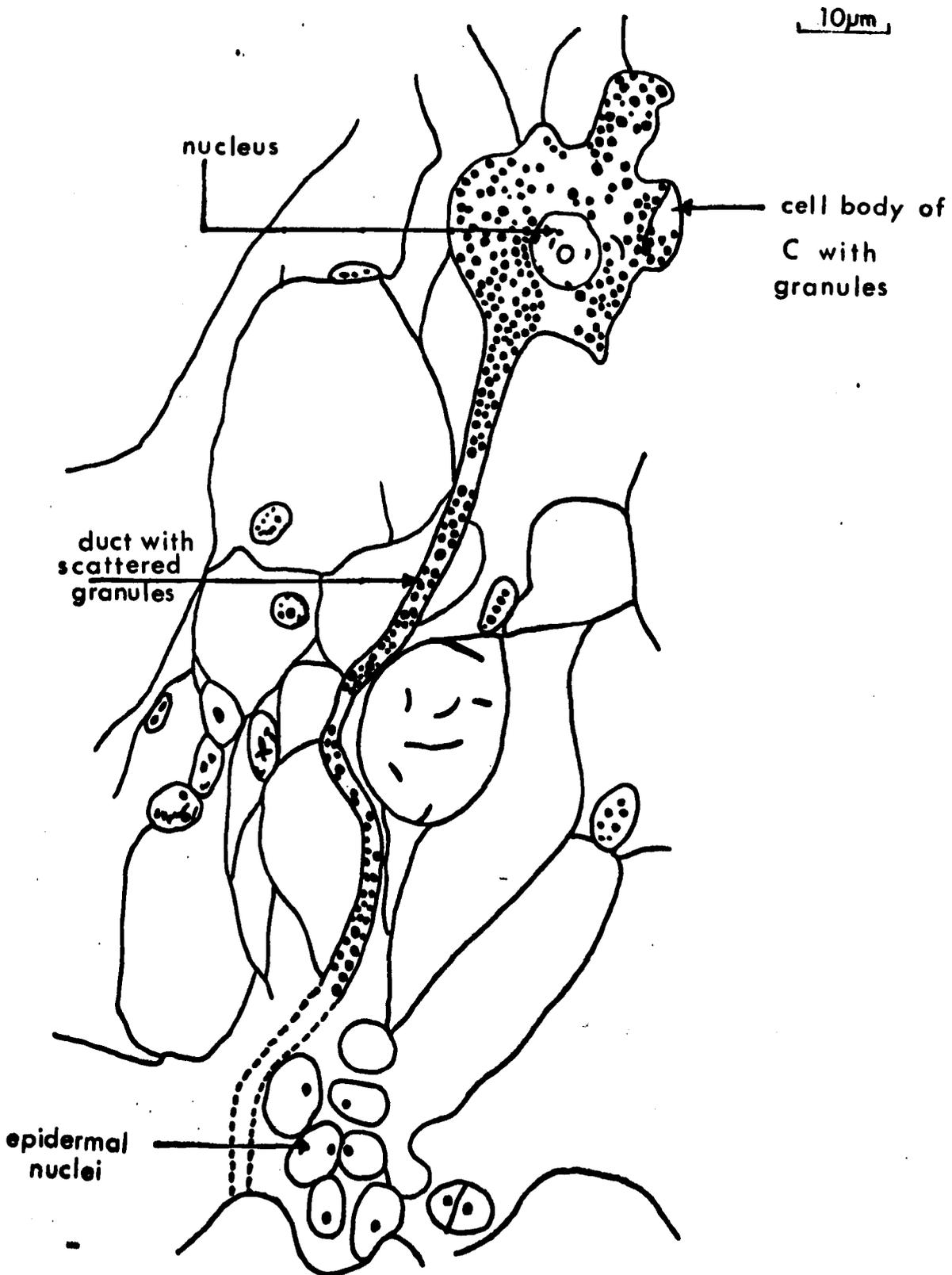


Fig 22 TS GLANDCELL C WITH LONG DUCT

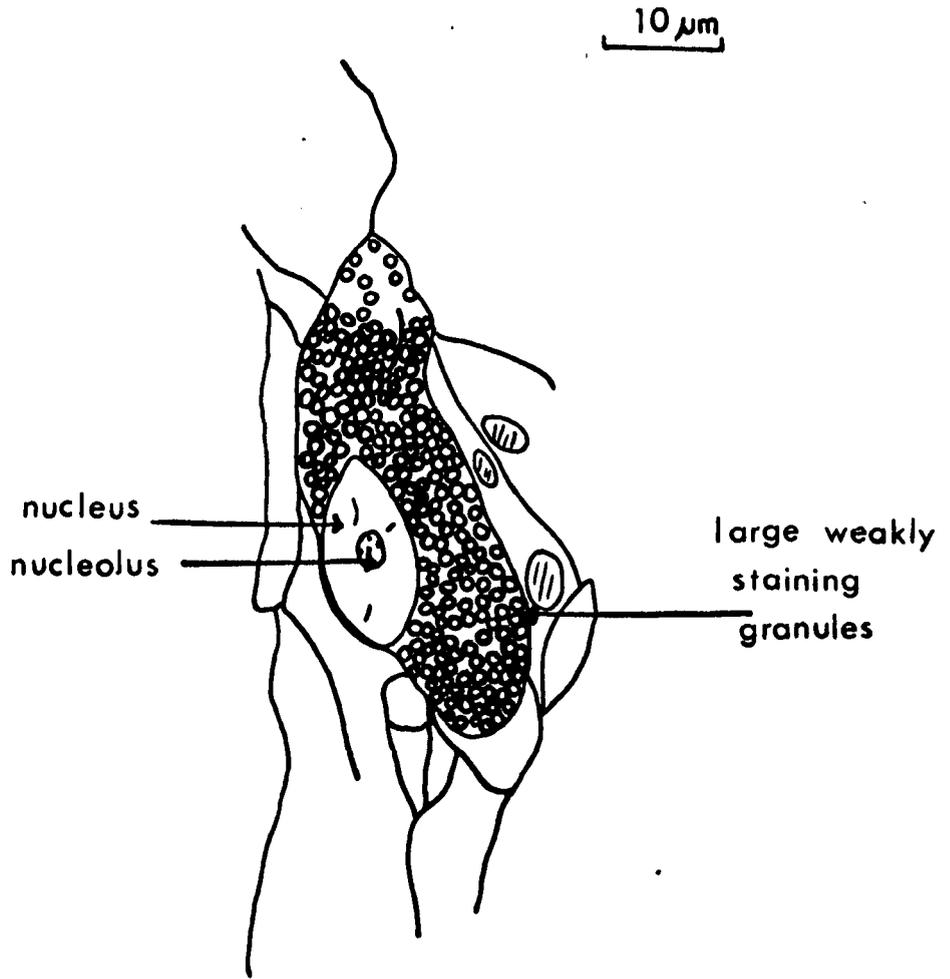


Fig 23 C, MUCOUS GLAND CELL OF SOLE WITH LARGE GRANULES. (TS).

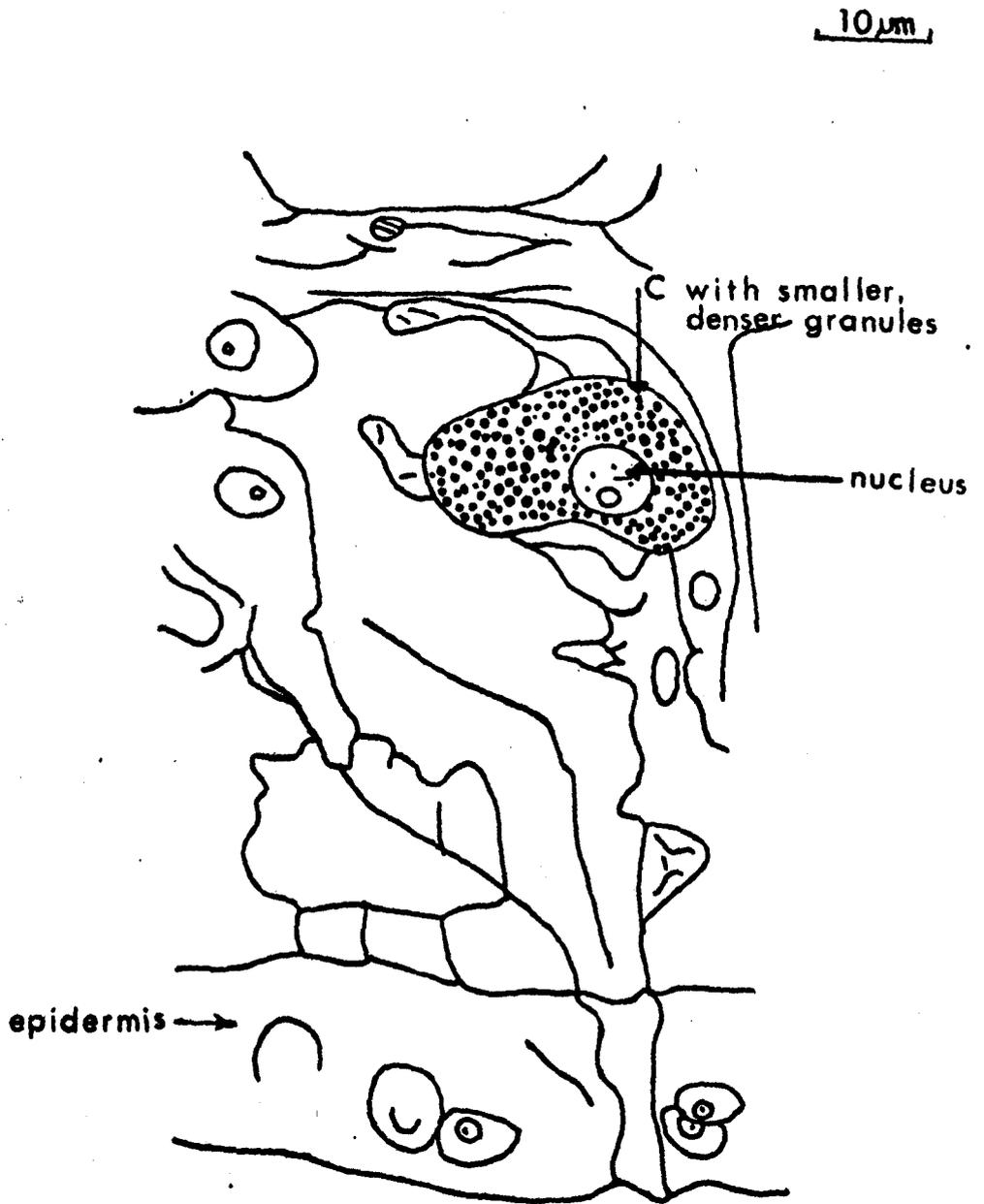


Fig 24 TS. C MUCOUS GLAND CELL of SOLE
SHOWING SMALLER, DENSER GRANULES

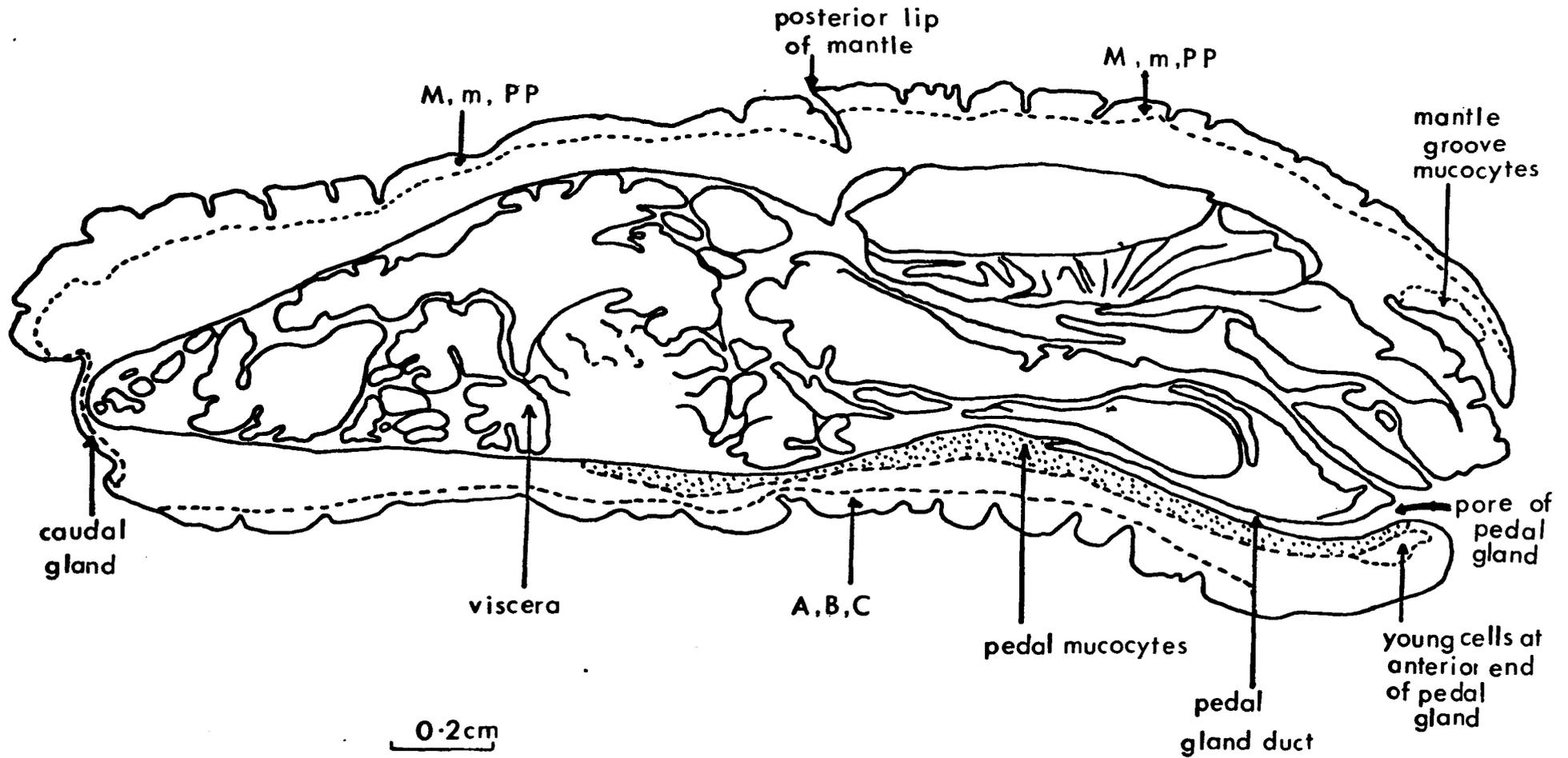


Fig25: L S TO SHOW DISTRIBUTION OF GLAND CELLS AND GLANDS

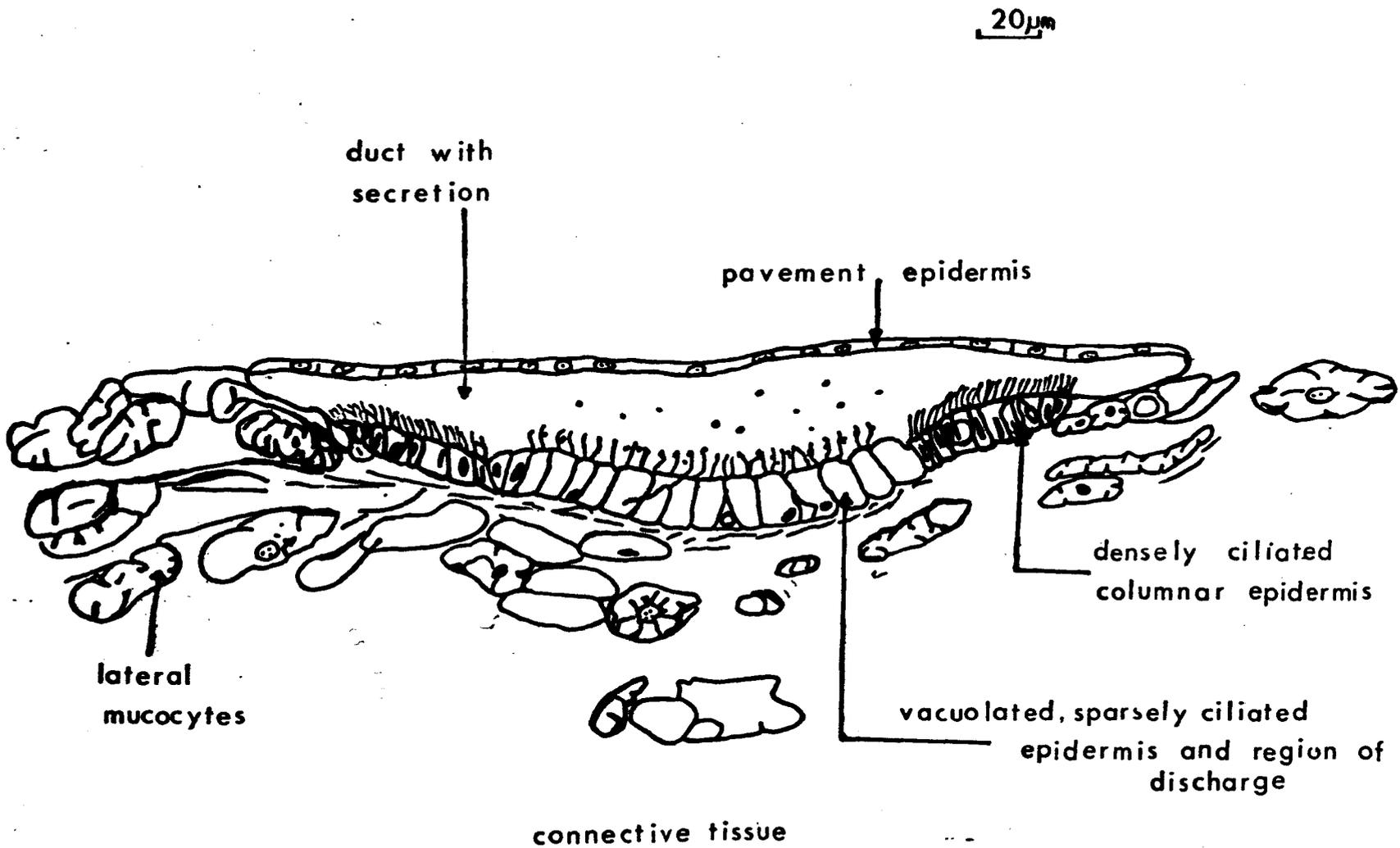


Fig 26 TS. PEDAL GLAND

10 μ m

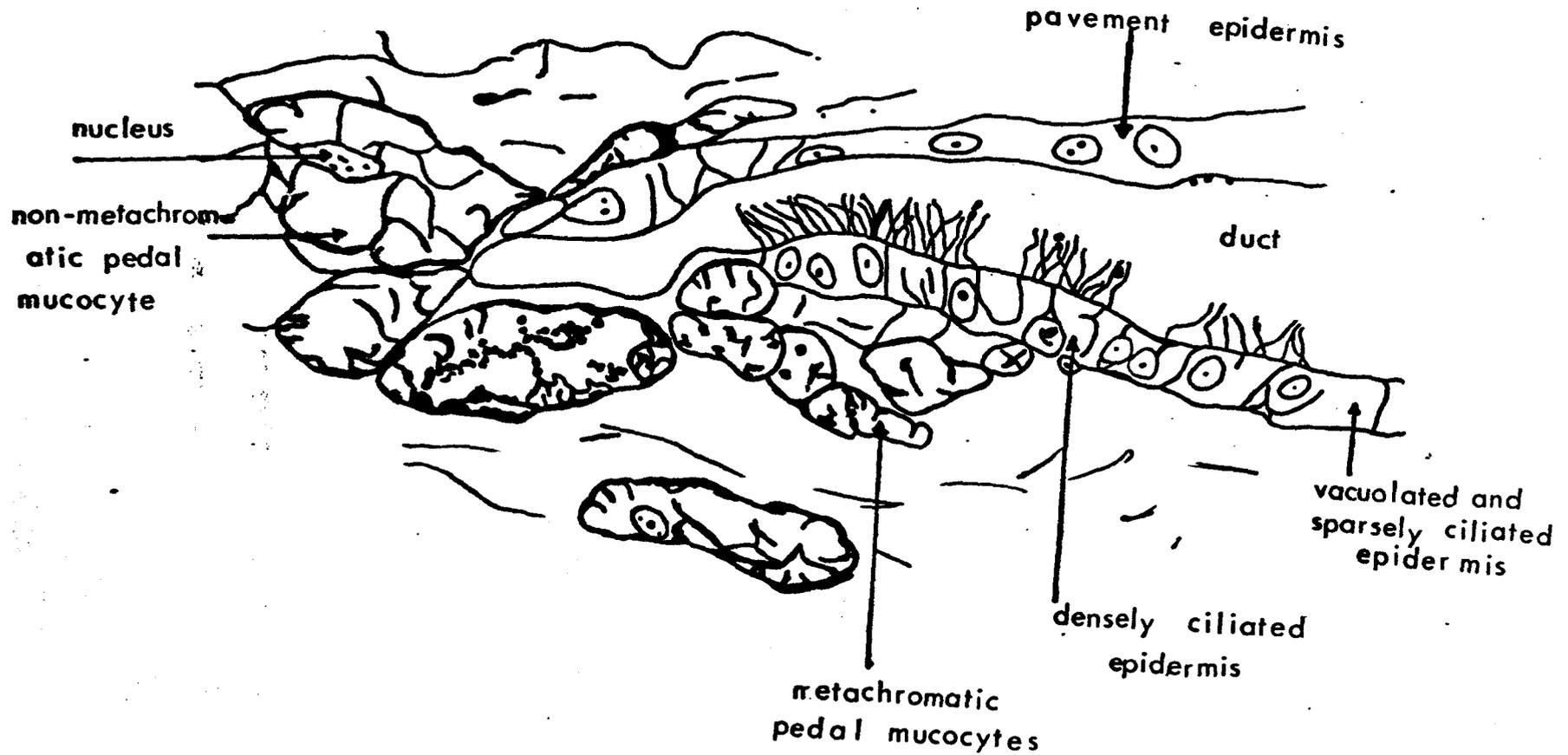


Fig 27. TS. DETAIL of PEDAL GLAND

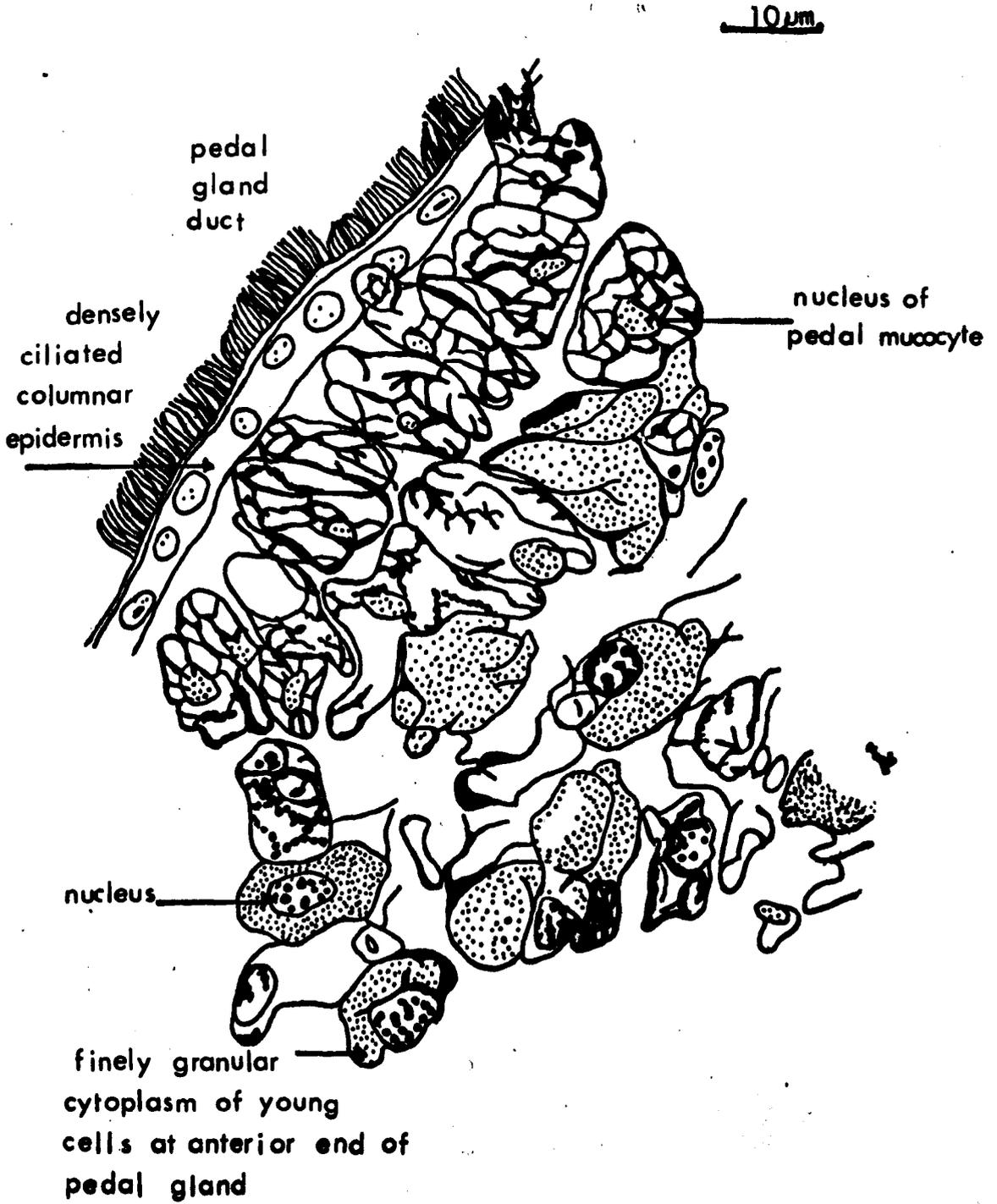
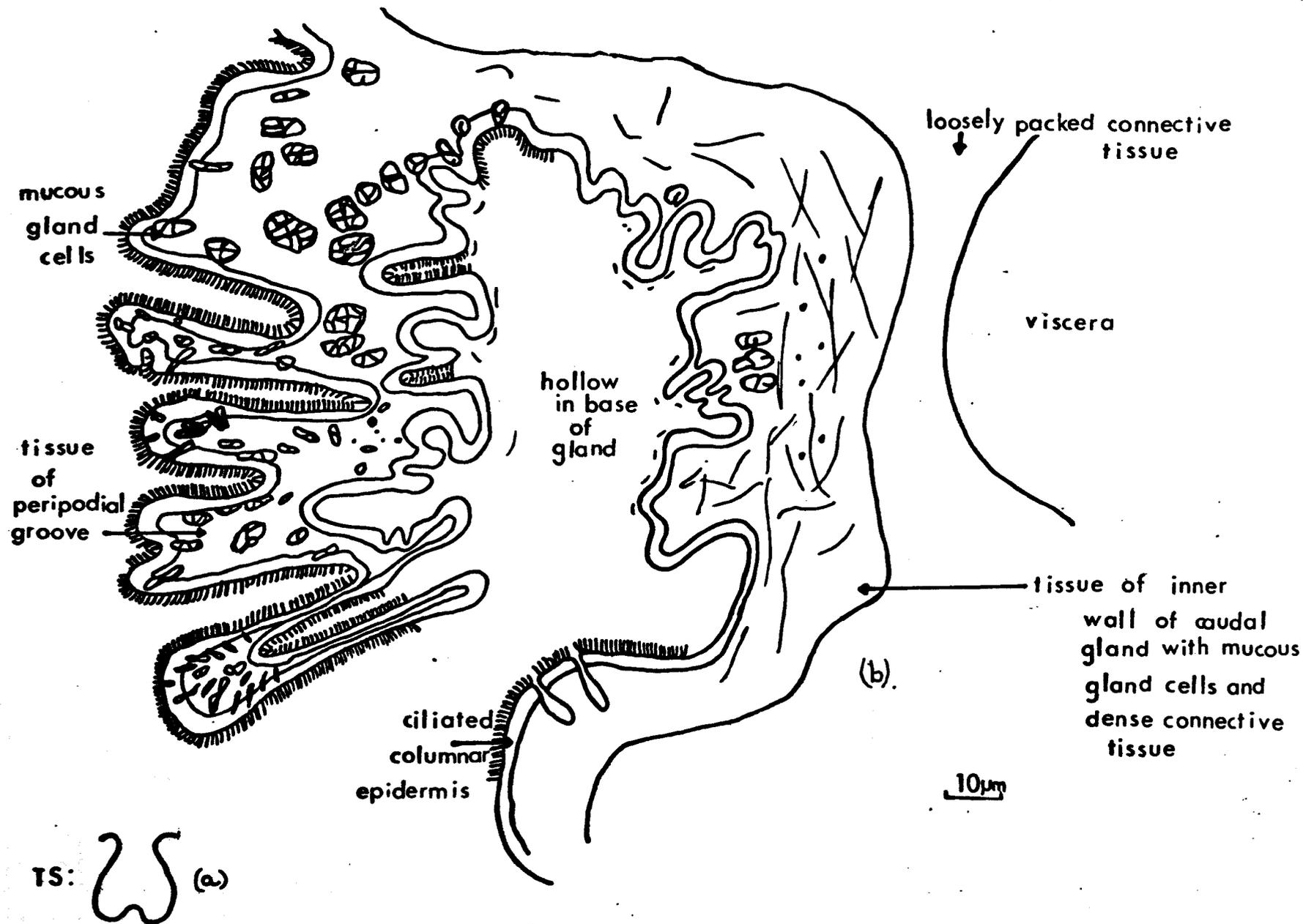
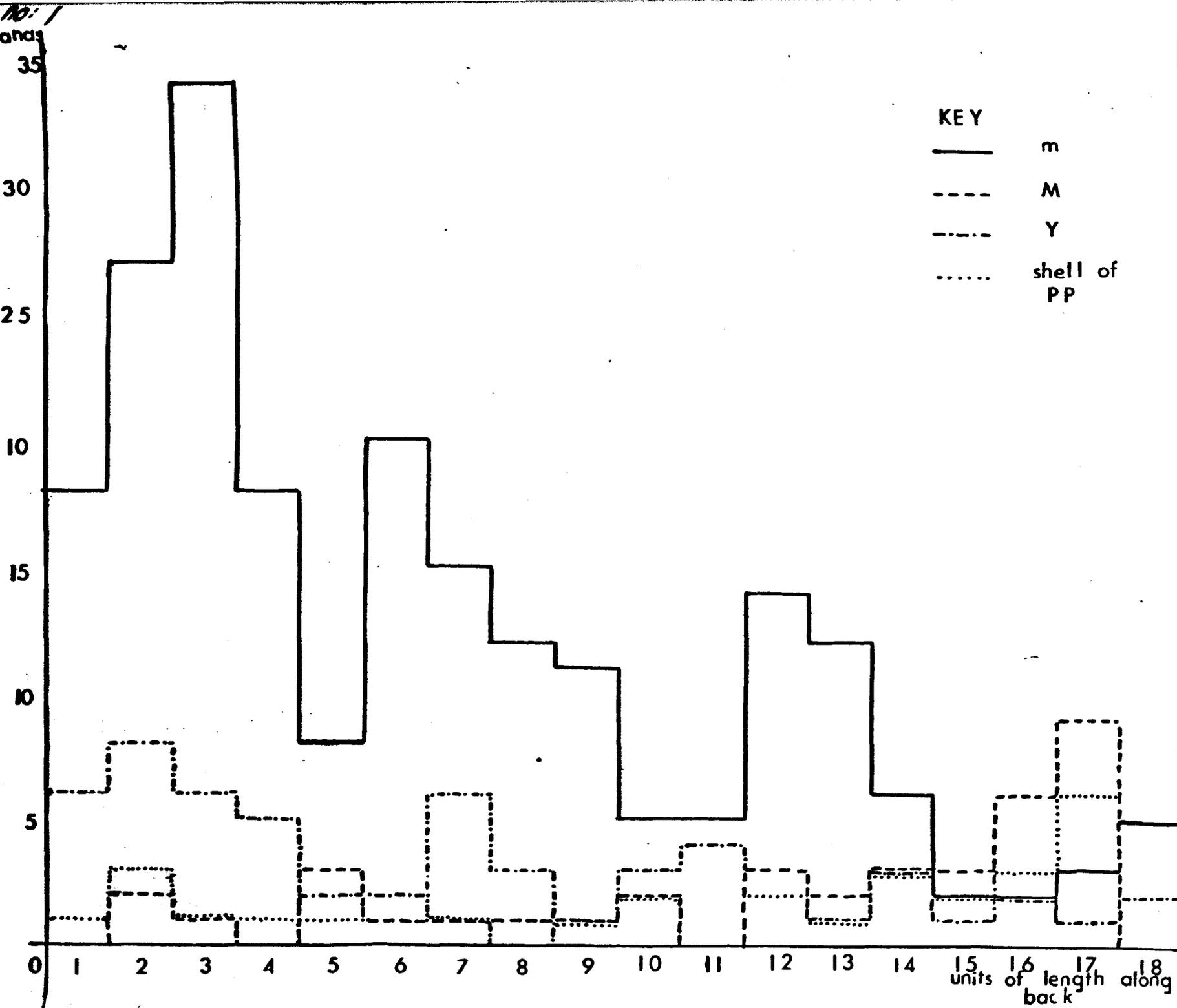


Fig 28 YOUNG CELLS AT ANTERIOR END OF PEDAL GLAND. (TS).



