Some Effects of Thyroid Hormones on Renal and Hepatic Ultrastructure in the Mouse

VOLUME TWO

by

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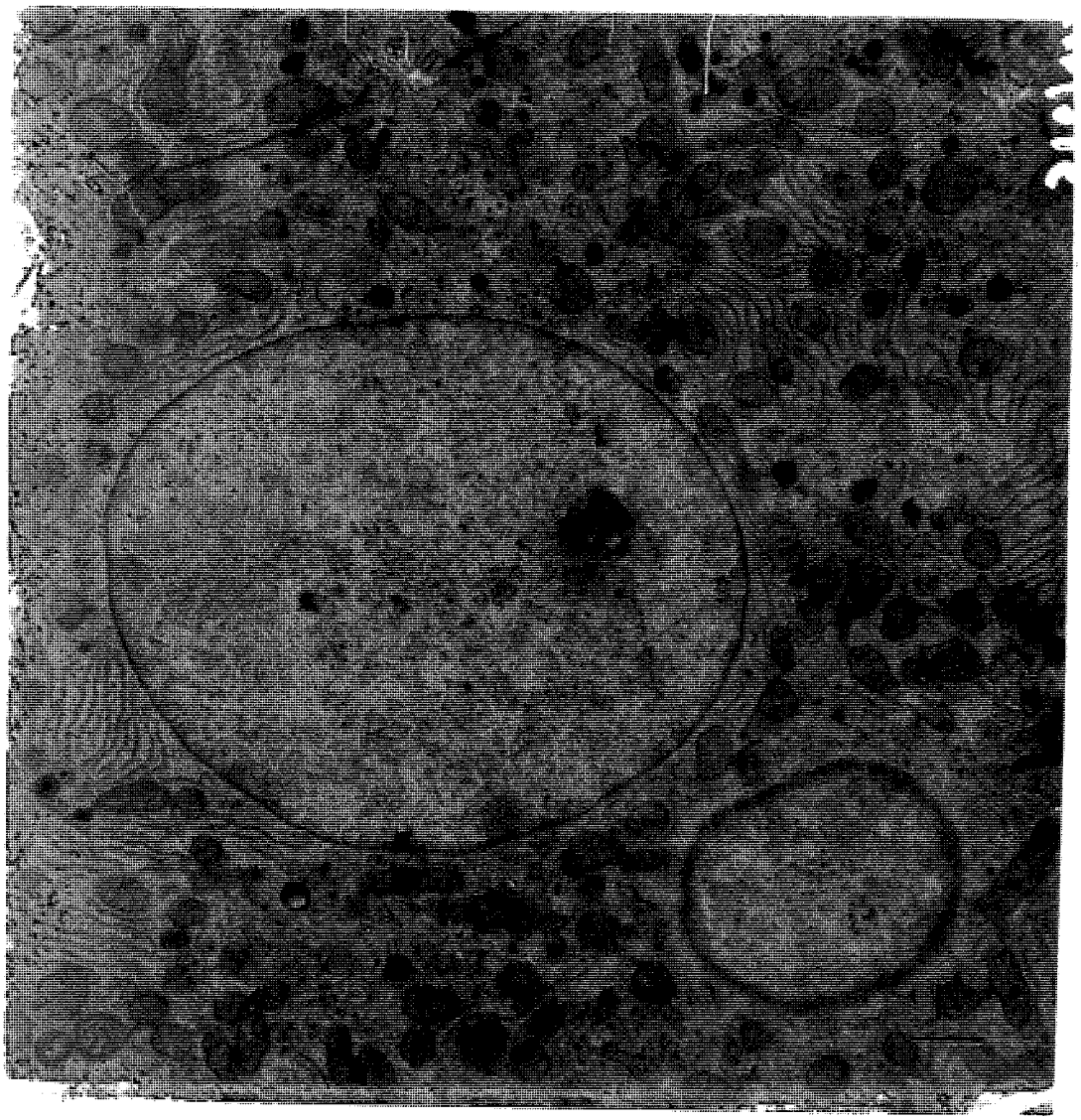
Key.

N	–	Nucleus
M	–	Mitochodrion
ER	–	Endoplasmic reticulum.

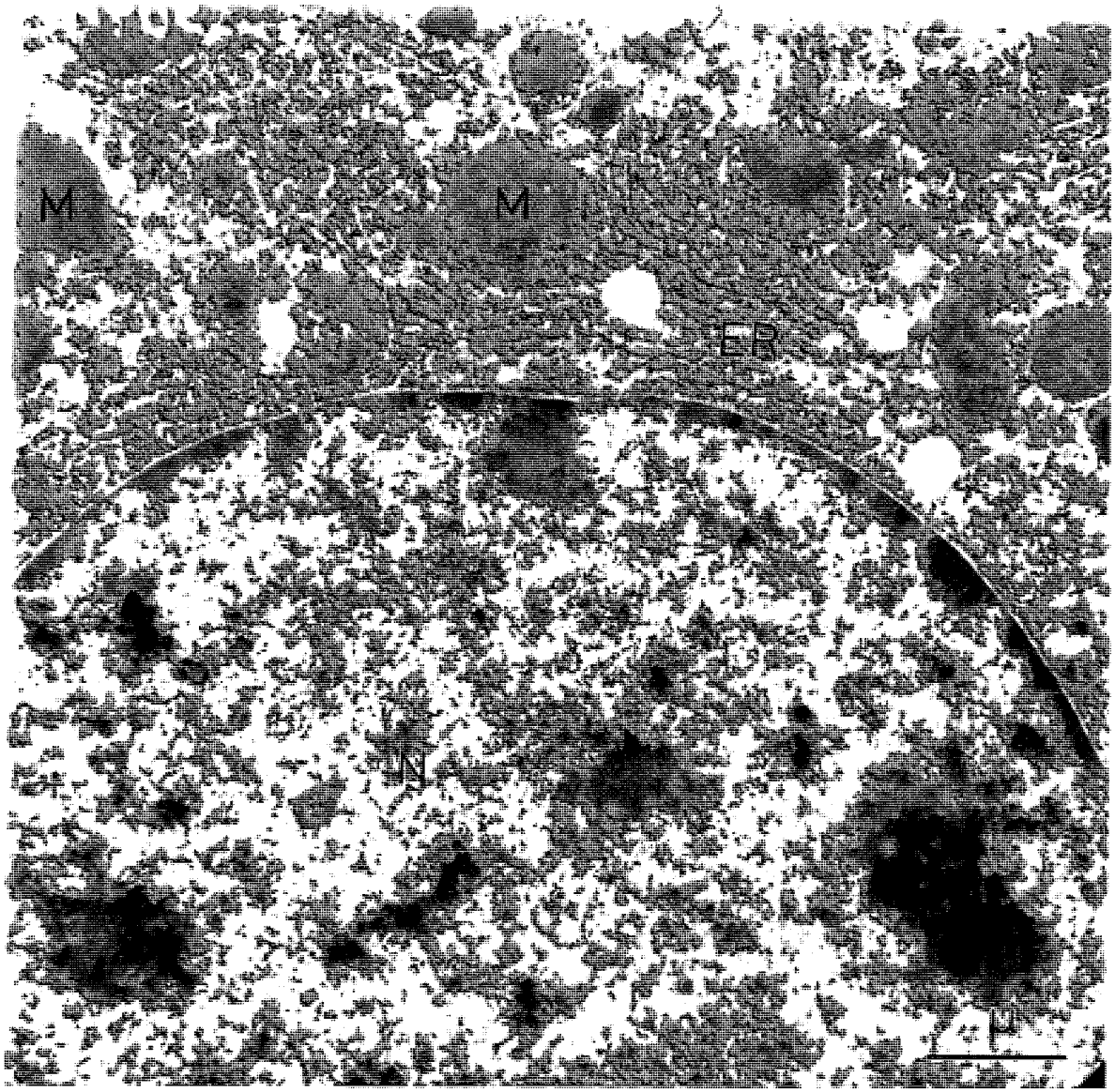
Plate 1.

316/71



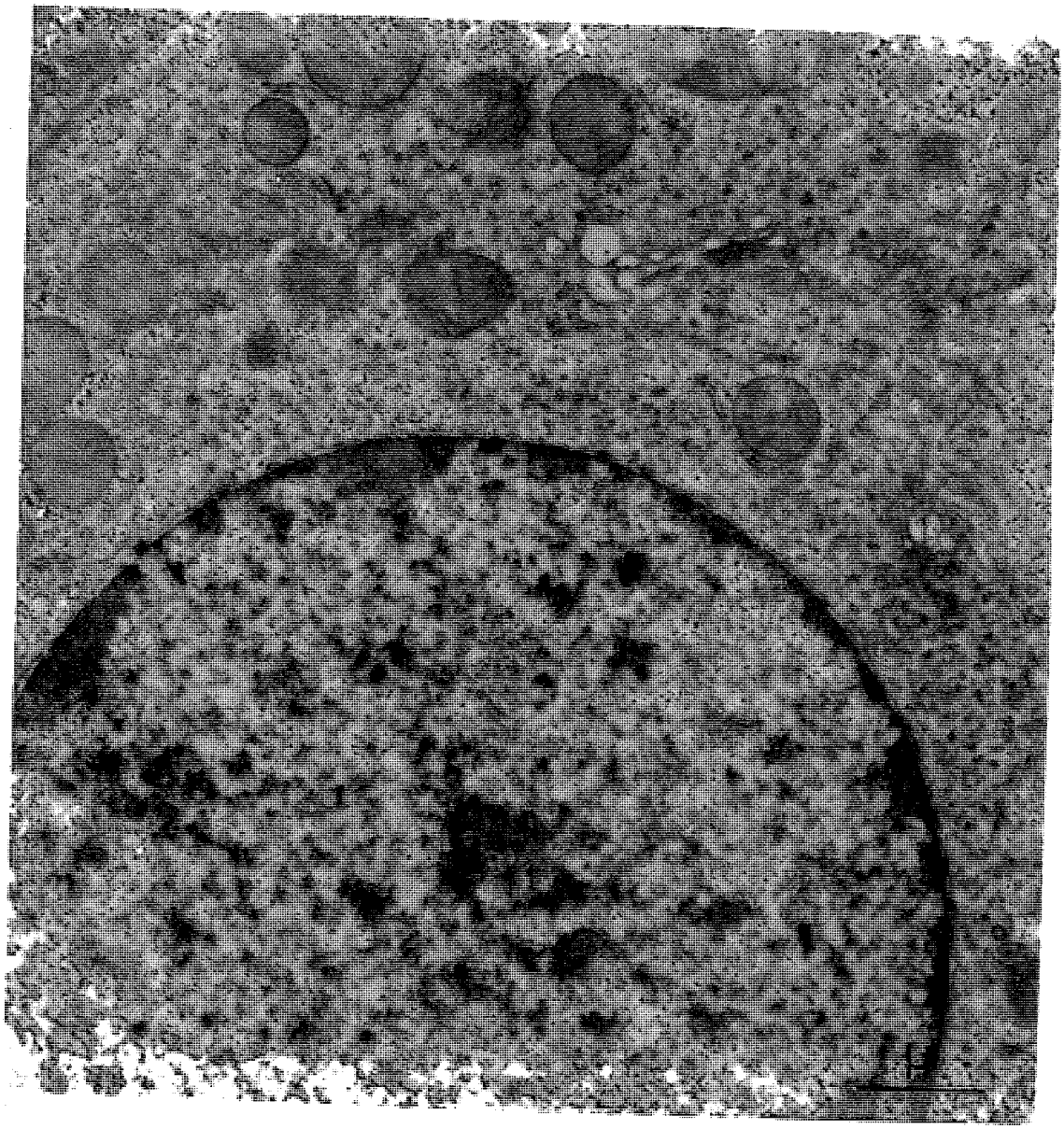
Mouse liver fixed with Caulfield's 2% osmium tetroxide and section stained with uranium. The cytoplasmic ground substance is pale with the cytoplasmic organelles standing out in darker contrast.

Plate 2. 369A/71



Mouse liver fixed in 5% glutaraldehyde and section stained with uranium. The cytoplasm is pale, organelles stand out in dark contrast, the cytoplasmic membranes such as the endoplasmic reticulum are not obvious.

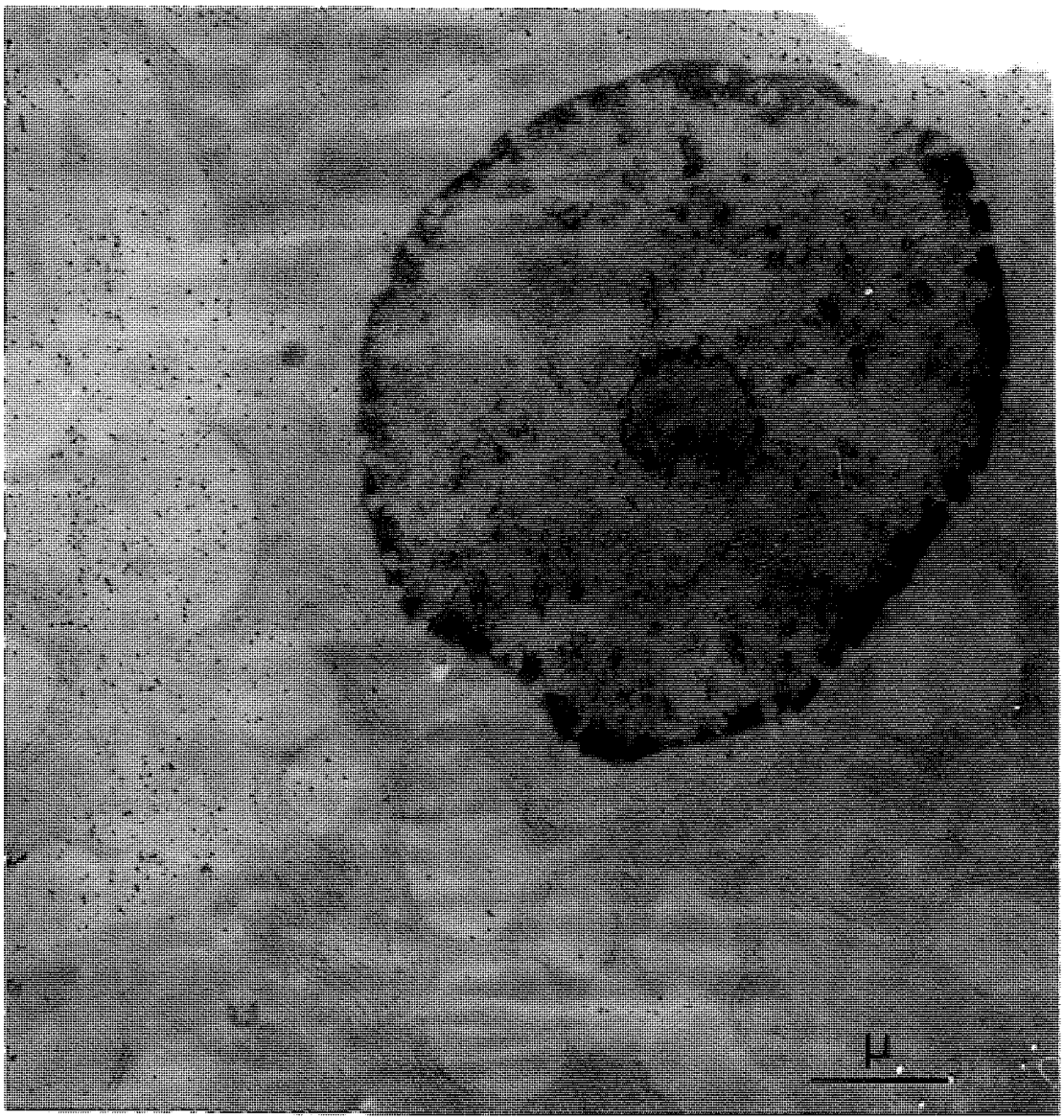
Plate 3.



Mouse kidney fixed in 5% glutaraldehyde and post-fixed in Caulfield's 2% osmium tetroxide, section stained with uranium. The cytoplasmic ground substance is pale, with organelles standing out in dark contrast, the cytoplasmic membranes are clearly visible.

Plate 4.

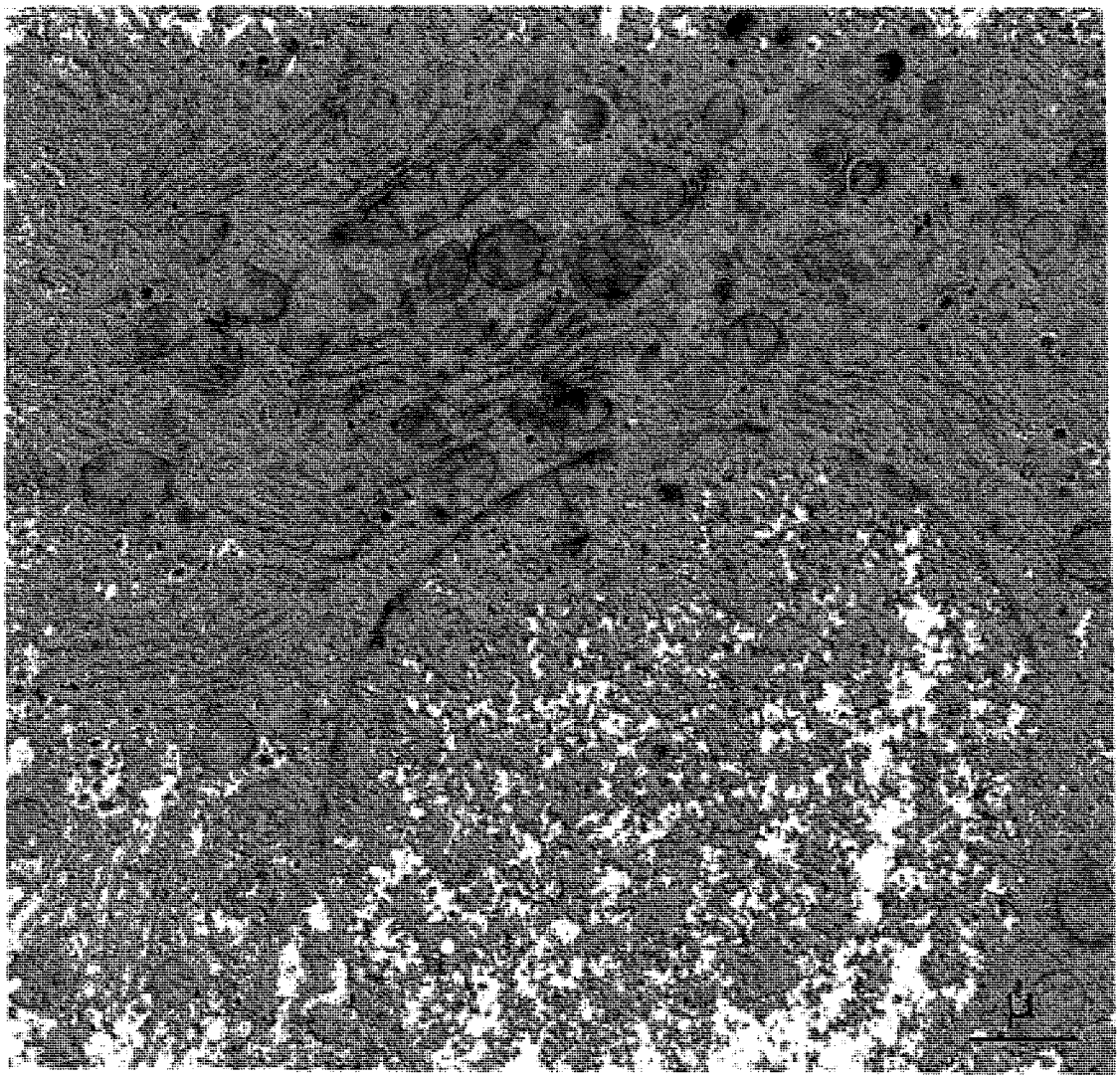
562/71



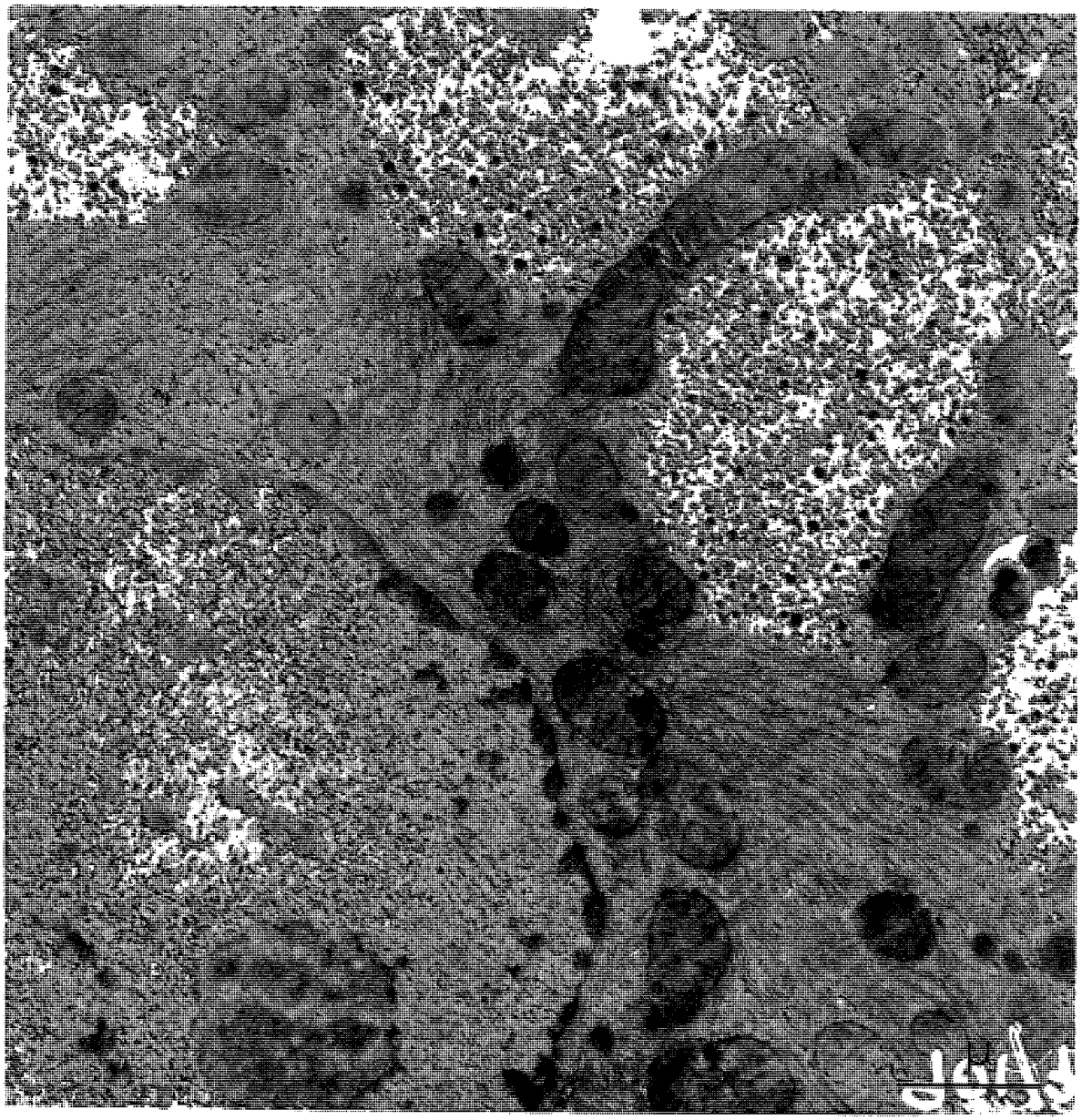
Mouse liver fixed in 5% glutaraldehyde and post-fixed in Caulfield's 2% osmium tetroxide, with the ommission of an intermediate wash in a sucrose buffer medium. The cytoplasm was relatively dense with the cytoplasmic organelles pale. The general contrast was low, with st structures difficult to distinguish, although the nucleus and other nucleoprotein structures were clearly visible. The cytoplasmic membranes were not usually evident.