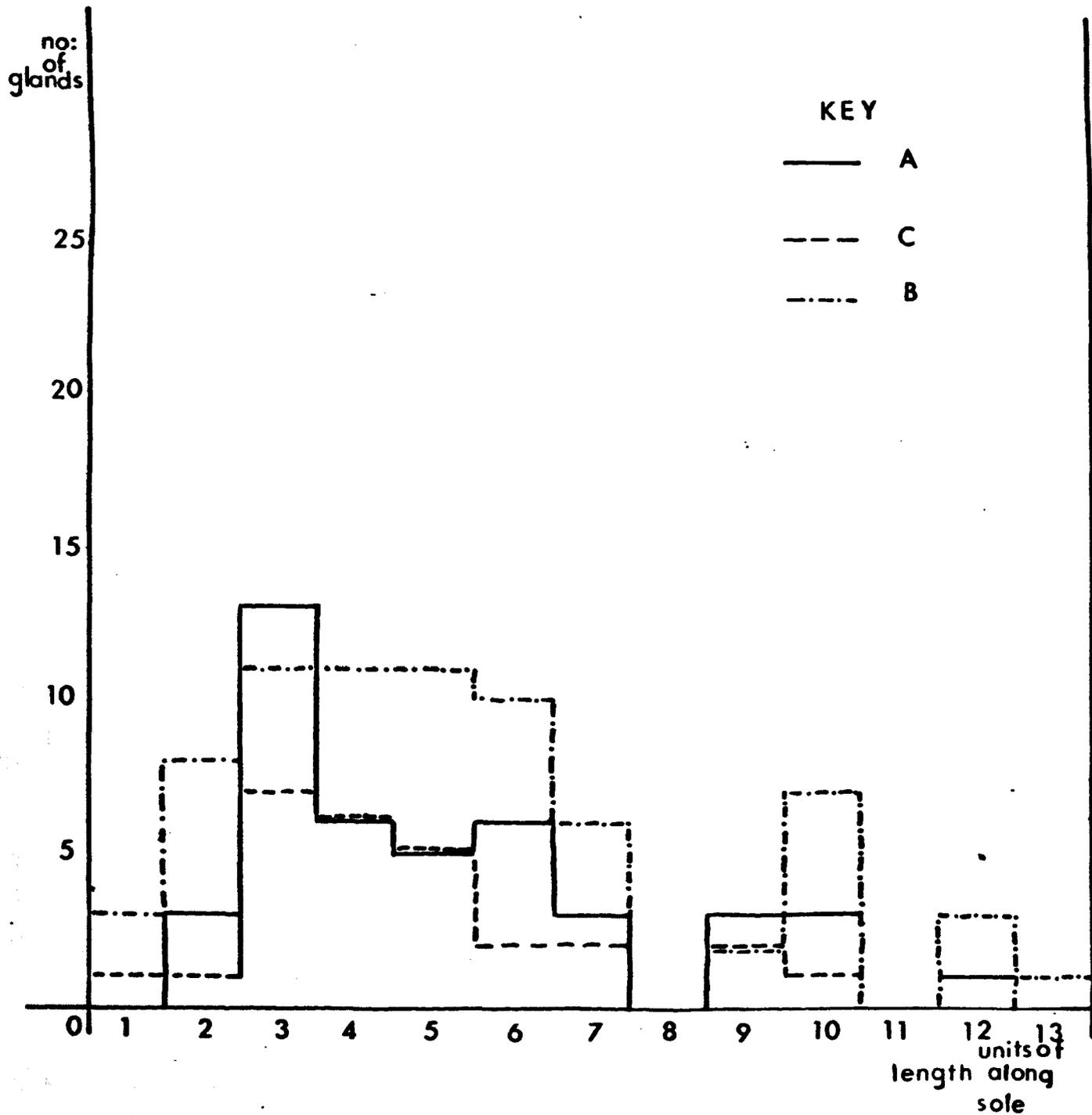
TS: W (a)

Fig 29: LS. CAUDAL GLAND



HISTOGRAM I
 DISTRIBUTION OF
 GLAND CELLS
 ALONG BACK
 FROM
 HEAD(1) TO
 TAIL(18)

1 UNIT OF
 LENGTH =
 79.92 μ



HISTOGRAM II
 DISTRIBUTION OF
 GLAND CELLS ALONG
 SOLE from HEAD(I)
 to TAIL (13)

1 unit of length
 = 79.92 μ

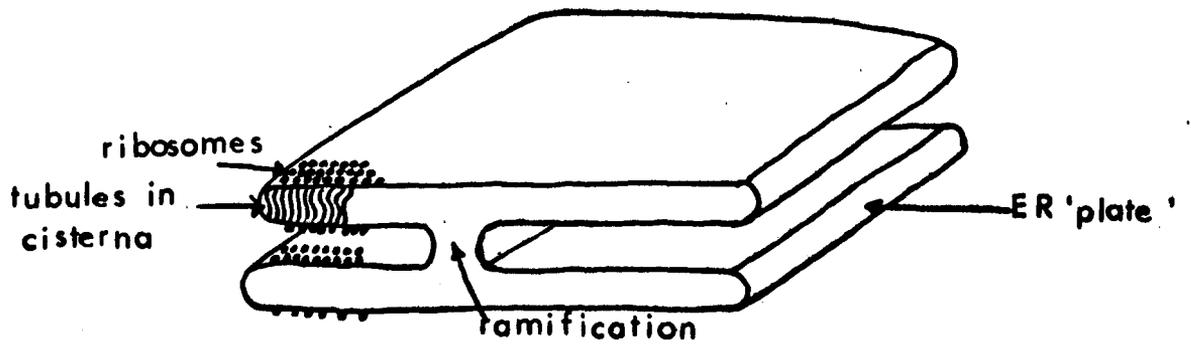


Fig 30 : SHOWING 'PLATES' OF ENDOPLASMIC RETICULUM (ER)

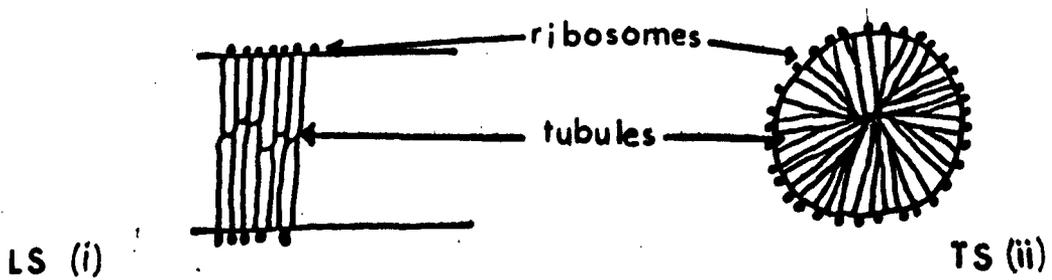


Fig 31: ARRANGEMENT OF TUBULES IN ER, AFTER WONDRAK (1967)

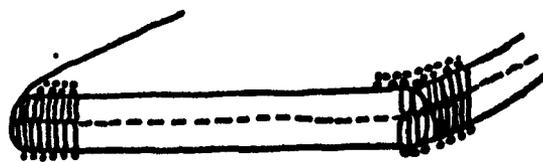


Fig 32: MODIFICATION OF FIG 31 FOR SYSTEM OF ER PLATES

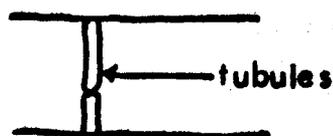


Fig 33: APPEARANCE OF SOME TUBULES IN ER.

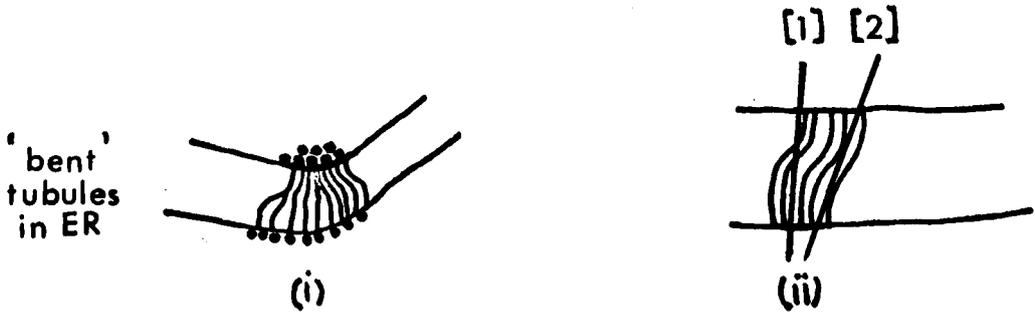


Fig 34: (i) 'BENT' TUBULES IN ER, AND (ii) ANGLES OF SECTIONING -- [1] FOR $\frac{1}{3}$ - $\frac{2}{3}$ TUBULES AND [2] FOR A WHOLE TUBULE

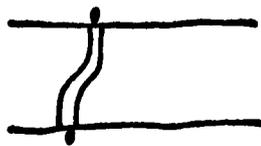


Fig 35: ARRANGEMENT OF TUBULES AND RIBOSOMES



Fig 36: DIAGRAM SHOWING PRODUCTION AND ISOLATION OF PROTEIN



Fig 37: TUBULES IN ER, AFTER VALERI ET AL. 1971

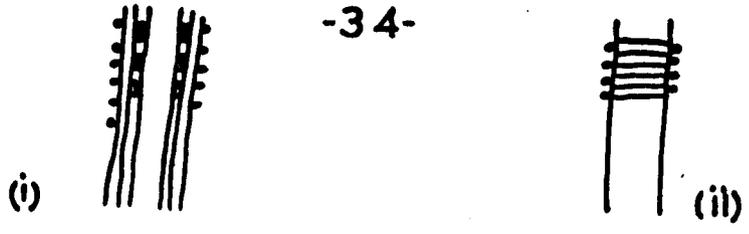


Fig 38: TUBULES IN ER, AFTER SPITZNAS ET AL. (1971)

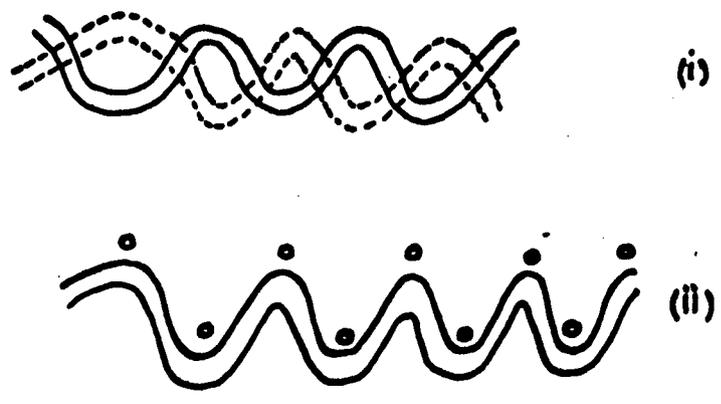


Fig 39: TUBULES IN ER, AFTER CHANDRA (1968)

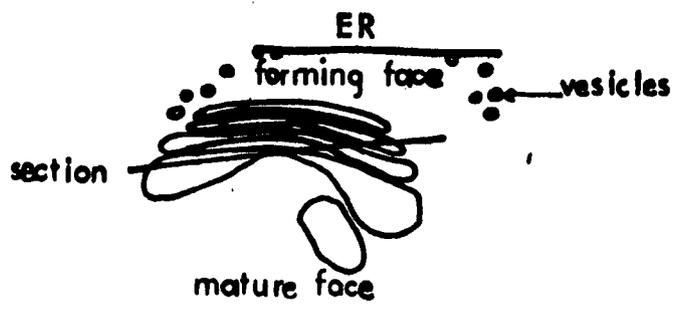


Fig 40: GOLGI COMPLEX OF PEDAL MUCOCYTE

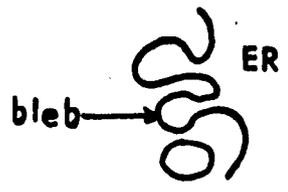


Fig 41: 'BLEBS' FROM ER.

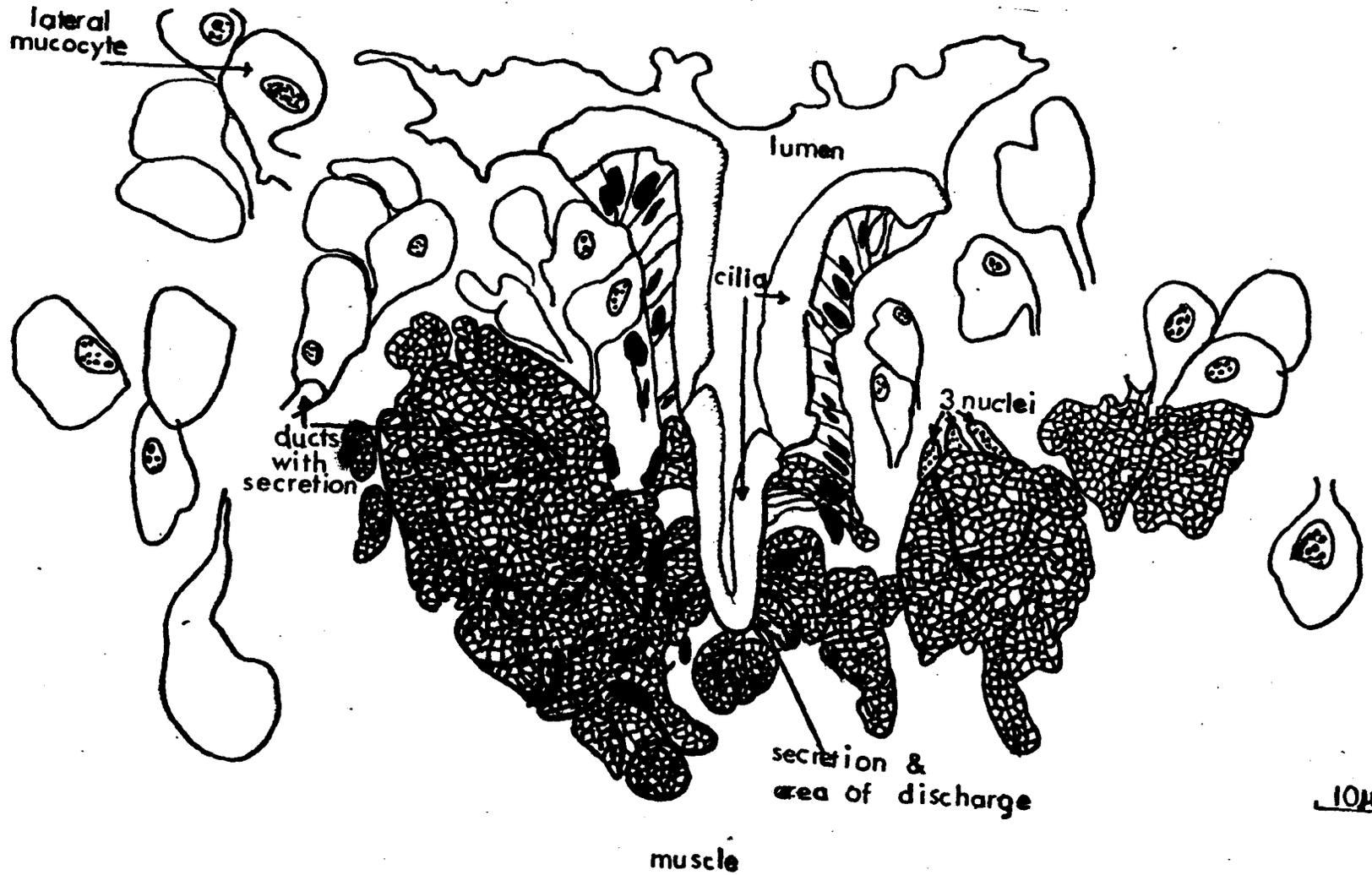


Fig 42 : TS . ULTRATHIN SECTION OF PEDAL GLAND

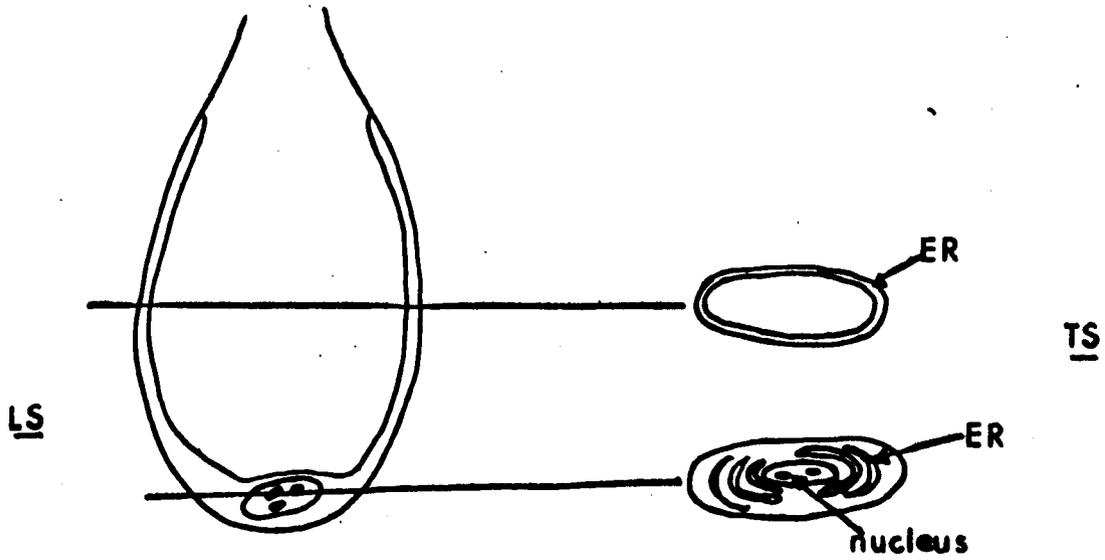


Fig 43: MATURE PEDAL MUCOCYTE

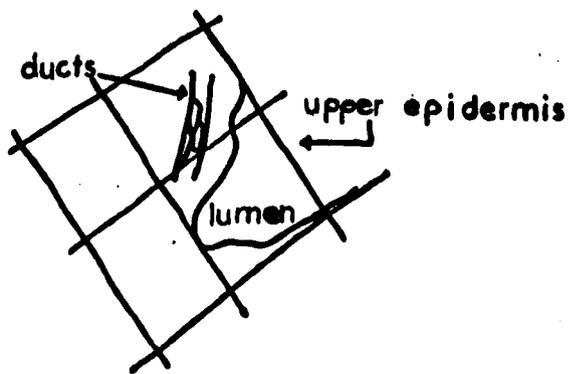


Fig 44: POSITION OF DUCTS SEEN IN
PLATE 38

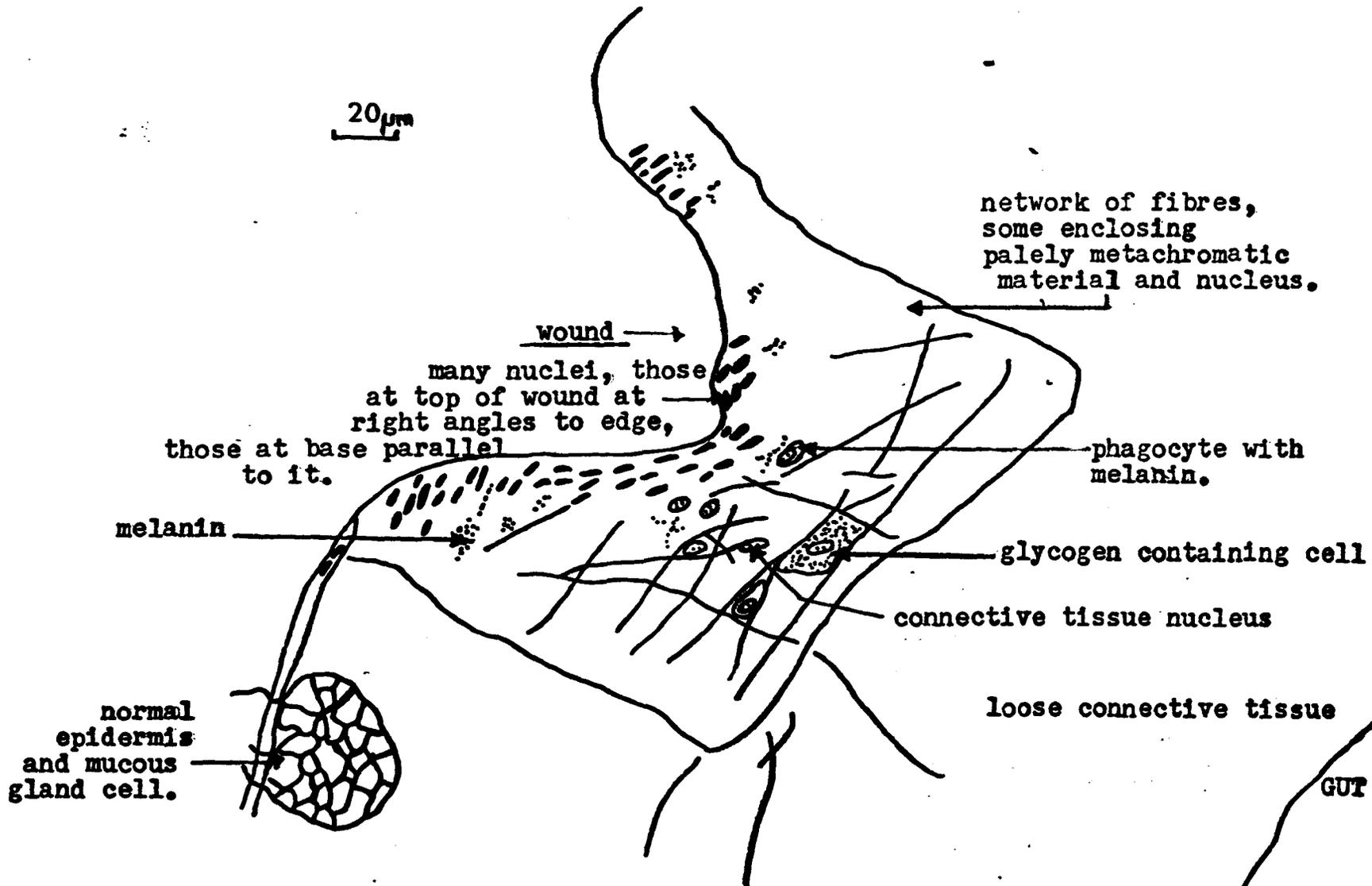


Fig 45: DAY 1 AFTER WOUNDING MANTLE (TS).

20µm

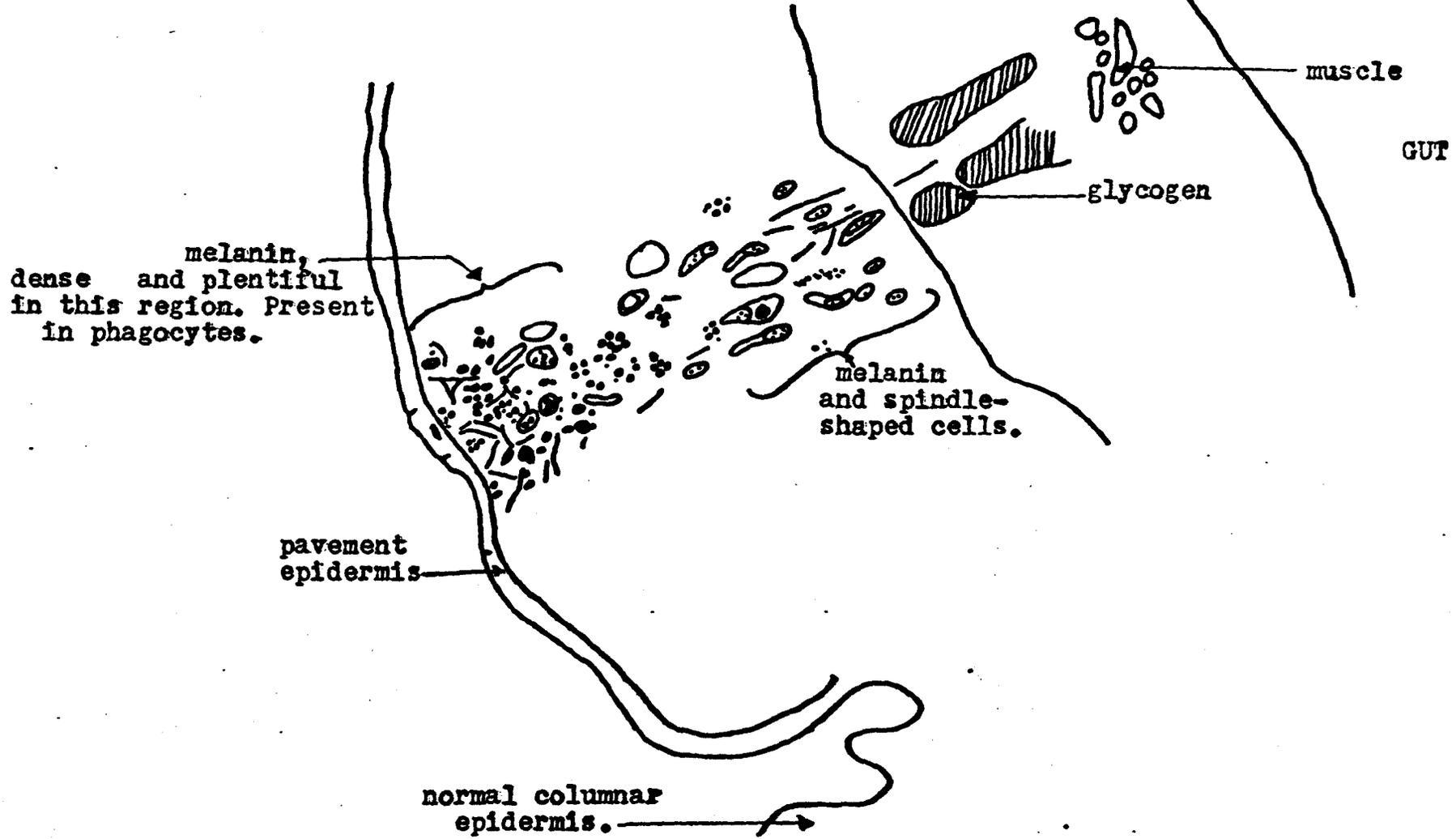


Fig 46: DAY 6 AFTER WOUNDING MANTLE . (TS) .

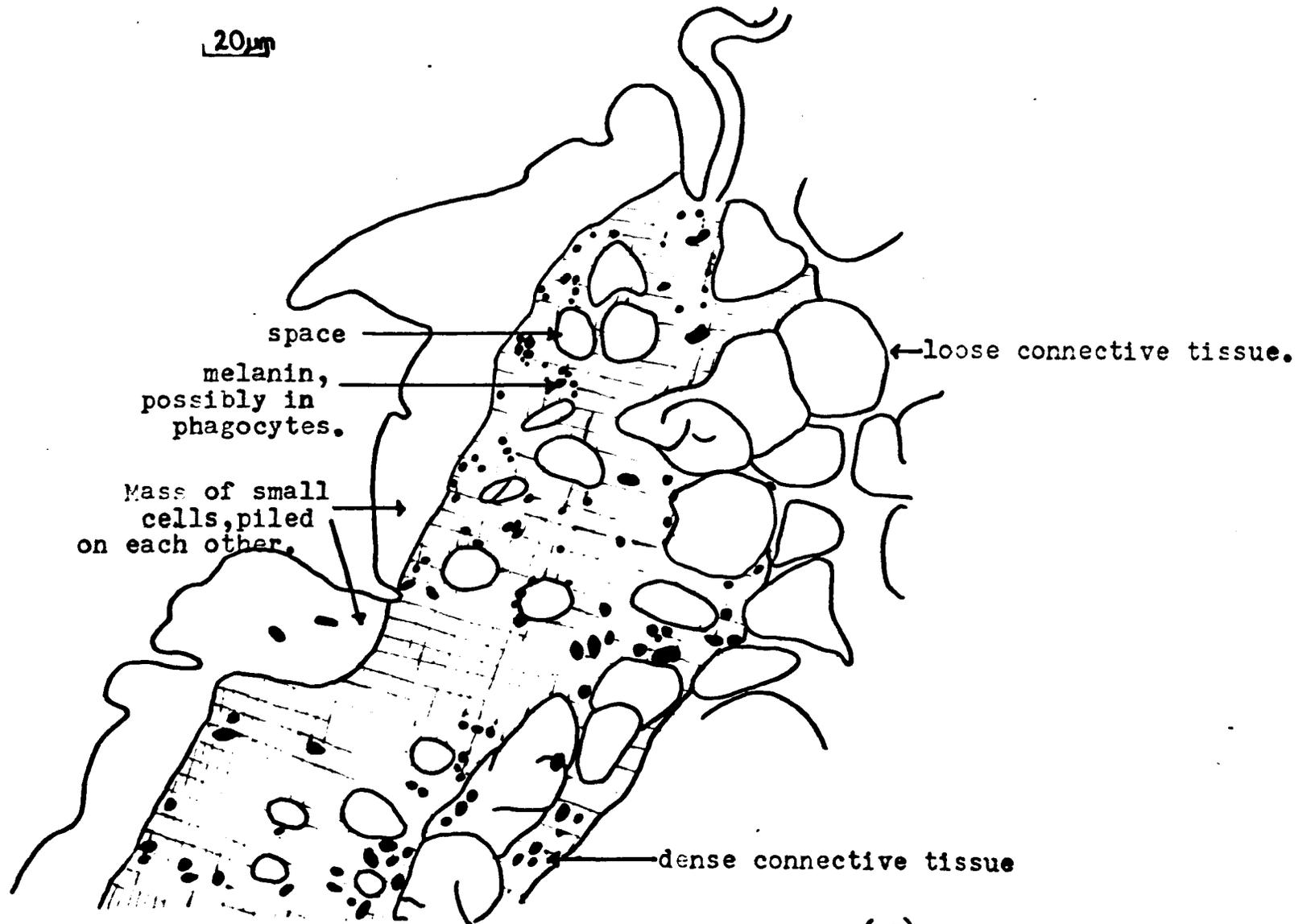


Fig 47 : DAY 19 AFTER WOUNDING. MANTLE. (TS).

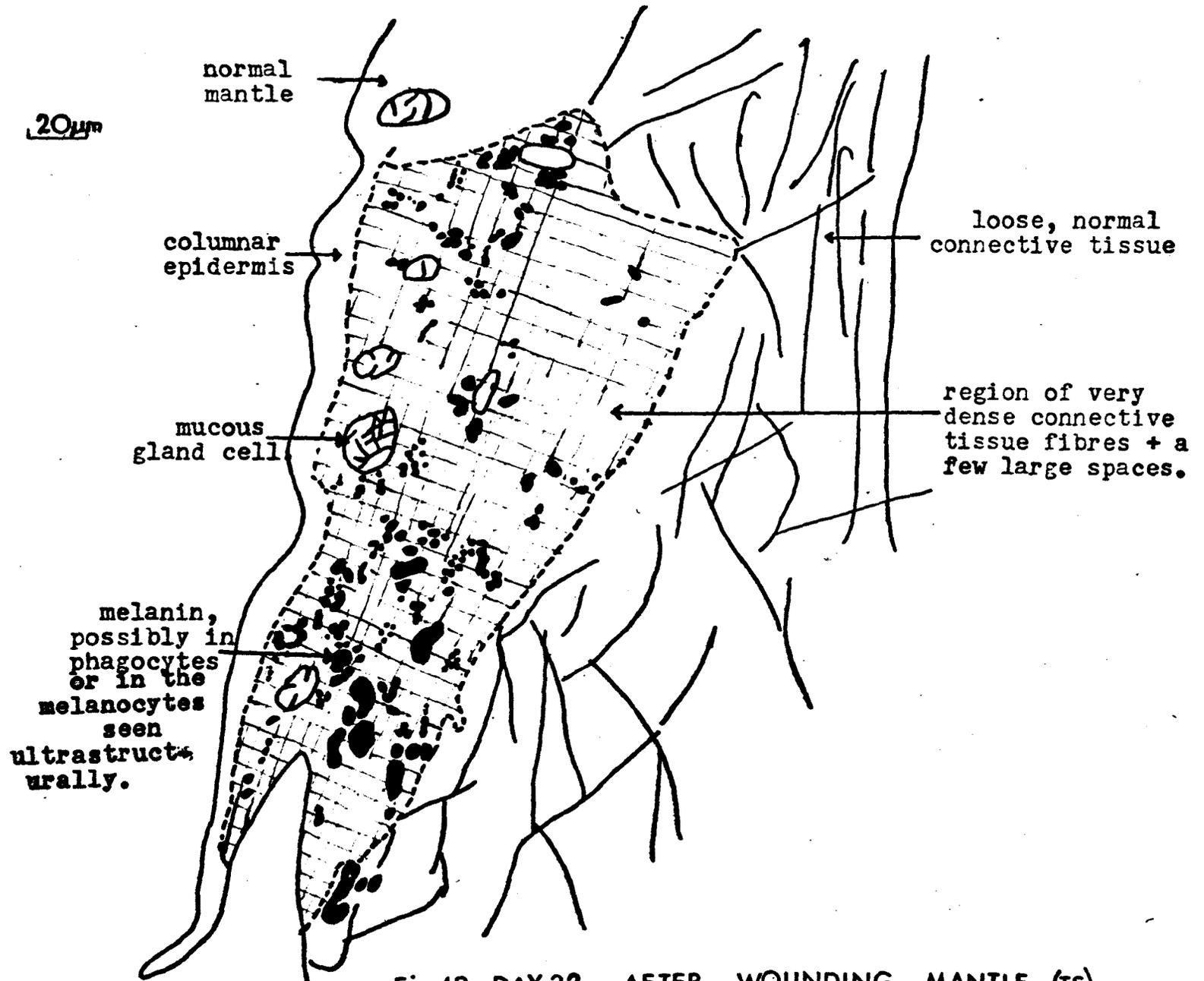


Fig 48. DAY 32 AFTER WOUNDING . MANTLE .(TS).

20µm

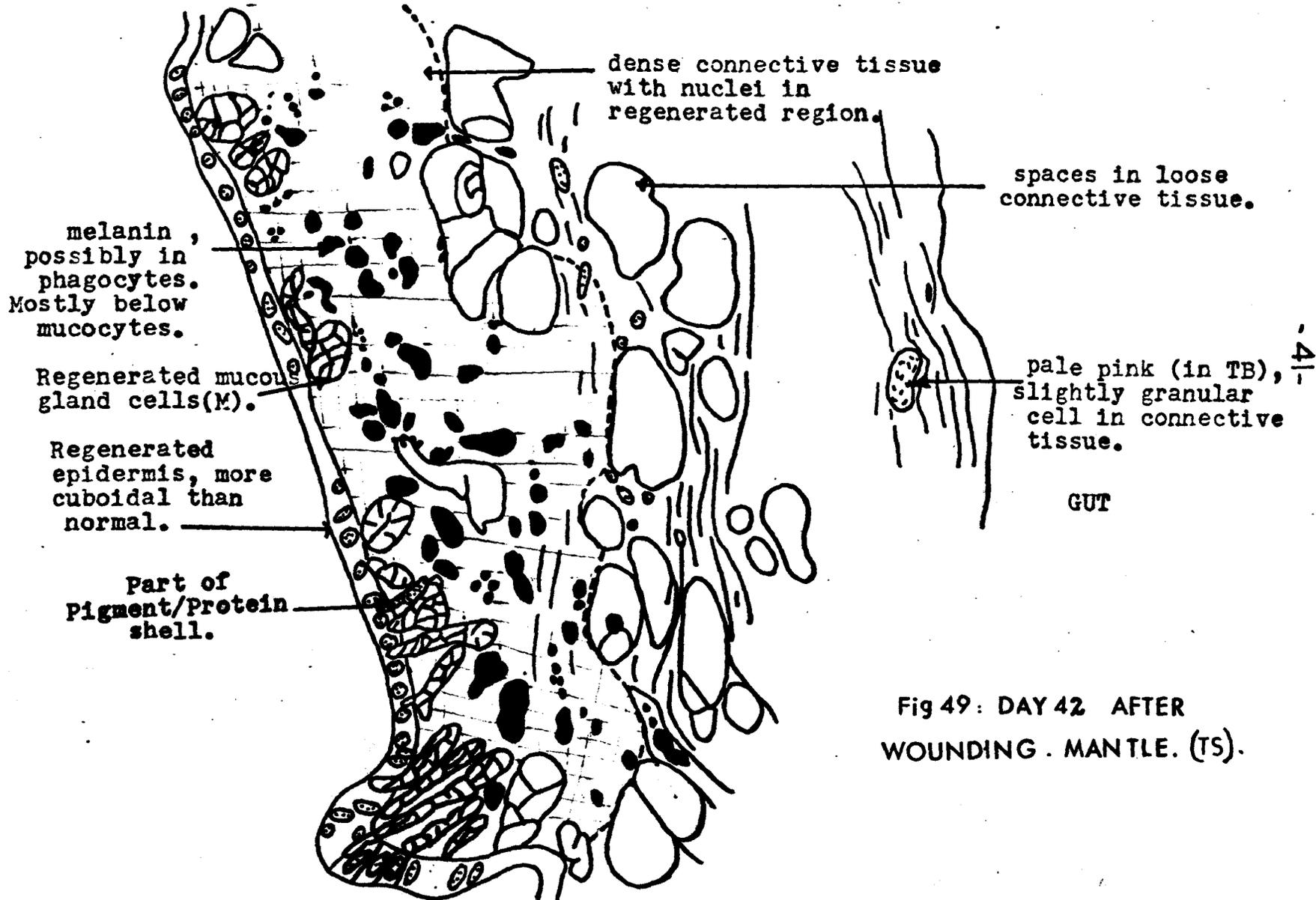


Fig 49: DAY 42 AFTER WOUNDING. MANTLE. (TS).

1µm



Plate 1: UPPER EPIDERMIS OF PEDAL GLAND DUCT.

1 μm

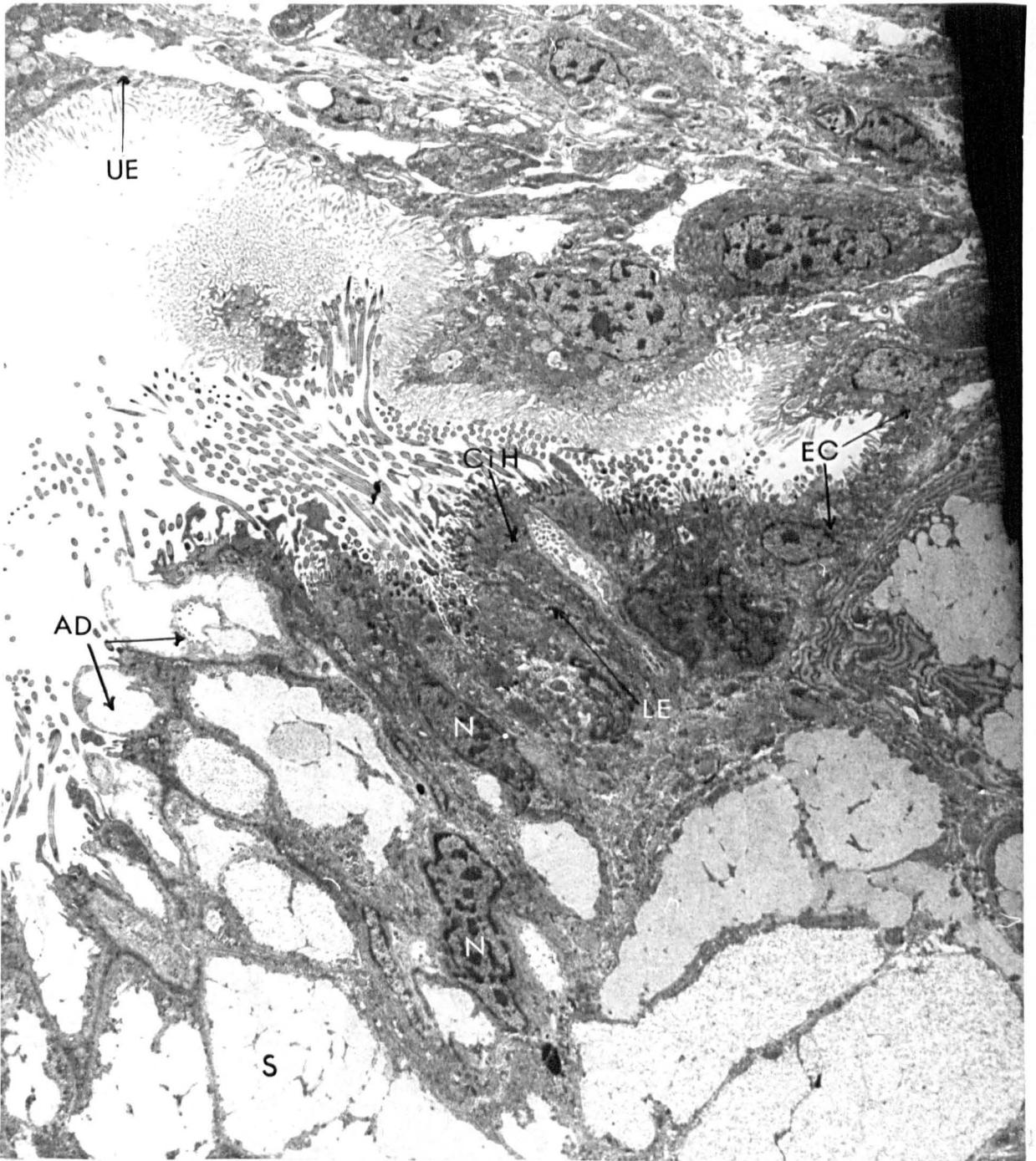


Plate 2: CONNECTION BETWEEN UPPER AND LOWER EPIDERMIS
OF PEDAL GLAND DUCT.

1µm



Plate 3: CILIATED 'HUMP' OF LOWER EPIDERMIS OF

PEDAL GLAND DUCT.

1 μ m



Plate 4: PART OF CILIATED 'HUMP', SHOWING NERVE.

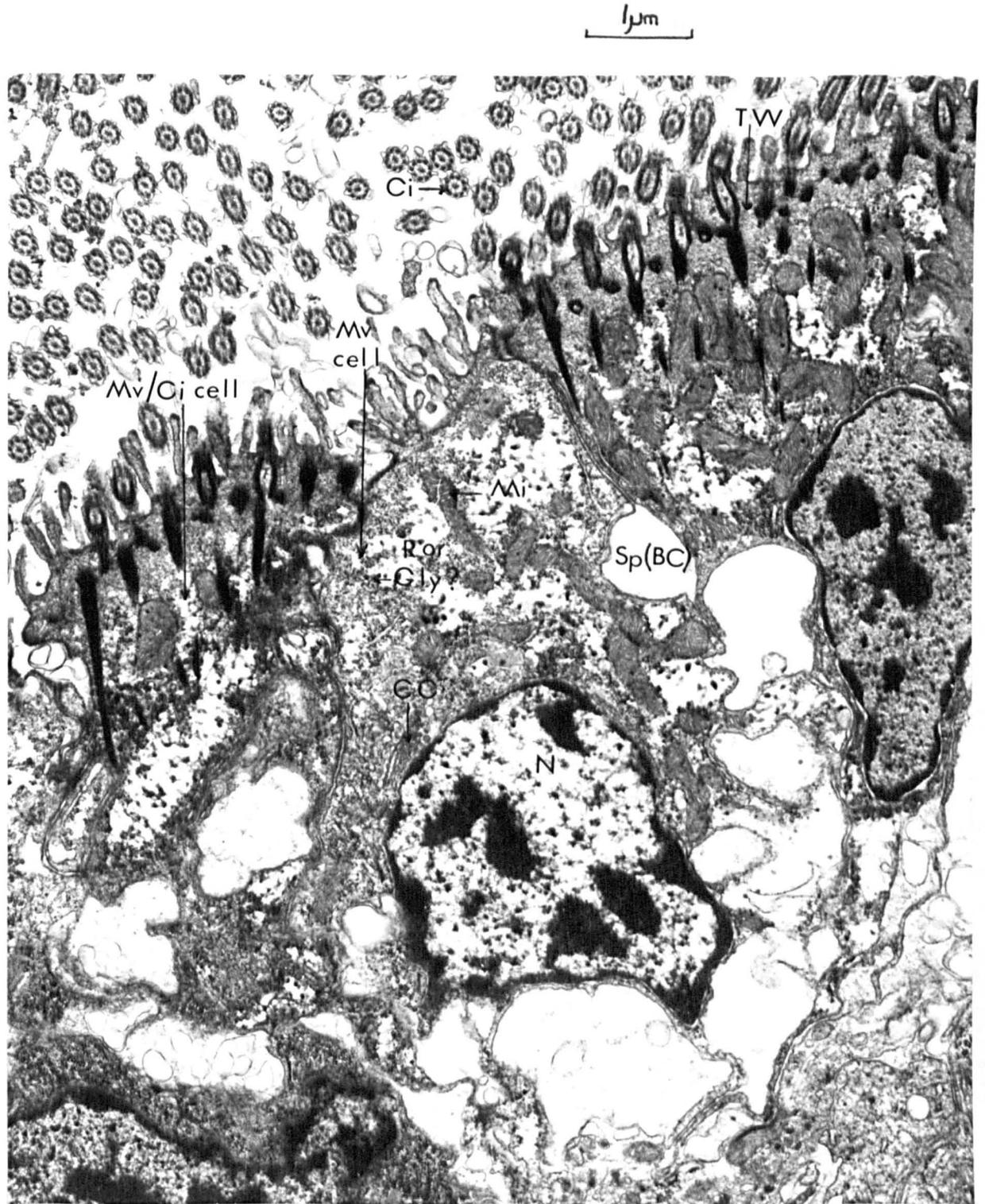


Plate 5: PART OF CILIATED 'HUMP', SHOWING MICROVILLAR

CELL.

1µm

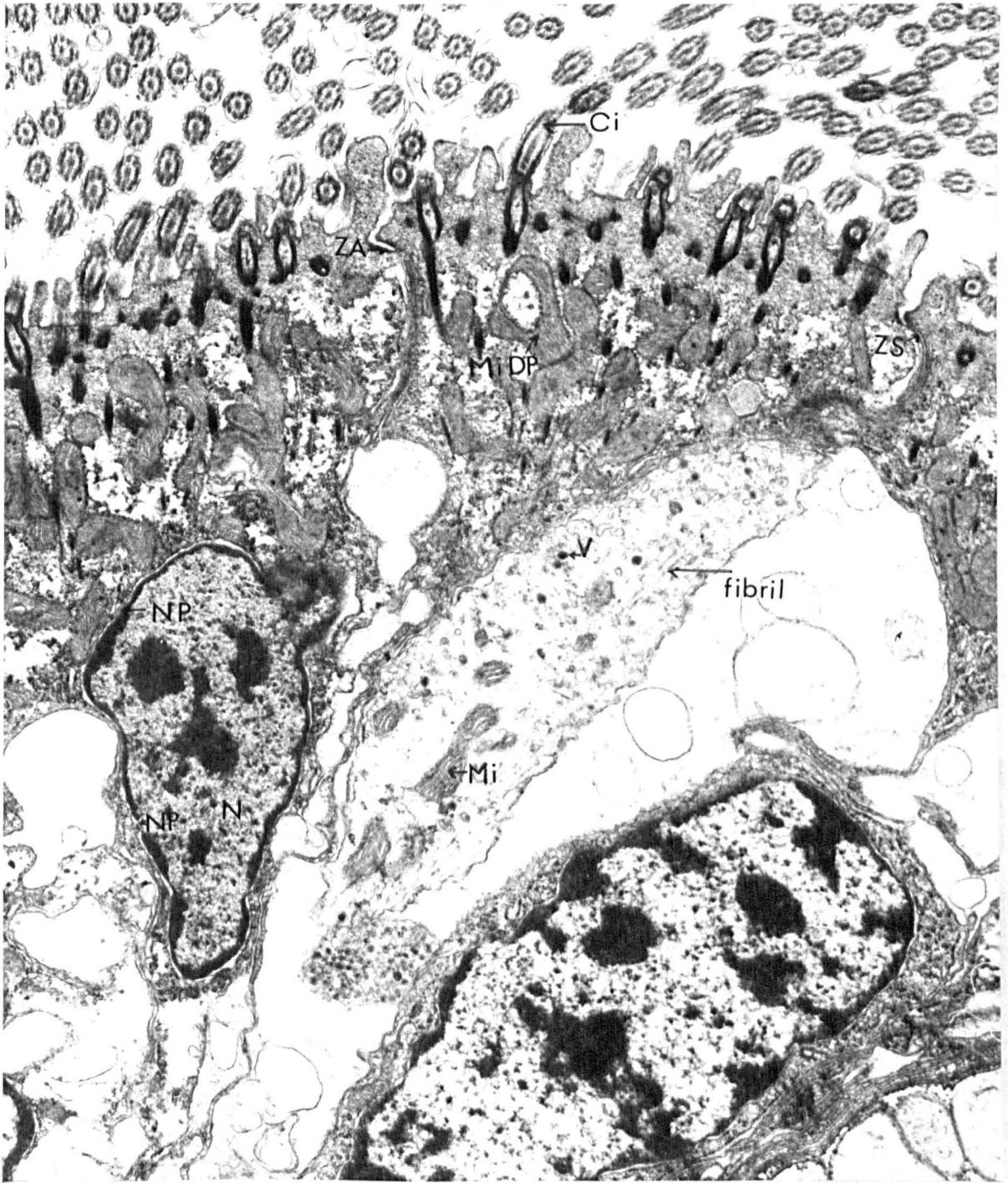


Plate 6: PART OF CILIATED 'HUMP'.

1 μ m

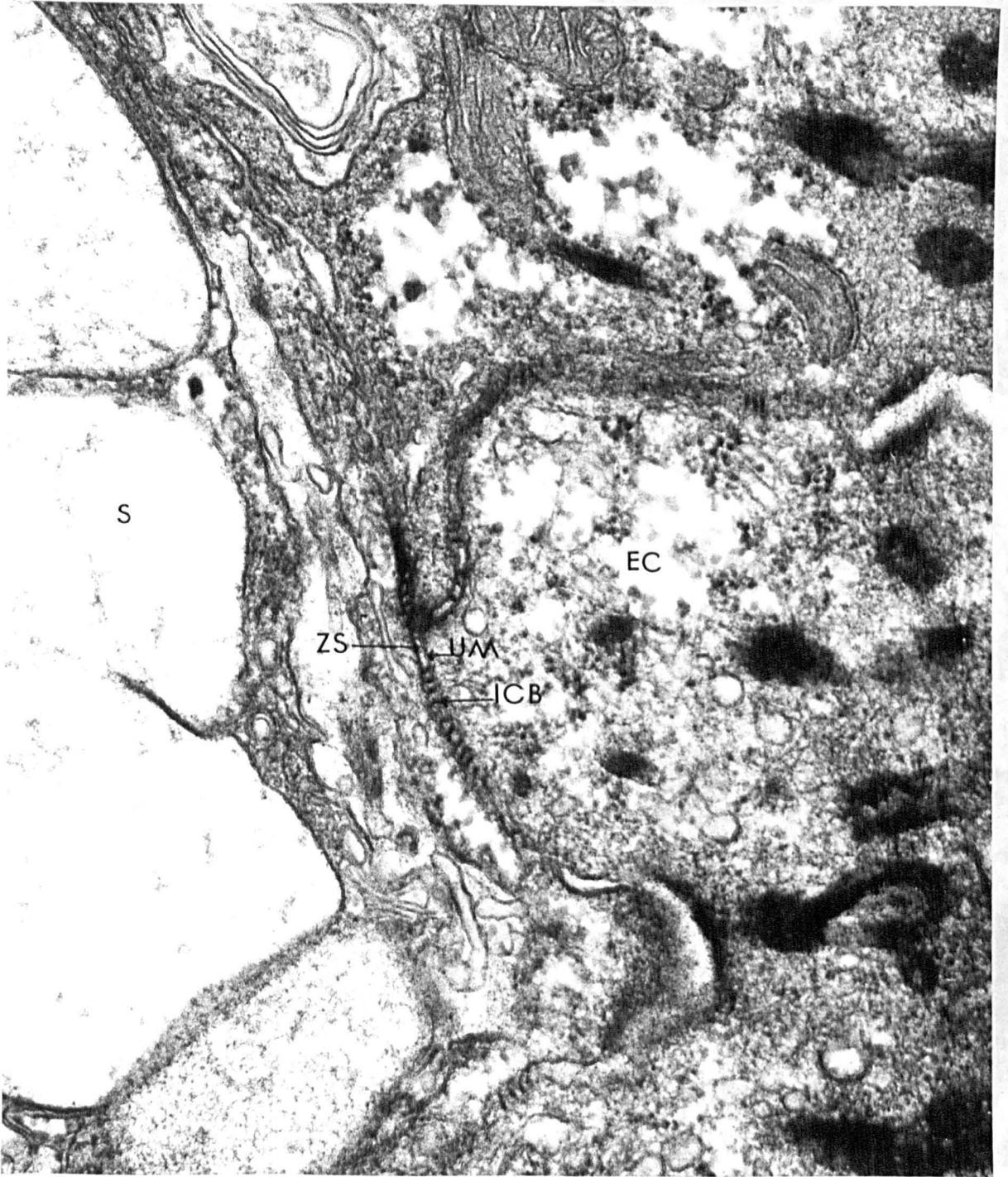


Plate 7: INTERCELLULAR BRIDGES BETWEEN MUCOCYTE AND
CELL OF LOWER EPIDERMIS OF PEDAL GLAND DUCT.

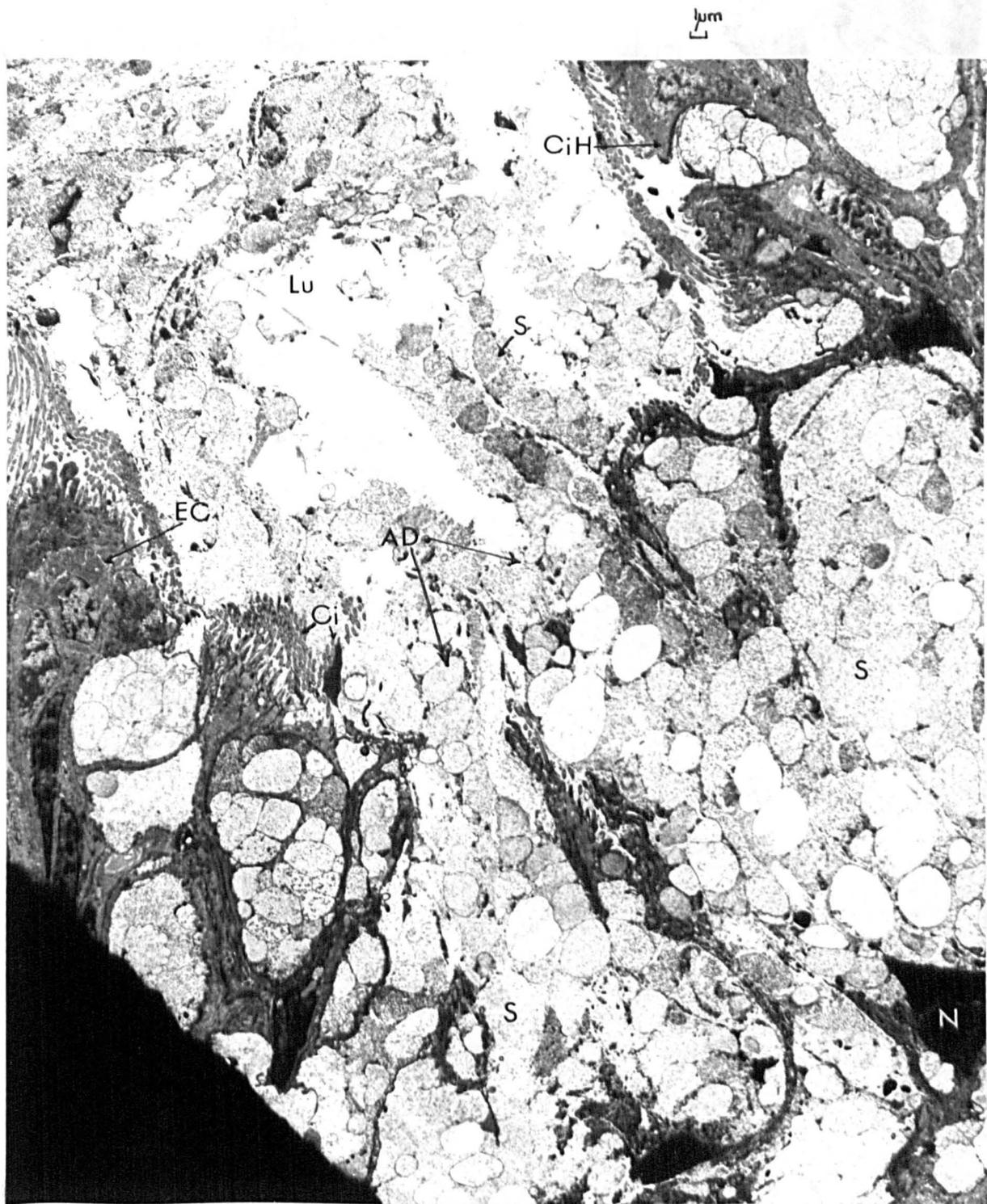


Plate 8: CENTRAL REGION OF LOWER EPIDERMIS OF PEDAL

GLAND DUCT.

CELLS ASSOCIATED WITH CELLS OF

LOWER EPIDERMIS OF PEDAL GLAND DUCT.