Plate 5.

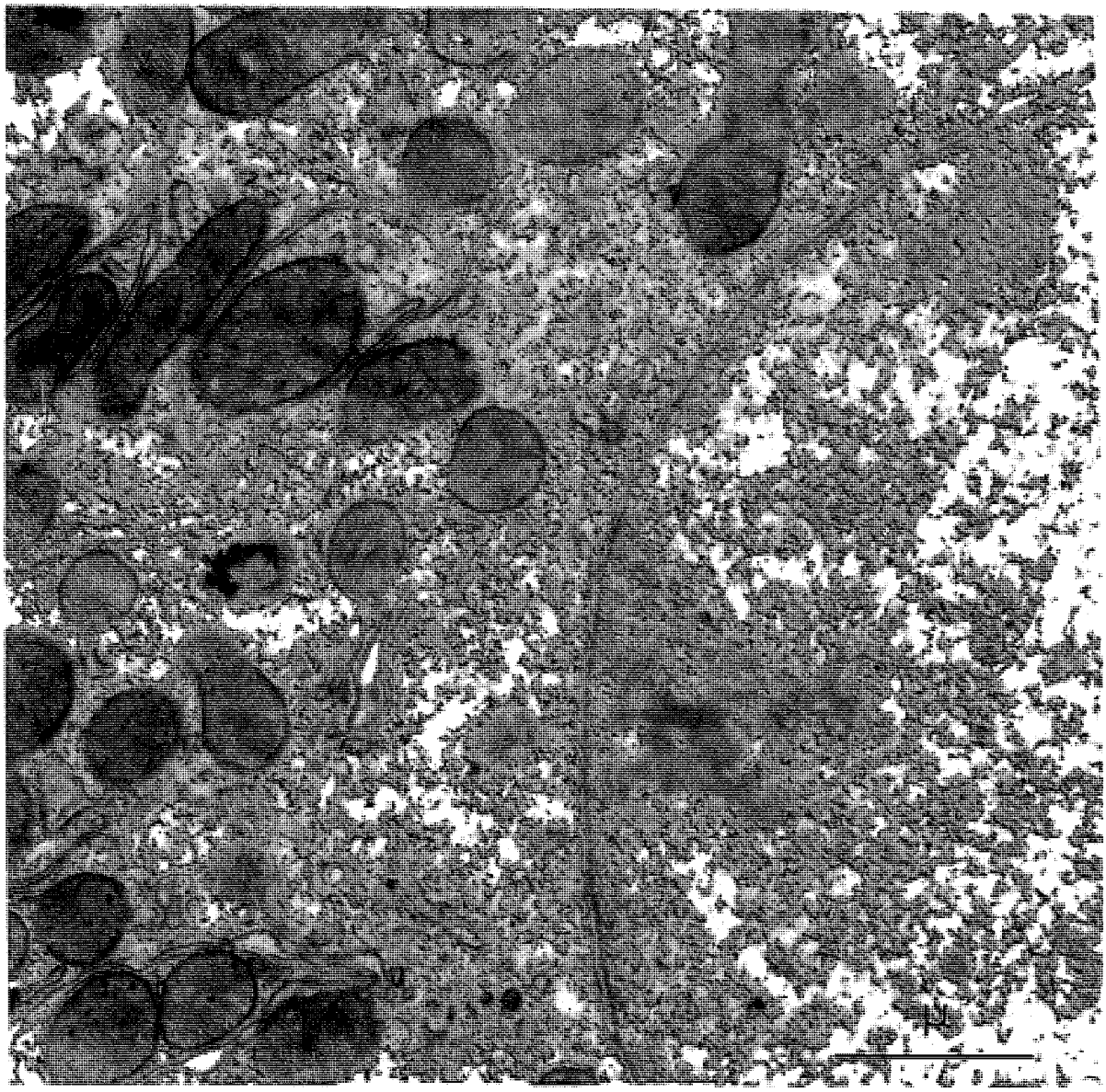
759/69



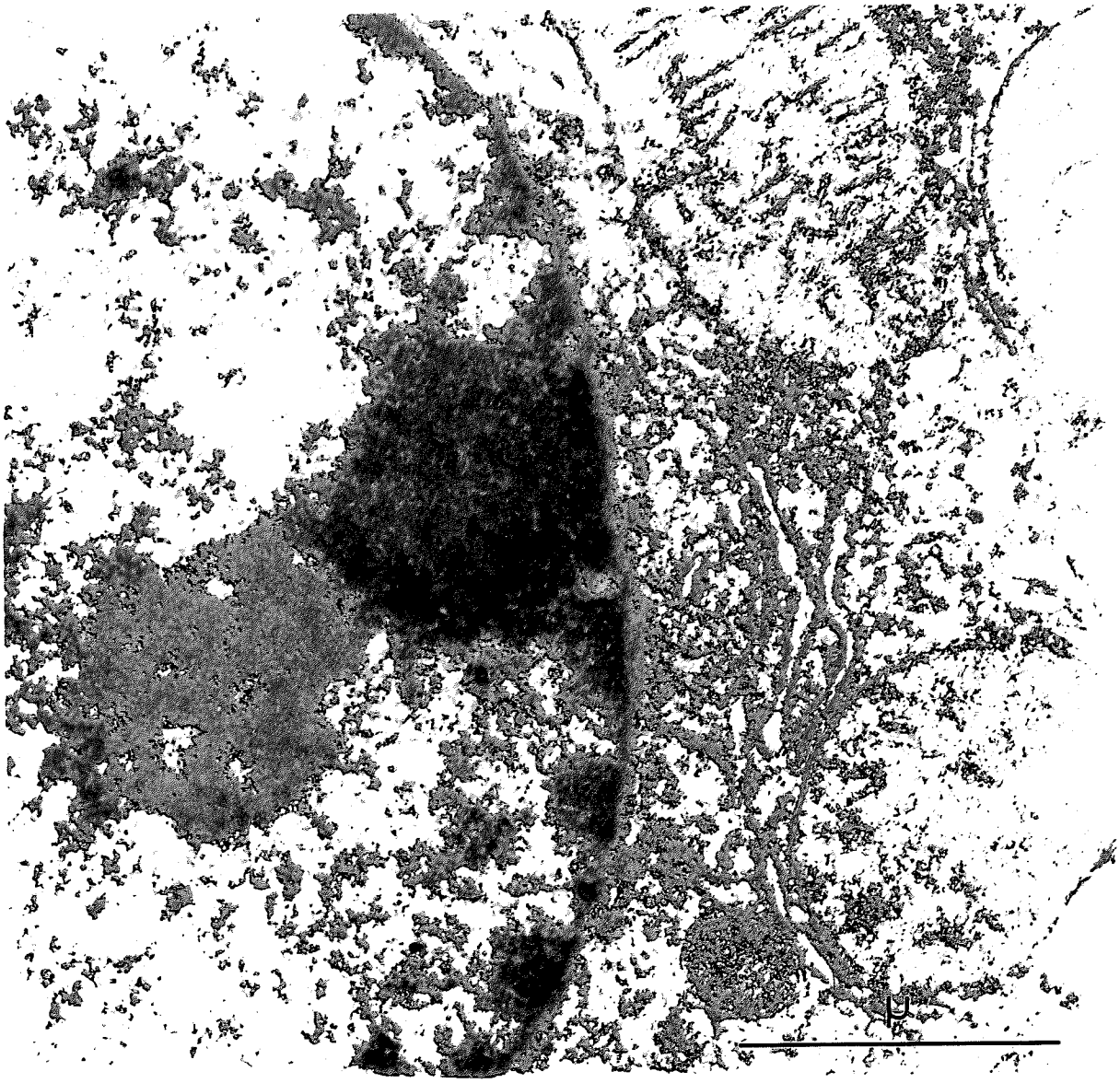
Mouse liver fixed in glutaraldehyde and osmium tetroxide as in Plate 3., but stained with uranium and lead. The general appearance of the tissue resembled that of Plate 3. with the exception of the better definition of the cytoplasmic membranes and the nuclear envelope.



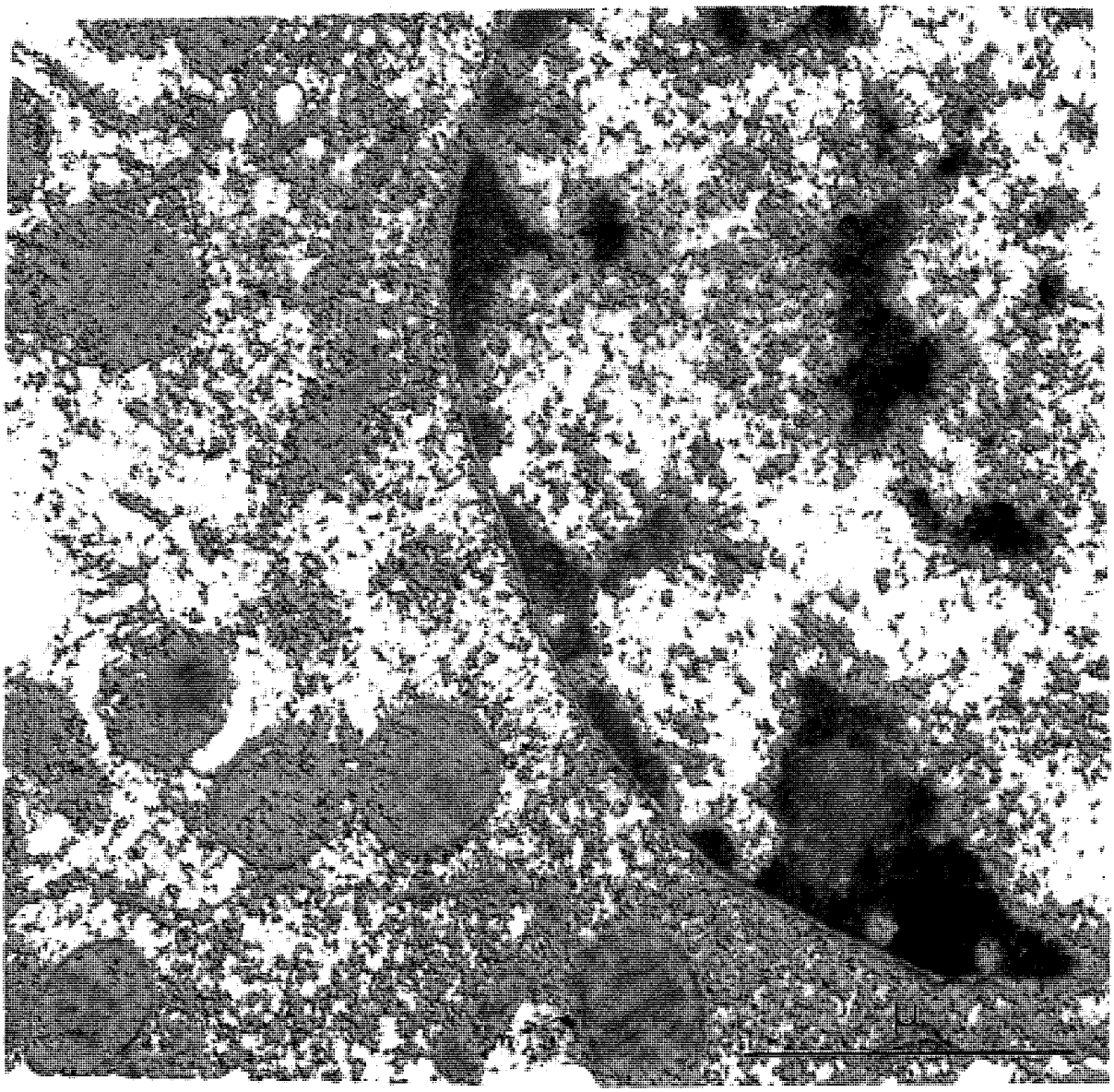
Mouse liver prepared as in Plates 3 & 5, with a stage of digestion with ribonuclease between the two fixation stages. The general appearance of the tissue resembles that shown in Plates 3 & 5 with the exception that the contrast of ribonucleoprotein structures was greatly reduced, ribosomes were not evident and the pars fibrosa of the nucleolus is usually paler than after normal preparation.



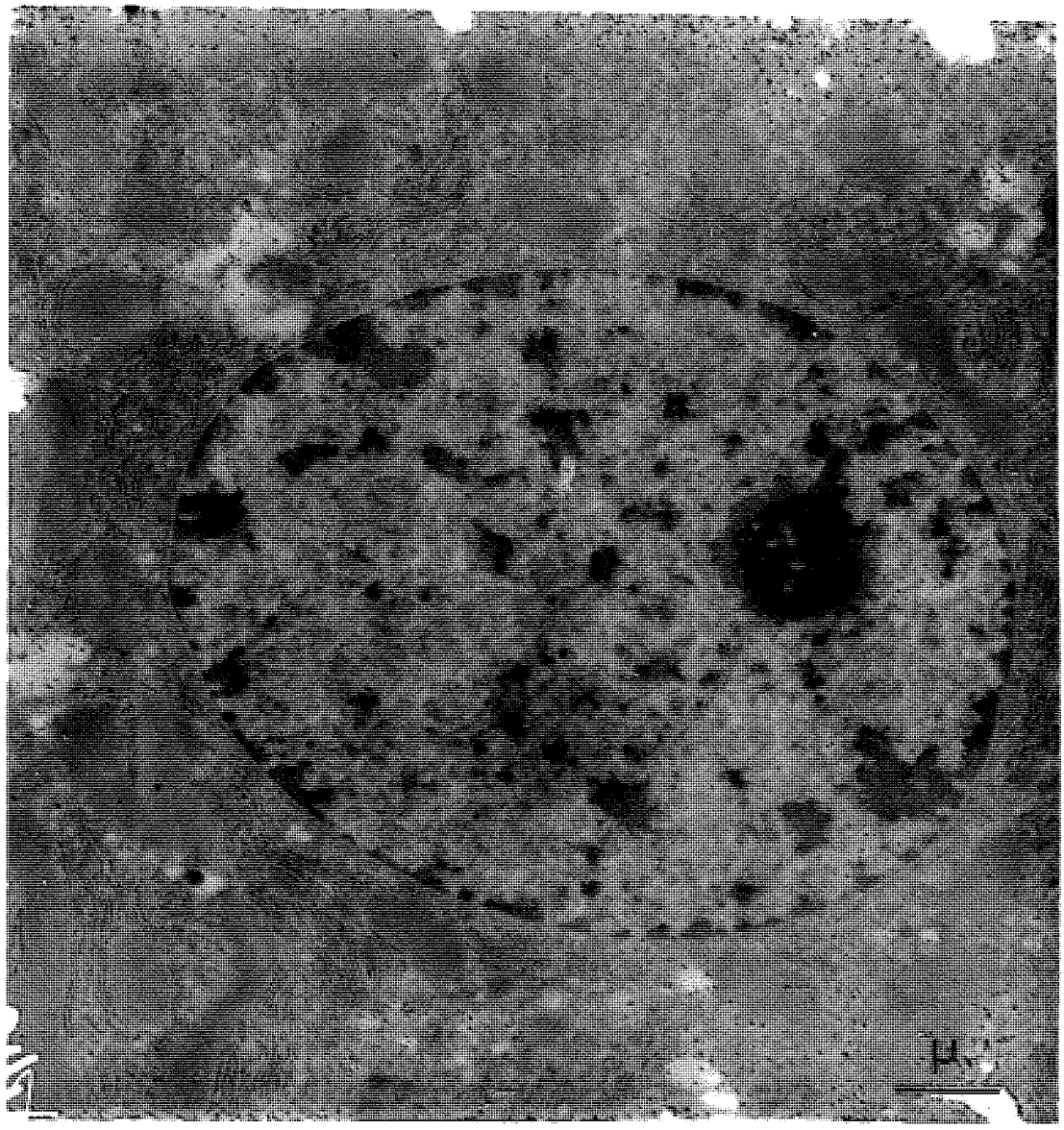
Mouse kidney prepared as in Plate 6. The loss of detailed structure of ribonucleoprotein structures such as ribosomes and the nucleolus is clearly evident.



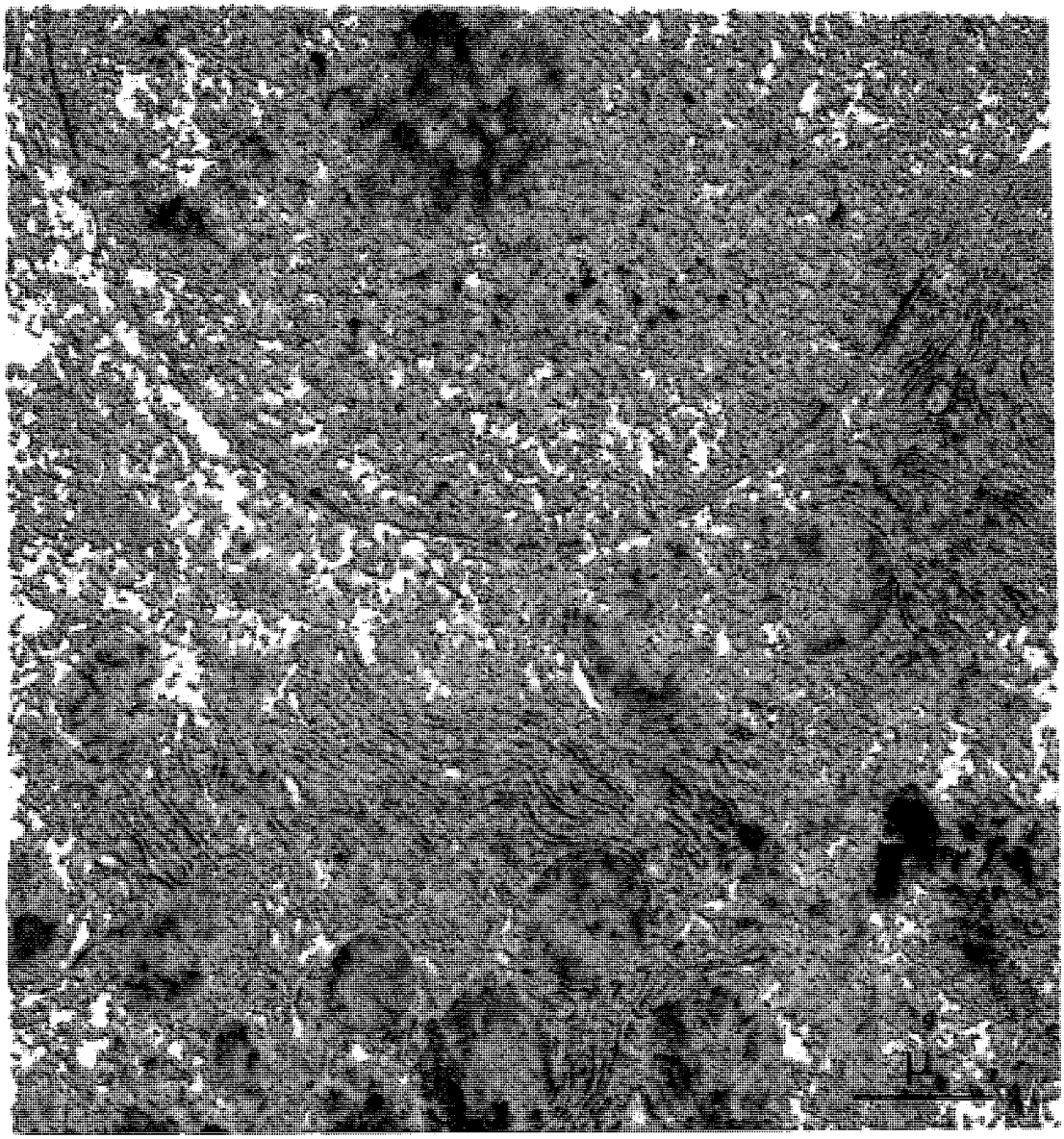
Mouse liver prepared as in Plates 3 & 5 with a stage of digestion with pepsin between the two fixation stages. The general appearance of the tissue resembles that shown in Plate 3 & 5 although a slight deterioration in quality is evident.



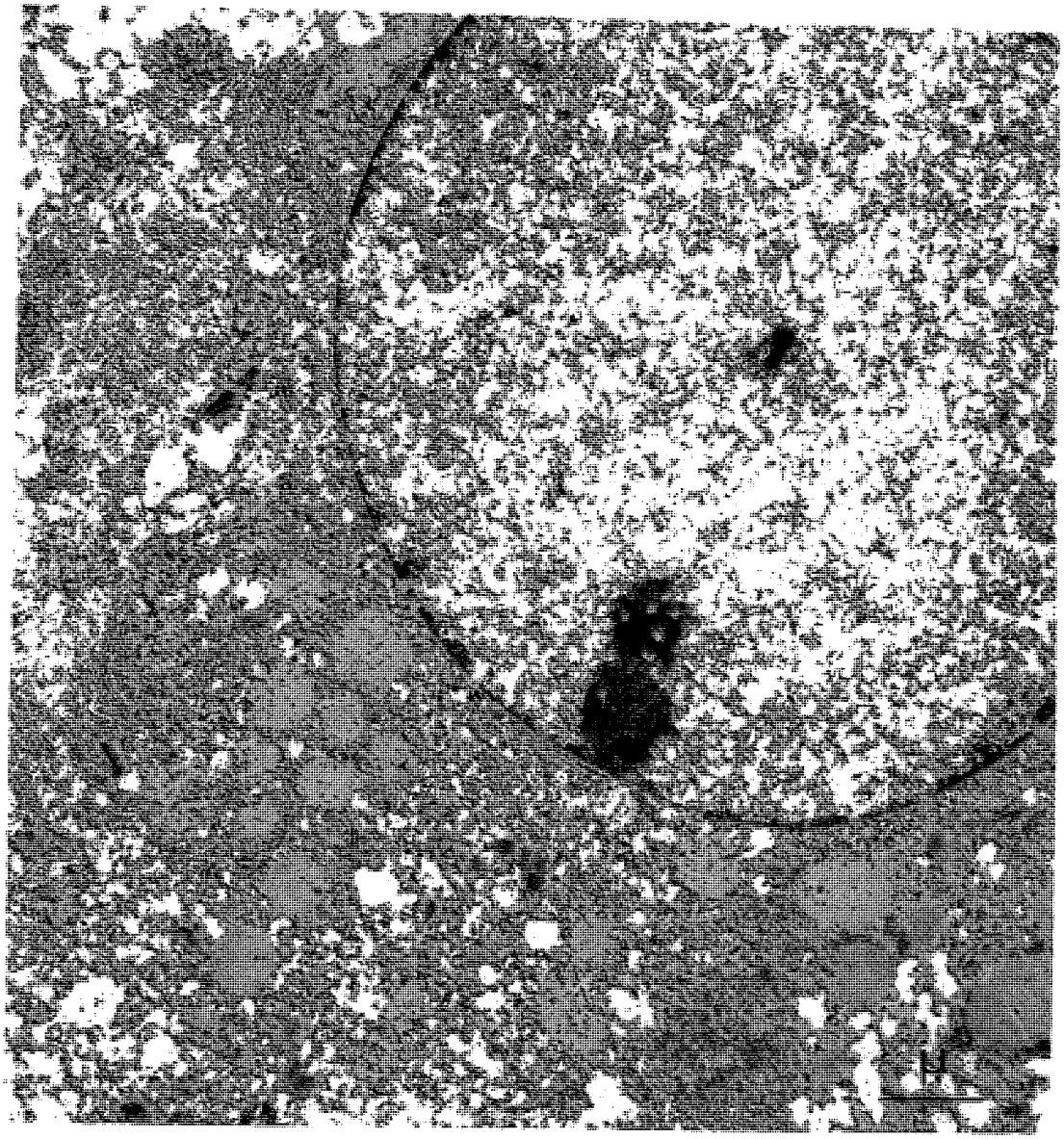
Mouse kidney prepared in thessame way as in Plate 8. The slight loss of quality in detailed structure is again evident.