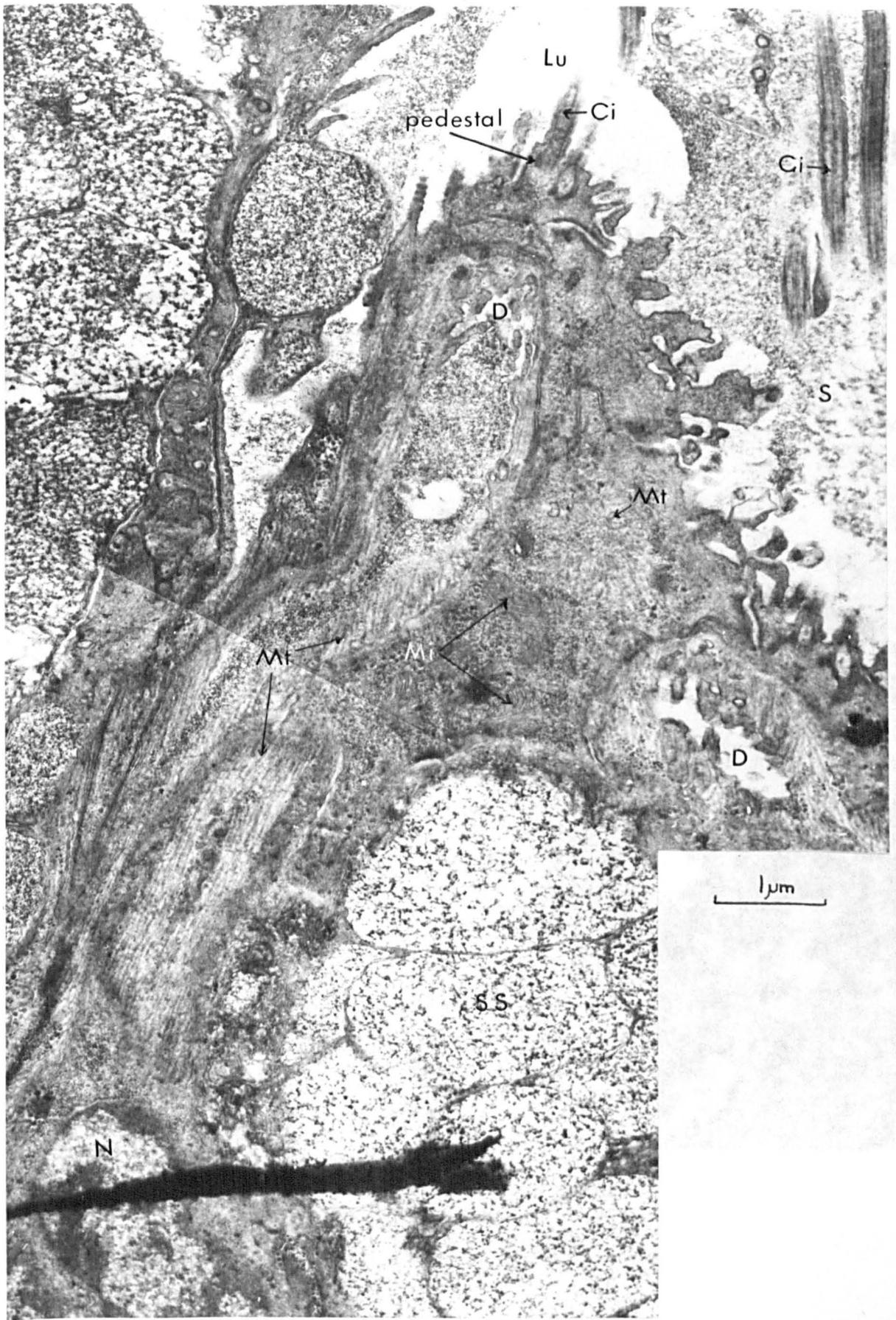


Plate 9: MICROTUBULES ASSOCIATED WITH CELLS OF
LOWER EPIDERMIS OF PEDAL GLAND DUCT.

1µm

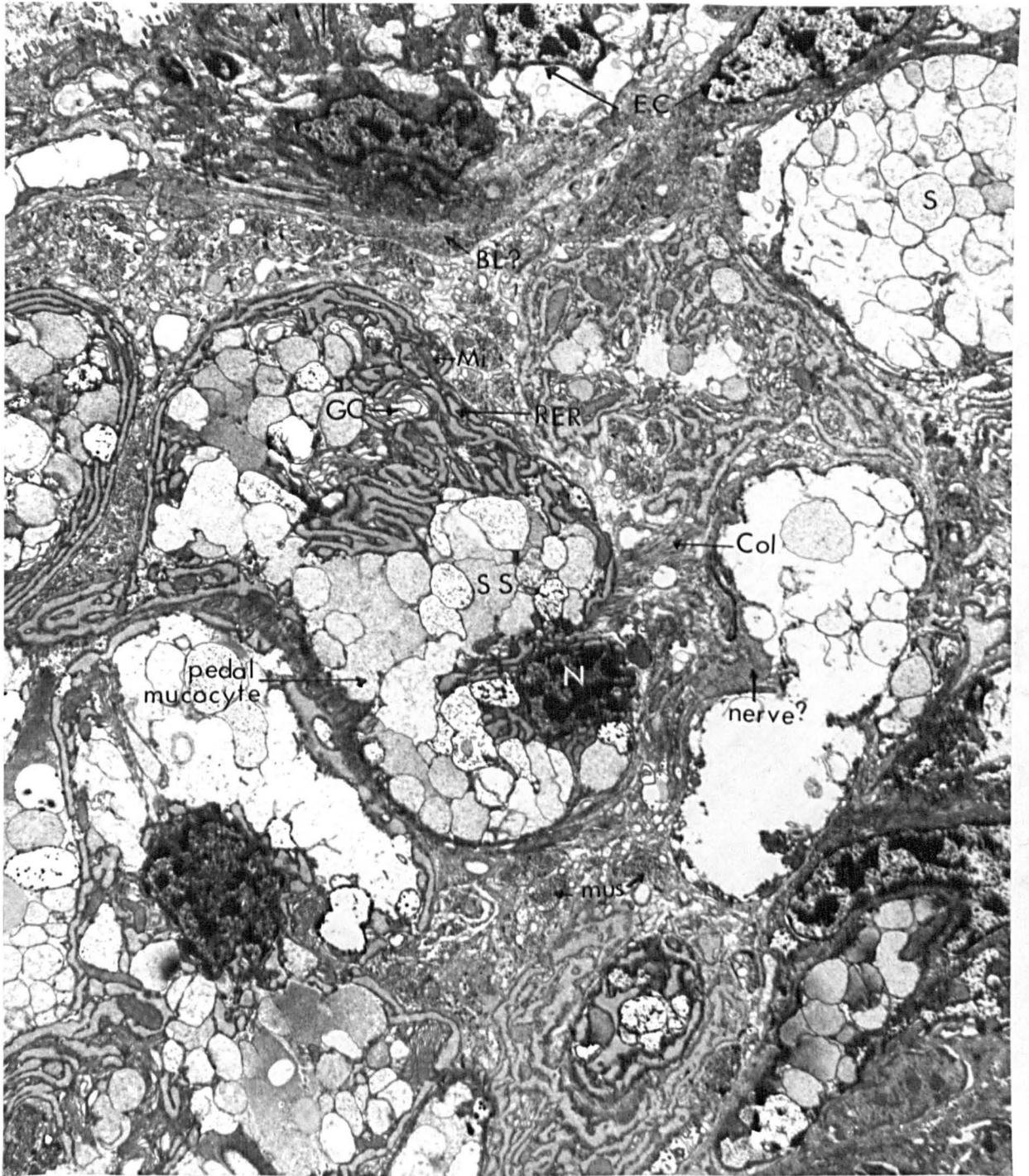


Plate 10: PEDAL MUCOCYTE

μm

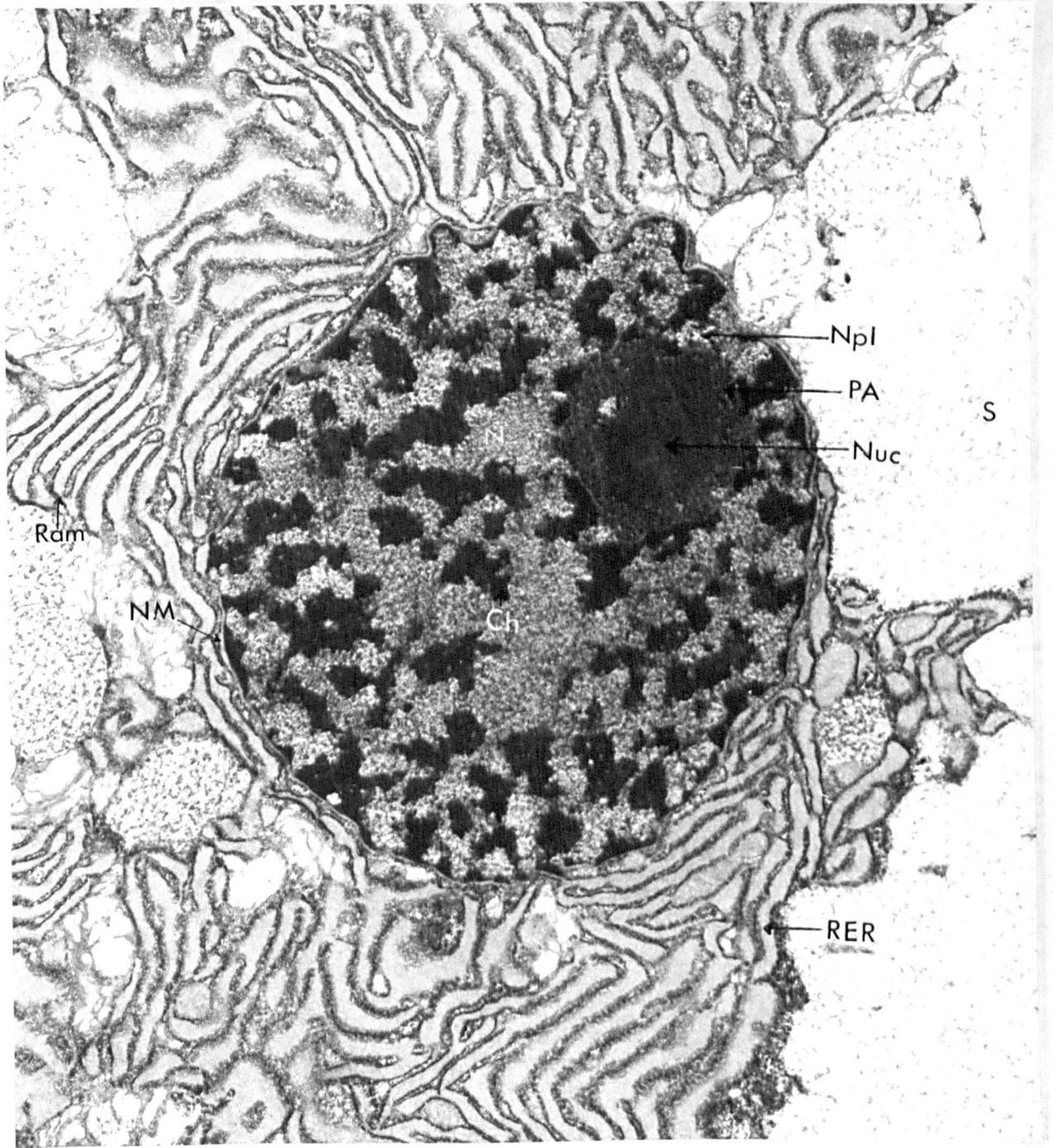


Plate 11: NUCLEUS AND NUCLEOLUS OF PEDAL MUCOCYTE.

1 μ m

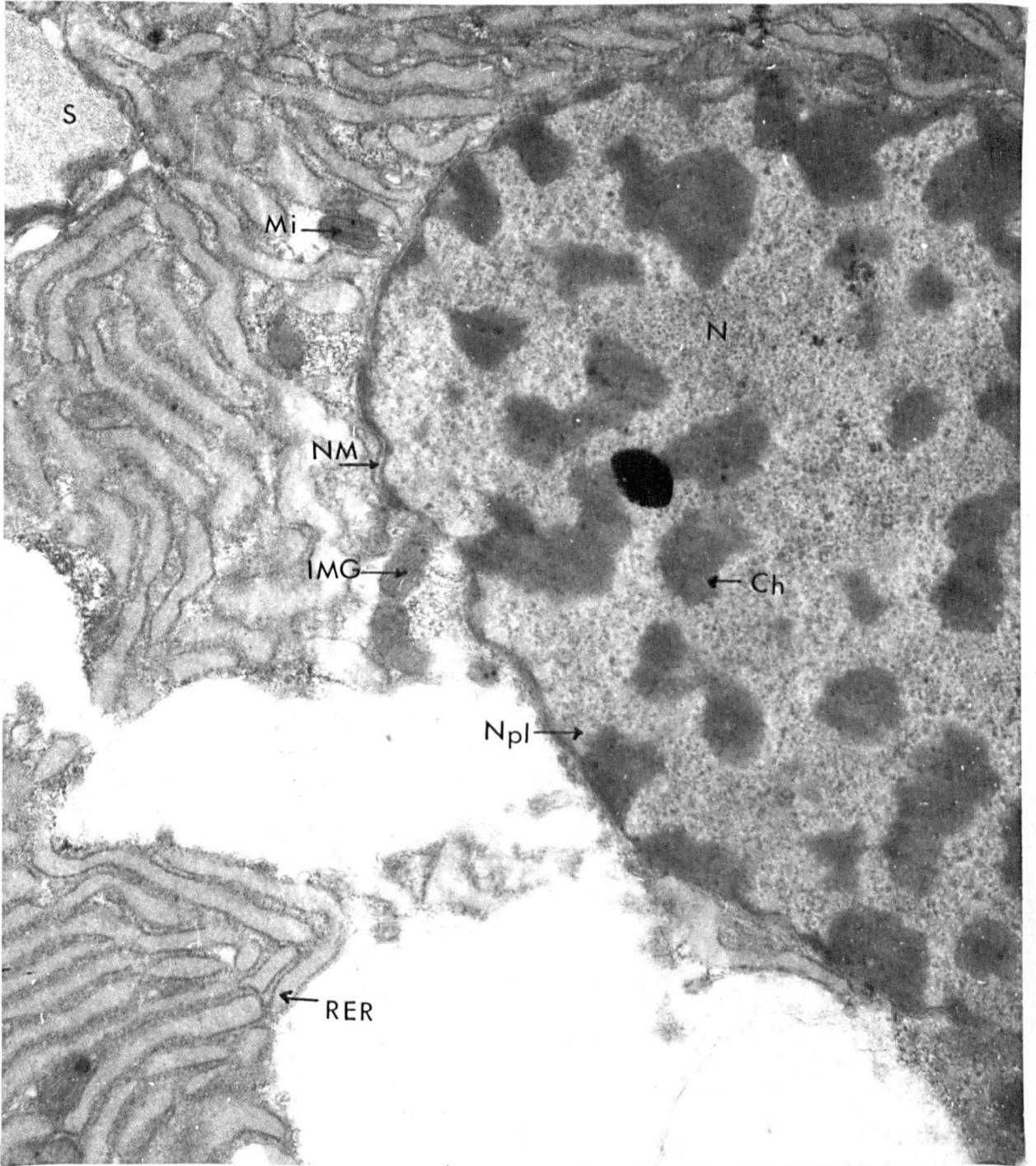


Plate 12: NUCLEUS OF PEDAL MUCOCYTE.

1 μ m

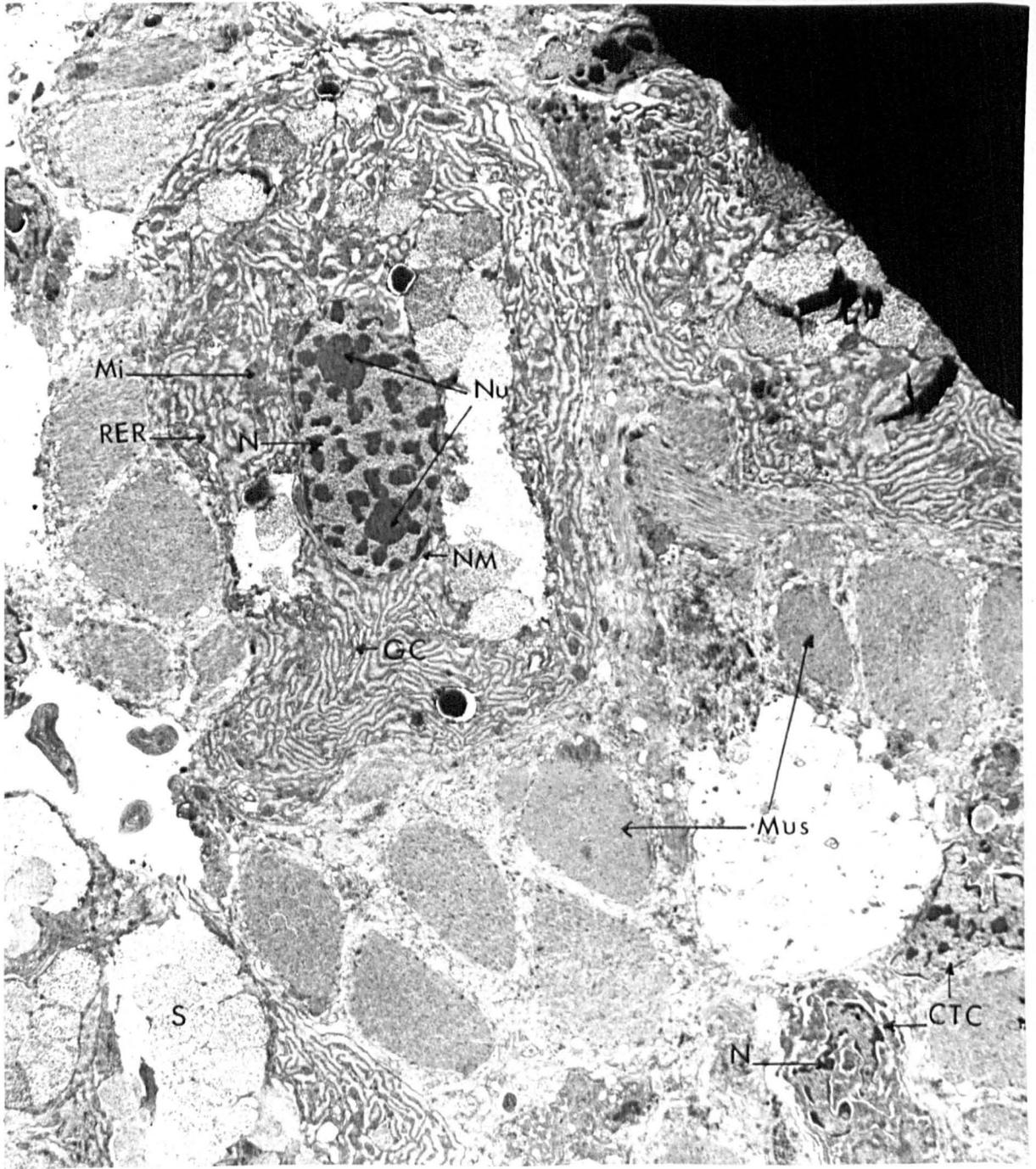


Plate 13: BINUCLEOLATE NUCLEUS OF PEDAL MUCOCYTE.

1µm

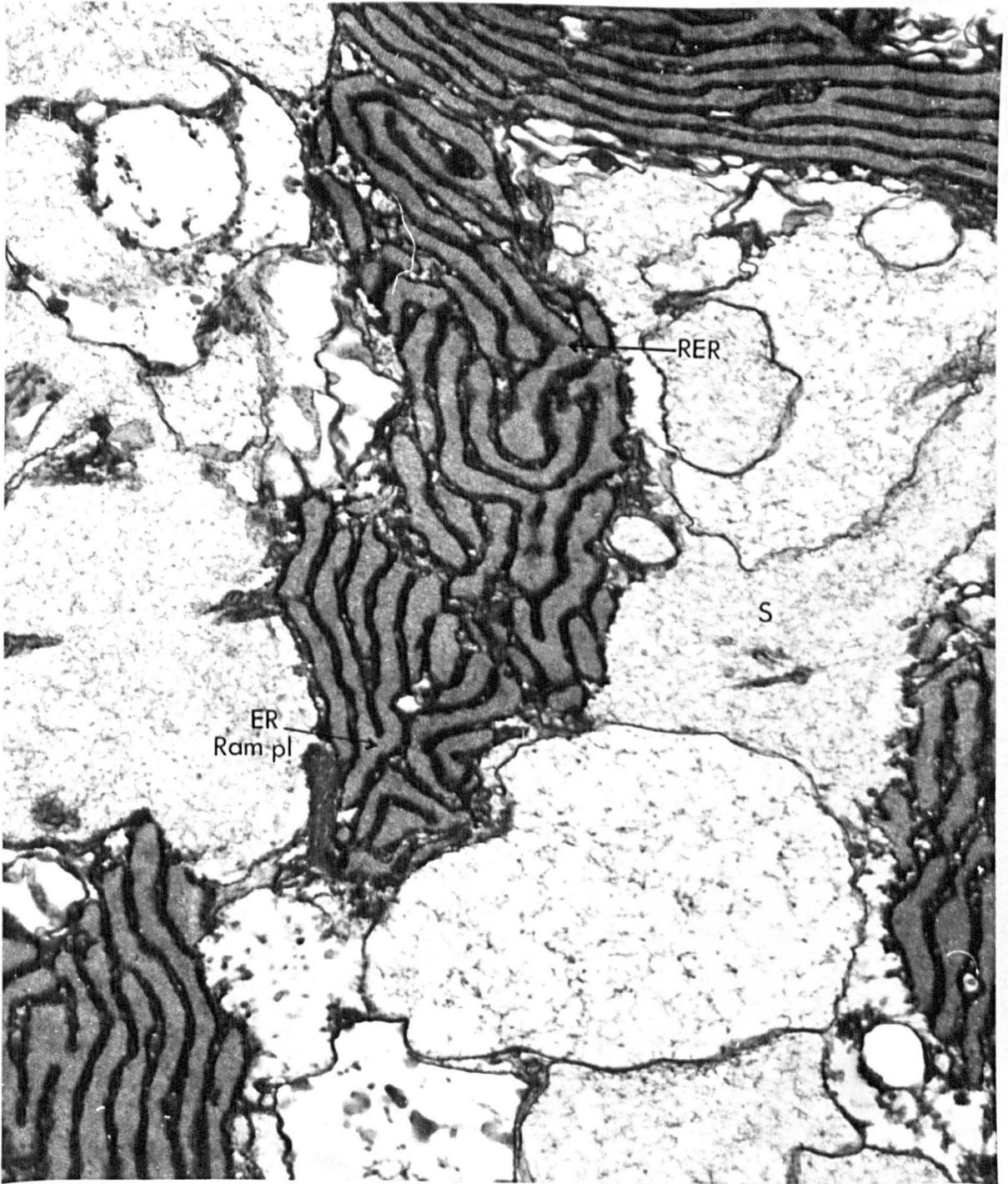


Plate 14: ENDOPLASMIC RETICULUM OF PEDAL MUCOCYTE.

IN PEDAL MUCOCYTE.

$\frac{1}{2} \mu\text{m}$

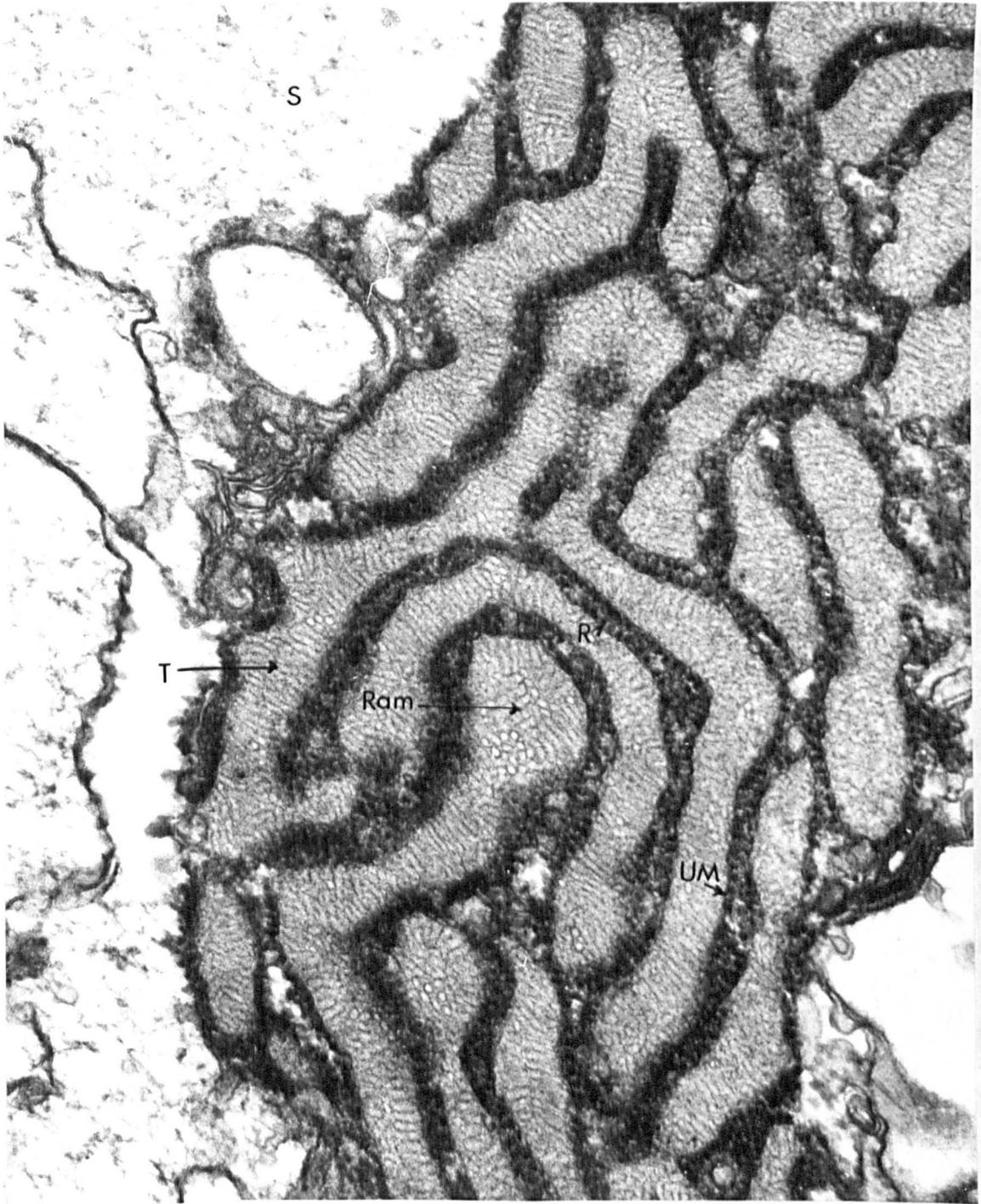


Plate 15: HIGH MAGNIFICATION OF ENDOPLASMIC RETICULUM

OF PEDAL MUCOCYTE.

$\frac{1}{2} \mu\text{m}$

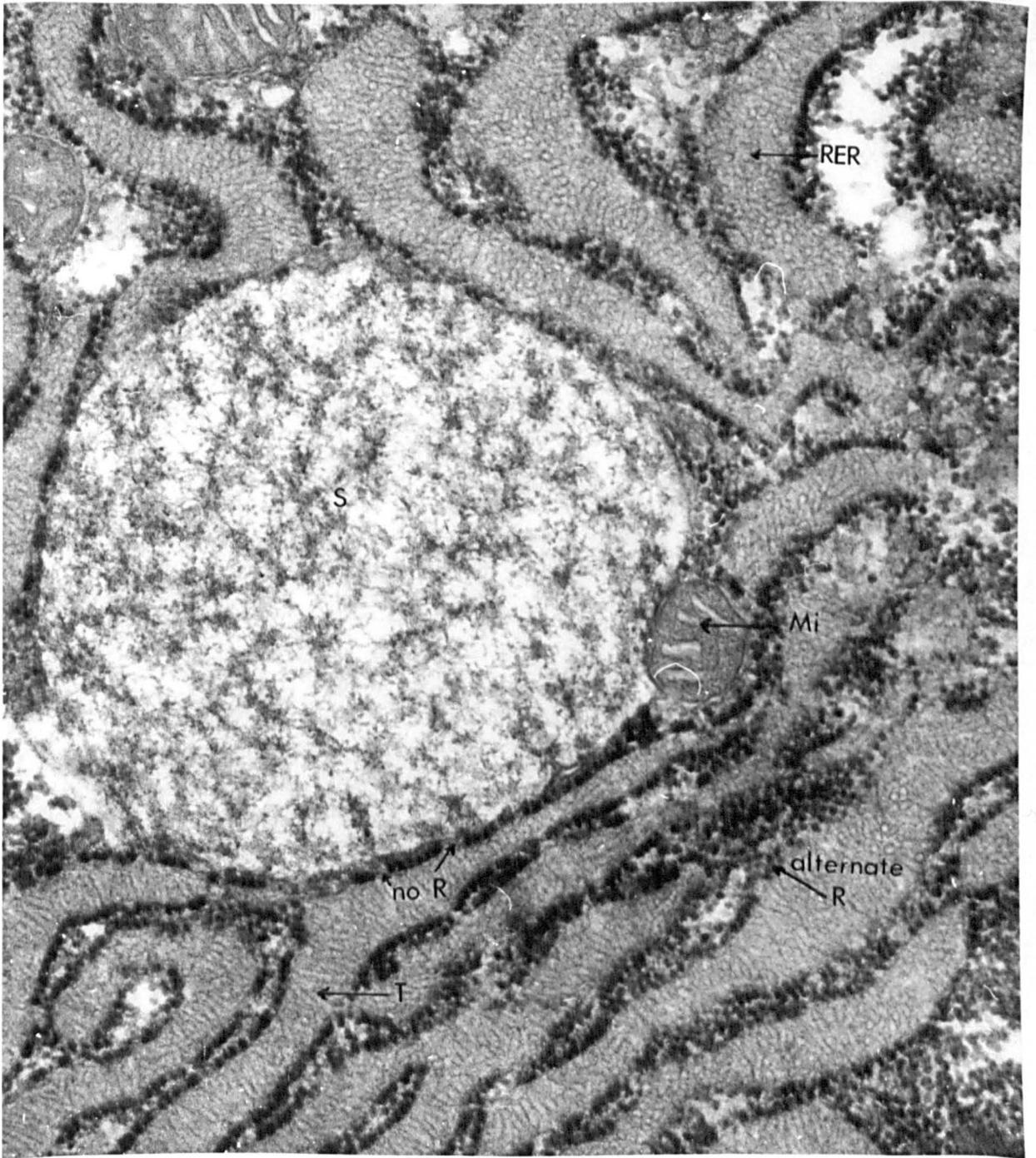


Plate 16: HIGH MAGNIFICATION OF ENDOPLASMIC RETICULUM
OF PEDAL MUCOCYTE.

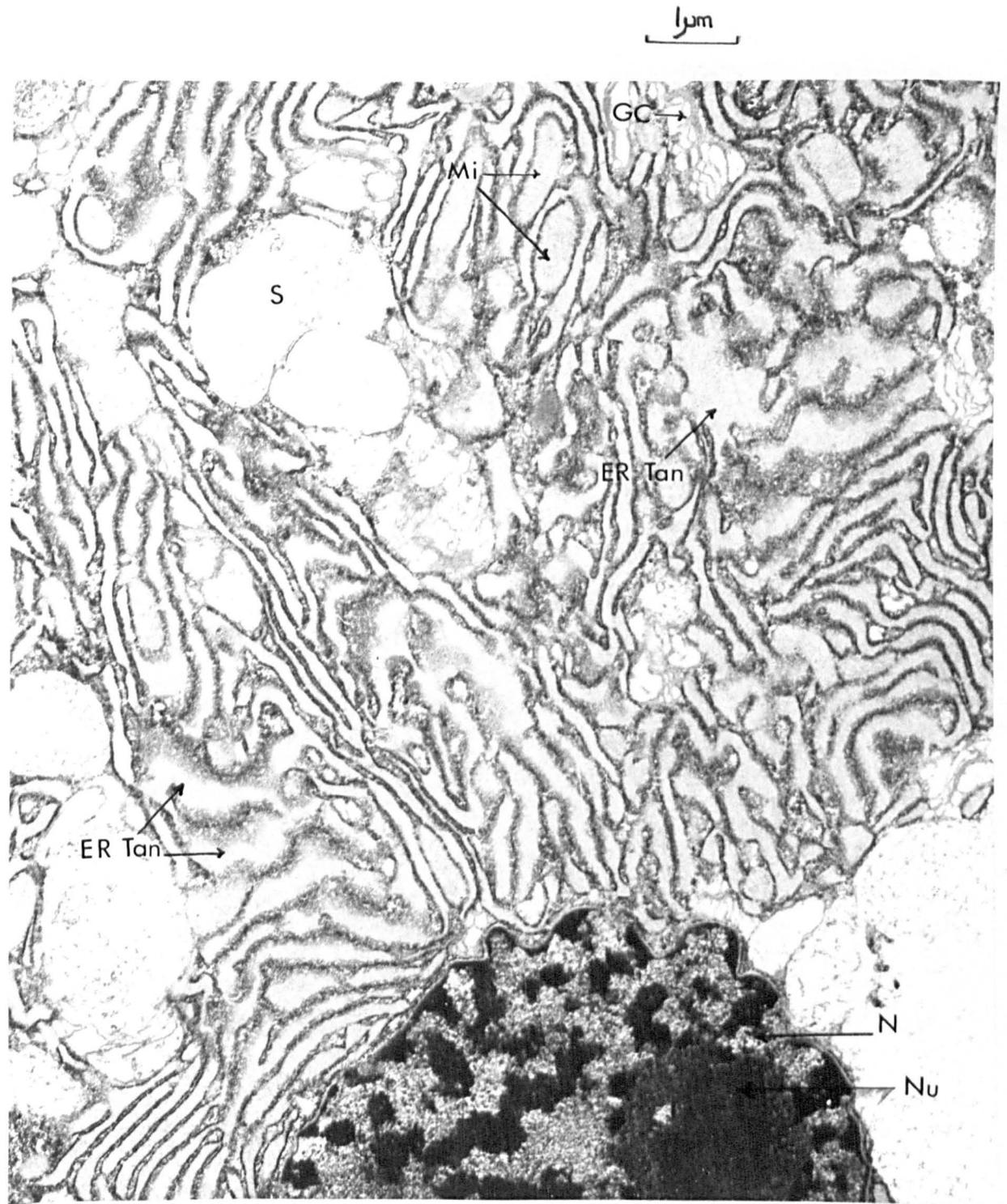


Plate 17: SHOWING TANGENTIAL SECTIONS OF 'PLATES' OF
ENDOPLASMIC RETICULUM.

$\frac{1}{2}\mu\text{m}$

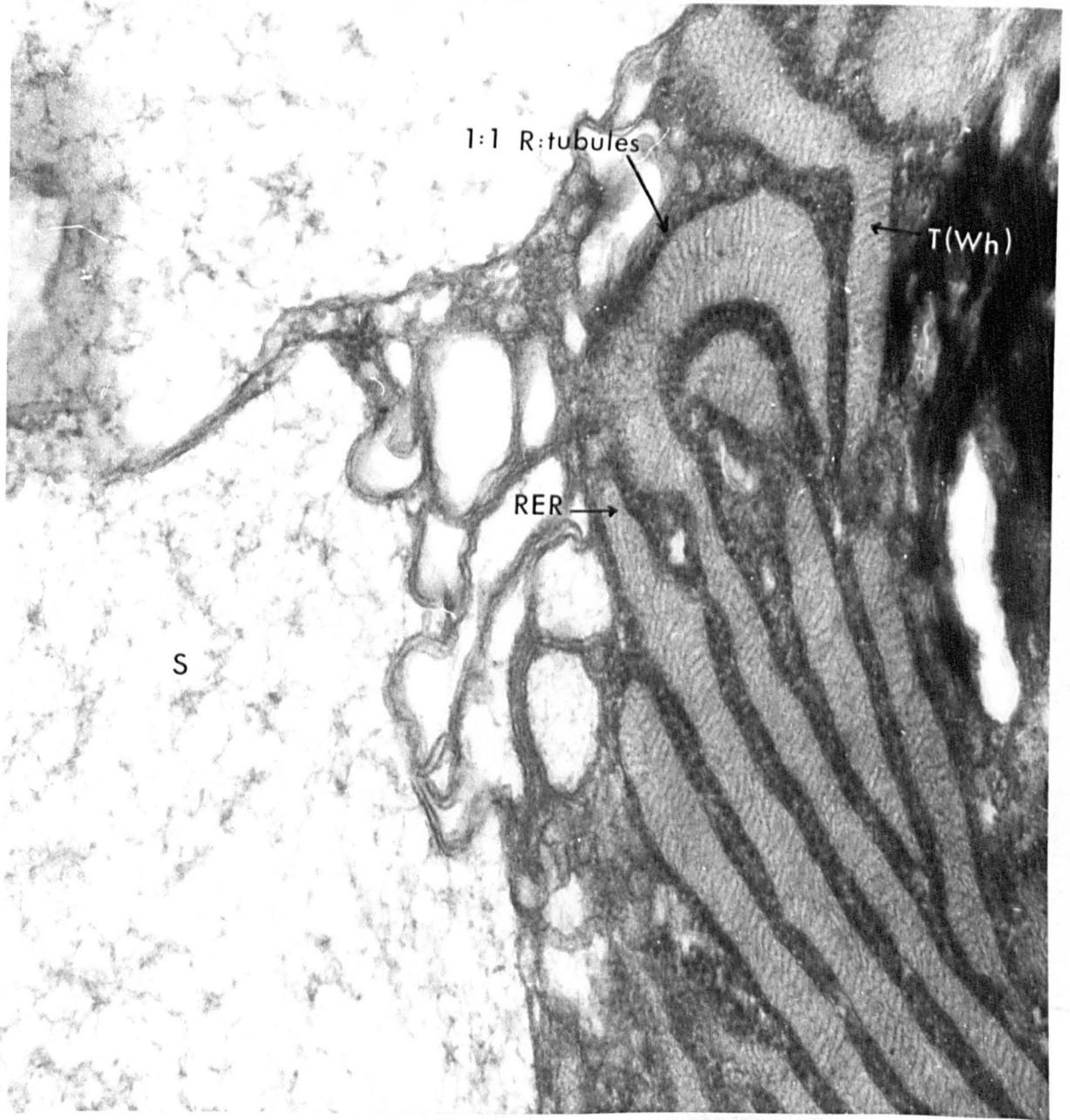


Plate 18: SHOWING LONG TUBULES IN ENDOPLASMIC RETICULUM,
AND 1:1 RATIO OF RIBOSOMES TO TUBULES.

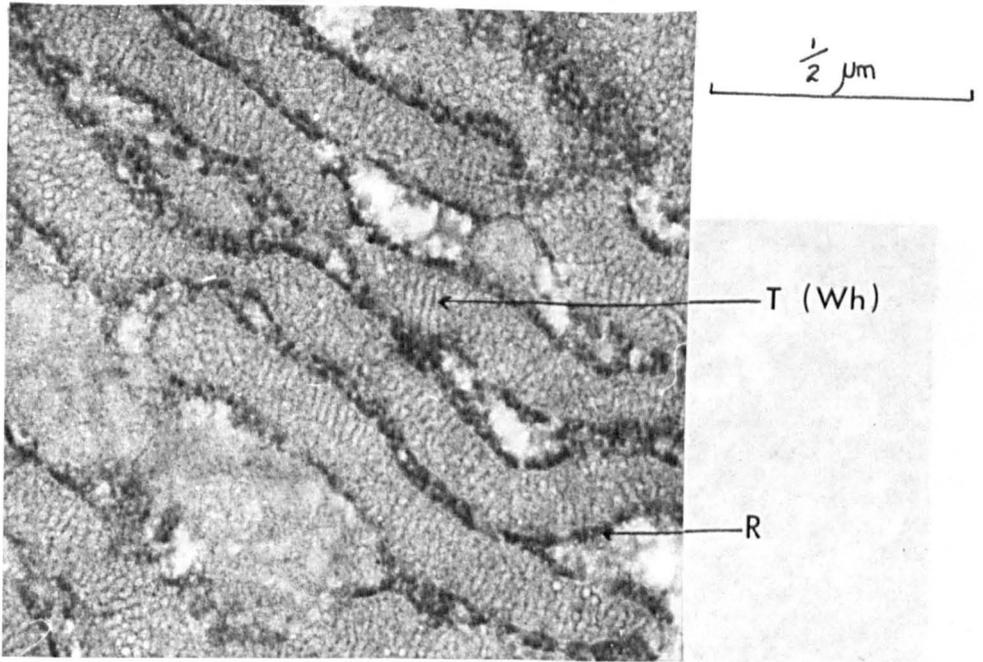


Plate 19: SHOWING LONG TUBULES IN ENDOPLASMIC
RETICULUM.

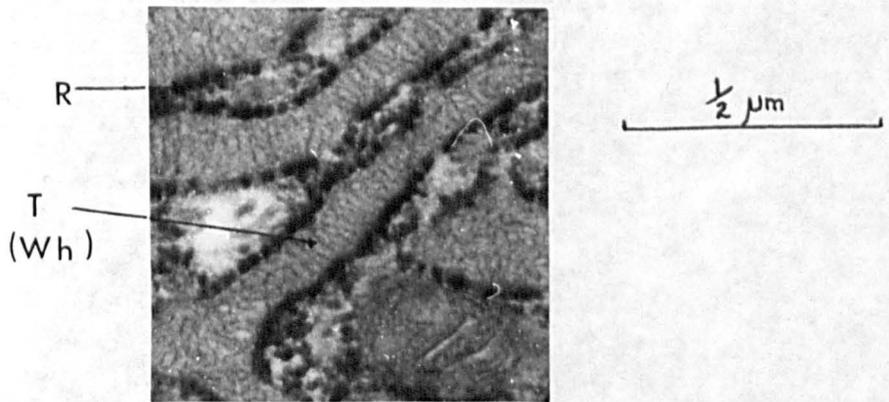


Plate 20: SHOWING LONG TUBULES IN ENDOPLASMIC
RETICULUM.

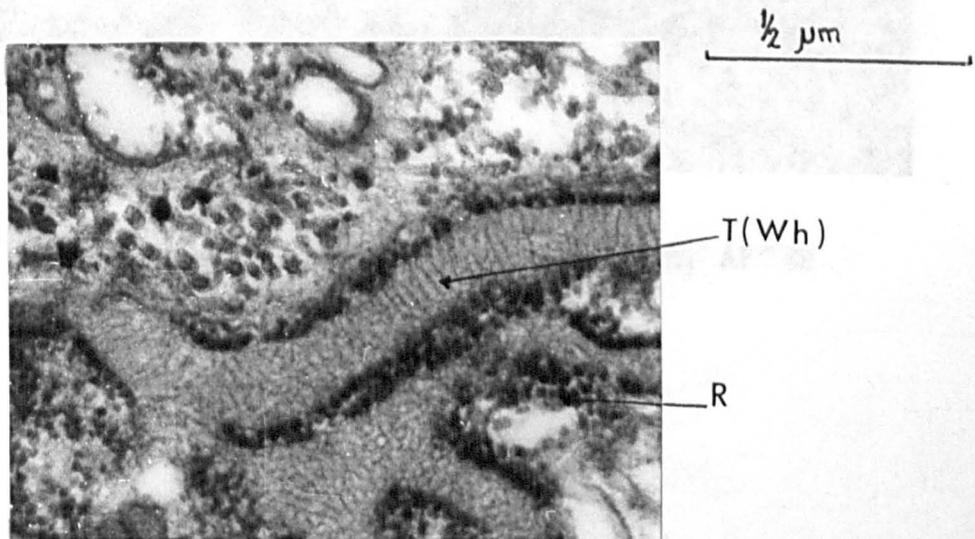


Plate 21: SHOWING LONG TUBULES IN ENDOPLASMIC
RETICULUM.

$\frac{1}{2} \mu\text{m}$

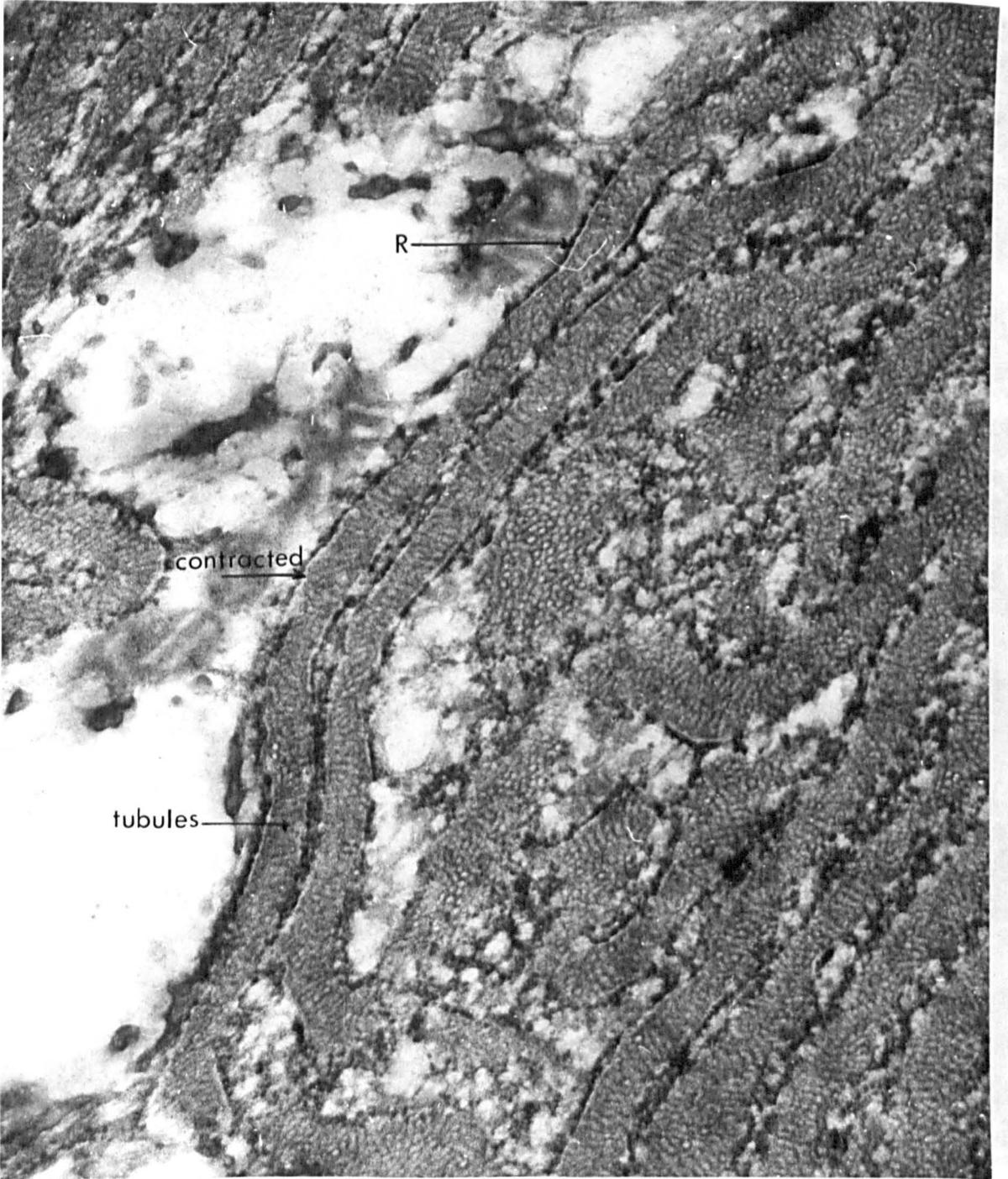


Plate 22: TUBULES IN ENDOPLASMIC RETICULUM, AFTER

DEAMINATION.

1 μ m

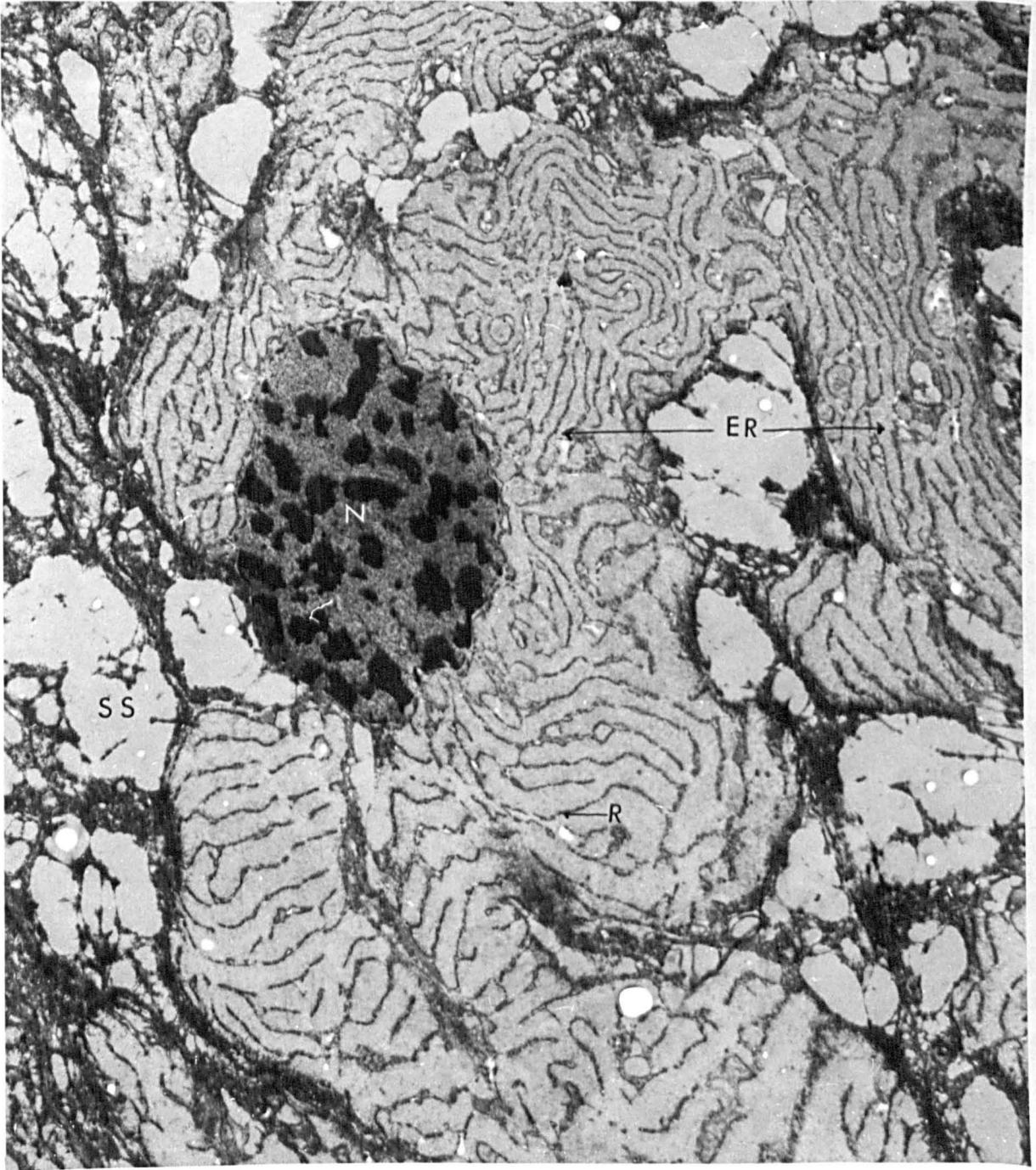


Plate 23: TUBULES IN ENDOPLASMIC RETICULUM, AFTER
PEPSIN DIGESTION.

$\frac{1}{2}\mu\text{m}$



Plate 24: HIGH MAGNIFICATION OF ENDOPLASMIC RETICULUM

AFTER PEPSIN DIGESTION.

1µm

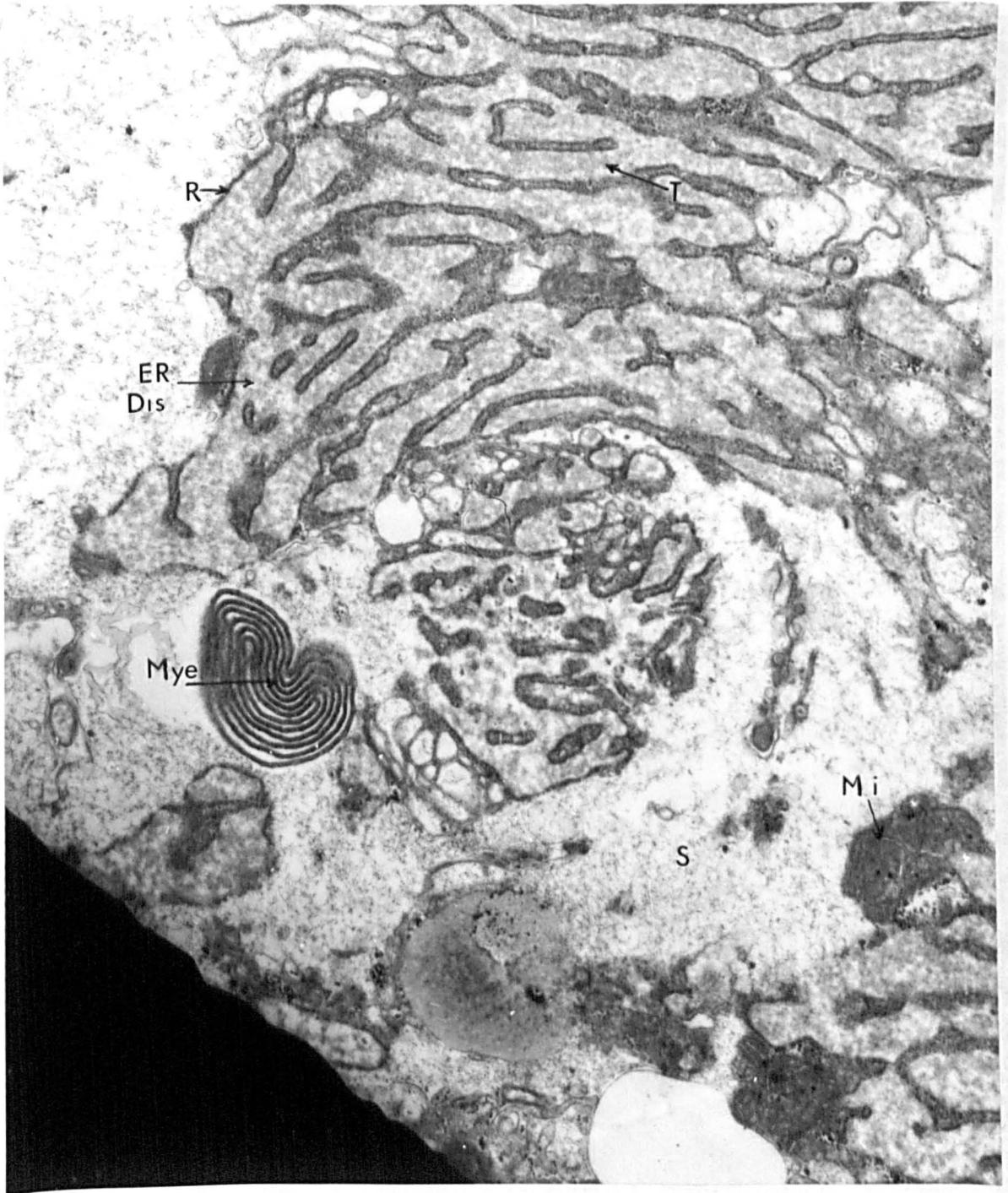


Plate 25: DISORGANISED ENDOPLASMIC RETICULUM.

1 μ m



Plate 26: DISORGANISED ENDOPLASMIC RETICULUM AND
GOLGI COMPLEX.

1 μ m

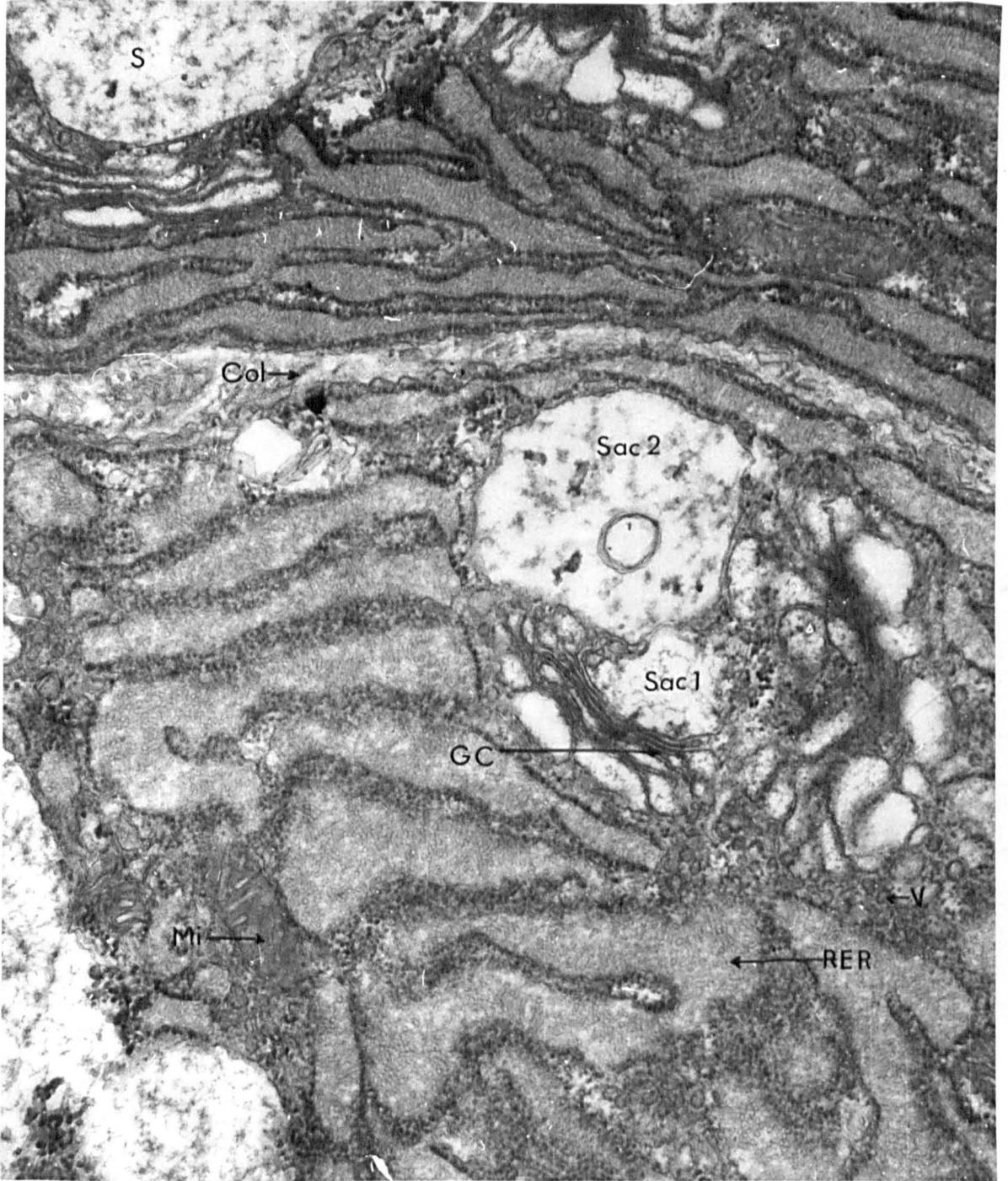


Plate 27: GOLGI COMPLEX OF PEDAL MUCOCYTE.