Mouse liver fixed in 10% acrolein and stained with silver nitrate. The general contrast of the tissue was low although sufficient to enable cytoplasmic structures to be discerned. Nucleoprotein structures are obvious from their overlying deposits of silver granules.



Mouse liver fixed in glutaraldehyde and stored in a cold sucrose phosphate buffer medium for three months before post-fixation in osmium and routine embedding. Section stained with uranium. The general appearance of the tissue resembles that shown in Plates 3 & 5 although there tends to be a reduction in contrast and a general loss of quality.



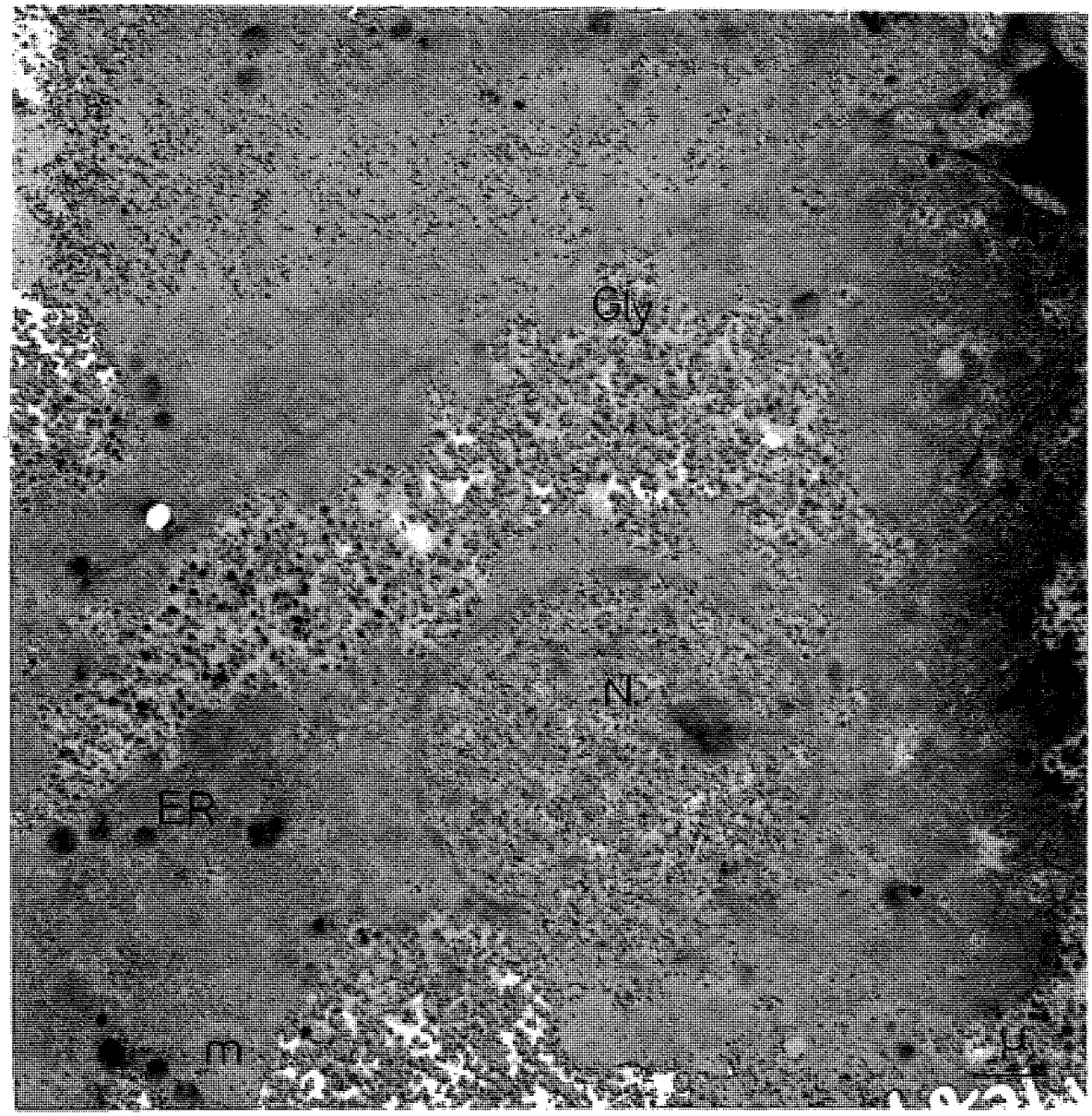
Mouse liver fixed in 10% acrolein and stored for three months in a cold sucrose phosphate buffer medium before routine embedding and sections staining in silver nitrate. The general contrast of the tissue resembles that of Plate 10 although the contrast is somewhat better. There was however, some deterioration in the quality.

Chapter 1.

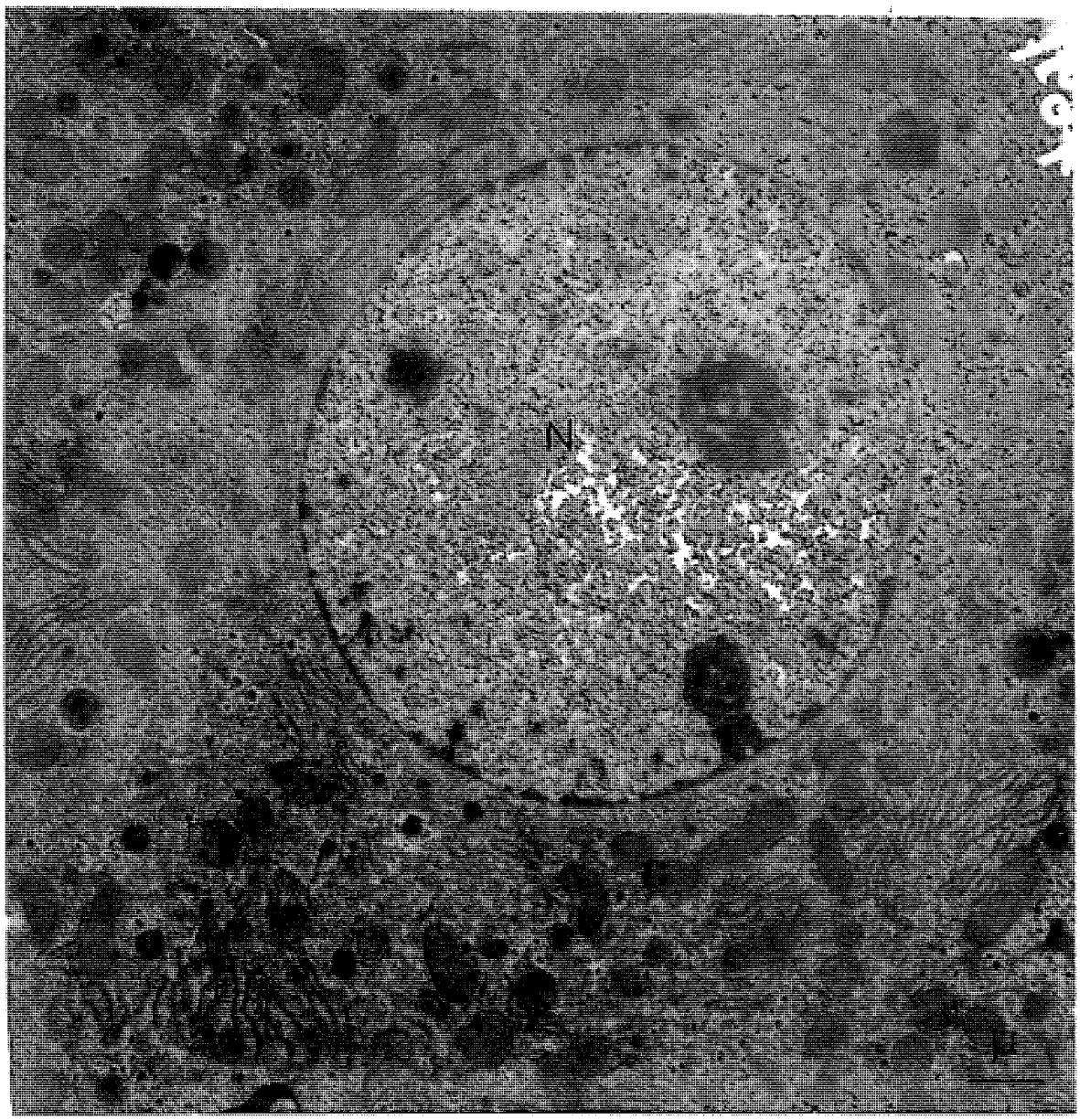
The Effects of Thyroid Hormones on Cellular Structure.

Key.

N	–	Nucleus
M	–	Mitochodrion
ER	–	Endoplasmic reticulum
Gly	–	Glycogen
bb	–	Brush border
av	–	Apical vacuole



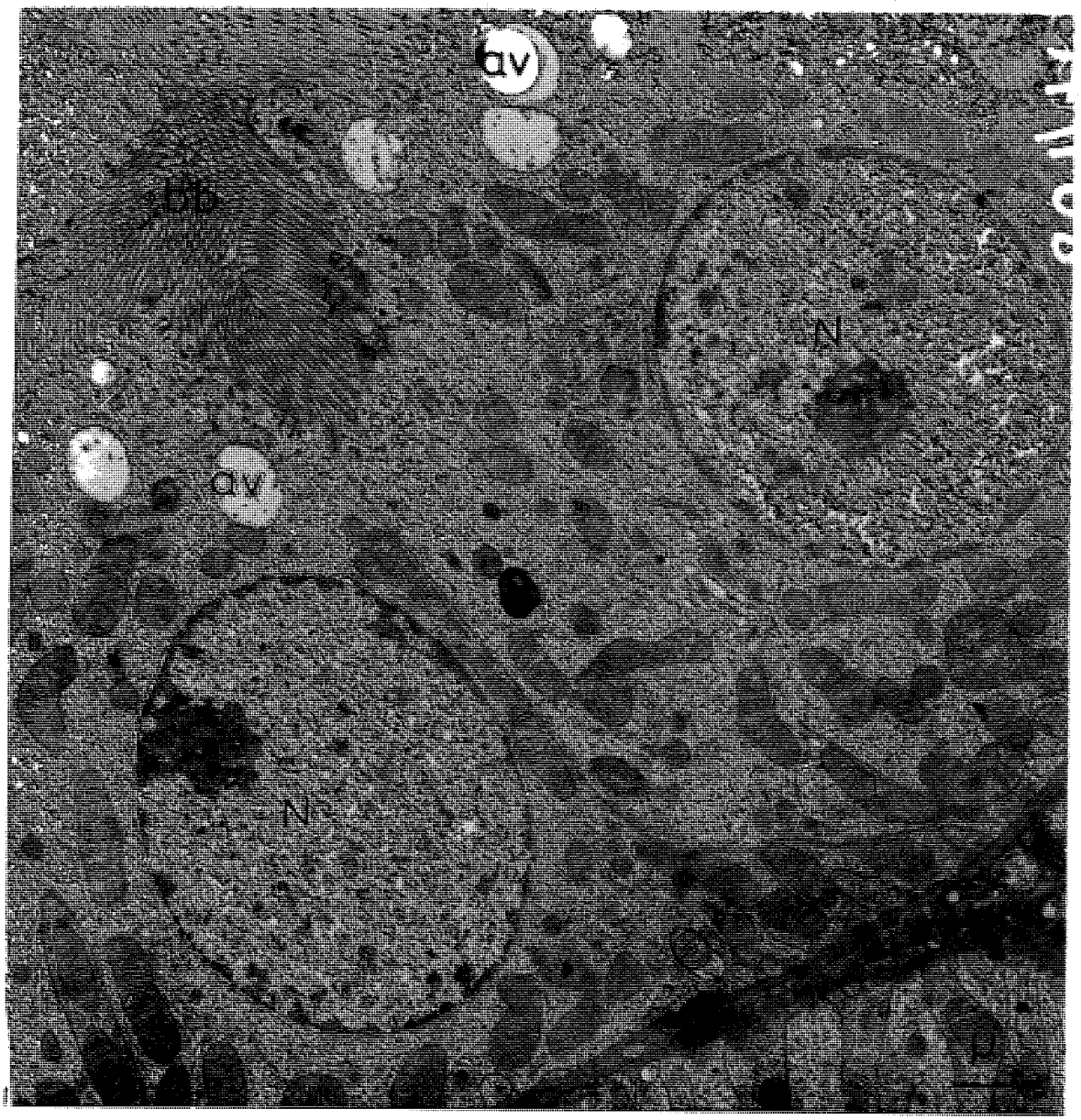
Mouse liver from a normal animal fixed in glutaraldehyde and osmium. The nuclei are rounded, with relatively little dark staining material present. Approximately 50% of the cytoplasm is occupied by areaseof glycogen granules devoid of other structures. Endoplasmic reticulum is present as loosely arranged groups of lamellae amoung profiles of mitochondria.



Mouse liver from an animal rendered hyperthyroid with thyroxine. There was a vast reduction in the amount of glycogen present, only small isolated groups of granules occurring. Endoplasmic reticulum is usually arranged in complex whorls and layers of lamellae amid masses of mitochondrial profiles.

Plate 15.

809/71



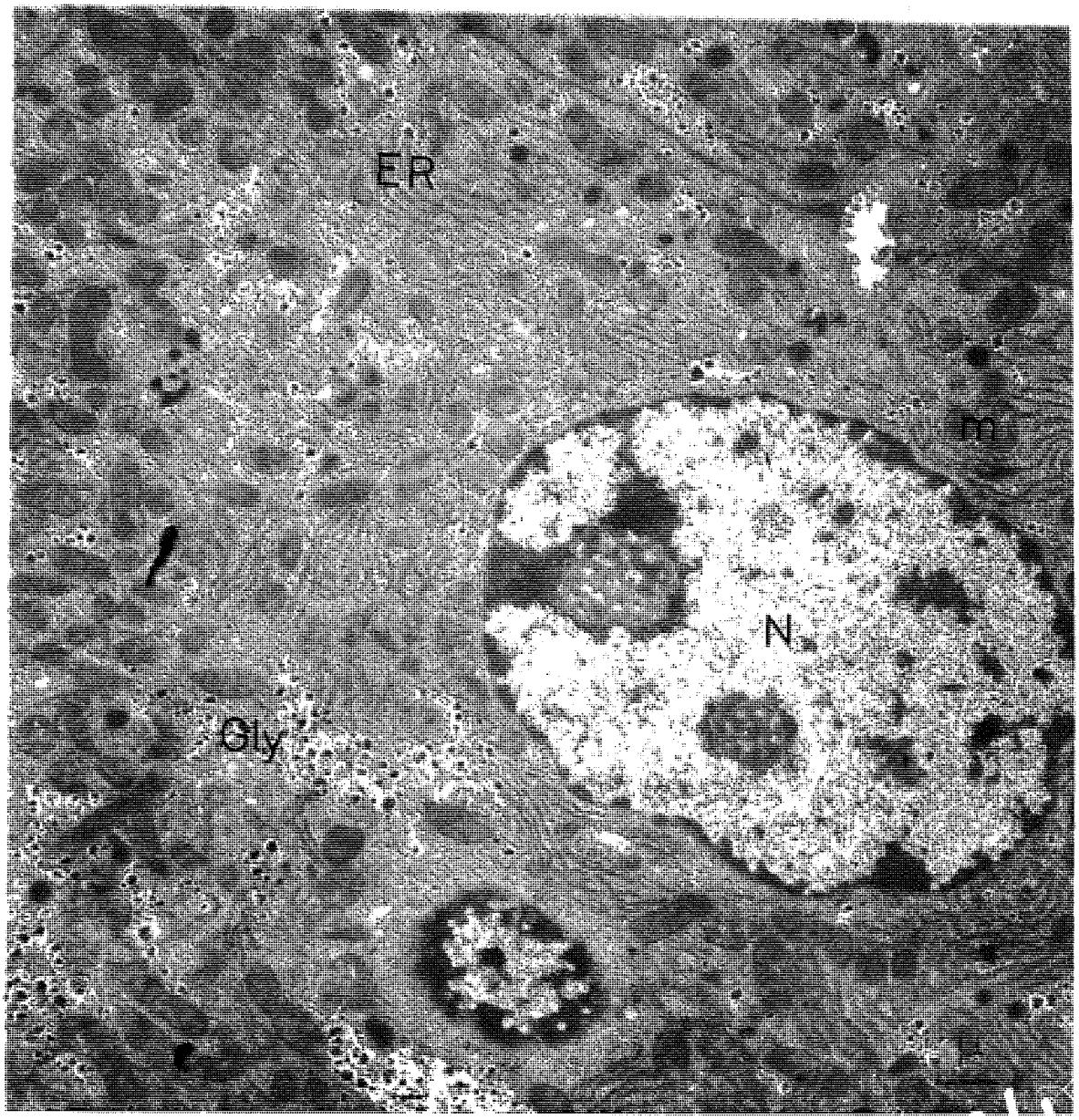
Proximal convoluted tubule from a normal animal's kidney. The appearance is characteristic of that of all experimental groups.

Chapter 2.

The Sequence of Ultrastructural Changes Produced under Thyroid Hormone Influence.

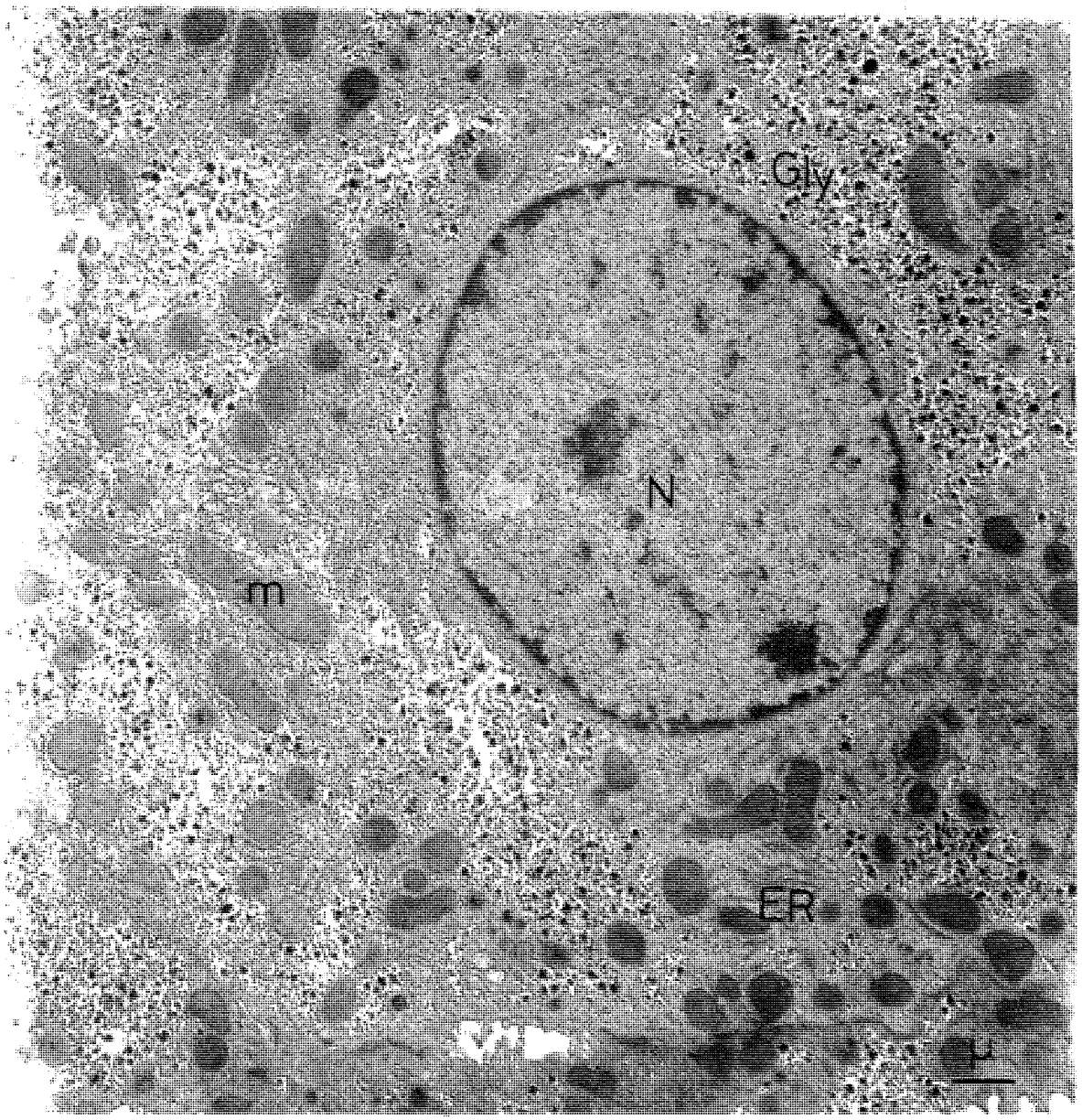
Key

N	–	Nucleus
ER	–	Endoplasmic reticulum
M	–	Mitochondrion
Gly	–	Glycogen
bb	–	Brush border
av	–	Apical vacuole

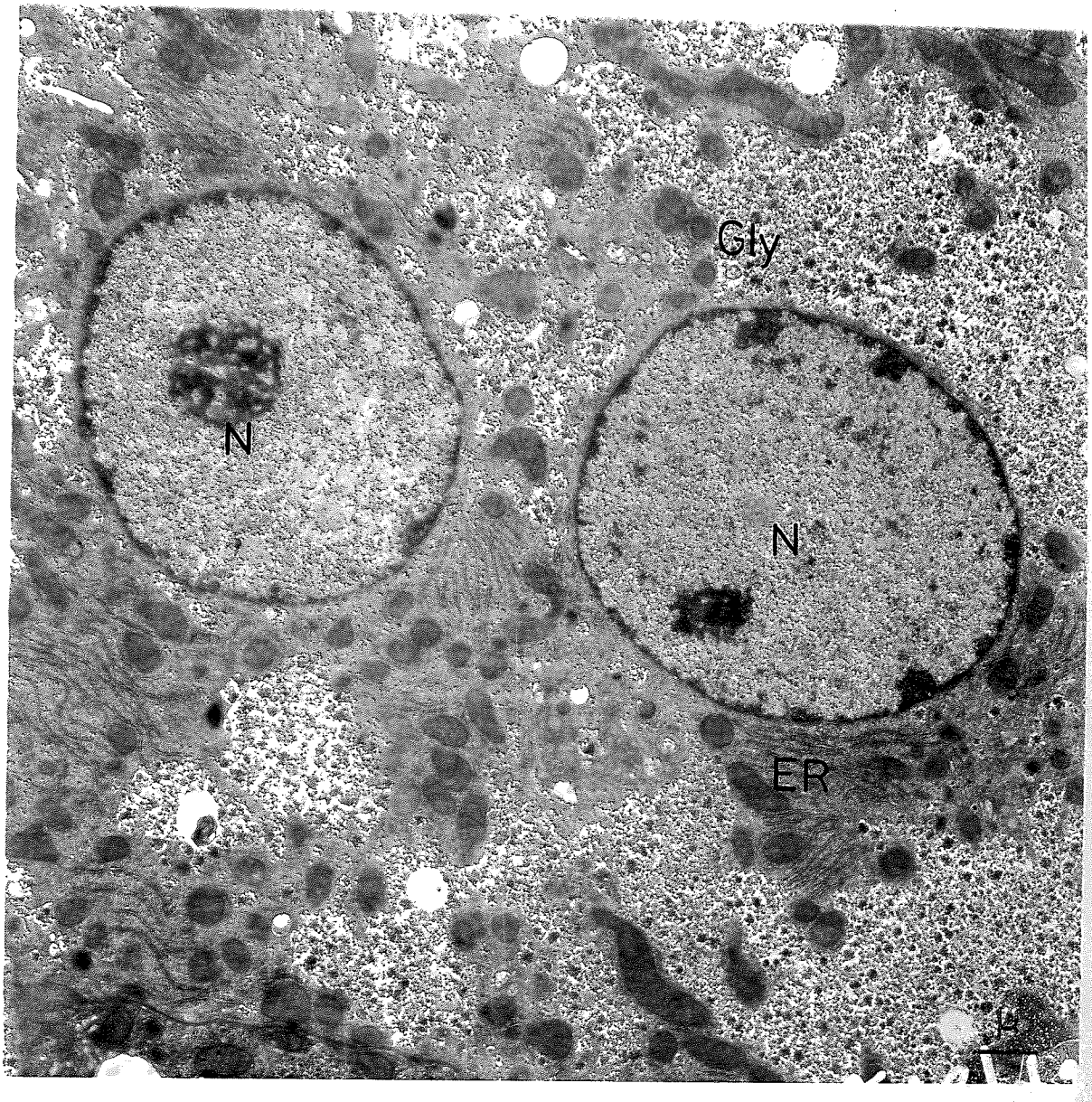


Mouse liver from an animal killed 0hrs after the administration of a single dose of triiodothyronine. Glycoged deposits are dispersed throughout the cytoplasm, although they tend to be aggregated into extensive deposits towards the periphery of cells. Mitochondria are fairly abundant although they tend to be small and rounded with few cristae. Groups of short parallel lamellae of endoplasmic reticulum are also fairly frequent, especially towards the centre of the cells.