1µm

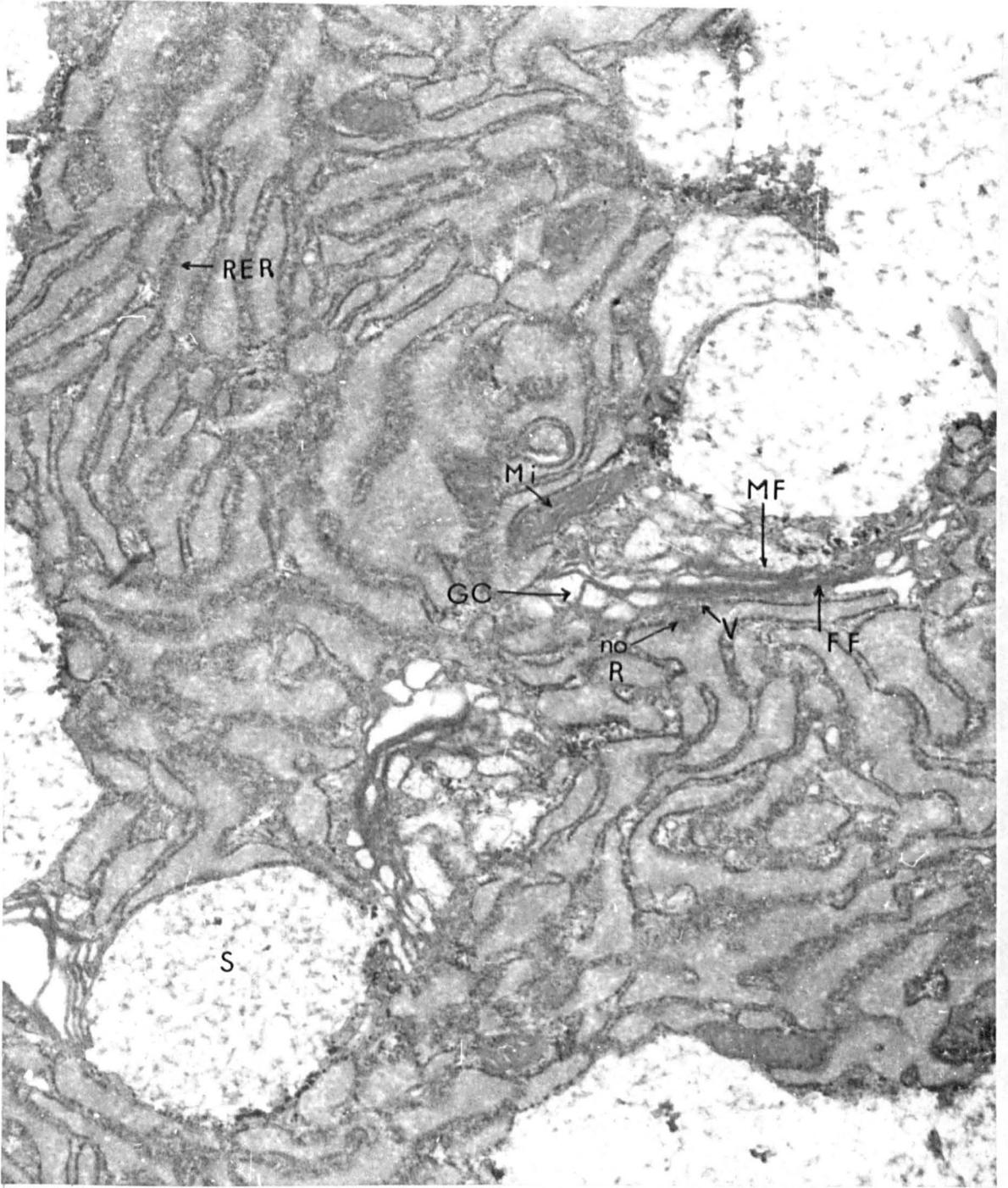


Plate 28: GOLGI COMPLEX WITH VESICLES BETWEEN IT
AND ENDOPLASMIC RETICULUM.

1µm

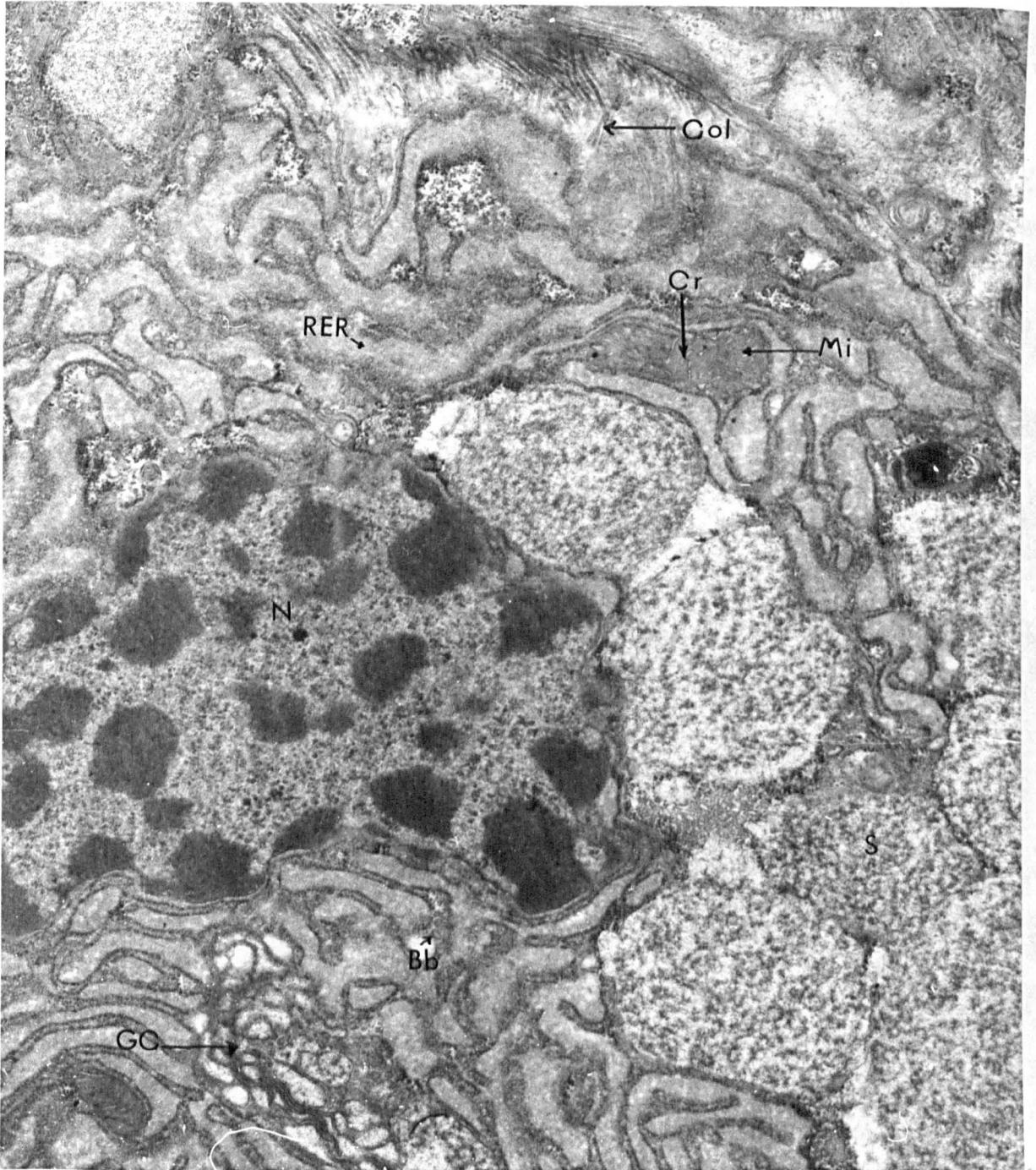


Plate 29: VESICLES BUDDING OFF FROM ENDOPLASMIC
RETICULUM.

1 μ m

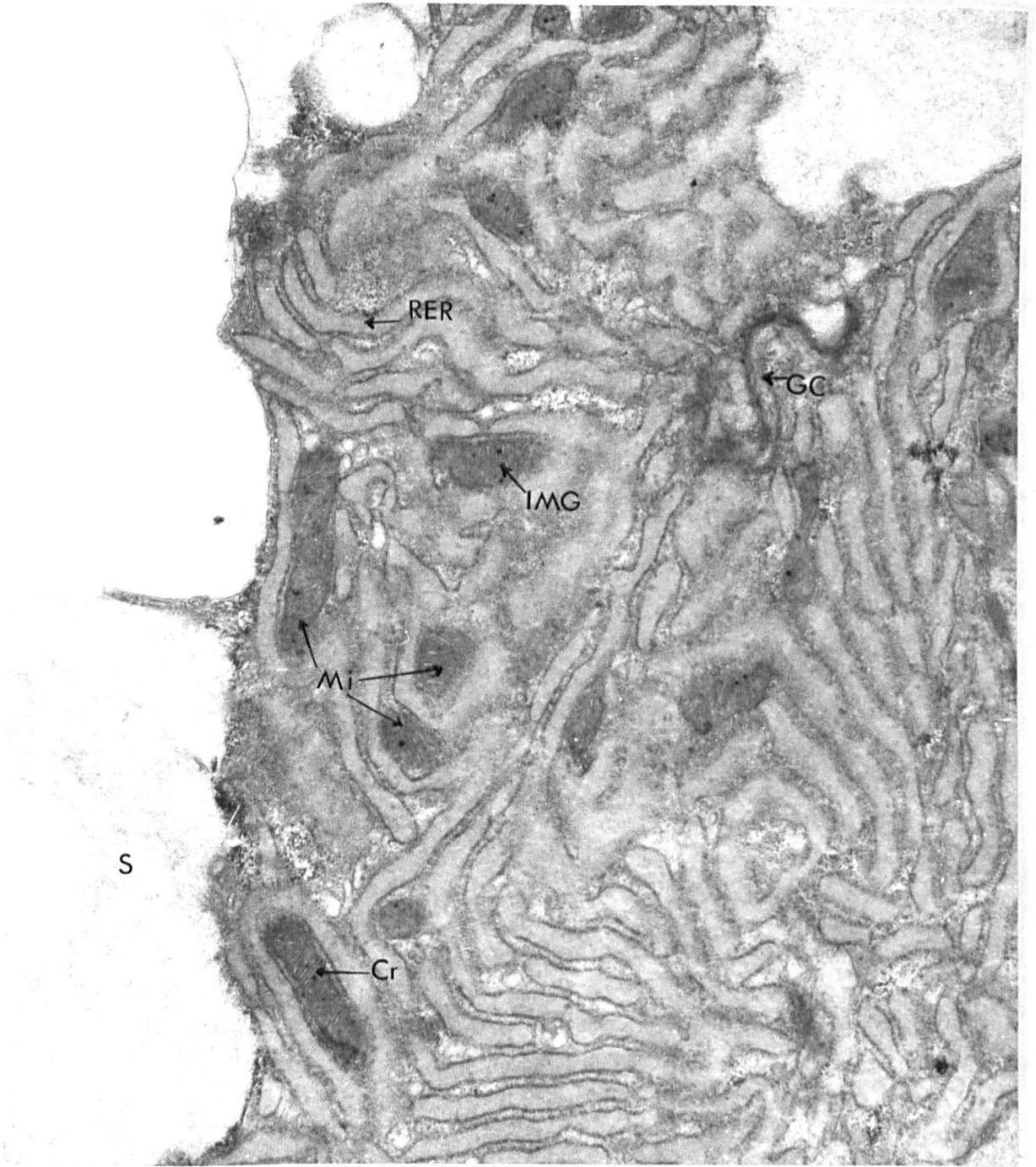


Plate 30: MITOCHONDRIA OF PEDAL MUCOCYTE.

1 μ m

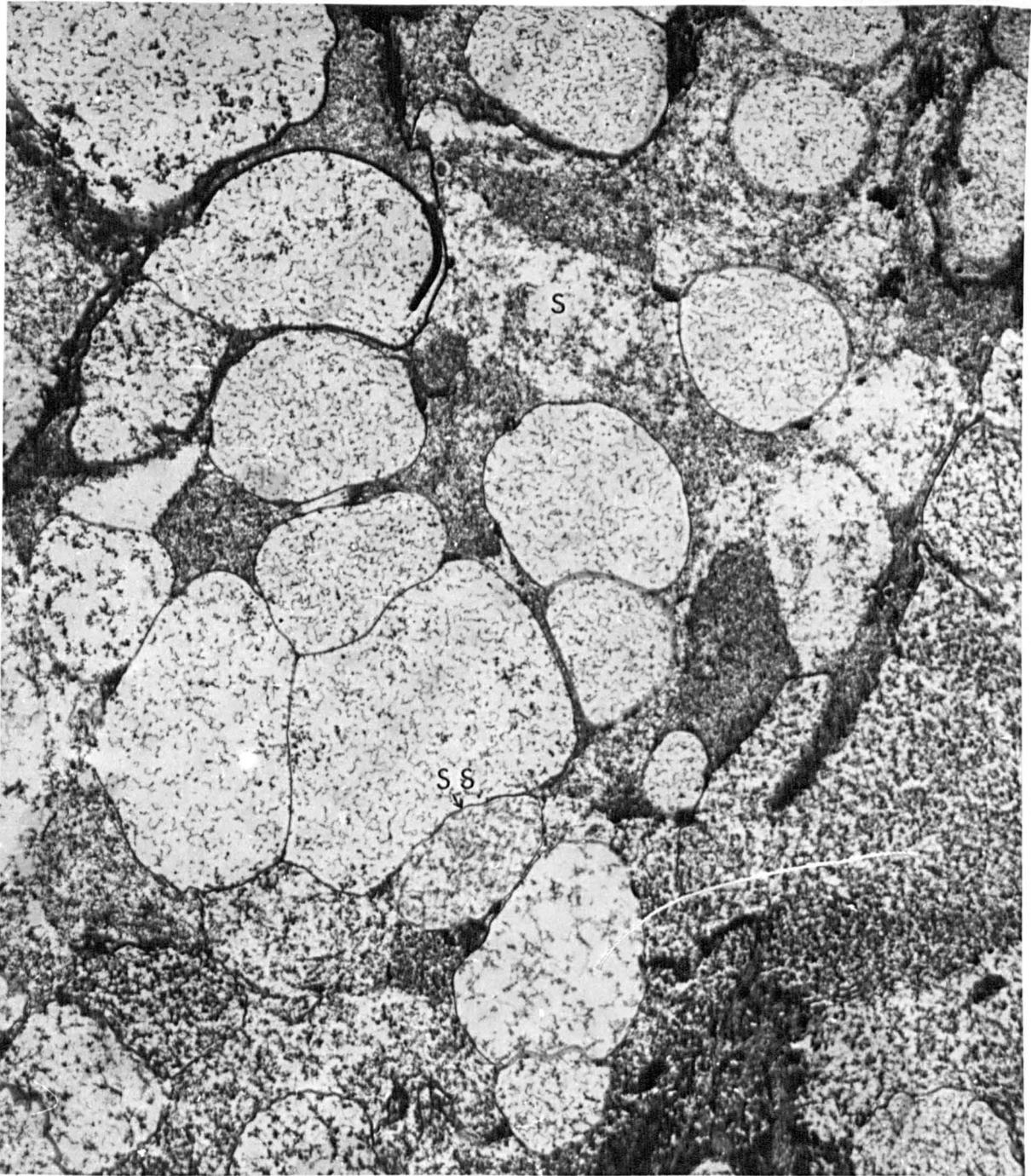


Plate 31: SACS OF SECRETION IN PEDAL MUCOCYTE.

$\frac{1}{2}\mu\text{m}$

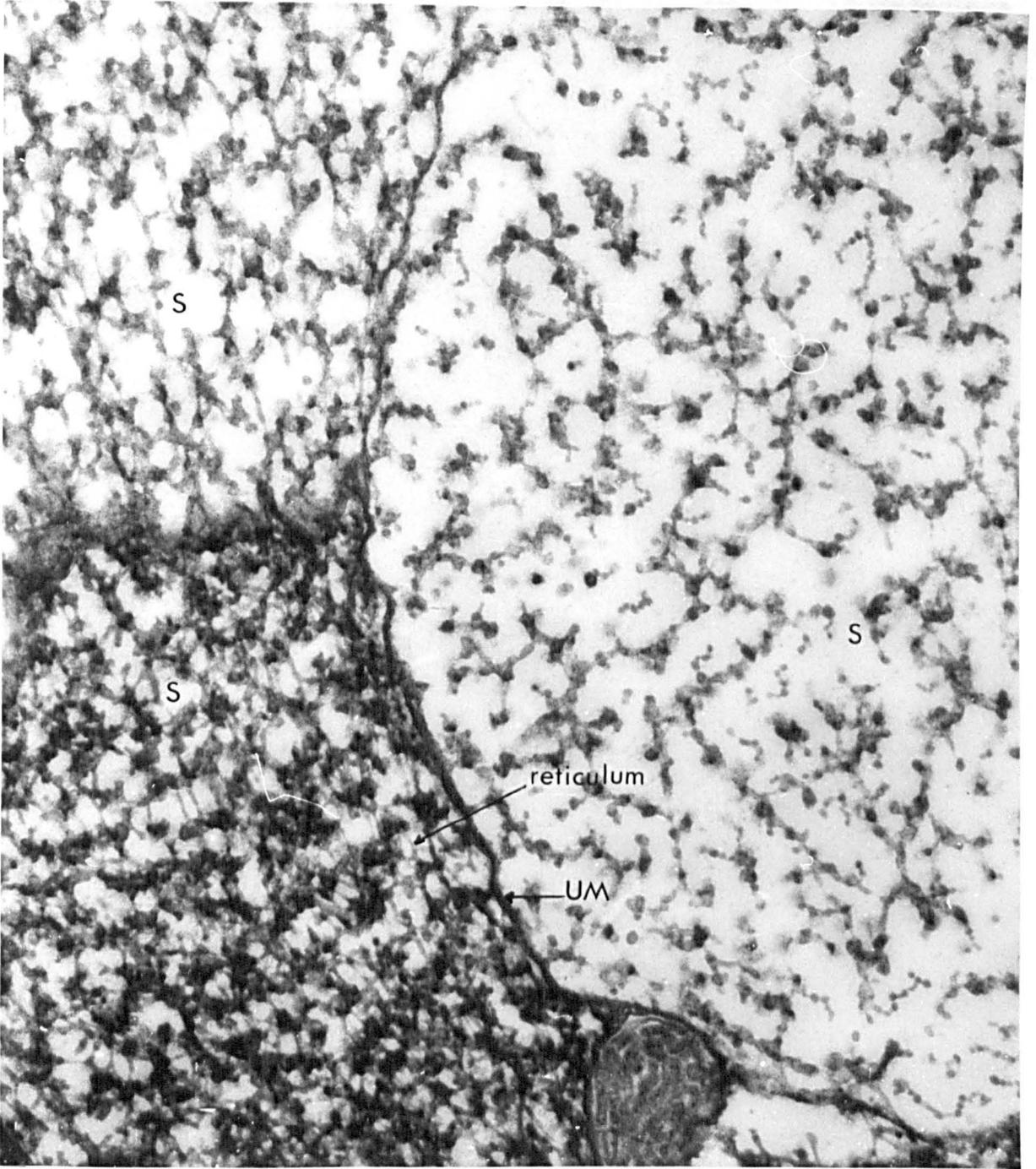


Plate 32: HIGH MAGNIFICATION OF SECRETION.

$\frac{1}{2}\mu\text{m}$

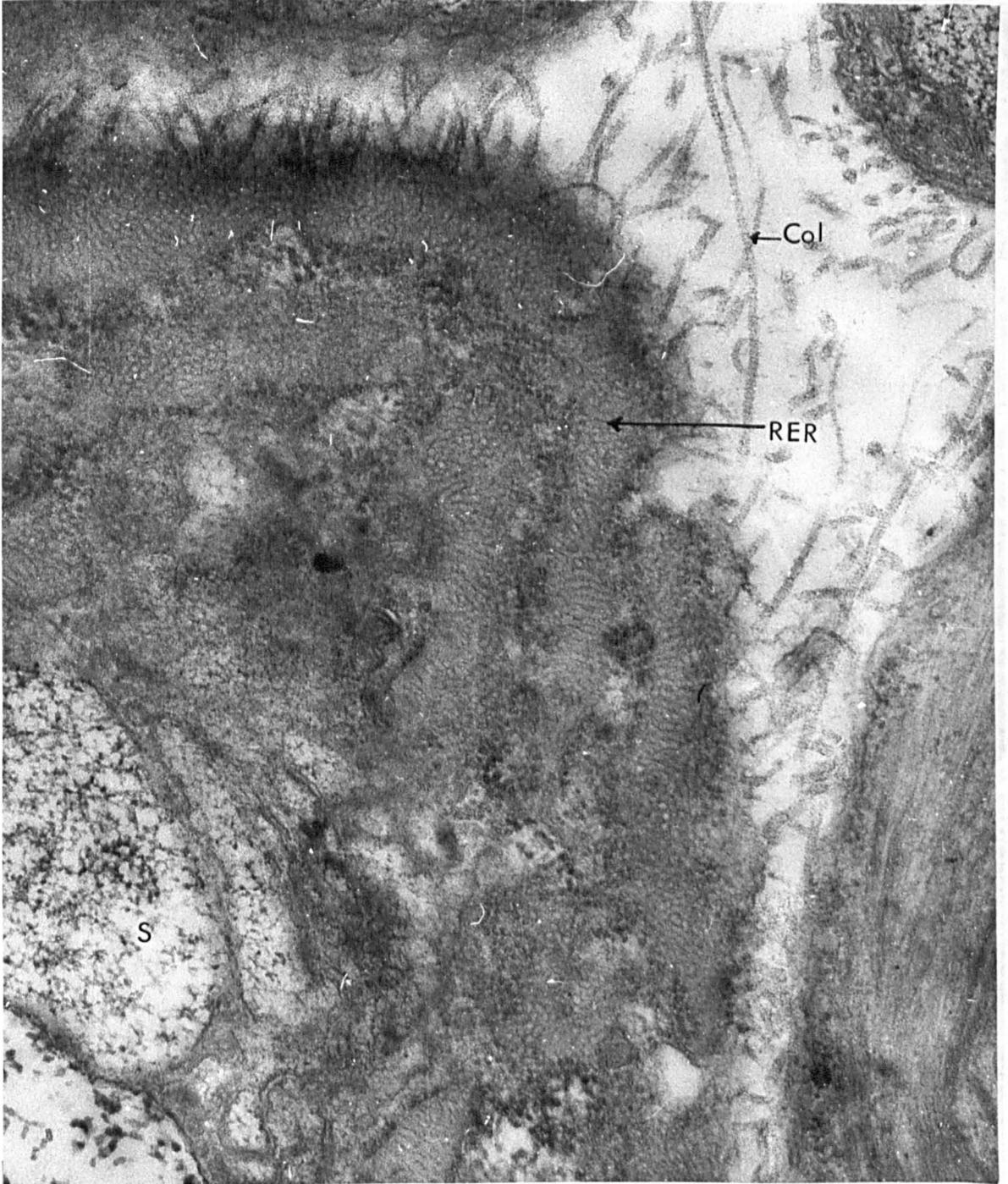


Plate 33: COLLAGEN FIBRES EXTERNAL TO A PEDAL
MUCOCYTE.

1µm

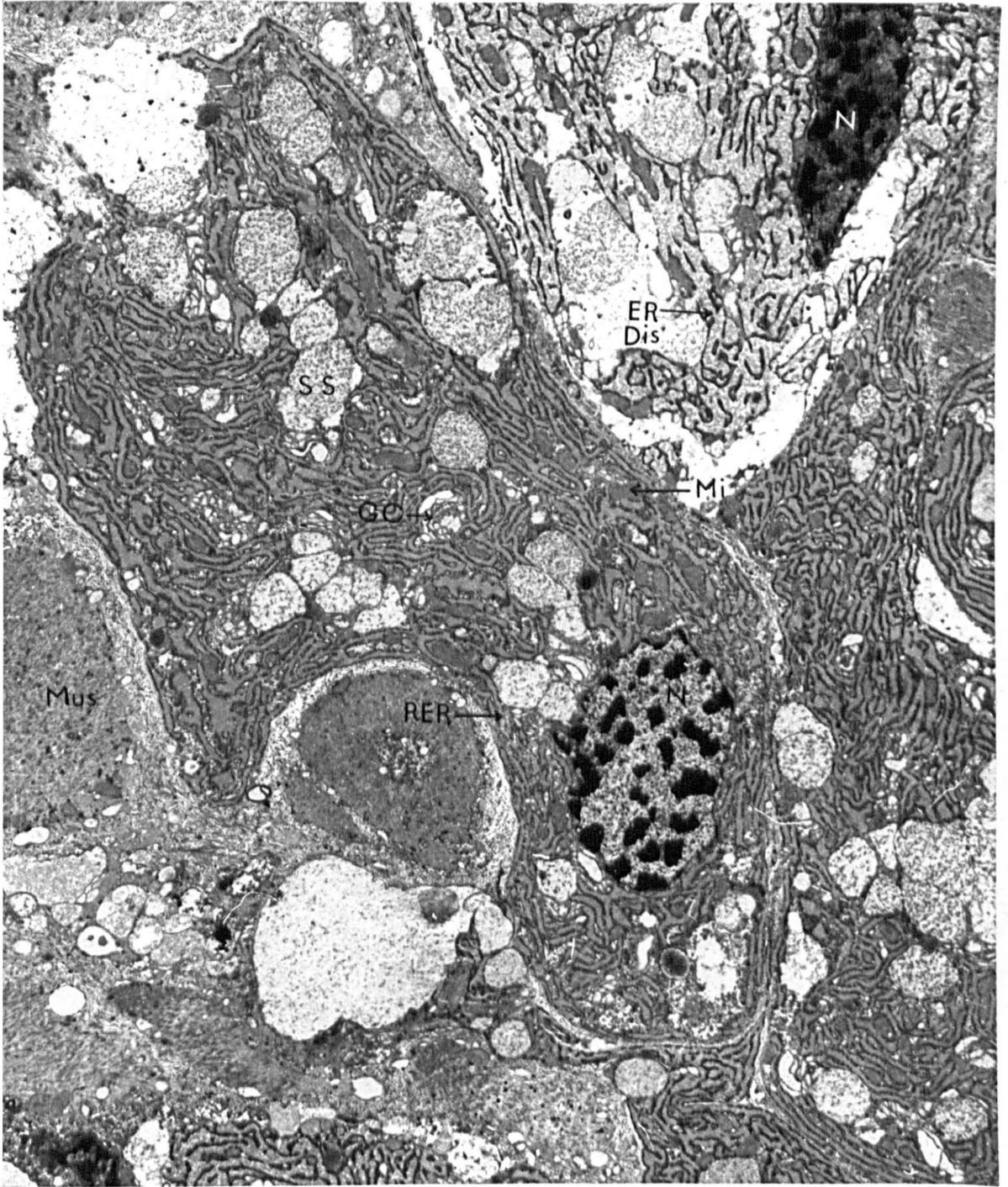


Plate 34: FAIRLY YOUNG PEDAL MUCOCYTE.

1µm

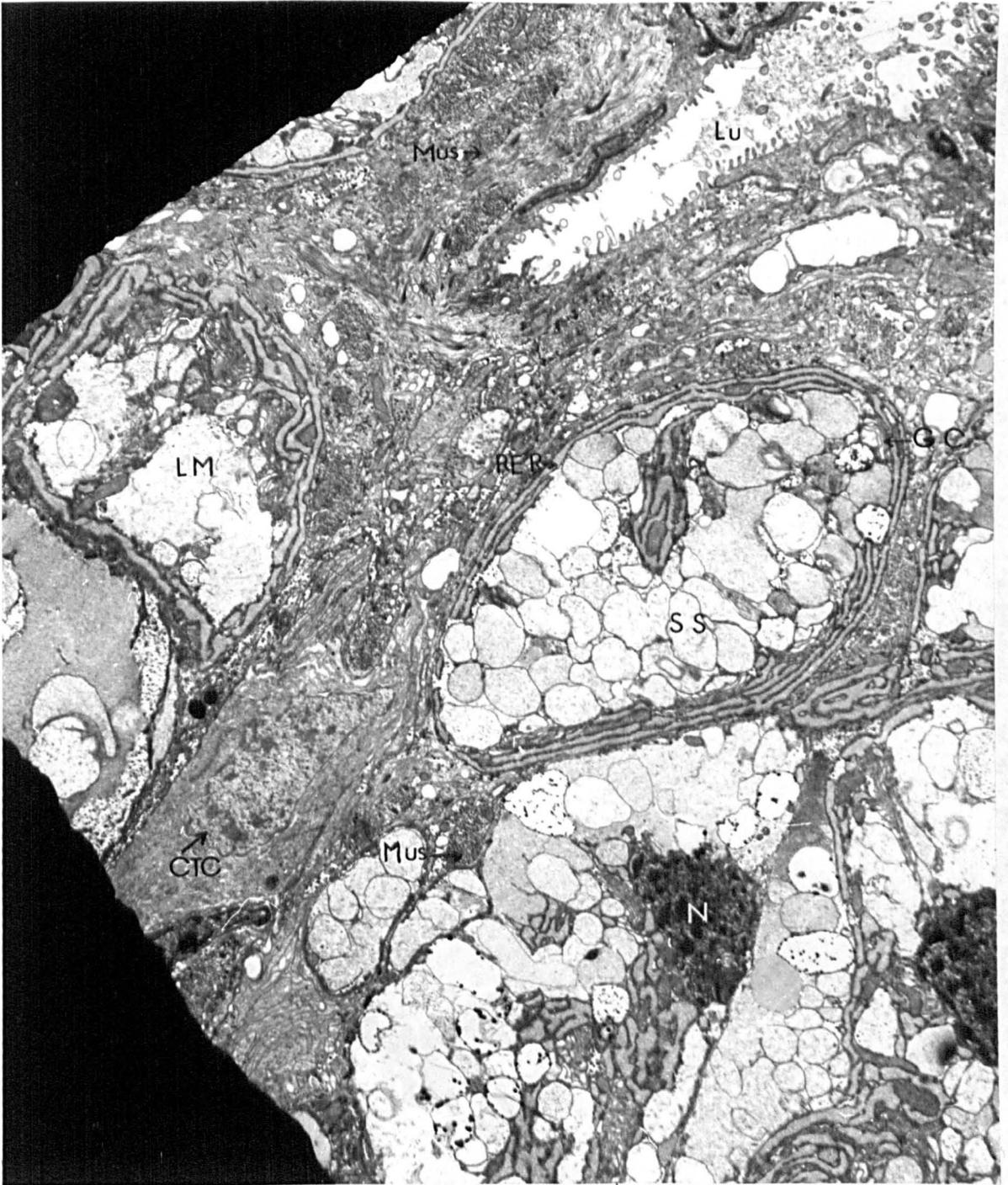


Plate 35: ALMOST MATURE PEDAL MUCOCYTE.

1µm



Plate 36: HIGH MAGNIFICATION OF ALMOST MATURE

PEDAL MUCOCYTE.

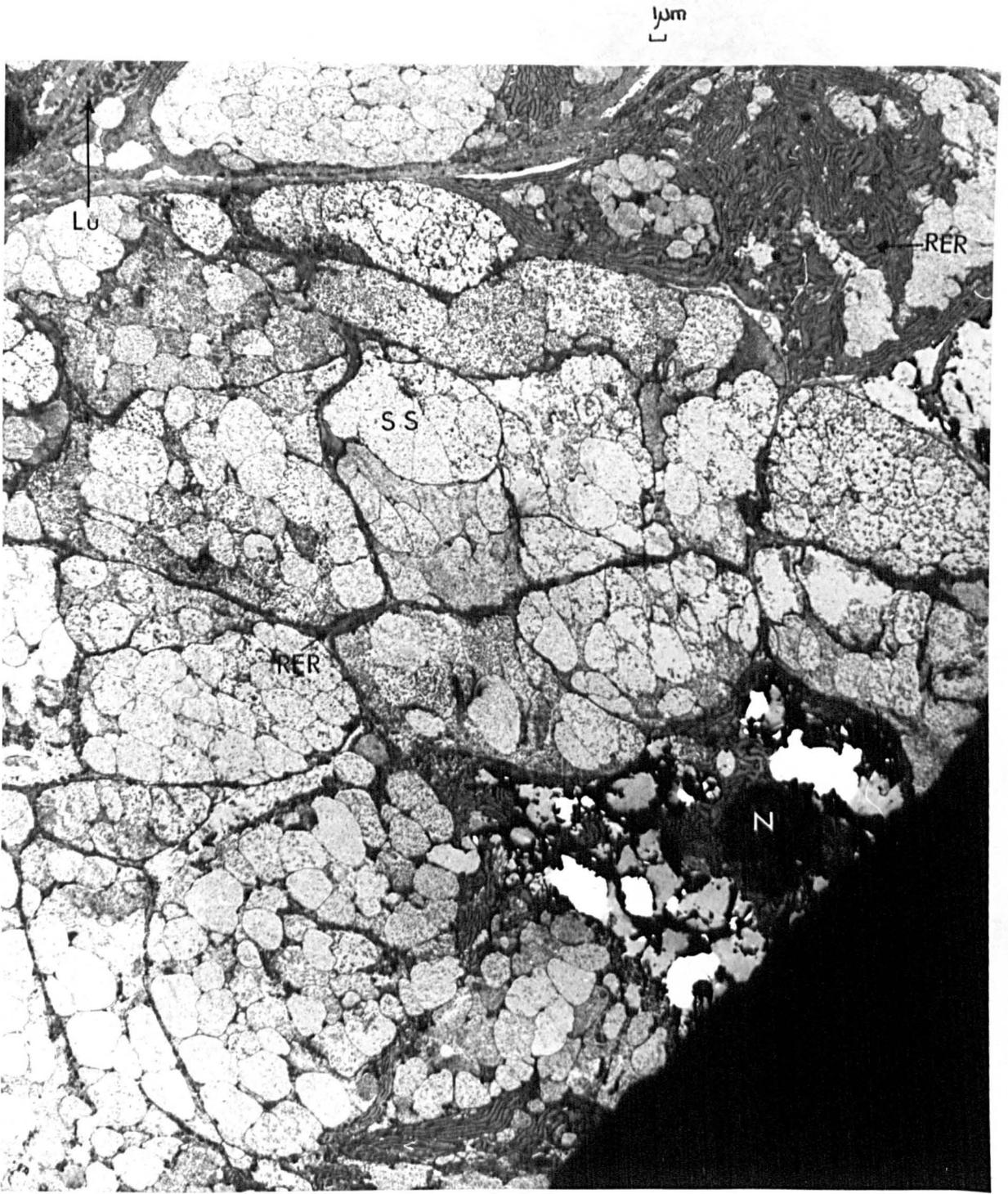


Plate 37: MATURE PEDAL MUCOCYTE.

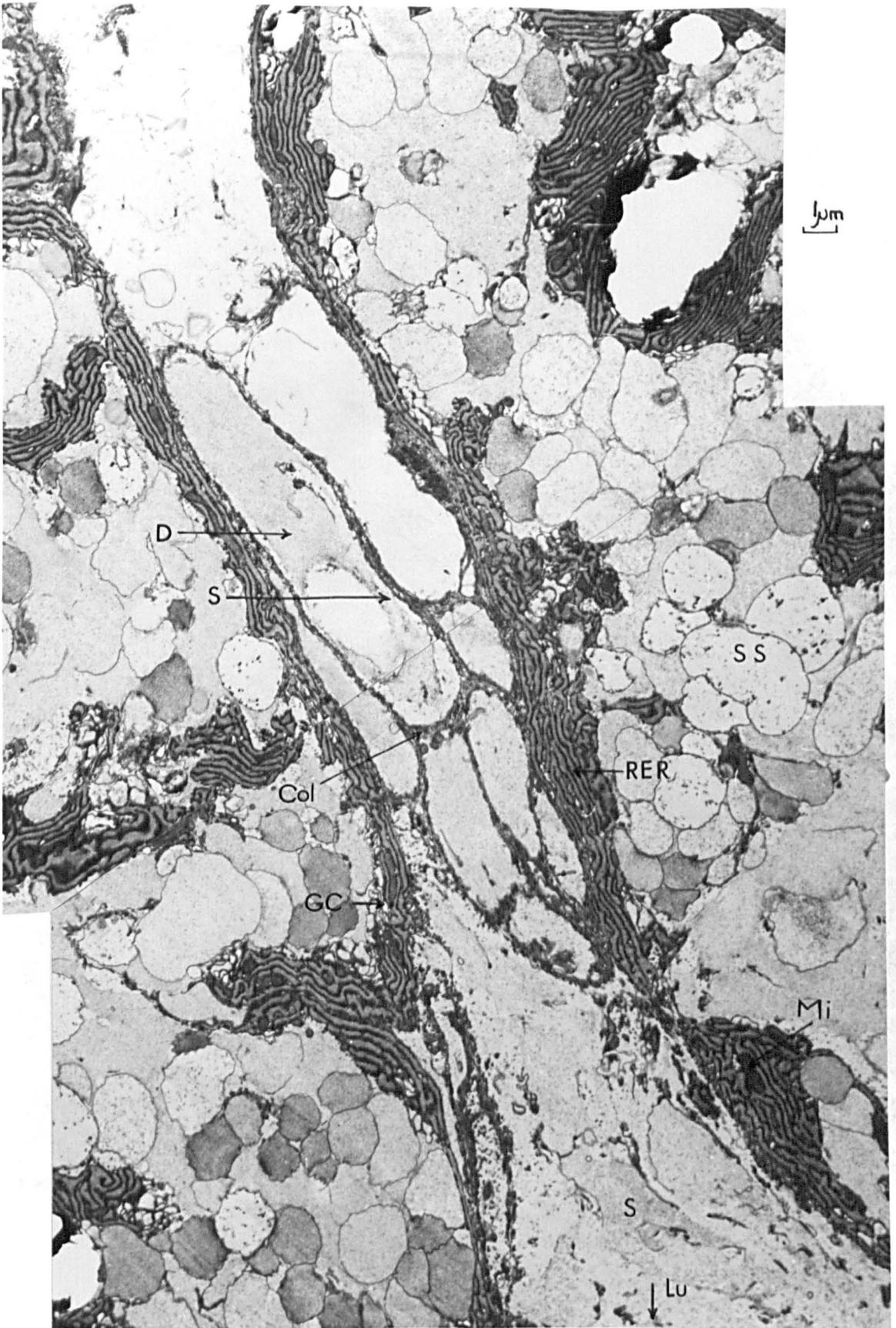


Plate 38: DUCTS FROM PEDAL MUCOCYTES.

1000



Plate 39: EPIDERMIS OF NORMAL MANTLE.

1 μ m



Plate 40: CELL JUNCTION IN MANTLE EPIDERMIS.

1 μ m



Plate 41: HIGH MAGNIFICATION OF CELL JUNCTION

IN MANTLE EPIDERMIS.



Plate 42: MUCOUS GLAND CELLS OF MANTLE.

1 μ m

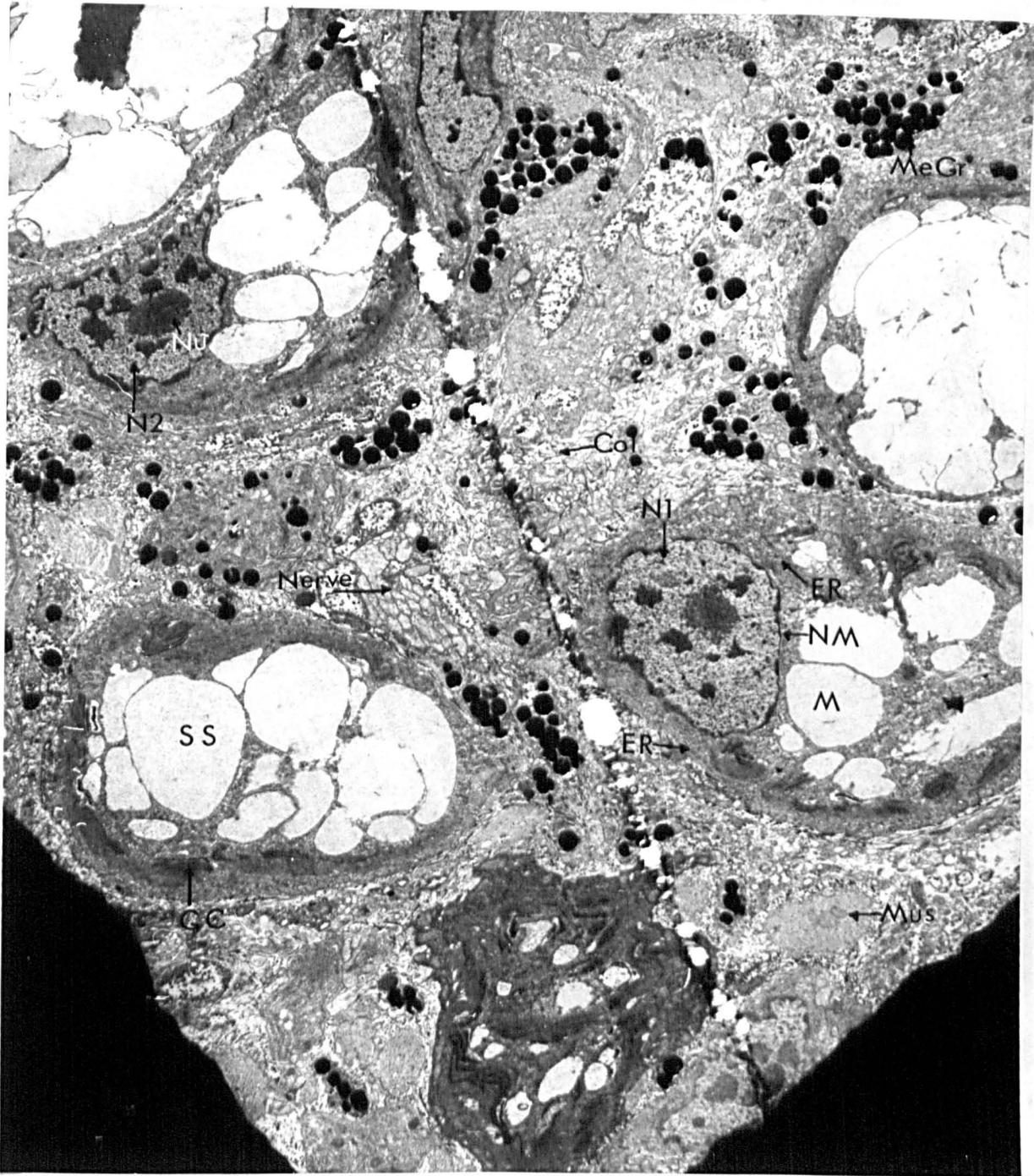


Plate 43: MUCOUS GLAND CELLS OF MANTLE, SECTION

THROUGH BASES.

1 μ m

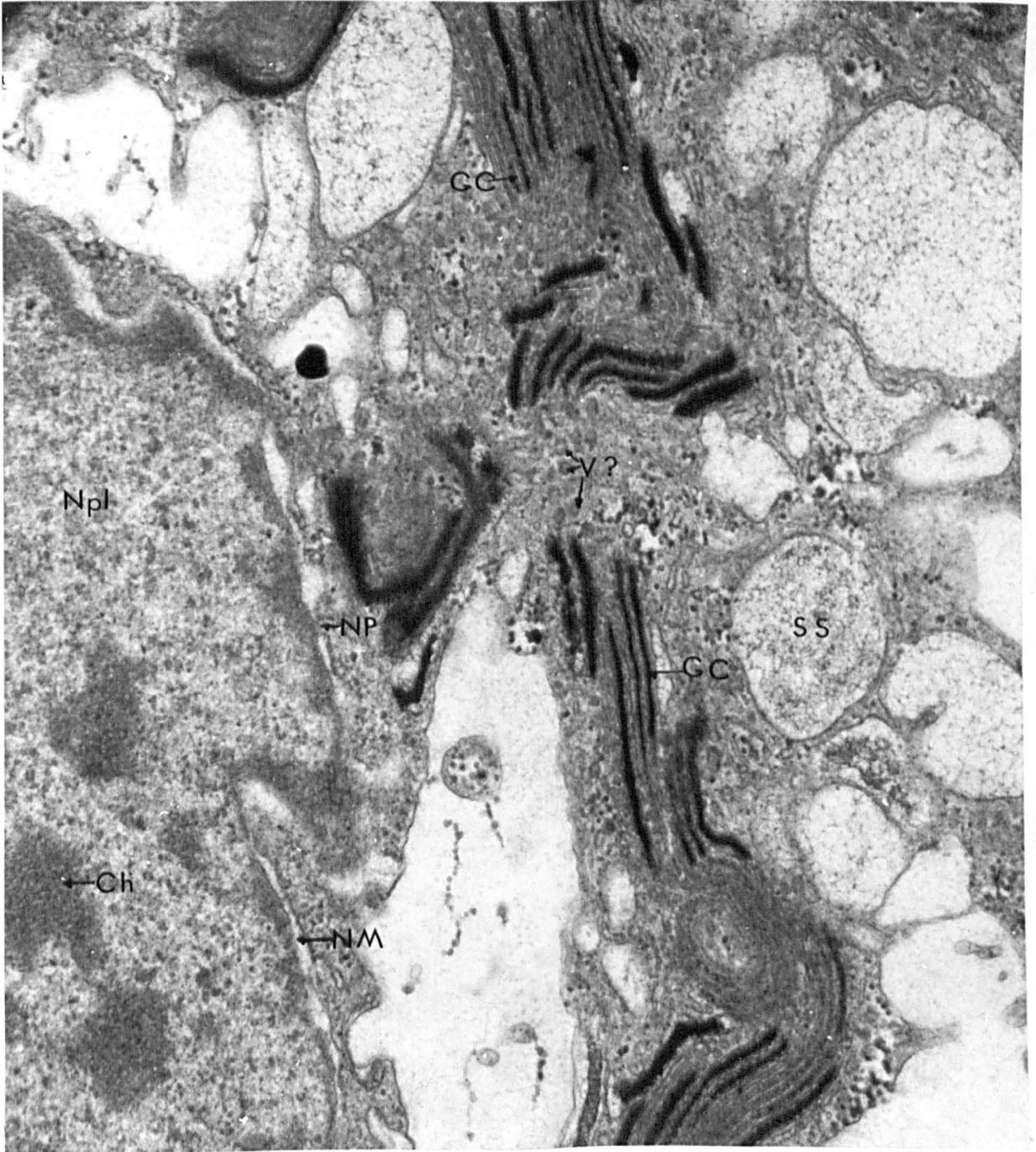


Plate 44: GOLGI COMPLEXES AND NUCLEUS OF MANTLE

MUCOUS GLAND CELLS.

1 μ m

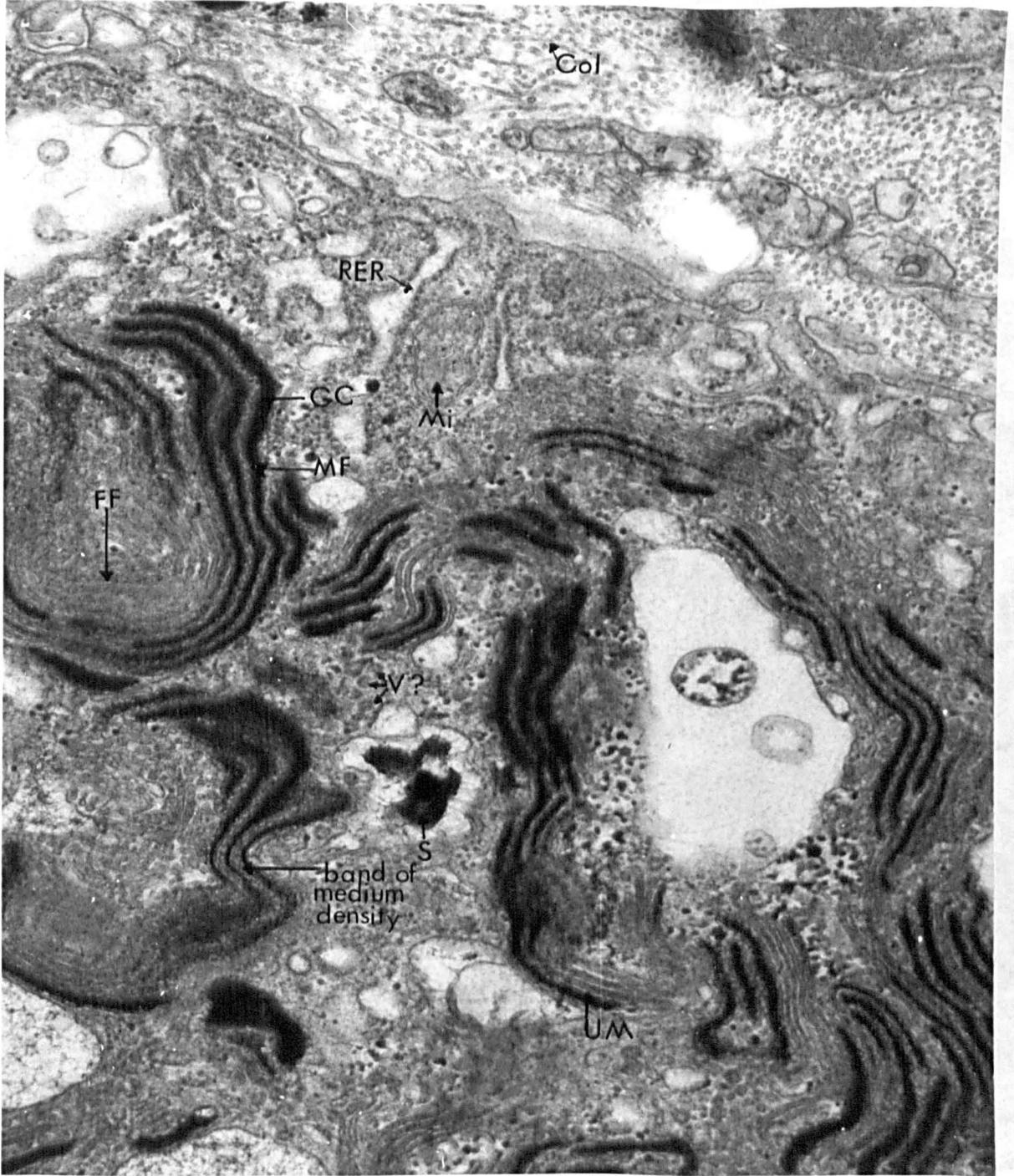


Plate 45: GOLGI COMPLEXES AND VESICLES OF MANTLE MUCOUS
GLAND CELL.

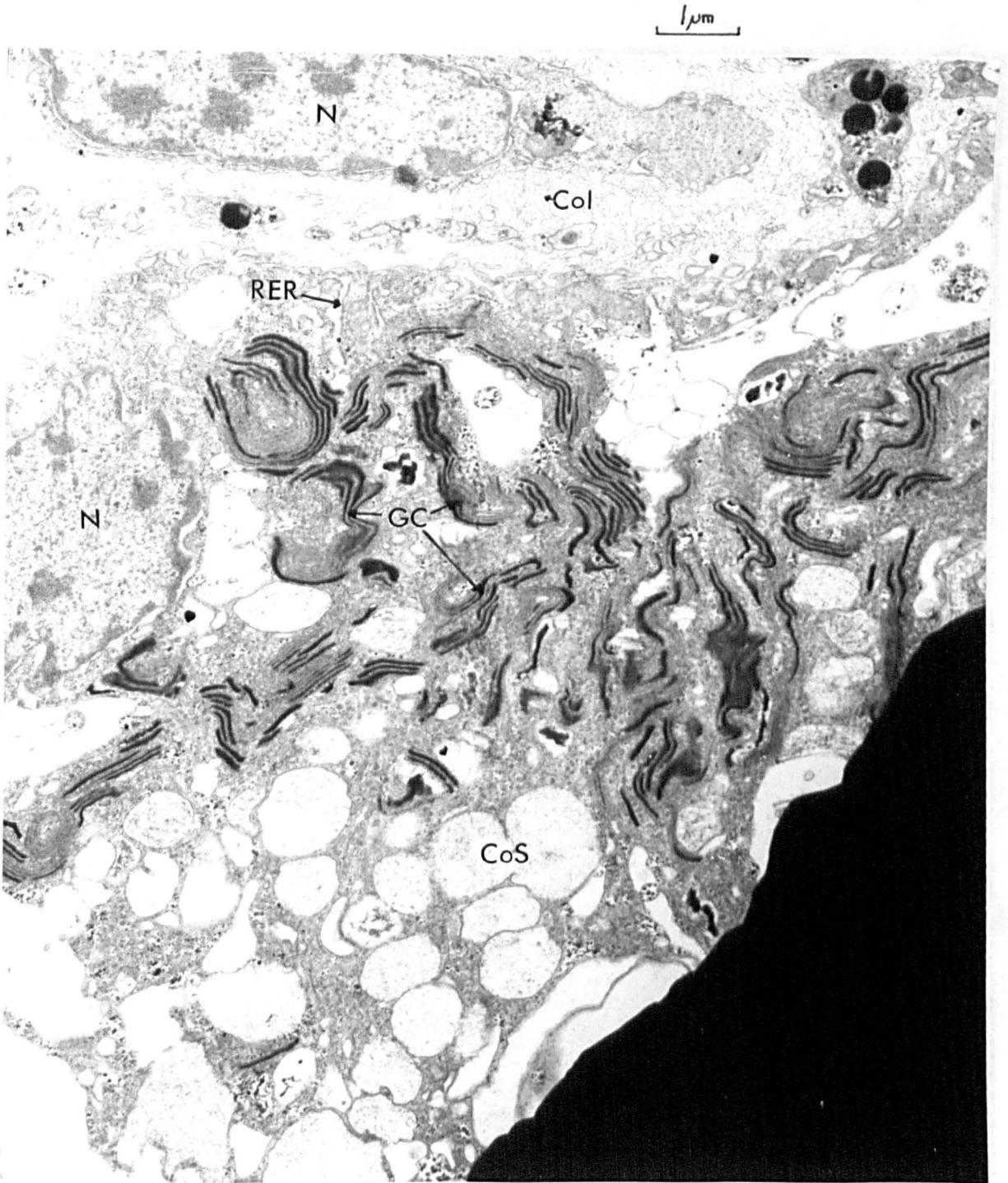


Plate 46: LOW MAGNIFICATION OF AREA IN PLATES

44 AND 45SECTION THROUGH

BASE OF MANTLE MUCOUS GLAND CELL OR

THROUGH YOUNG MUCOUS GLAND CELL.

1 μ m

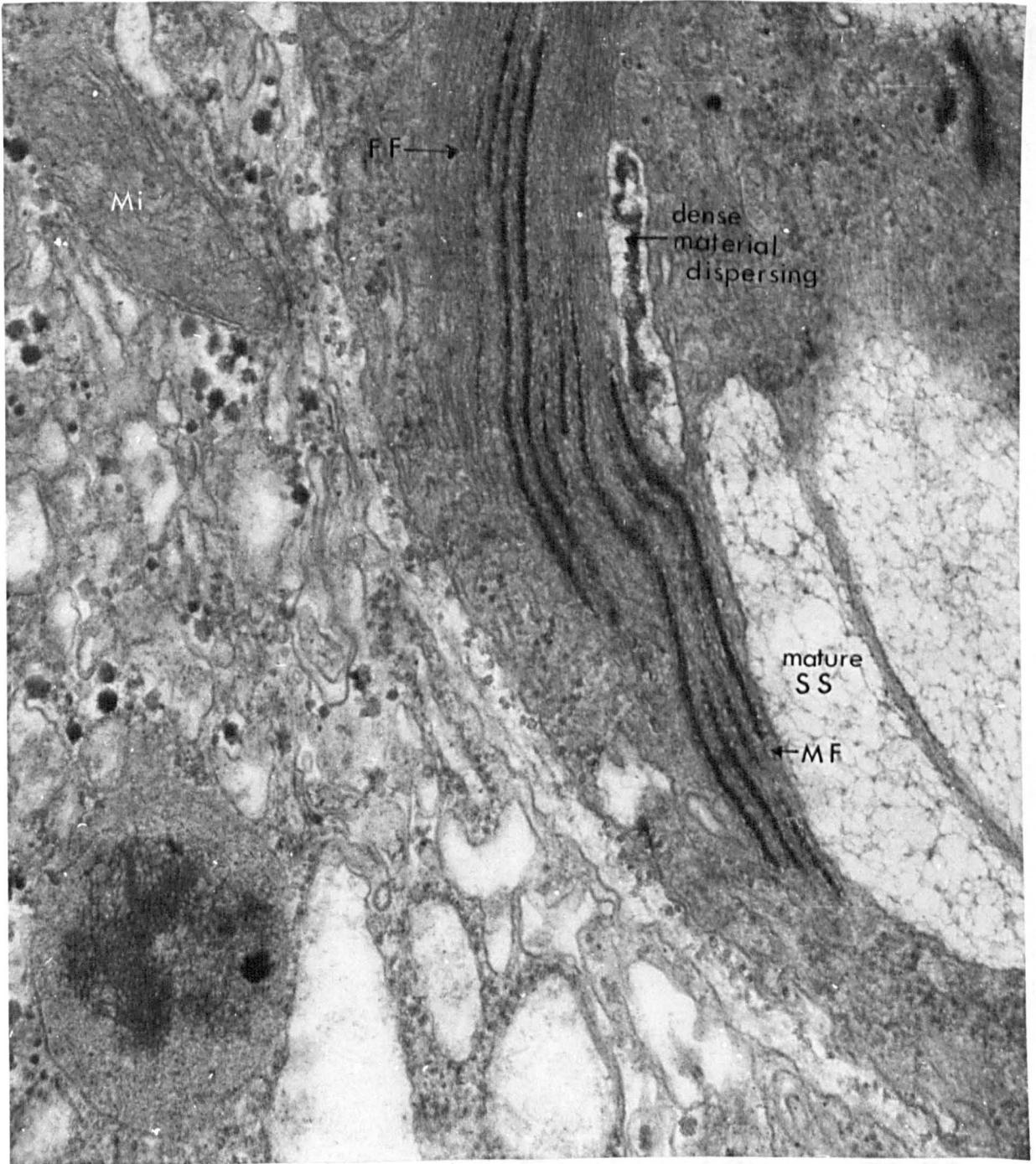


Plate 47: GOLGI COMPLEX AND SECRETION OF MANTLE

MUCOUS GLAND CELL.

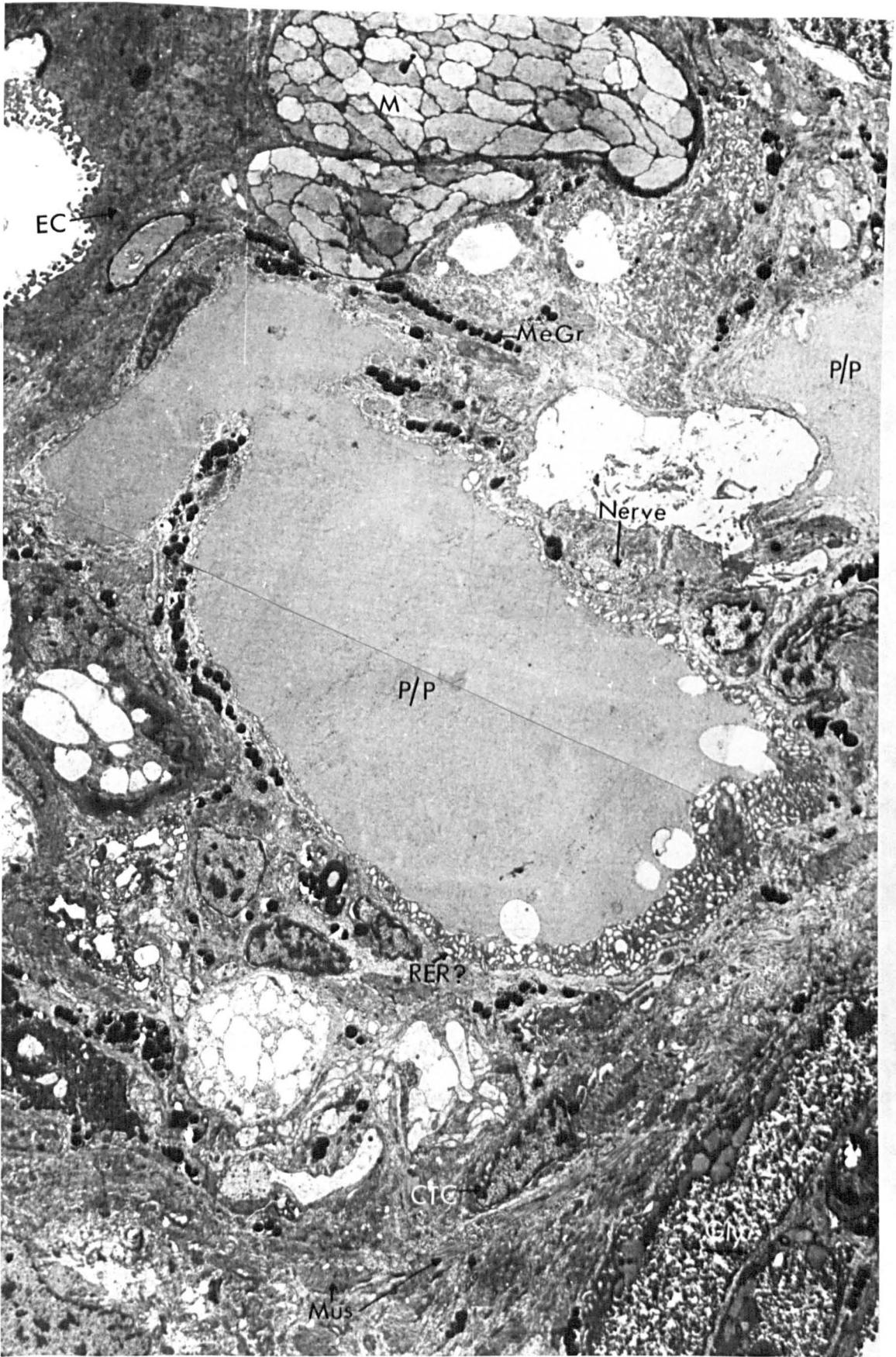


Plate 48: PROTEIN GLAND CELL OF NORMAL MANTLE.