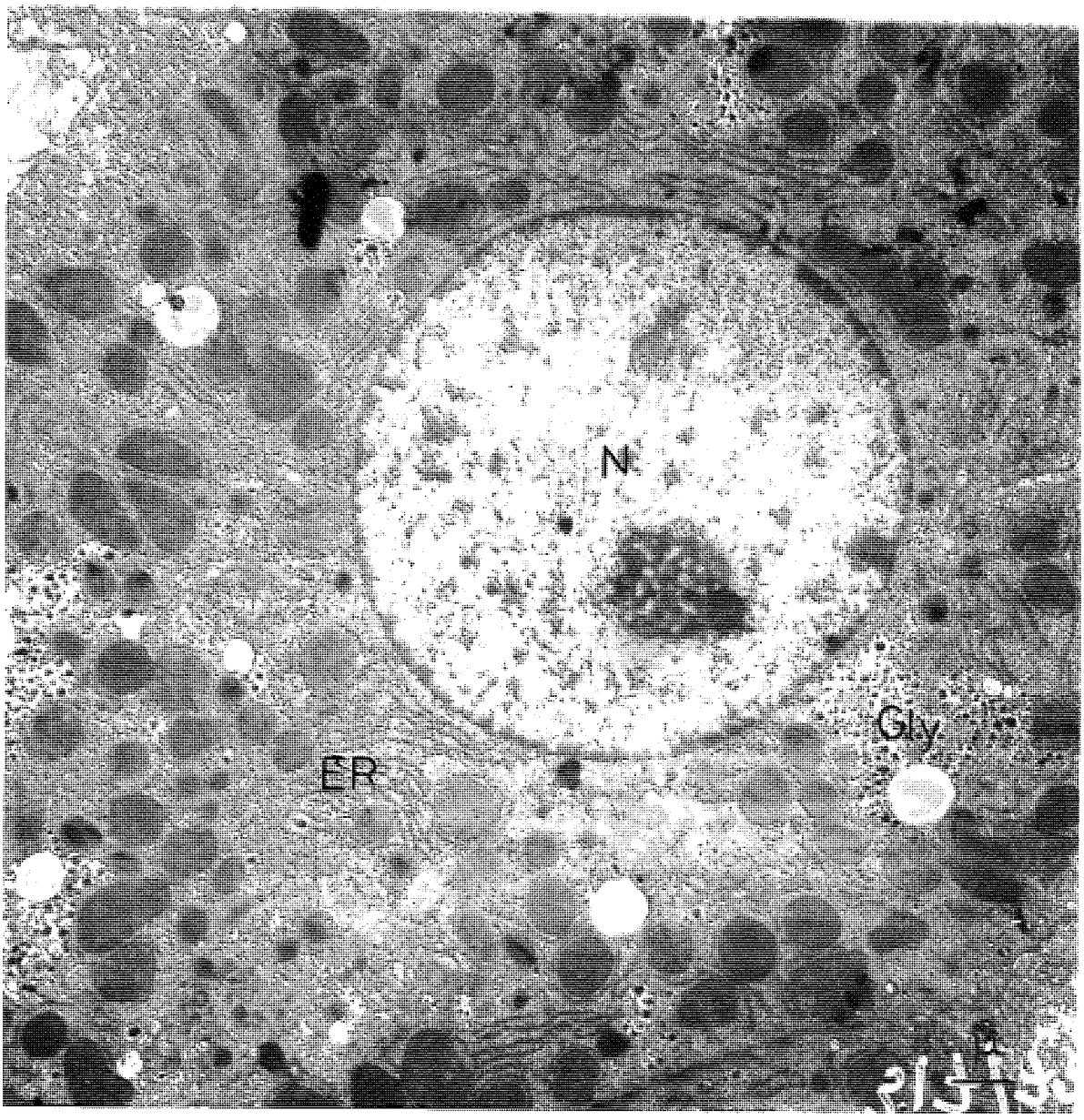
Plate 17.



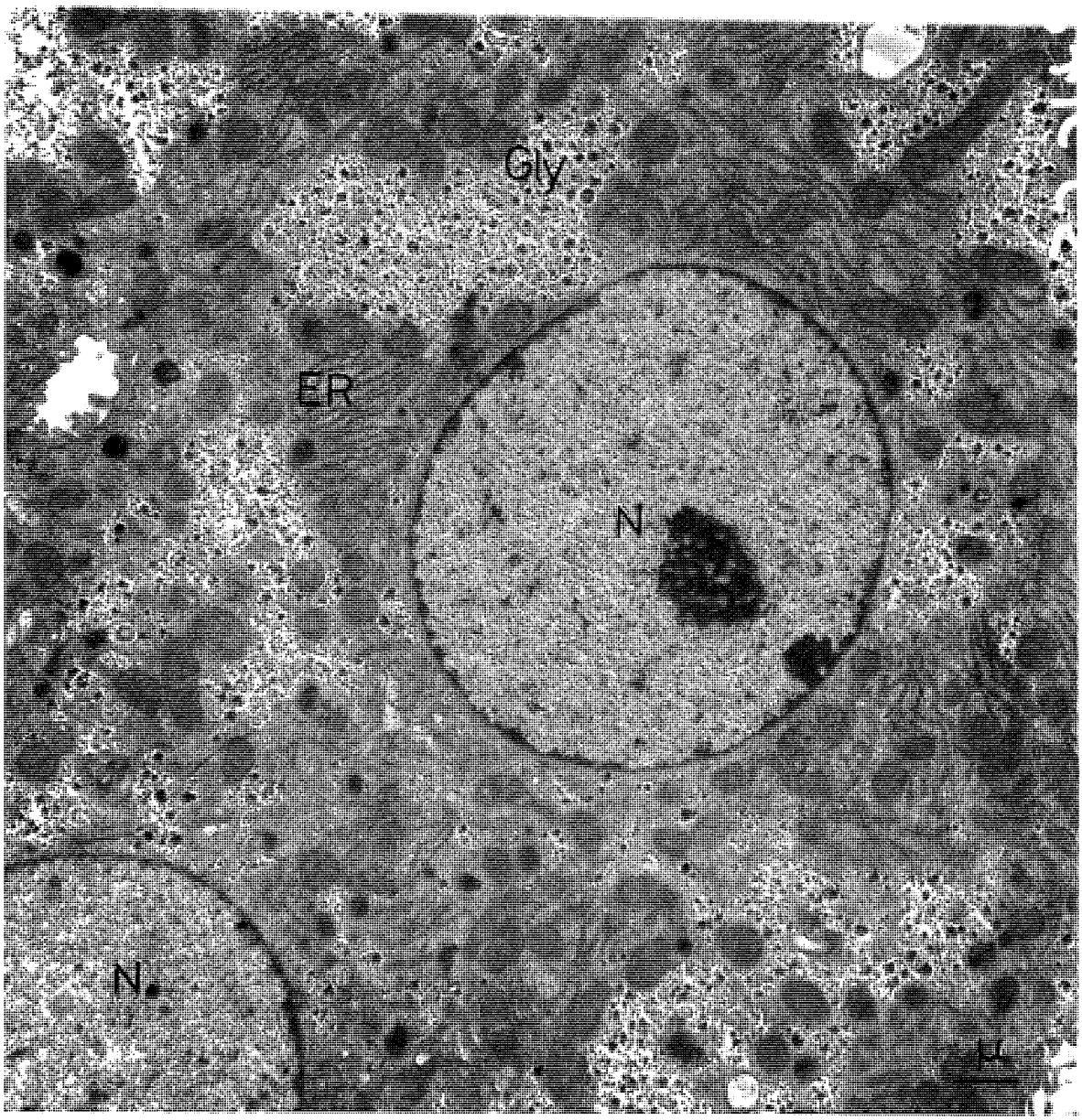
Mouse liver from an animal killed 60hrs after an injection of saline vehicle. More than half the cytoplasm is occupied by extensive deposits of glycogen granules. Mitochondria are relatively infrequent, small, rounded and lacking in cristae. Short profiles of endoplasmic reticulum occurr in loosely arranged groups frequently associated with the nucleus or groups of mitochondria.



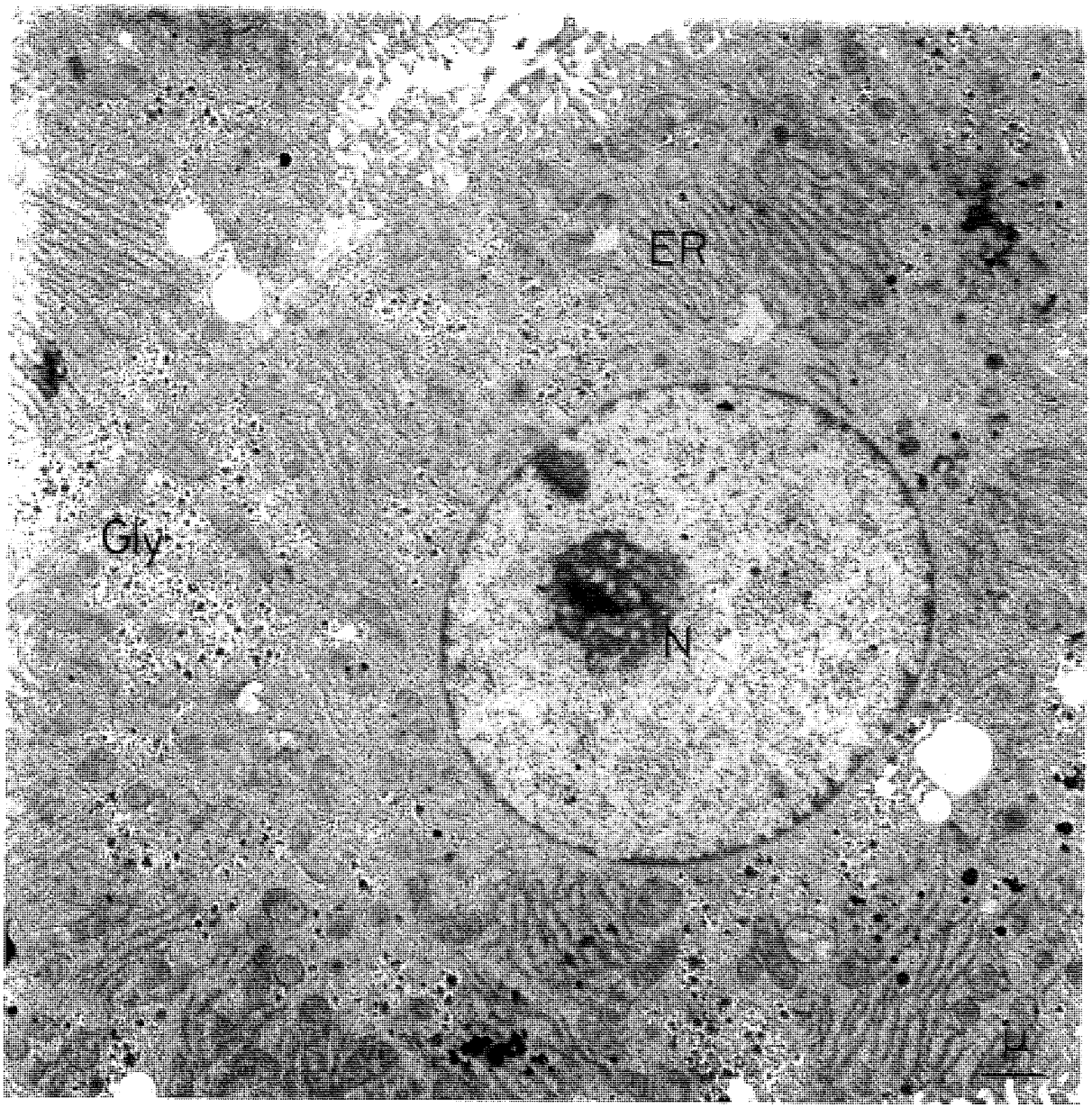
Mouse liver from an animal killed 15hrs after the administration of a single dose of triiodothyronine. Approximately half the cytoplasm is occupied by extensive deposits of glycogen granules. Mitochondria are small, rounded and lacking in cristae. Profiles of endoplasmic reticulum are short and loosely arranged.



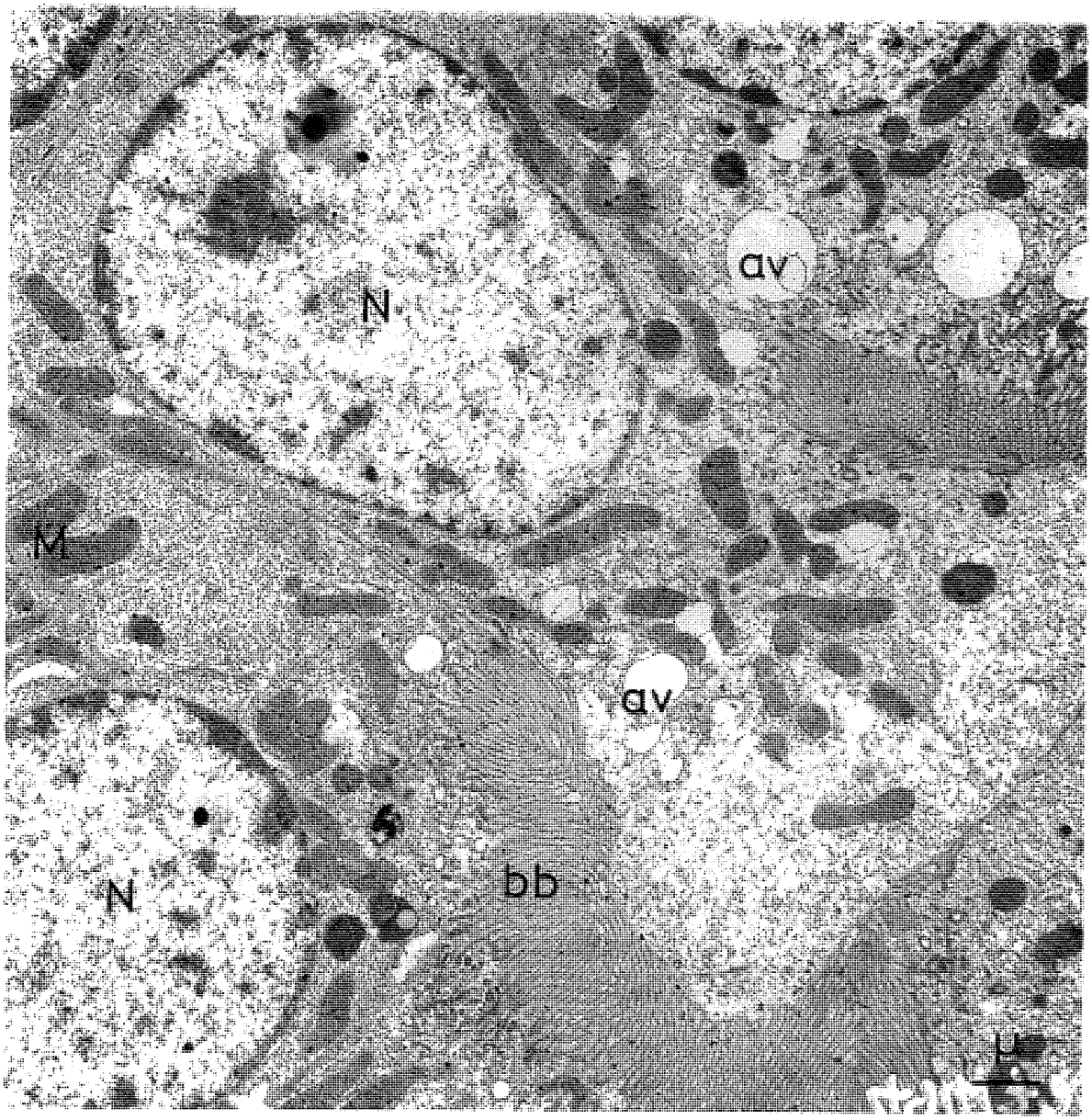
Mouse liver from an animal killed 30hrs after the administration of a single dose of triiodothyronine. There is a marked reduction in the amount of glycogen present, although granules are still aggregated into dense masses where they do occur. Mitochondria are rounded with few cristae but the profiles appear to be larger. Profiles of endoplasmic reticulum are loosely arranged but appear to be longer.



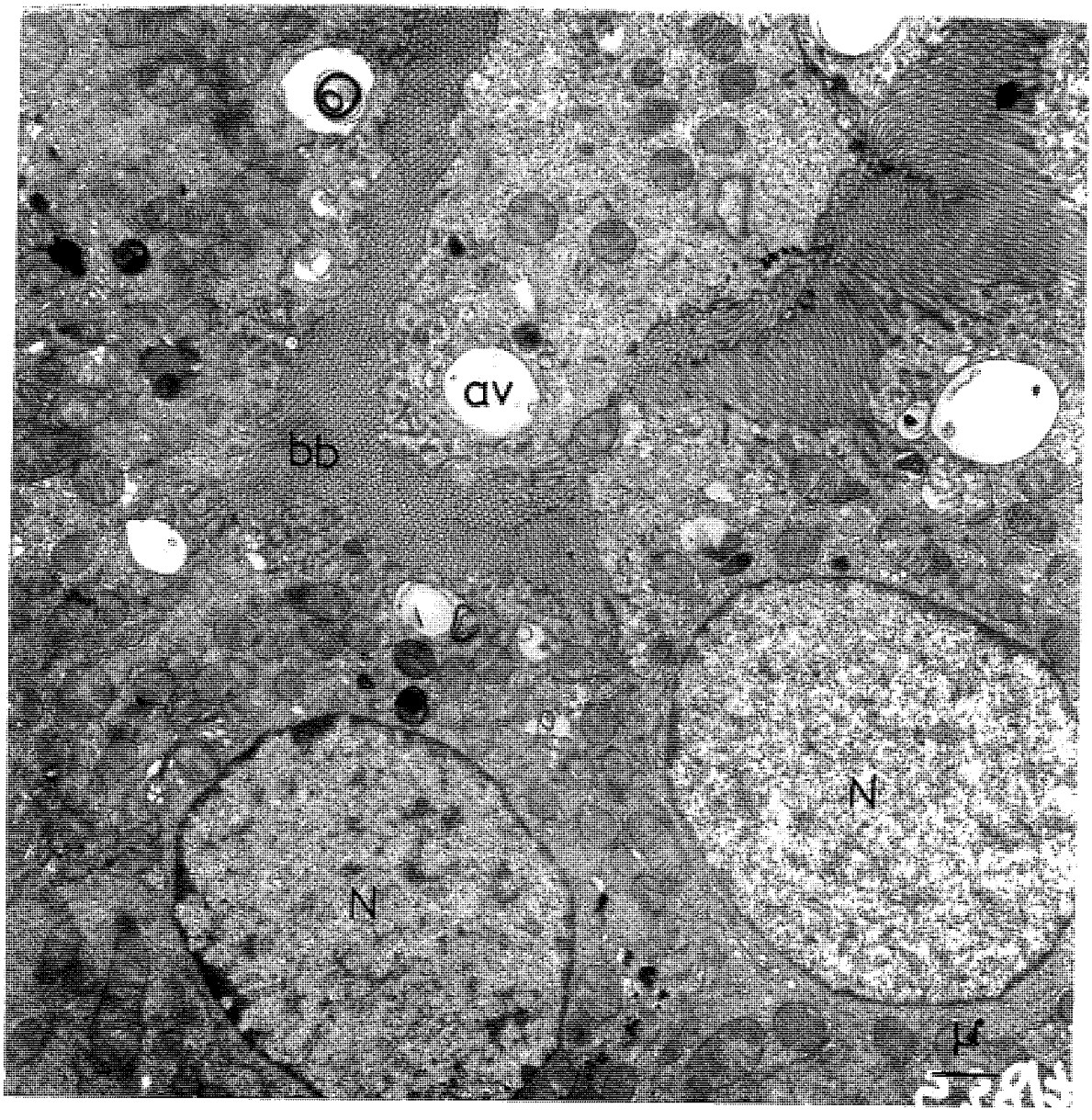
Mouse liver from an animal killed 45hrs after the administration of a single dose of triiodothyronine. Glycogen deposits are considerably less extensive than in the liver cells of normal animals. There was a slight increase over the amount present 30hrs after hormone administration. Small groups of granules occur intermingled with other organelles. Profiles of endoplasmic reticulum are longer and more closely arranged than in material from previous experimental groups, and much more abundant.