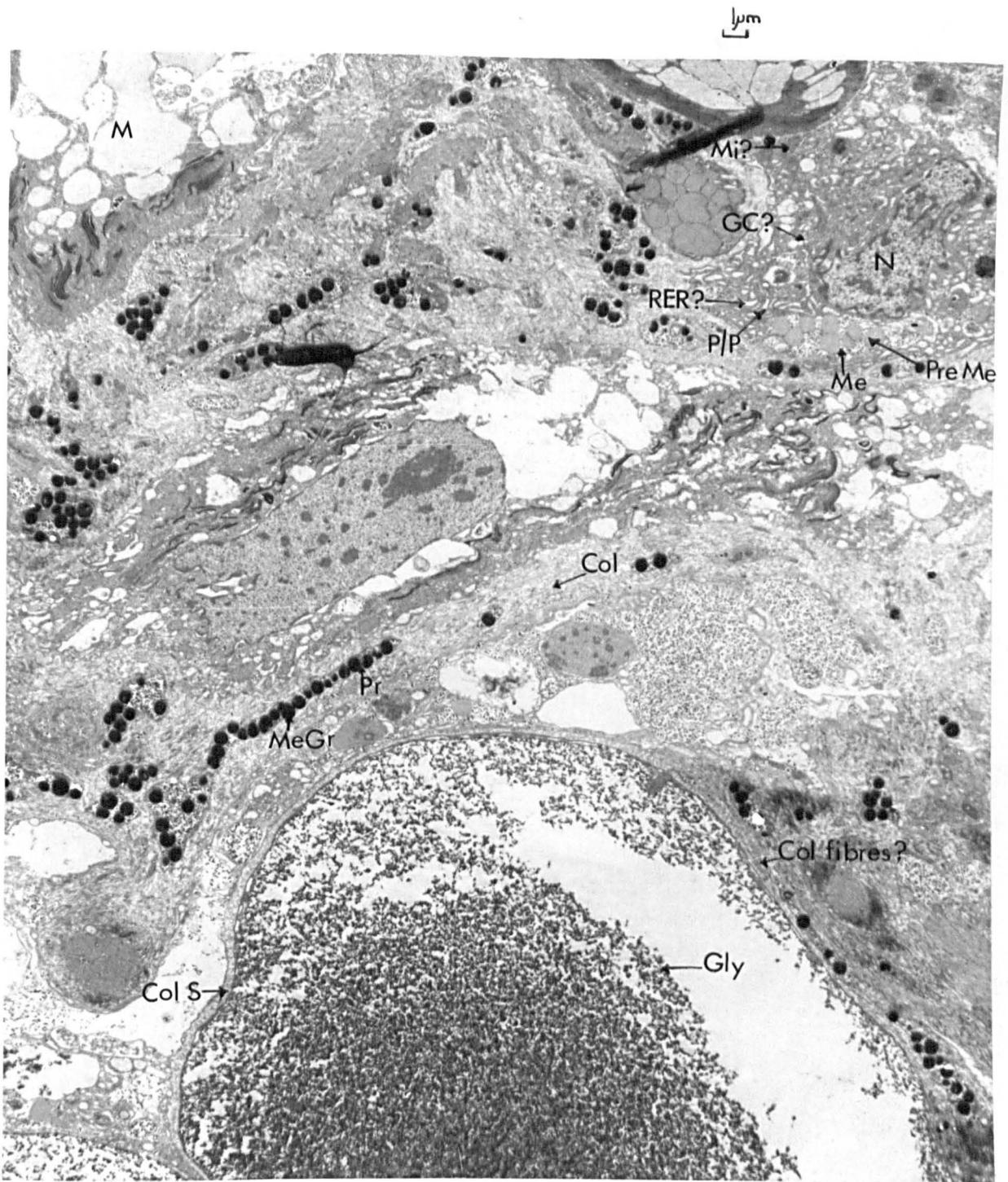


Plate 49: SECTION THROUGH BASE OF PROTEIN CELL

+ GLYCOGEN DEPOSIT.



Plate 50: DAY15 REGENERATE MANTLE TISSUE,
SHOWING EPIDERMIS.

1 μ m

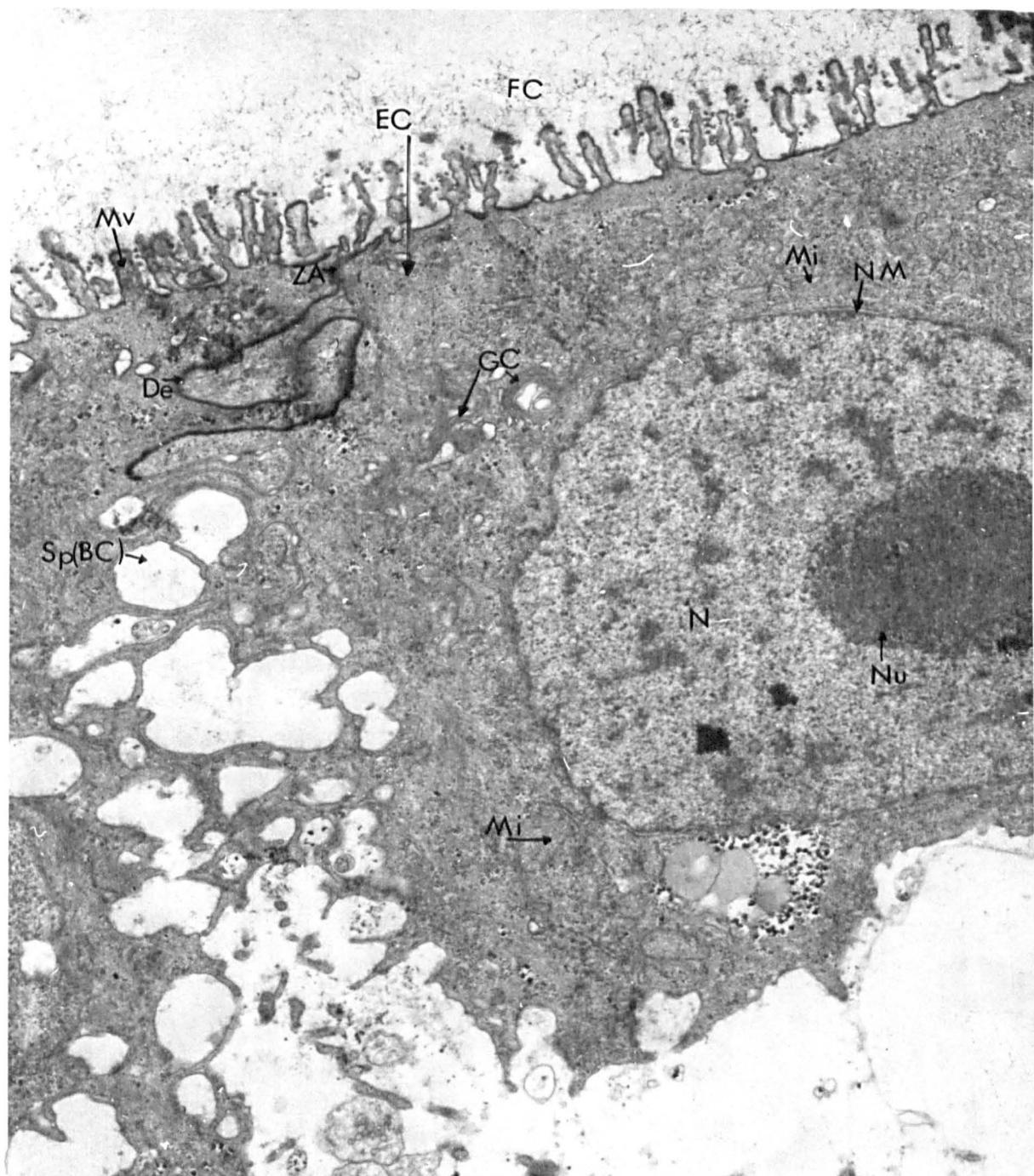


Plate 51: HIGH MAGNIFICATION OF EPIDERMIS OF
DAY 15 REGENERATE MANTLE TISSUE.

1µm



Plate 52: SUB-EPIDERMAL BLASTEMA OF DAY 15

REGENERATE MANTLE.

1 μ m

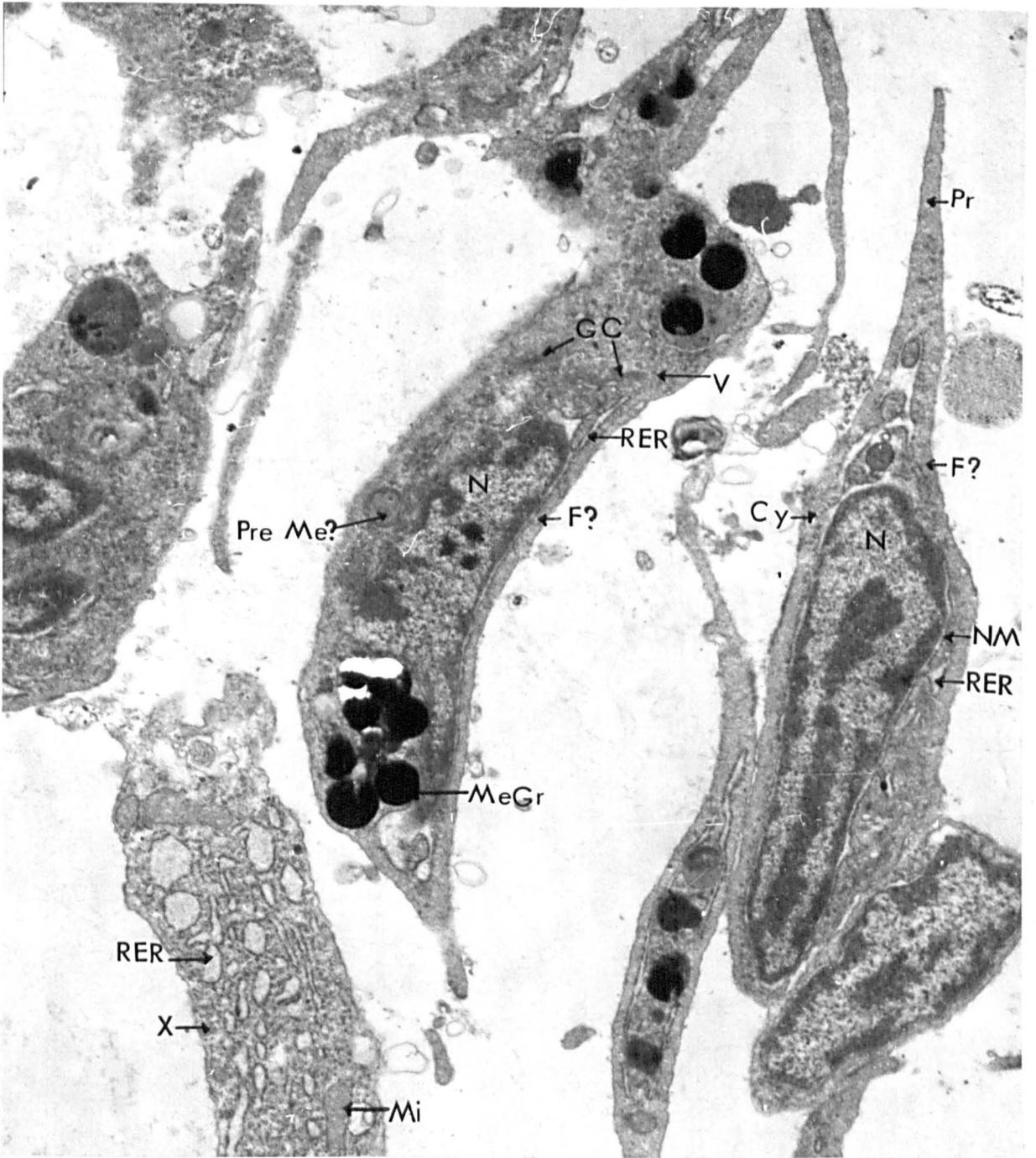


Plate 53: HIGH MAGNIFICATION OF CELLS OF DAY 15

BLASTEMA.

1 μ m

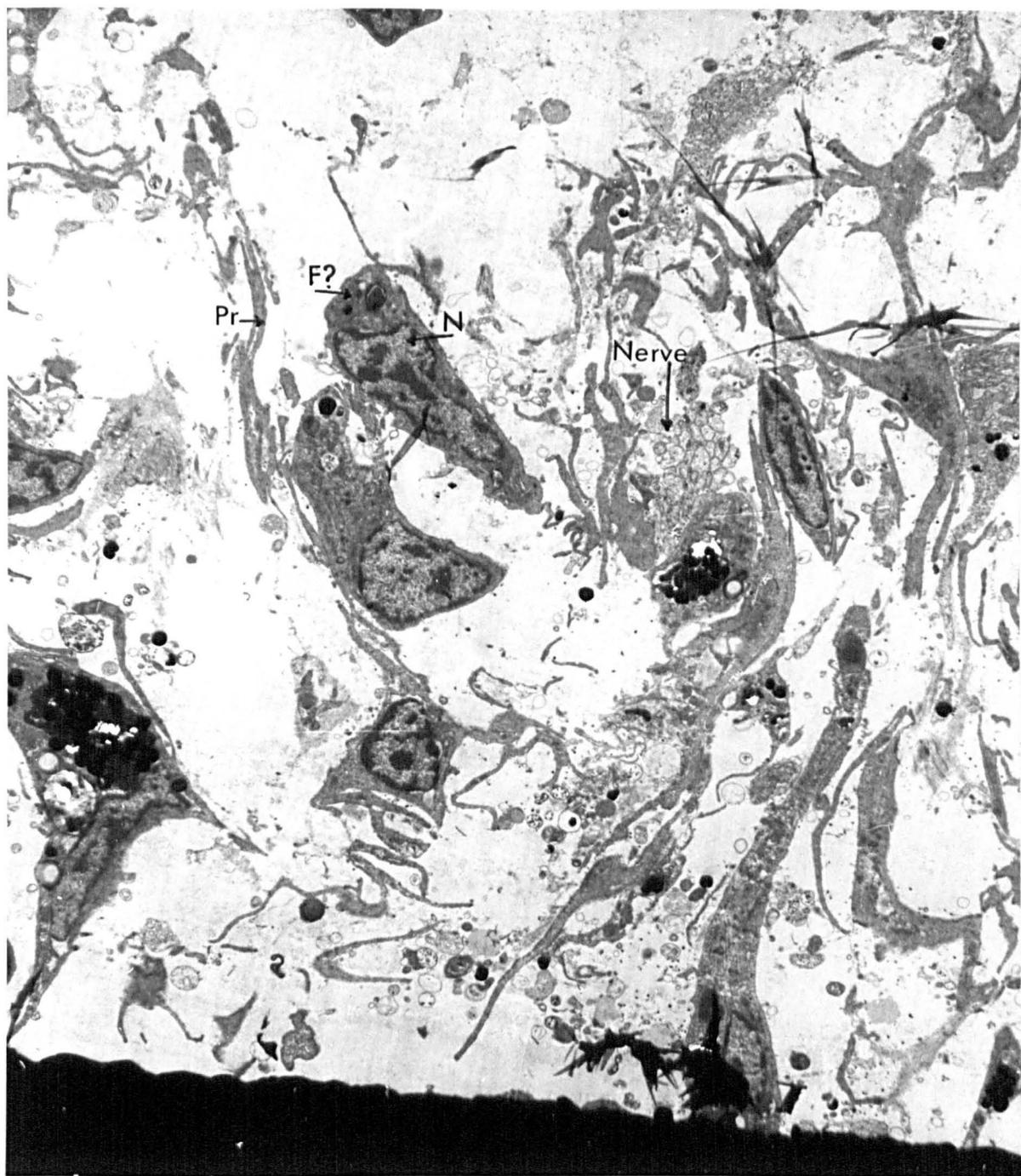


Plate 54: CELLS OF BLASTEMA OF DAY 15 REGENERATE
MANTLE, FURTHER BELOW EPIDERMIS.

1µm

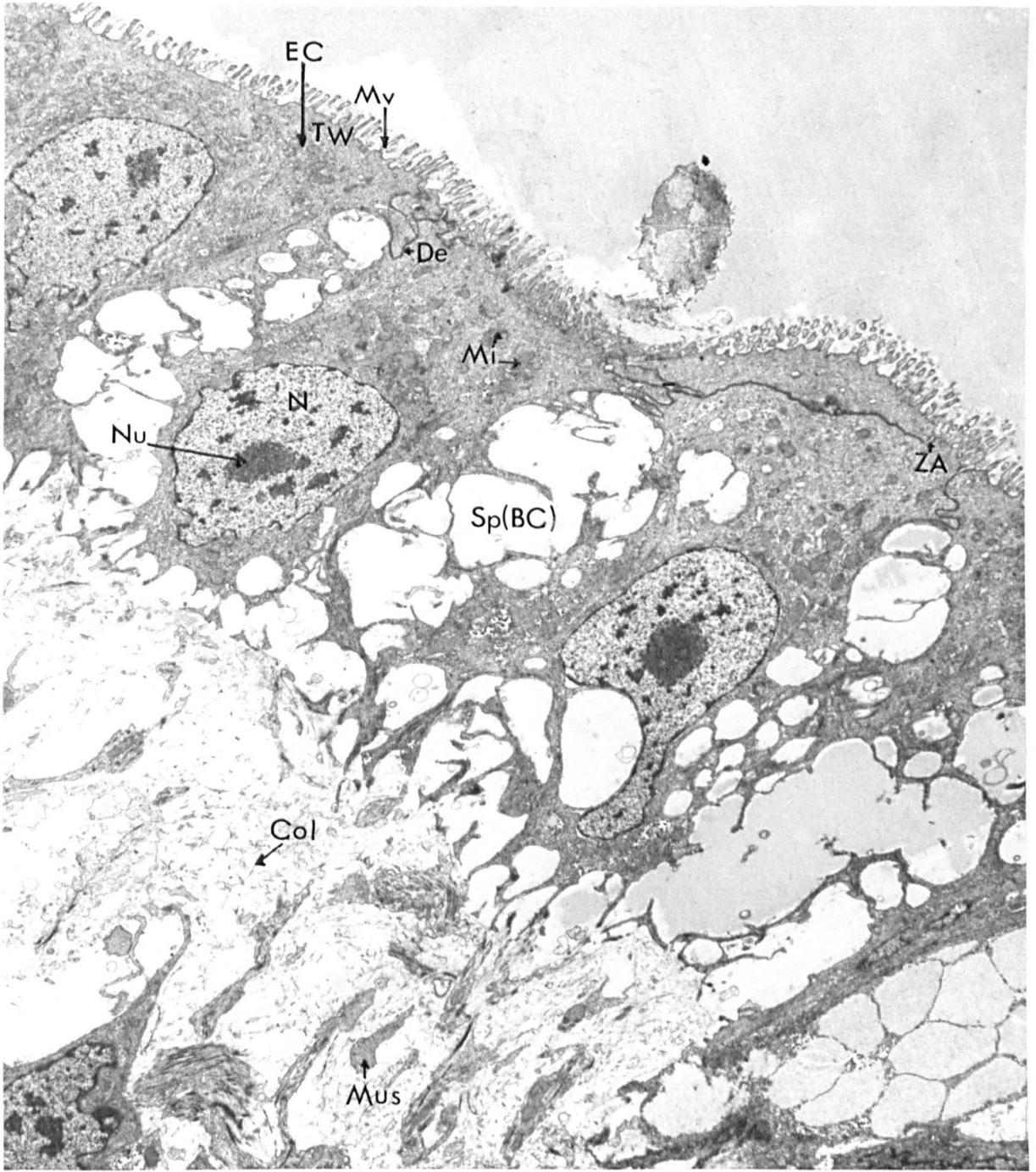


Plate 55: EPIDERMIS OF DAY 19 REGENERATE MANTLE.

1 μ m

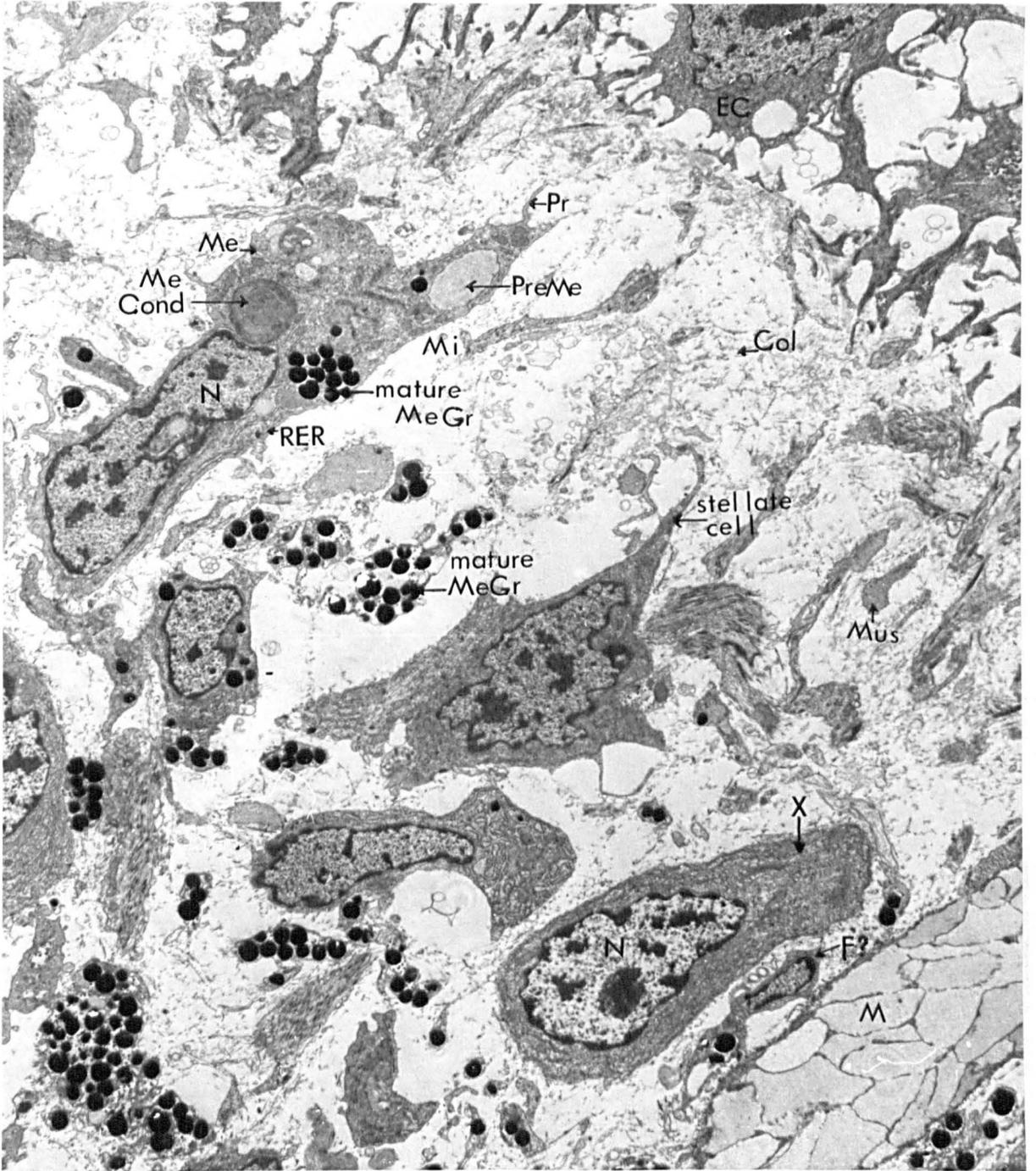


Plate 56: CELLS OF DAY 19 MANTLE BLASTEMA.

1 μ m

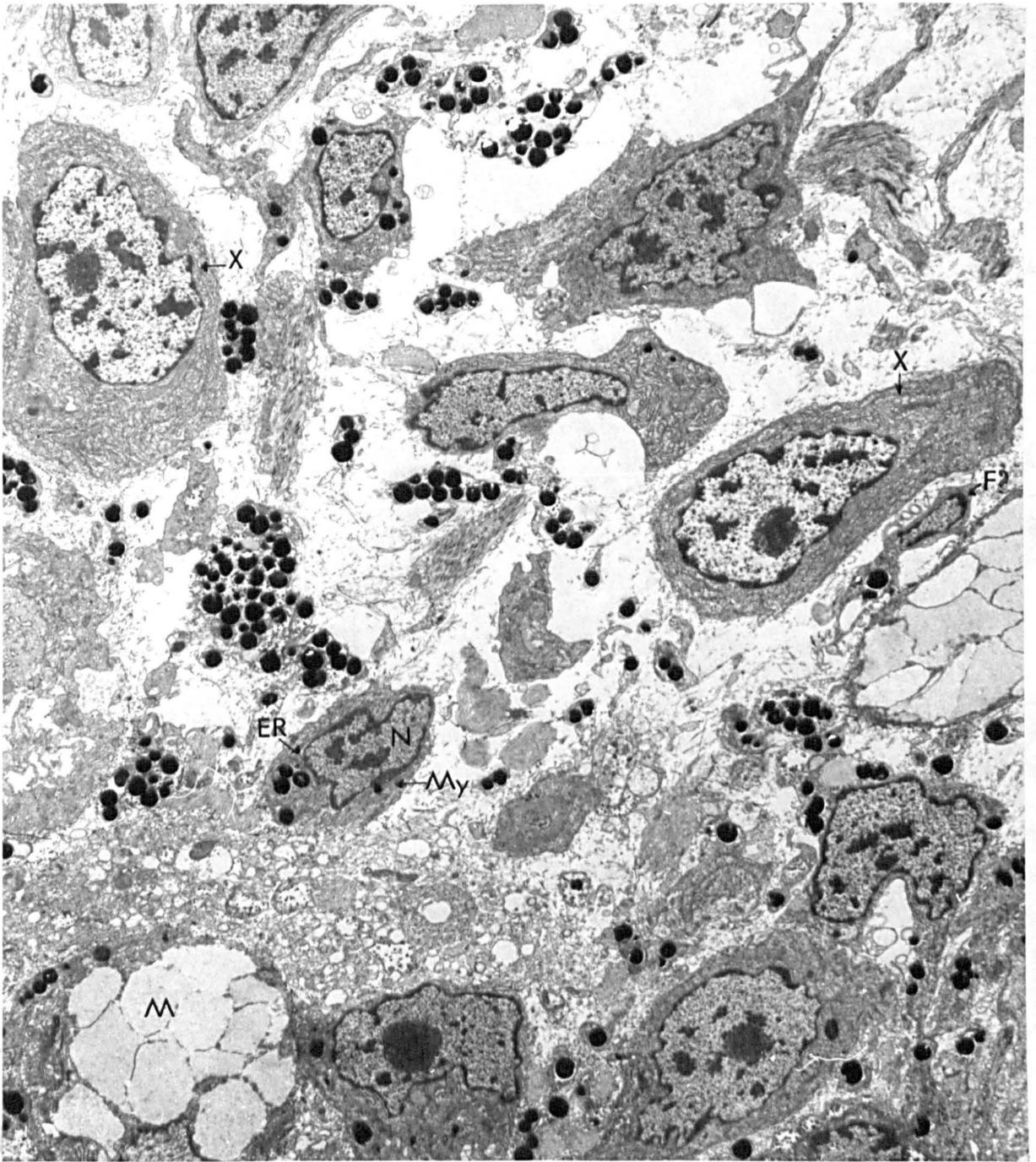


Plate 57: CELLS OF DAY 19 MANTLE BLASTEMA.

1µm

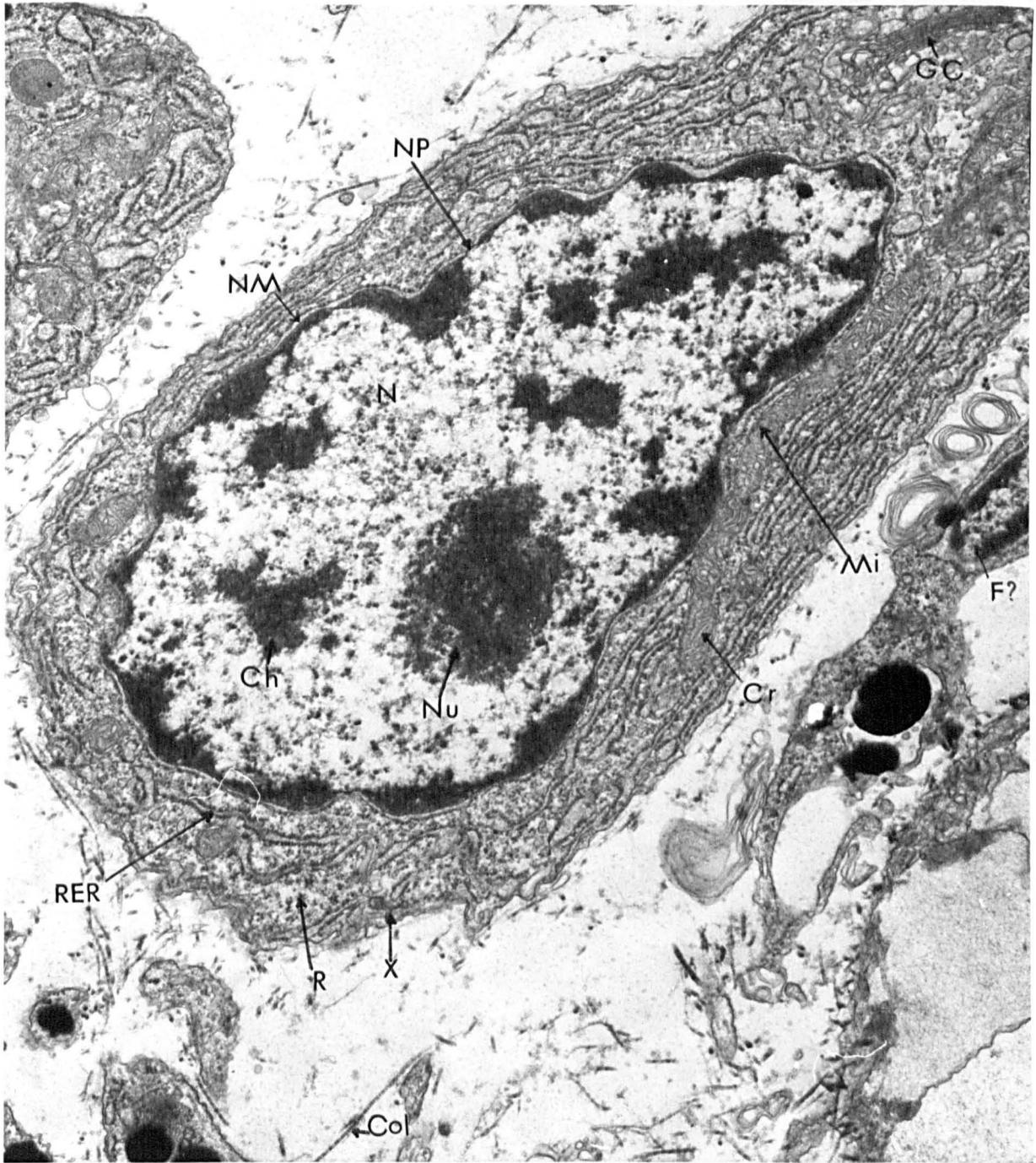


Plate 58: UNKNOWN CELL OF DAY 19 MANTLE BLASTEMA.