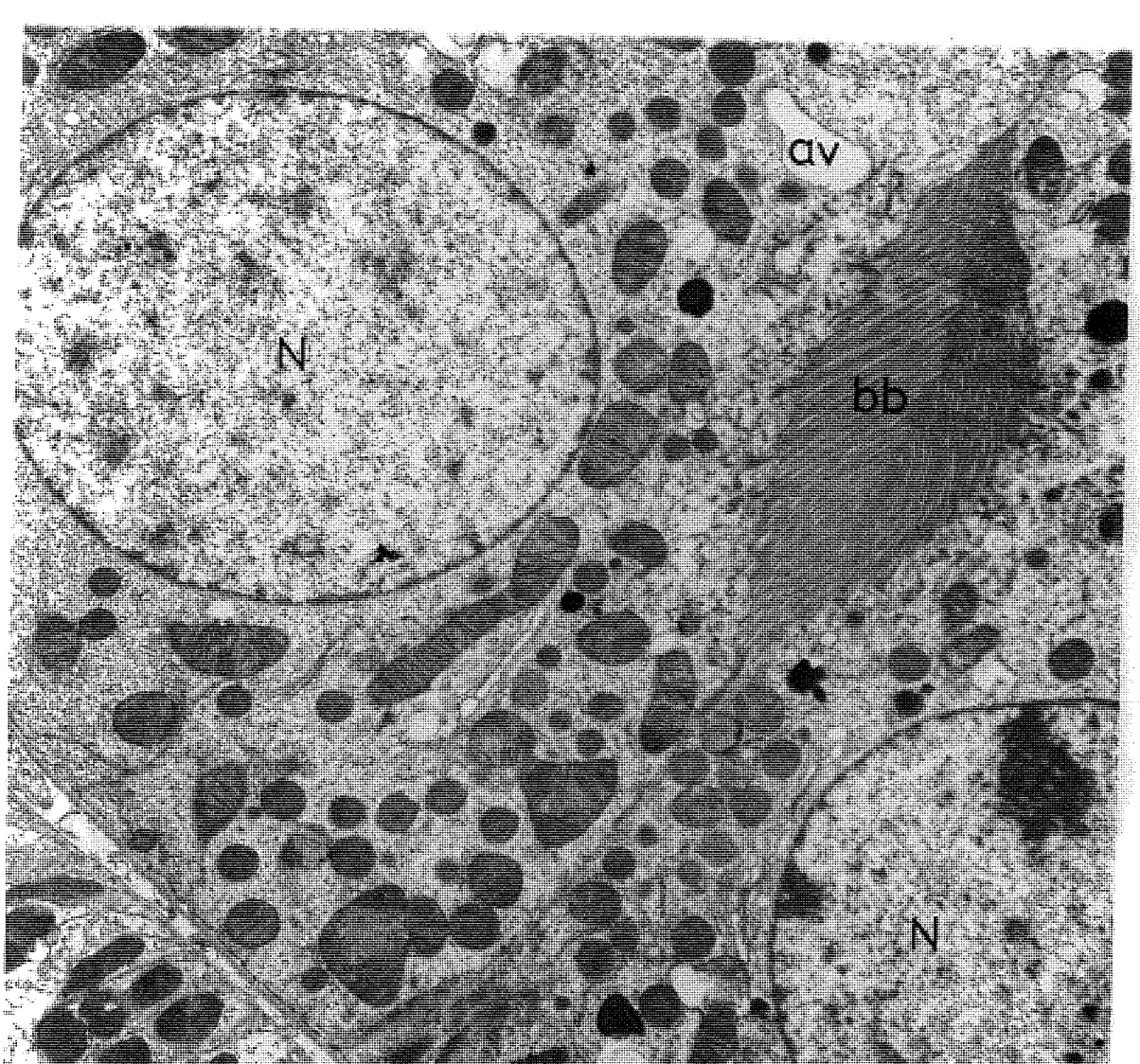
Mouse liver from an animal killed 60hrs after the administration of a single dose of triiodothyronine. Glycogen deposits again occupy approximately half of the cytoplasmic areas, although the granules tend to be more dispersed through the cytoplasm than in normal animals. Profiles of endoplasmic reticulum are abundant, arranged in long parallel arrays of lamellae throughout the cytoplasm.



Mouse kidney from an animal killed ohrs after the administration of a single dose of triiodothyronine. The nuclei of proximal convoluted tubule cells are rounded with little or no dark staining material present. The nuclear membranes are regular. There is little endoplasmic reticulum present.

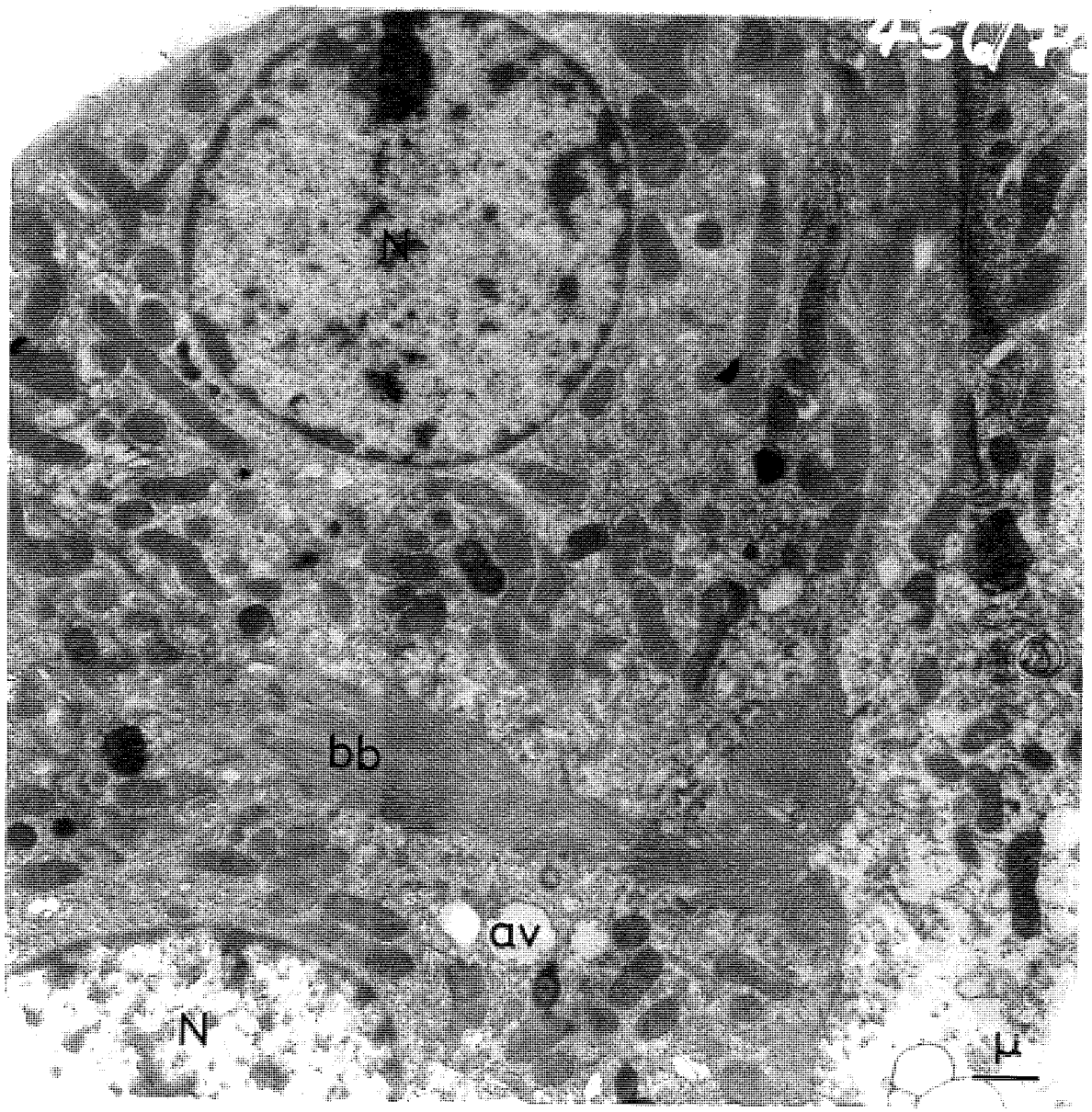


Mouse kidney from an animal killed 60hrs after an injection of saline vehicle. The appearance of the proximal convoluted tubule cells resembled that of those killed at the beginning of the experiment.



Mouse kidney from an animal killed 15hrs after the adminstration of a single dose of triiodothyromine. The appearance of the tissue resembles that of animals killed at the beginning of the experiment.

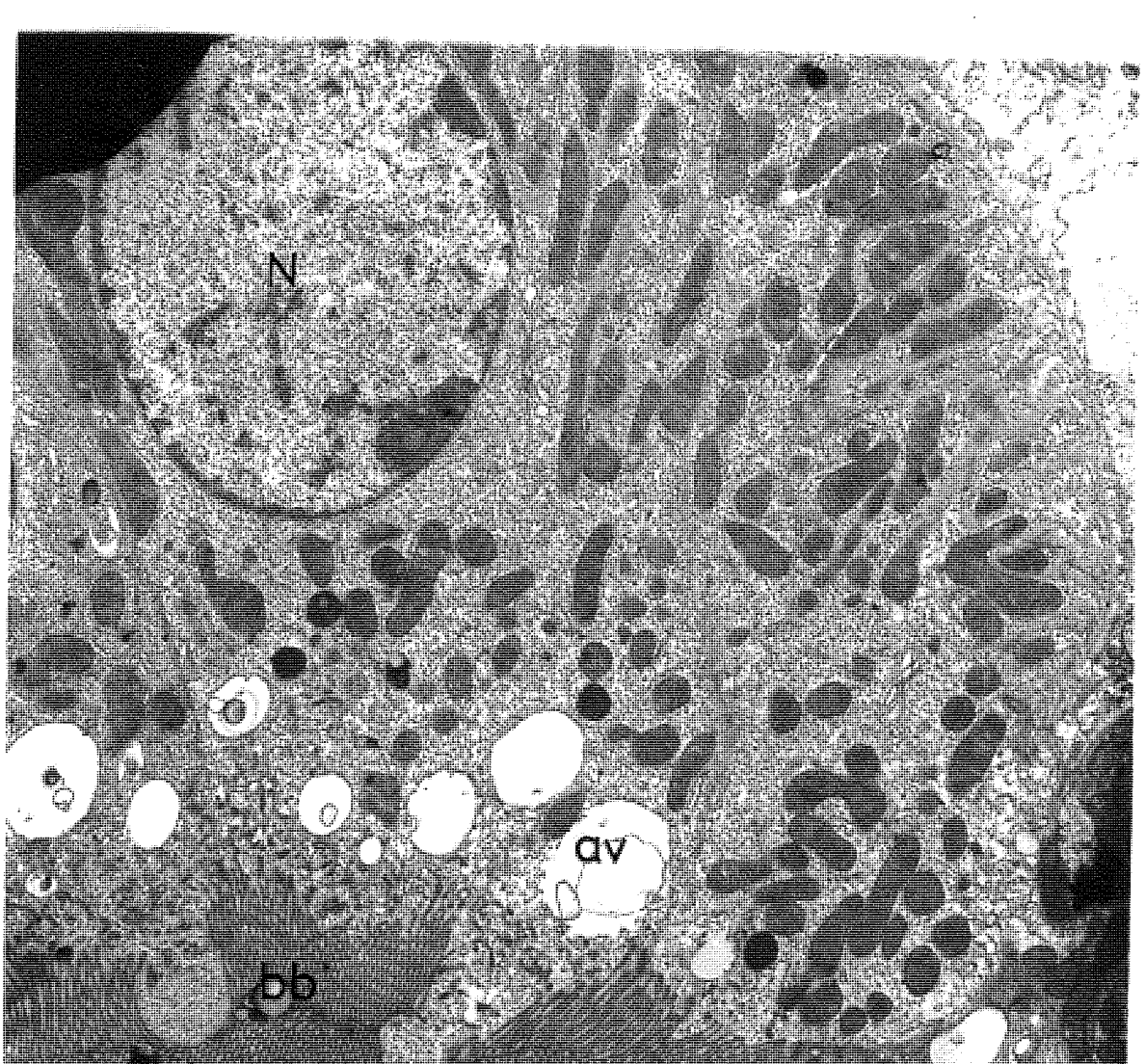
Plate 25.



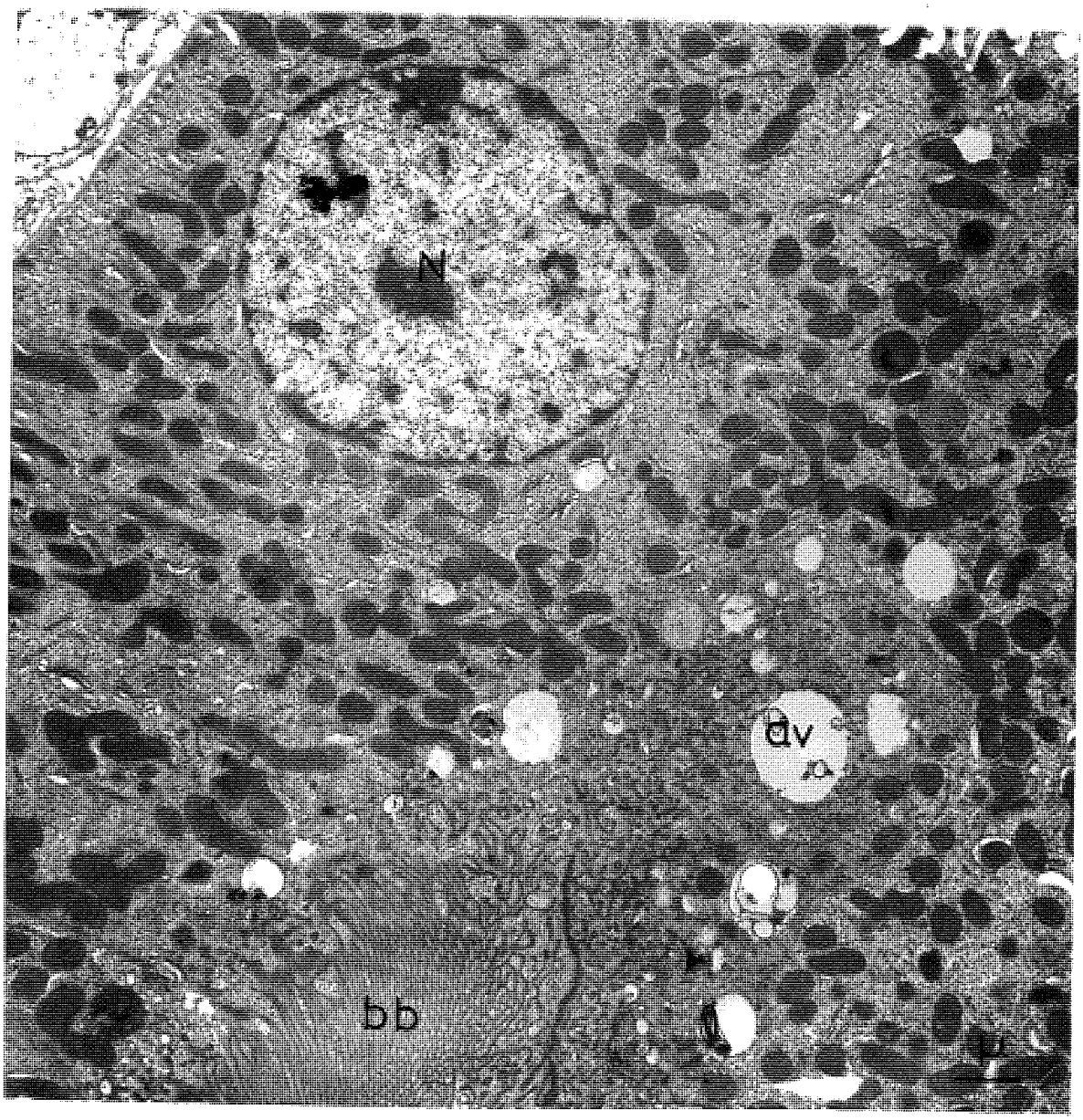
Mouse kidney from an animal killed 30hrs after the administration of a single dose of triiodothyronine. Again there is little difference in the appearance of proximal convoluted tubule cells from animals killed at the beginning of the experiment, although there appeared to be a reduction in the size of the apical vacuoles.

Plate 26.

514/72



Mouse kidney from an animal killed 45hrs after the administration of a single dose of triiodothyronine. The apical vacuoles of the proximal convoluted tubule cells have returned to normal size. There is no apparent difference in the size or distribution of any of the other organelles.



Mouse kidney from an animal killed 60hrs after the administration of a single dose of triiodothyronine. Again there was little apparent difference from the normal material although nuclei tended to be smaller in size.

Chapter 3.

The Effects of Thyroid Hormones upon Nuclear Morphology.

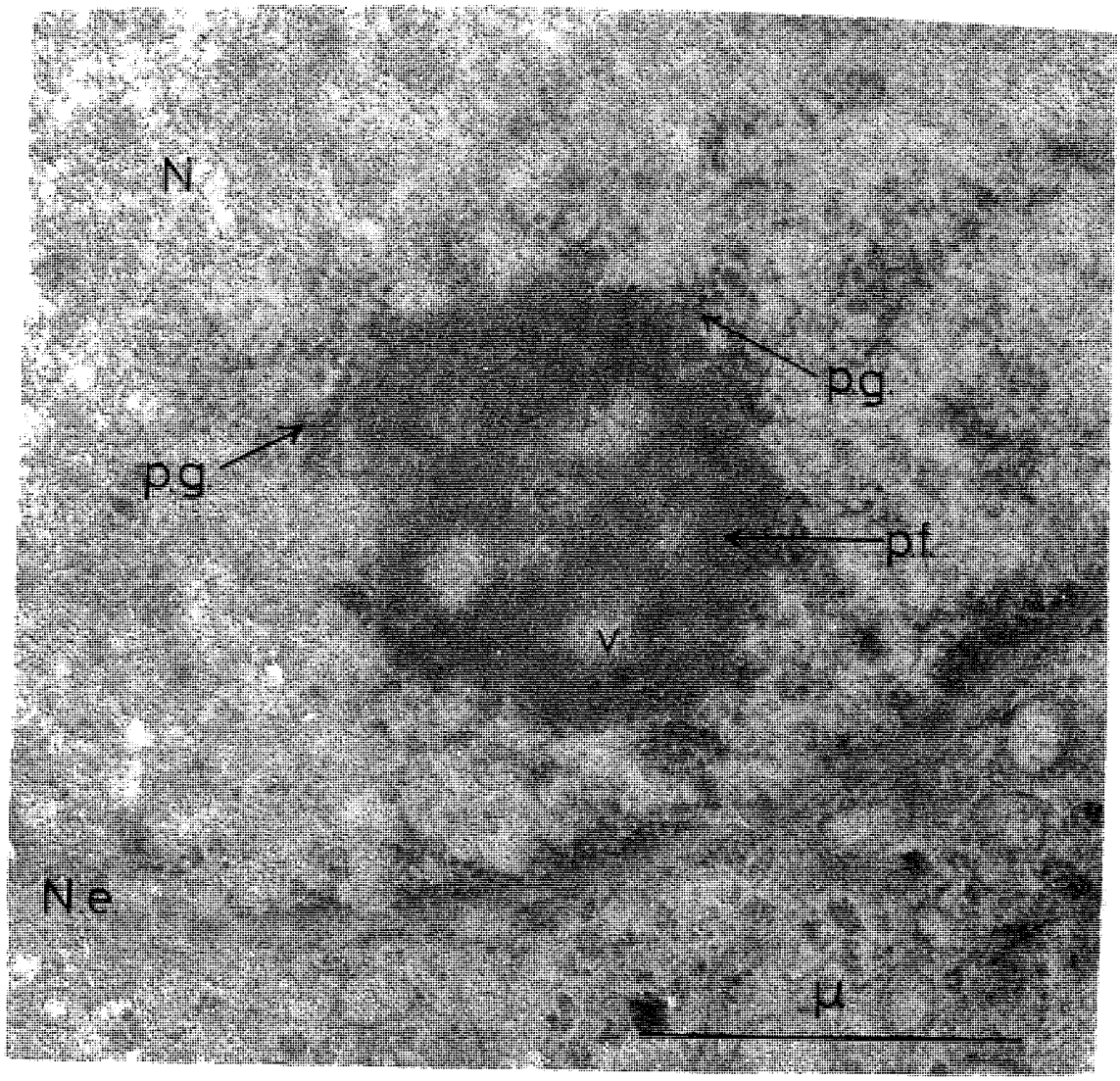
Plates 28 - 51. Nucleolar Morphology

Key

N	-	Nucleus
Ne	-	Nuclear envelope
pg	-	Pars granulosa
pf	-	Pars fibrosa
v	-	Vacuole
dv	-	Dark vacuole
lv	-	Light vacoule

Plate 28.

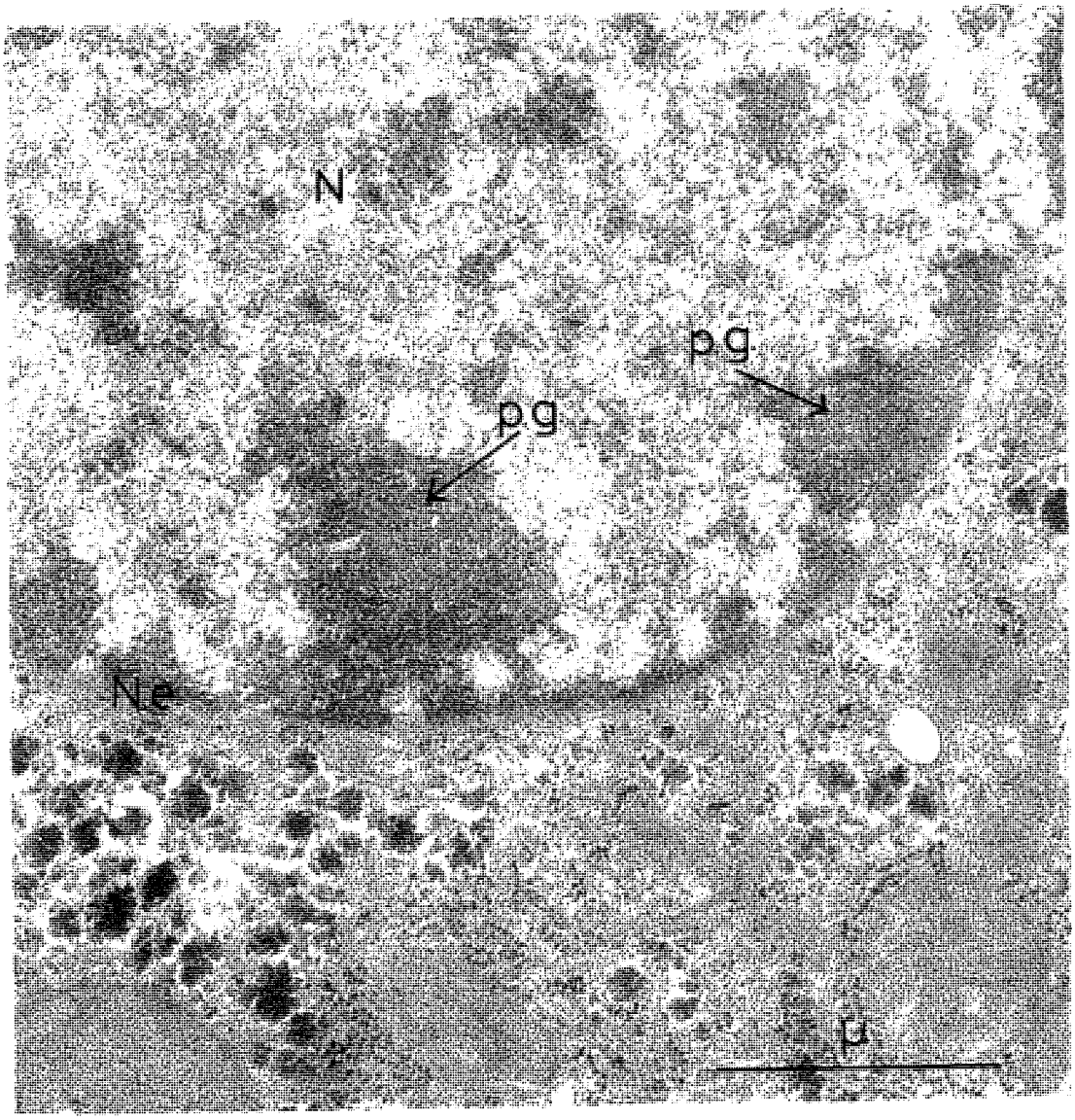
774/69



Nucleolar Category 1.

There is a distinct nucleolonema, with little or no associated pars granulosa material. Pars granulosa material that is present tends to be diffused. The pars fibrosa is composed of a network of fine fibrils, closely packed and embedded in a electron dense matrix.

Mouse liver fixed in glutaraldehyde and osmium.

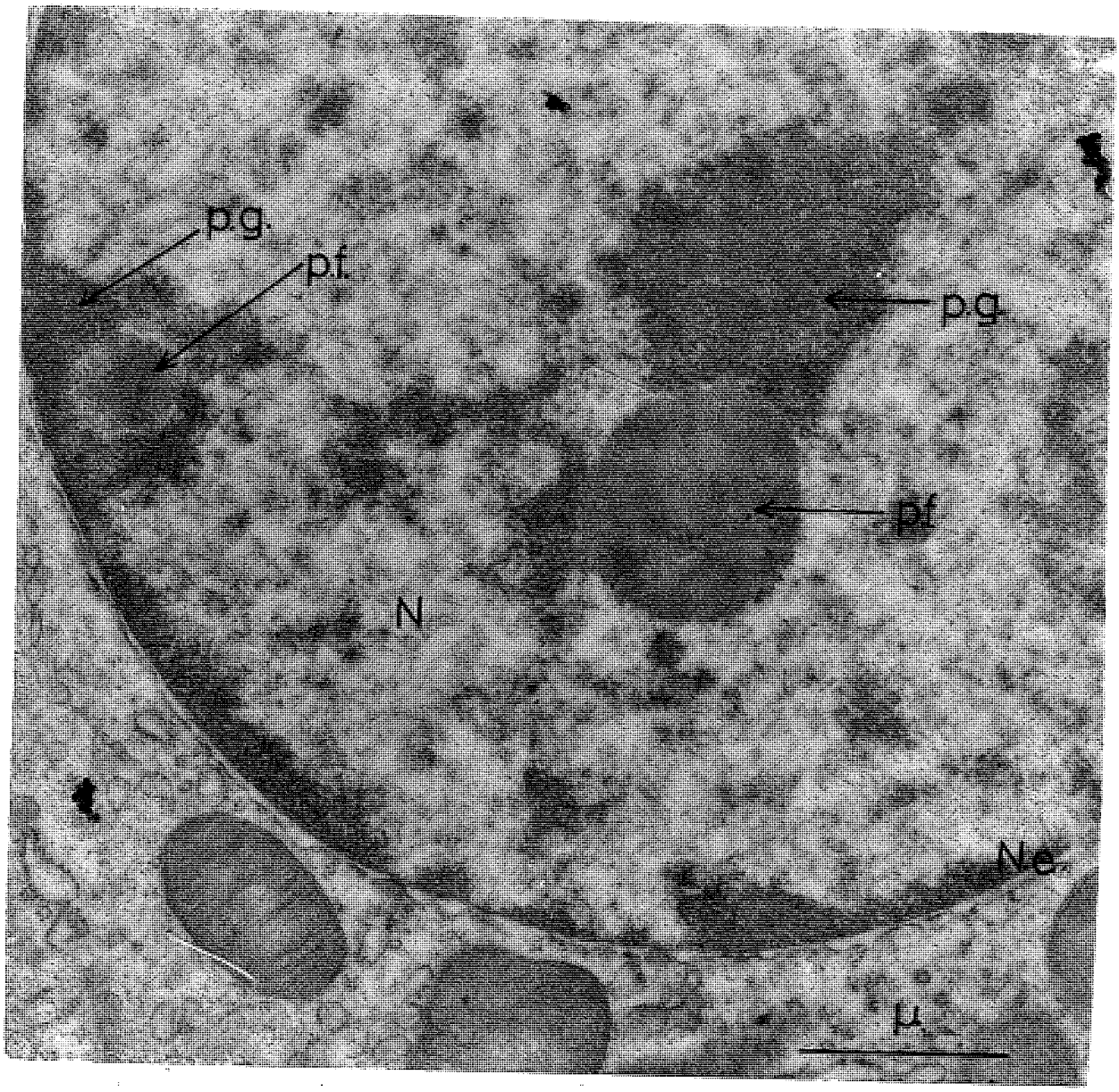


Nucleolar Category 2.

Mouse liver fixed in glutaraldehyde and osmium. A distinct mass of pars granulosa material is not associated with any recogniseable nucleolonoma or pars fibrosa.

Plate 30.

967/69



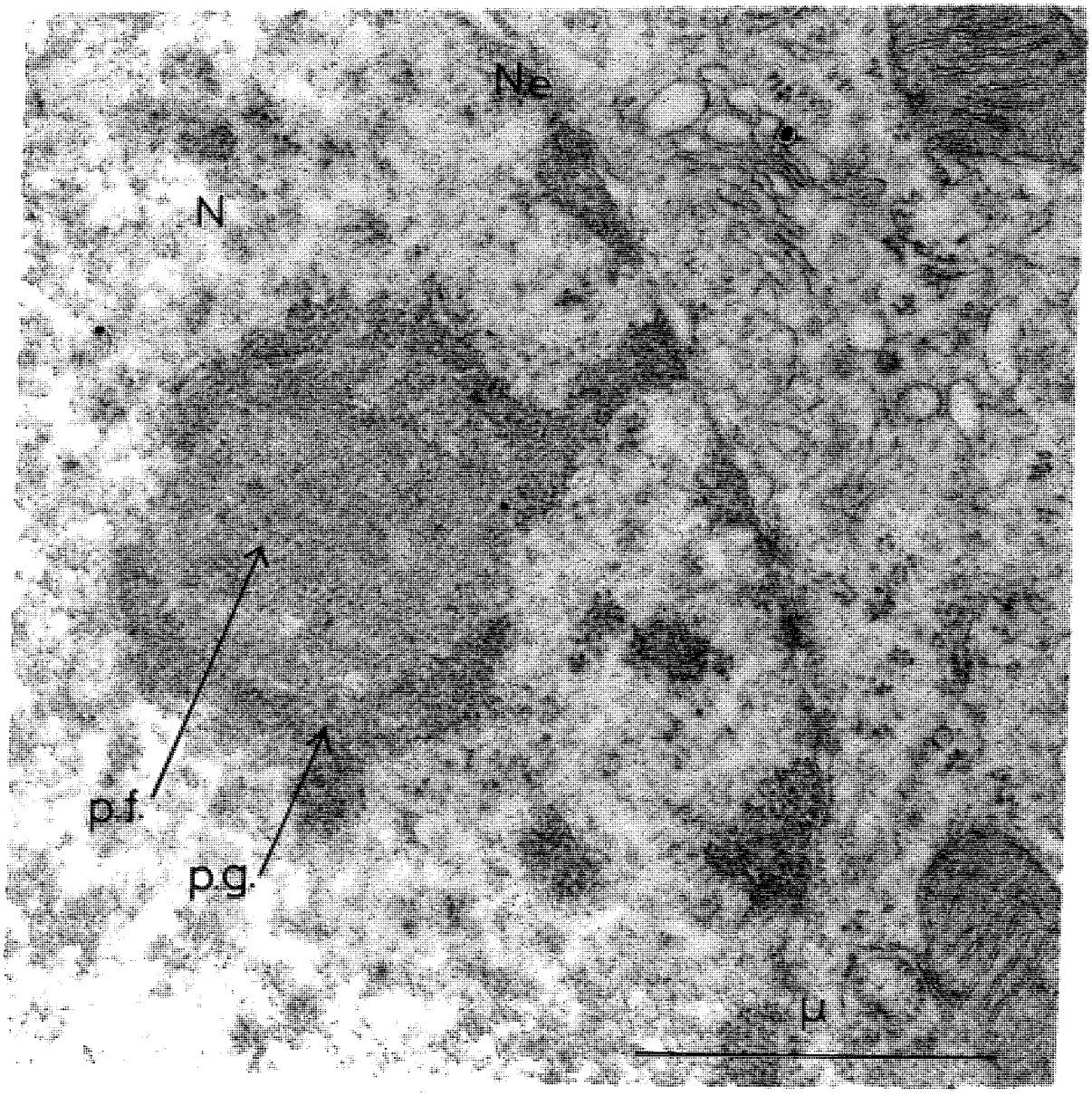
Nucleolar Category 3.

A distinct mass of pars fibrosa and pars granulosa occur adjacent to each other. The pars fibrosa is not completely surrounded by granulosa material. The pars fibrosa appears as a homogeneous mass of fibrils not organised into a nucleolonema. The two components of the nucleolus are separated by a narrow zone of low electron density. The central mass of the pars granulosa is so densely packed as to appear homogeneous.

Mouse kidney fixed in glutaraldehyde and osmium.

Plate 31.

951/69



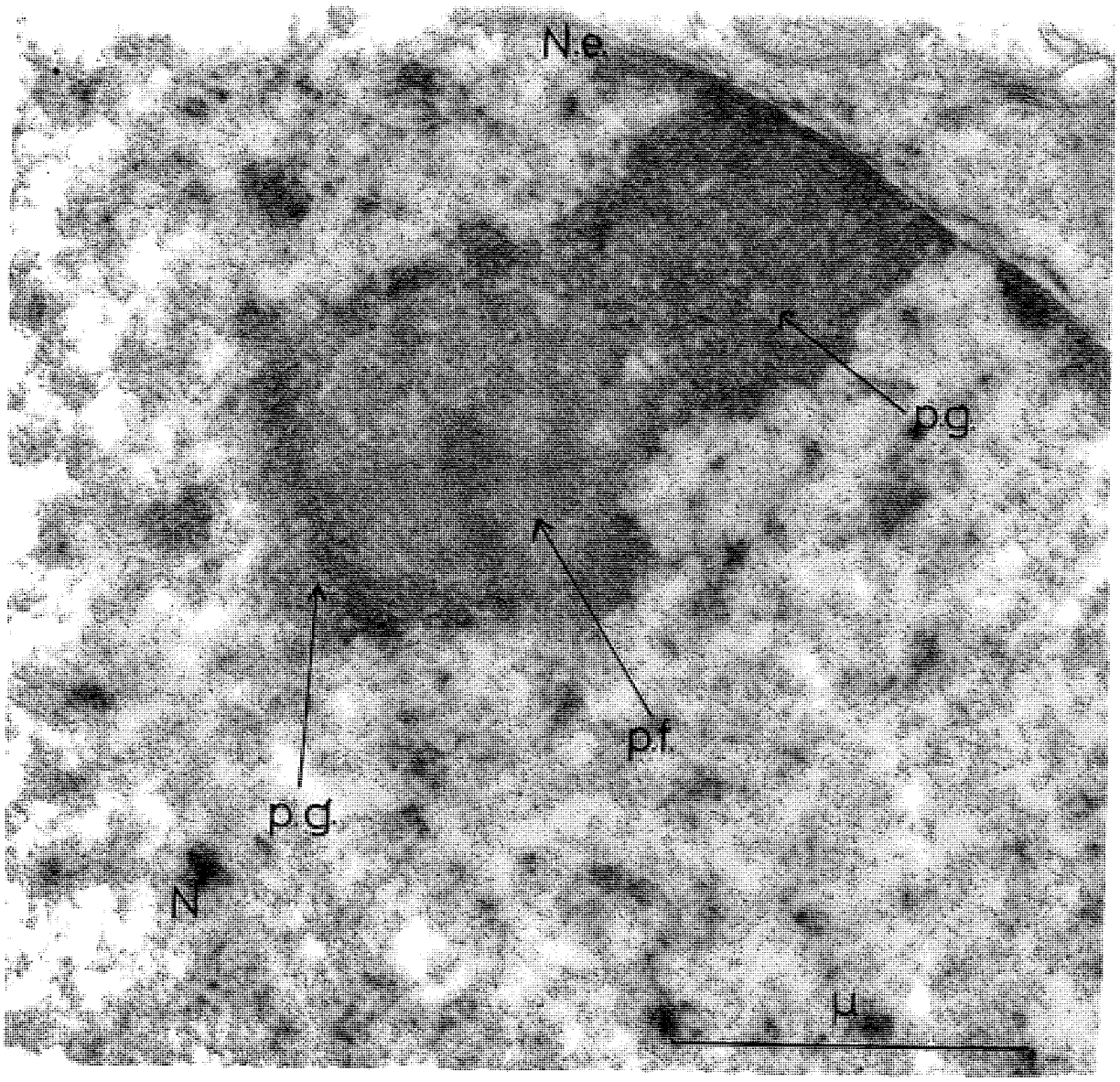
Nucleolar Category 4.

A distinct pars fibrosa is surrounded by a diffused mass of pars granulosa material which is not organised into a distinct mass. In this Plate the two zones are distinctly separated by an incomplete zone of lower electron density.

Mouse kidney fixed in glutaraldehyde and osmium.

Plate 32.

954/69



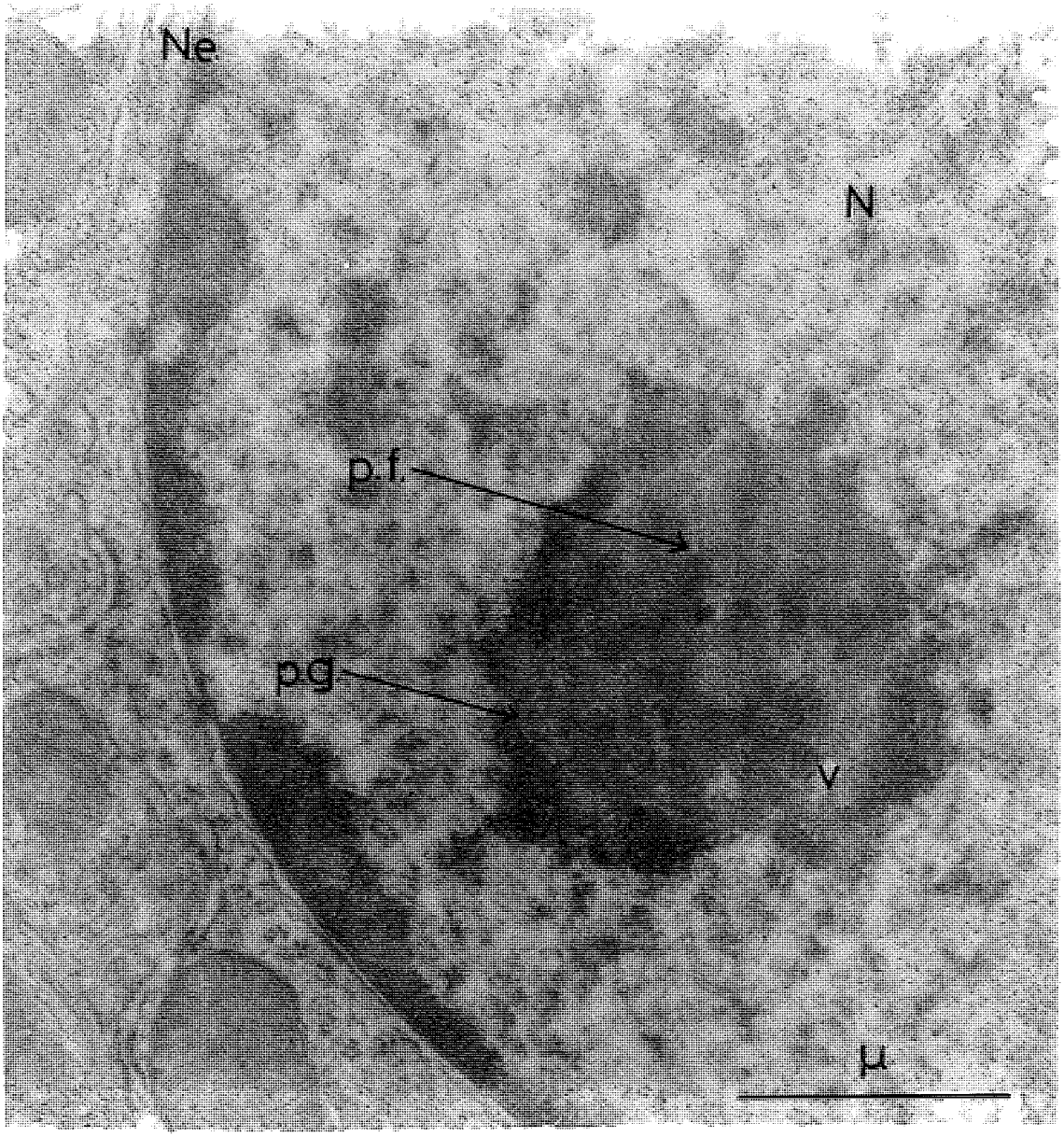
Nucleolar Category 5.

A well developed pars fibrosa is embedded in one side of a descrete mass of pars granulosa. The nucleolus is surrounded by a zone of diffused particles termed 'halo particles'.

Mouse kidney fixed in glutaraldehyde and osmium.

Plate 33.

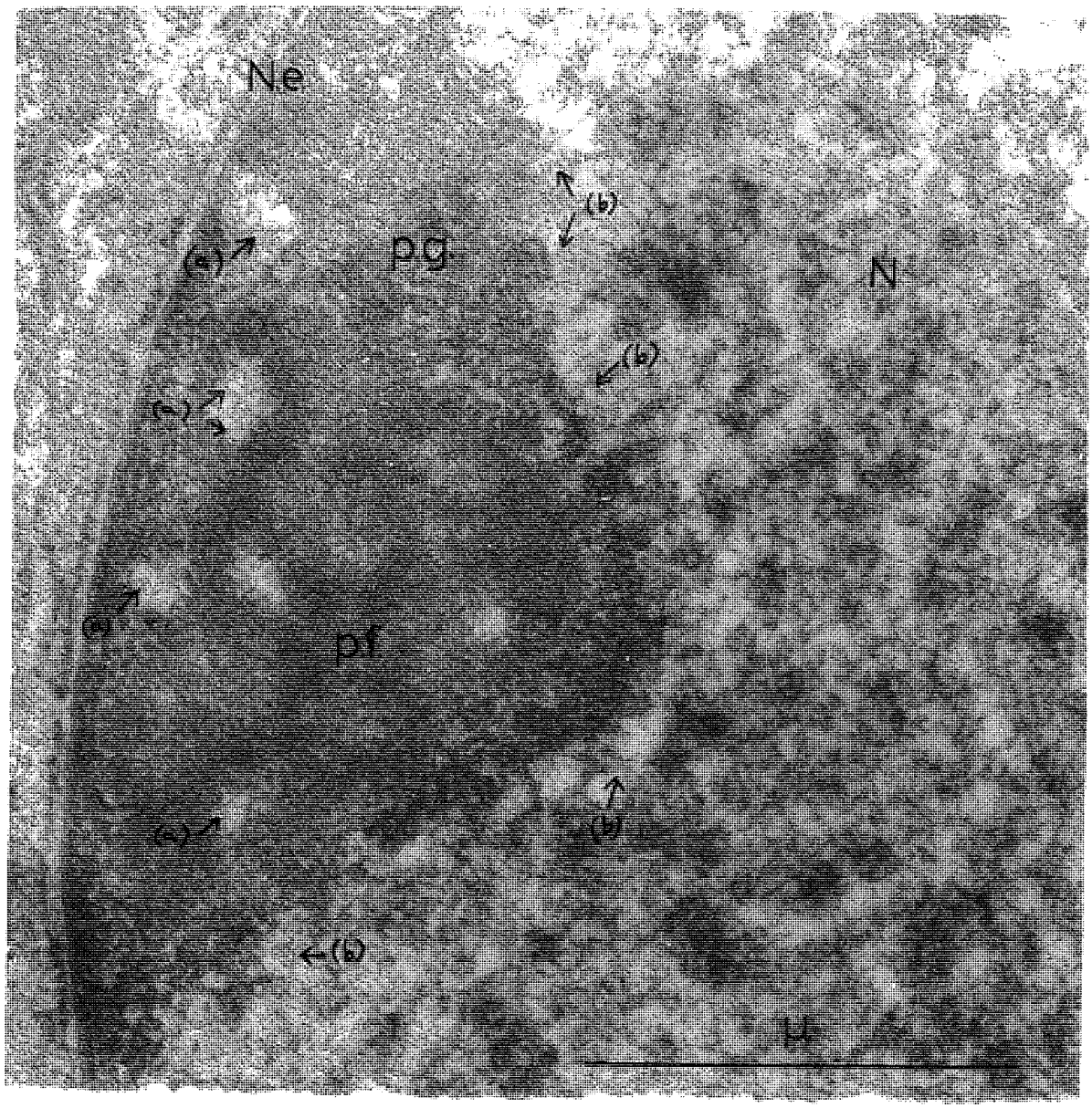
966/69



Nucleolar Category 6.

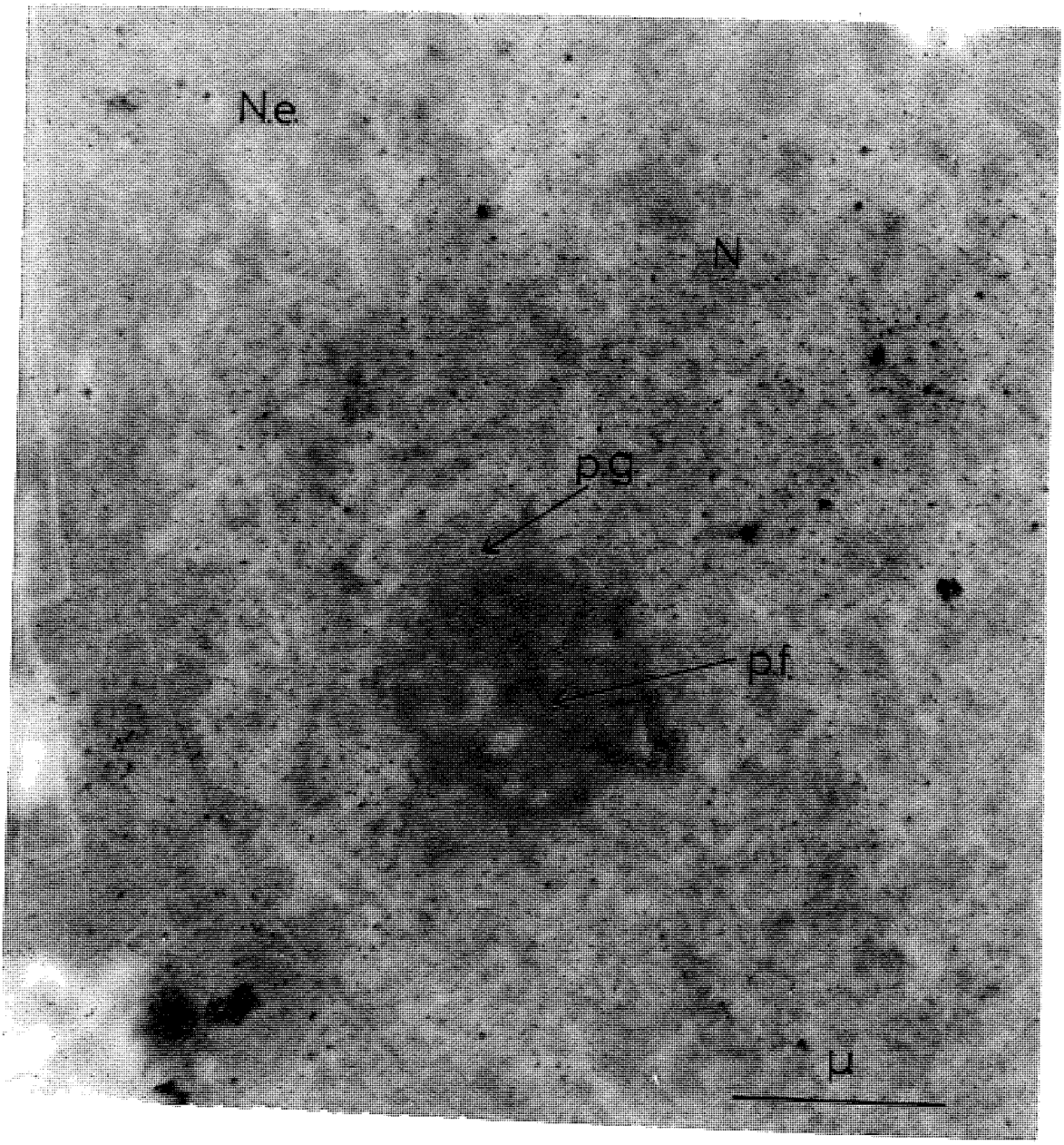
The nucleolus is present as a distinct body within which it is possible to distinguish elements of both the pars fibrosa and the pars granulosa, although these are not clearly separated into two distinct bodies. Here, the organisation of the pars fibrosa into a poorly defined nucleolonema is visible. The vacuoles of the nucleolonema are filled with an electron dense material.

Mouse kidney fixed in glutaraldehyde and osmium.



A section of a nucleus from a liver cell of a normal mouse, fixed in glutaraldehyde and osmium.

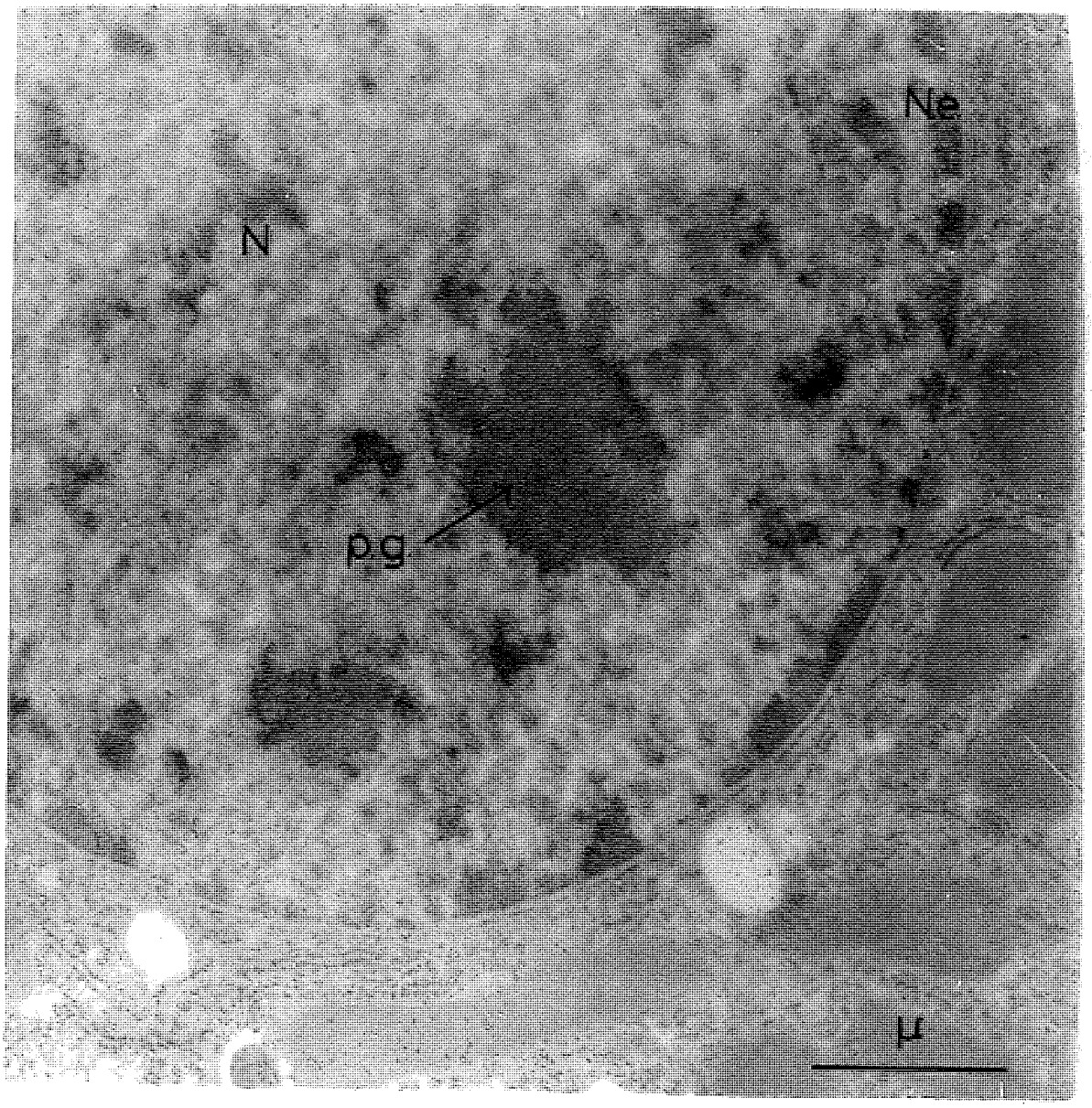
The nucleolus resembles one of Category 6. where the pars fibrosa and the pars granulosa appear to merge. The underlying network of fine fibrils can be distinguished both within the vacuoles of the pars fibrosa (arrows a) and associated with the granules around the margins of the pars granulosa (arrows b).



Nucleolar Category 1.

Mouse liver fixed in acrolein and stained with silver nitrate.

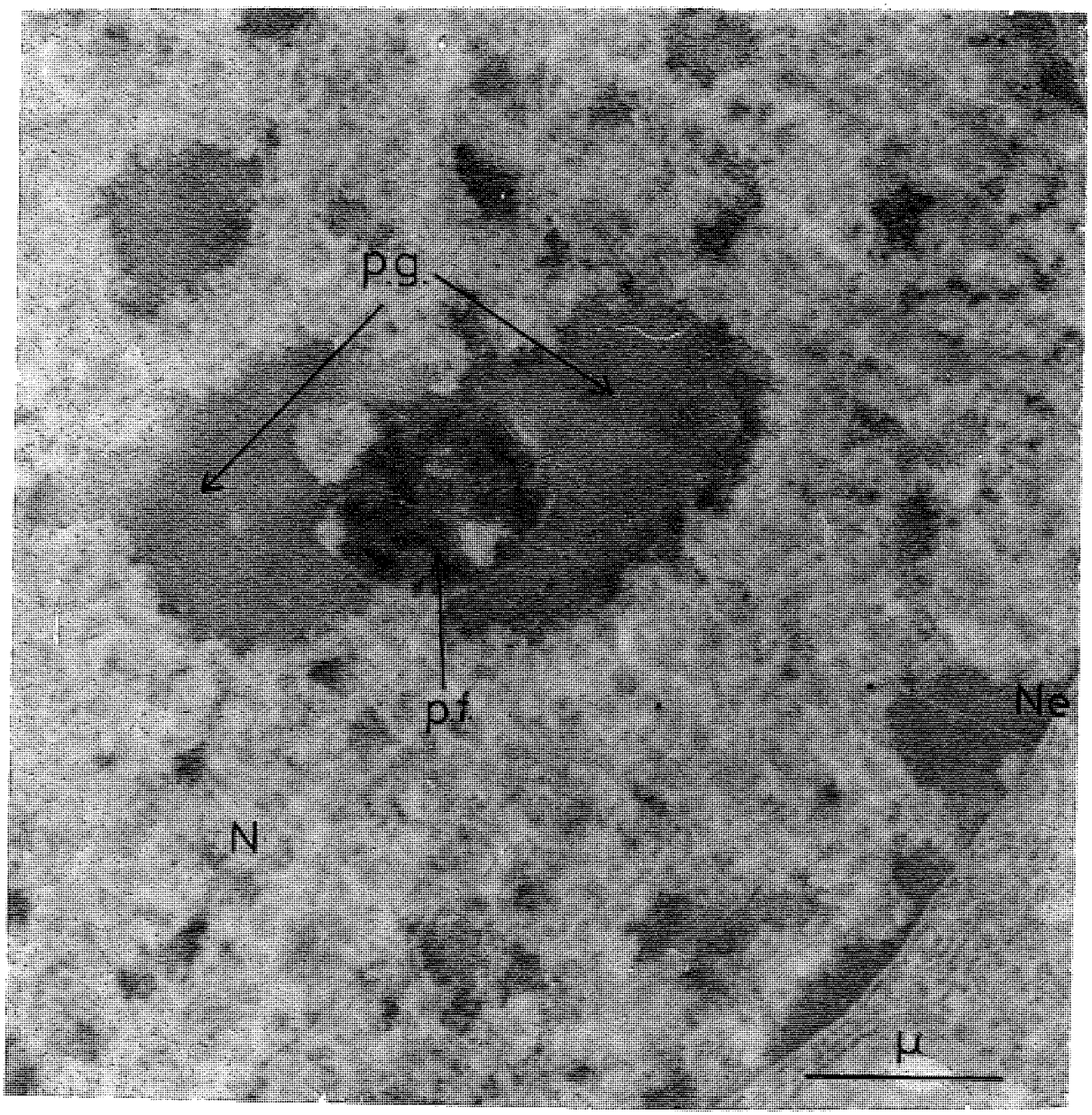
A well developed pars fibrosa, is almost devoid of granulosa material. The parsfibrosa is organised into an indistinct nucleolonema, with numerous poorly defined vacuoles.



Nucleolar Category 2.

Mouse liver fixed in acrolein and stained with silver nitrate.

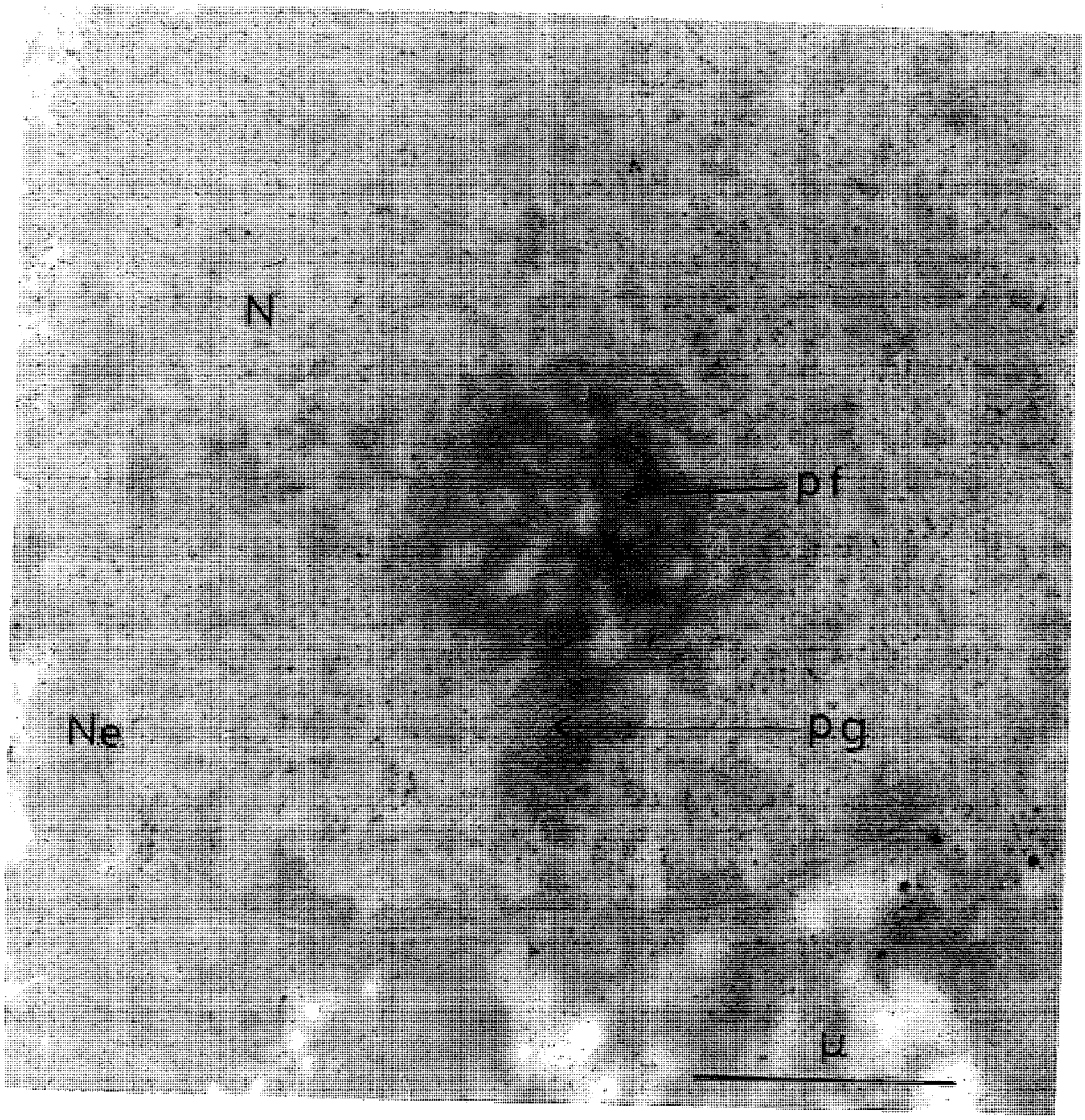
A descrete mass of pars granulosa not associated with any distinguishable pars fibrosa. The pars granulosa is of lower electron density than the nucleolus associated chromatin.



Nucleolar Category 3.

Mouse liver fixed in acrolein and stained with silver nitrate.

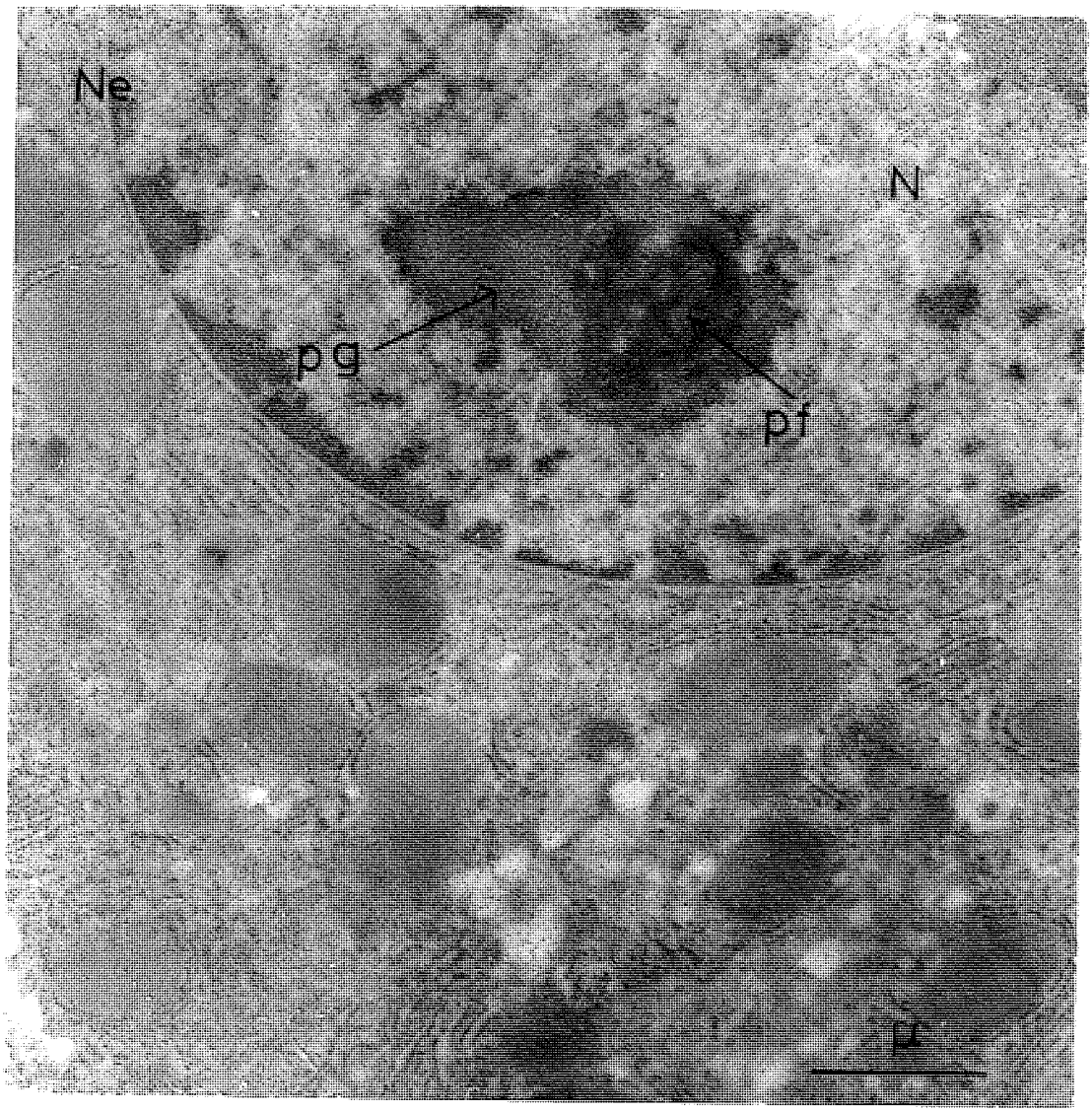
The pars fibrosa and pars granulosa are present as distinct bodies separated by a narrow zone of lower electron density. The pars granulosa is of lower electron density than the nucleolus associated chromatin.



Nucleolar Category 4.

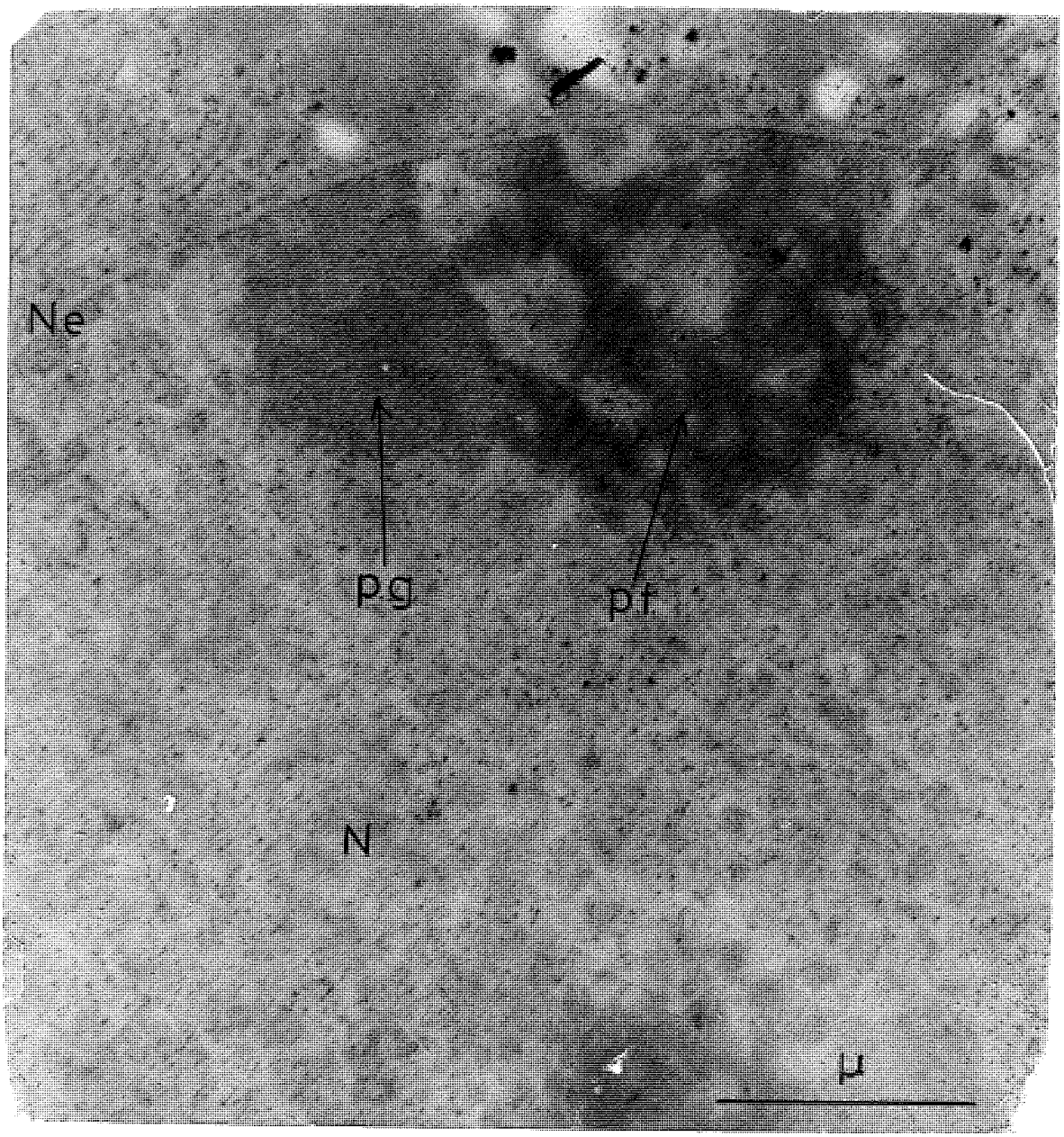
Mouse liver fixed in acrolein and stained with silver nitrate.

A descrete mass of pars fibrosa material is surrounded by pars granulosa material. The existence of light and dark vacuoles within the nucleolonema is clear.



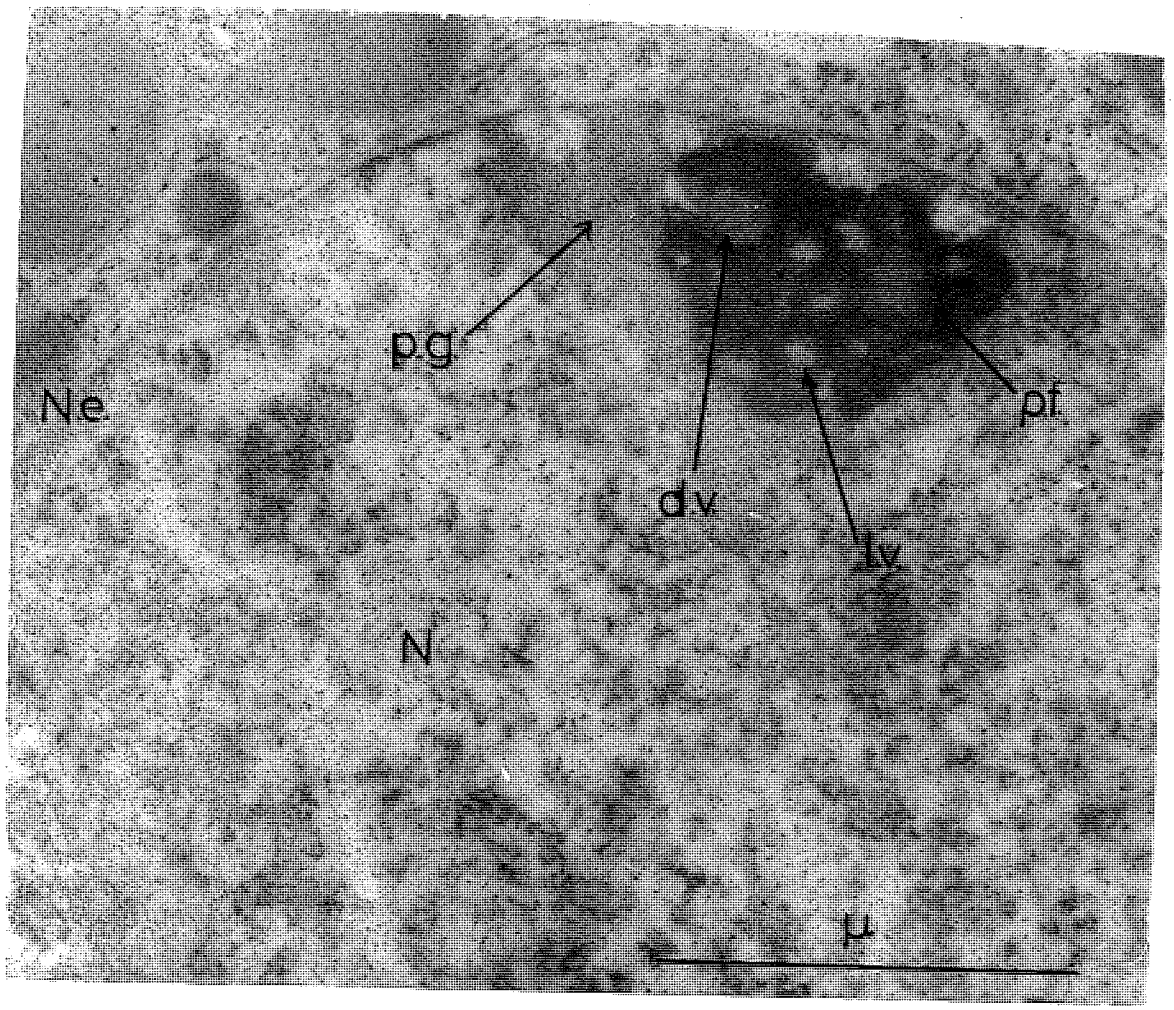
Nucleolar Category 5.

Mouse liver fixed in acrolein and stained with silver nitrate. A distinct mass of pars fibrosa is embedded in a mass of pars granulosa. There is a clear distinction between the pars granulosa and the nucleolus associated chromatin.

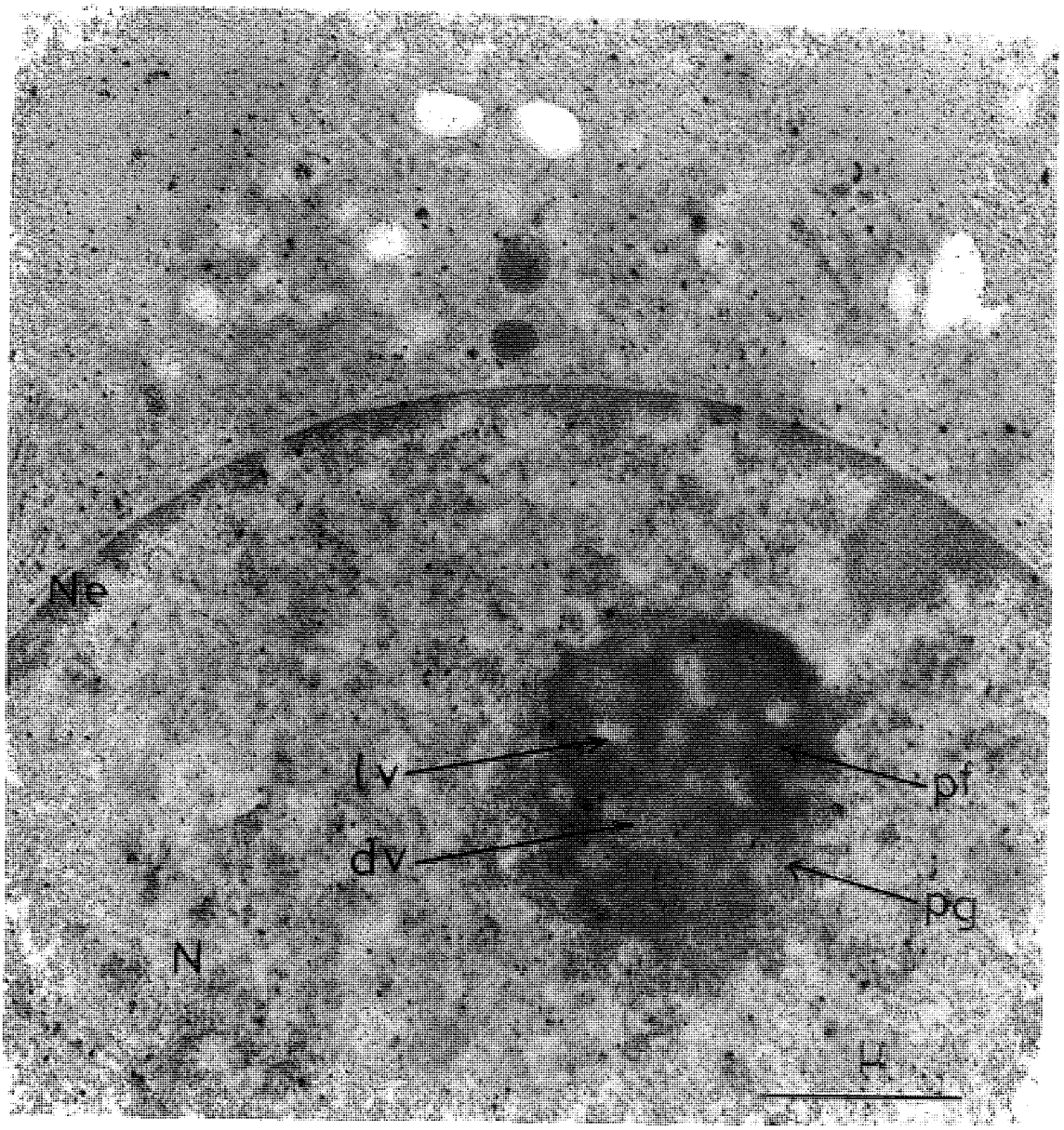


Nucleolar Category 6.

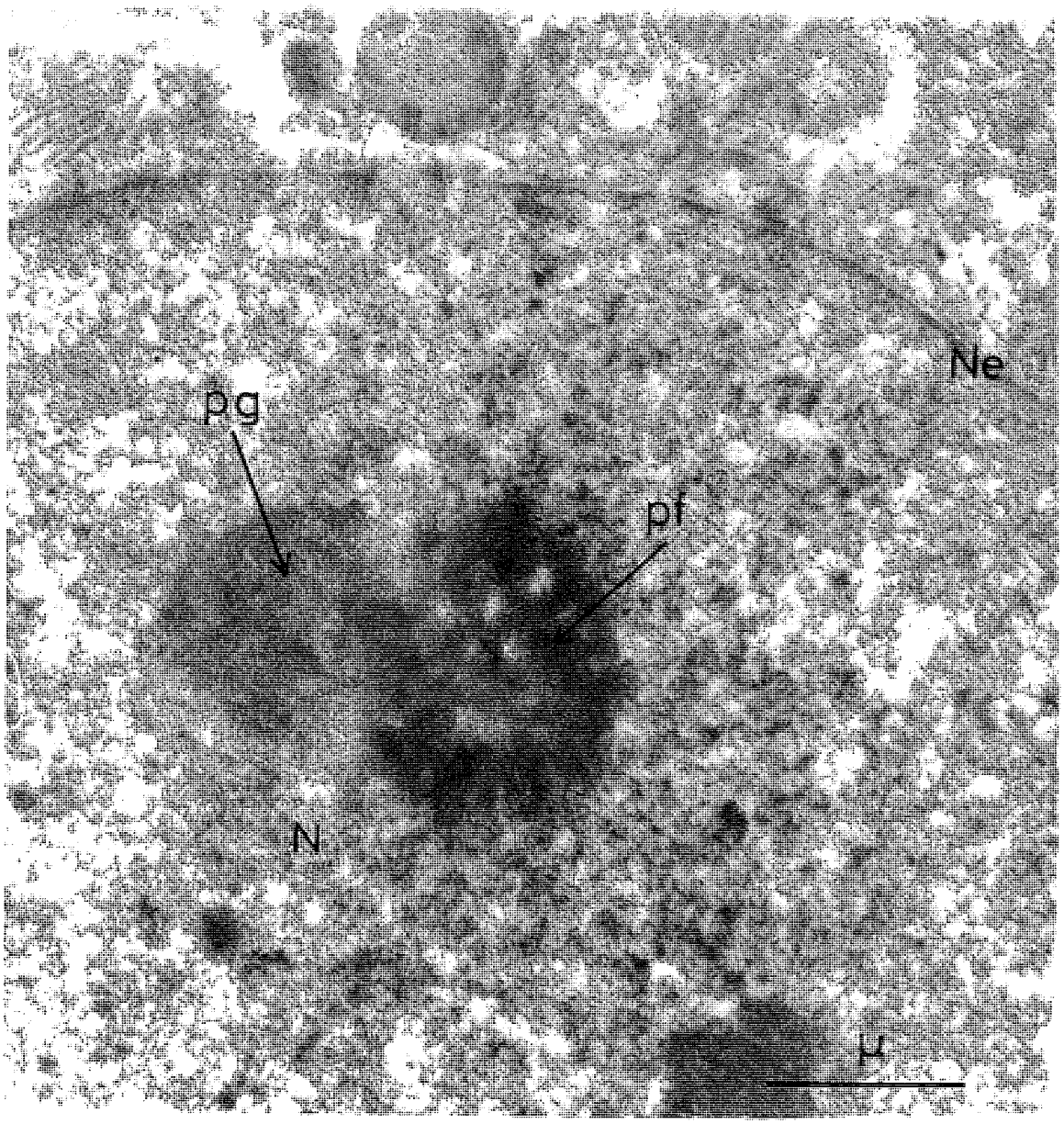
Mouse liver fixed in acrolein and stained with silver nitrate. Elements of both pars fibrosa and pars granulosa are present in the nucleolus but are not readily distinguishable as separate bodies. The pars fibrosa is obviously vacuolated, with four very large light vacuoles and numerous smaller vacuoles, both light and dark.



Mouse kidney fixed in acrolein and stained with silver nitrate.
A section of a nucleus showing a well developed nucleolus separated into a distinct pars fibrosa and pars granulosa. The pars fibrosa is organised into a nucleolonema within which can be distinguished both light and dark vacuoles. The dark vacuoles contain material resembling the pars granulosa.

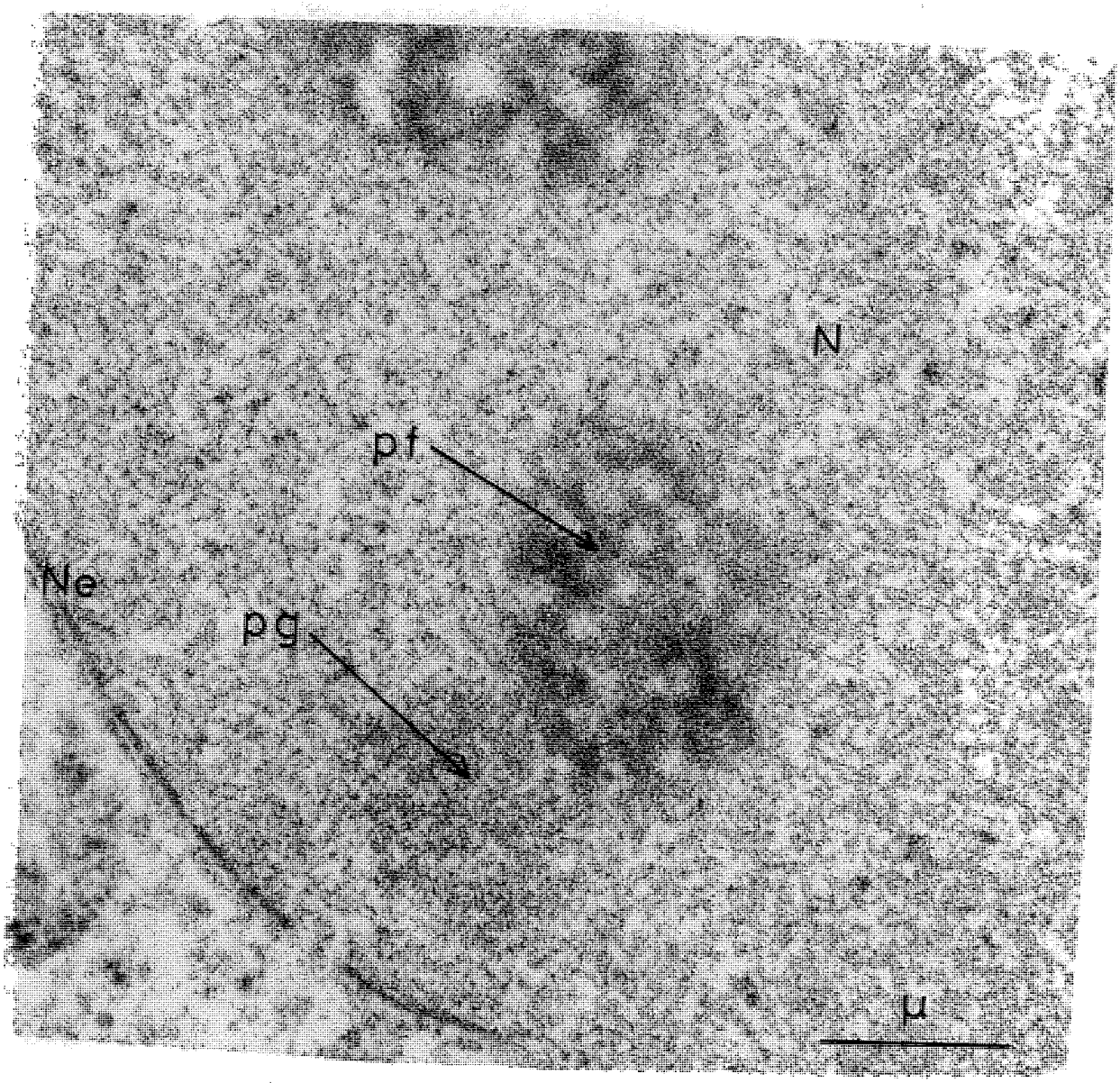


Mouse liver fixed in acrolein and stained with silver nitrate, A section of a nucleus showing a nucleolus within which elements of pars granulosa and pars fibrosa are closely intermingled. The dark vacuoles can be seen to be ramifications of the nucleus containing granulosa material.

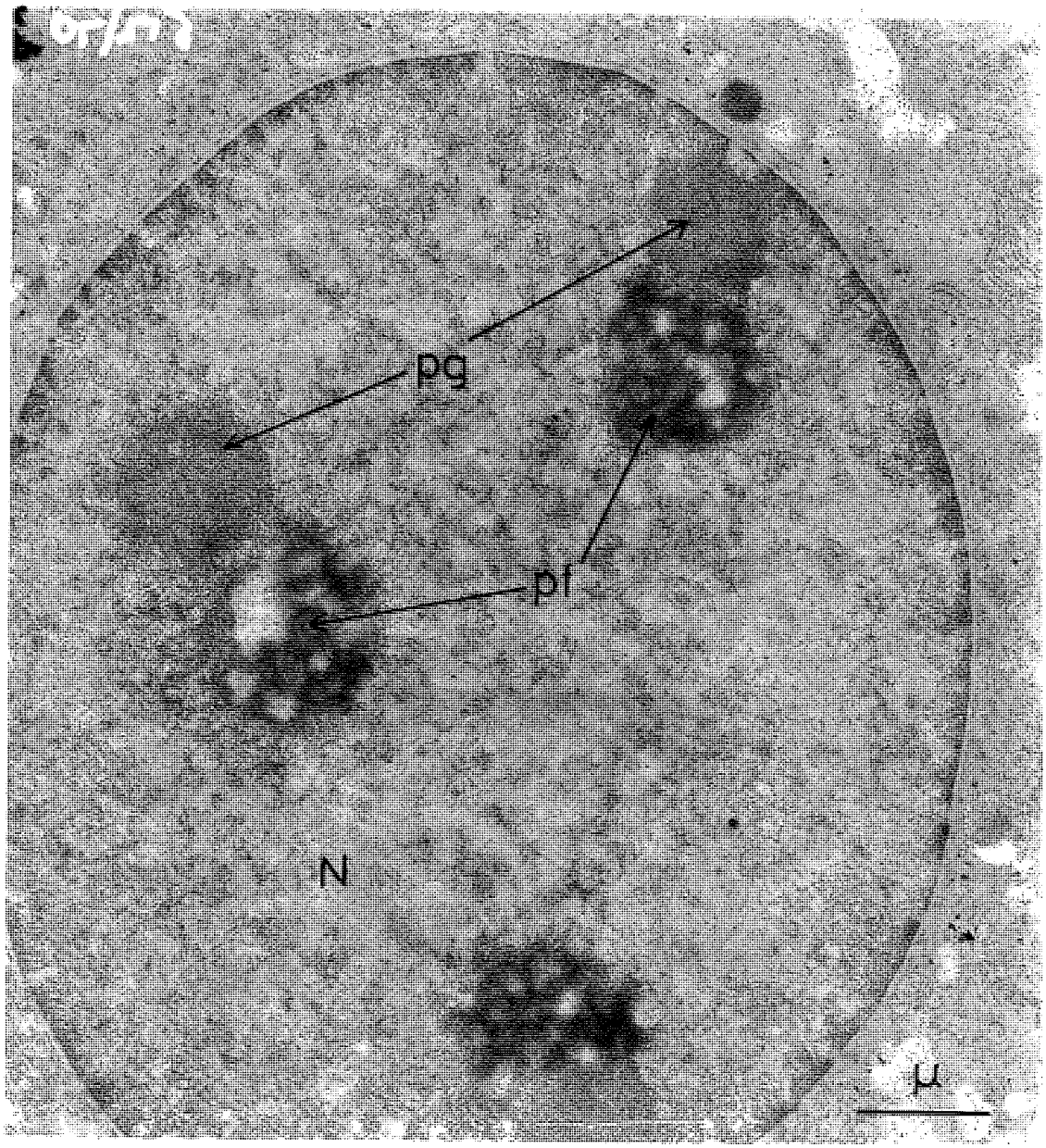


Mouse liver fixed in glutaraldehyde and stored in cold buffer before osmium post fixation and uranium and lead section staining.

The general appearance of nucleoli of cells of tissues stored in cold buffer following glutaraldehyde fixation resembled that shown here. There tended to be a general reduction in contrast and a loss of material from the pars granulosa. Here, the pars fibrosa is organised into a nucleolonema but this is less distinct than after normal preparation, and is not clearly separated from the pars granulosa.



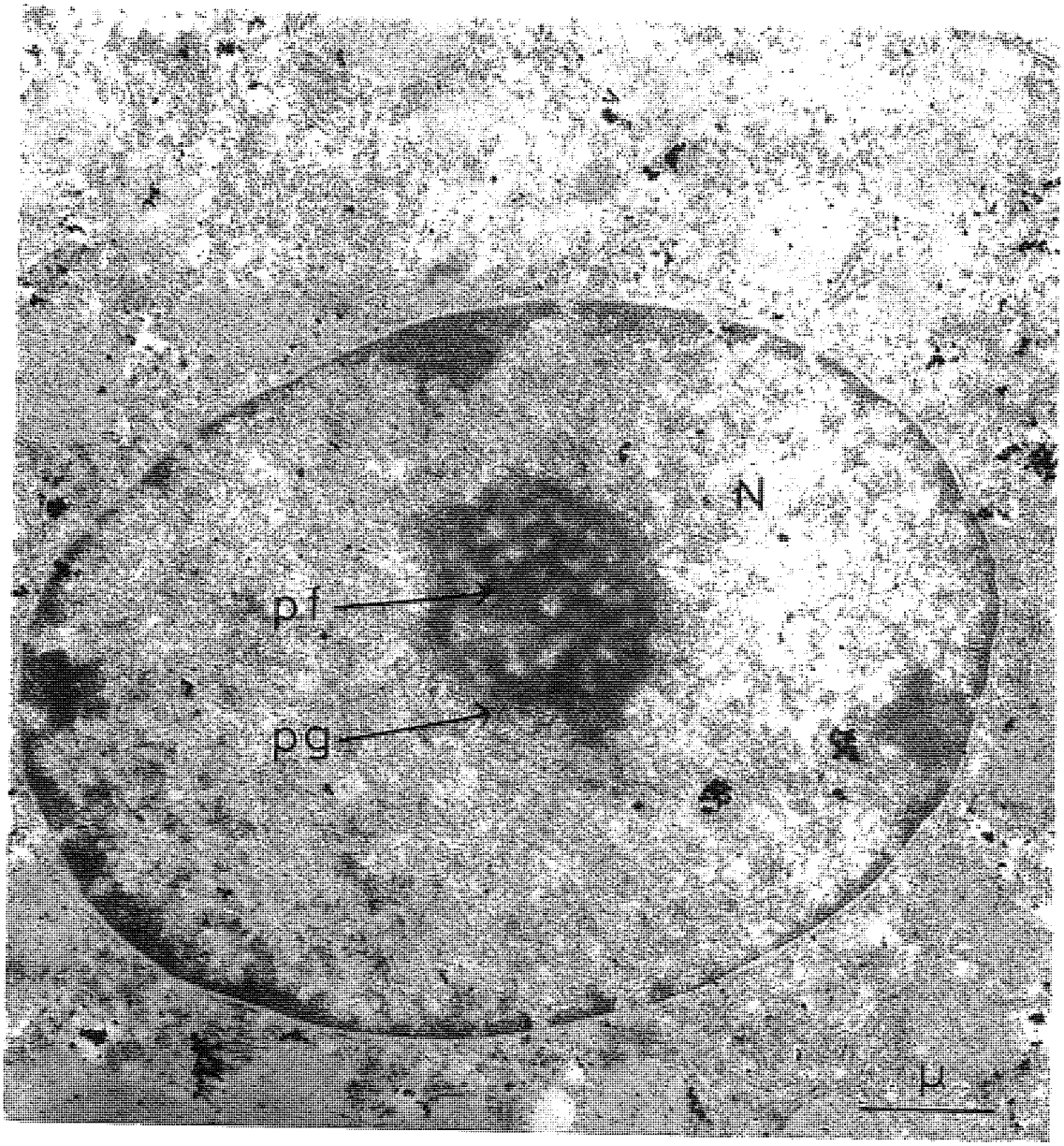
Mouse liver fixed in glutaraldehyde and stored in cold buffer before osmium post fixation and section staining with uranium and lead.
Animal treated with thyroxine.
There is a massive reduction in the contrast and the amount of material associated with both the pars fibrosa and the pars granulosa. The granular nature of much of the nucleolar material is obvious, but the components of the pars fibrosa also appear to be granular as a result of the preparation proceedure.



Mouse liver fixed in acrolein before storage in cold buffer and section staining with silver nitrate.

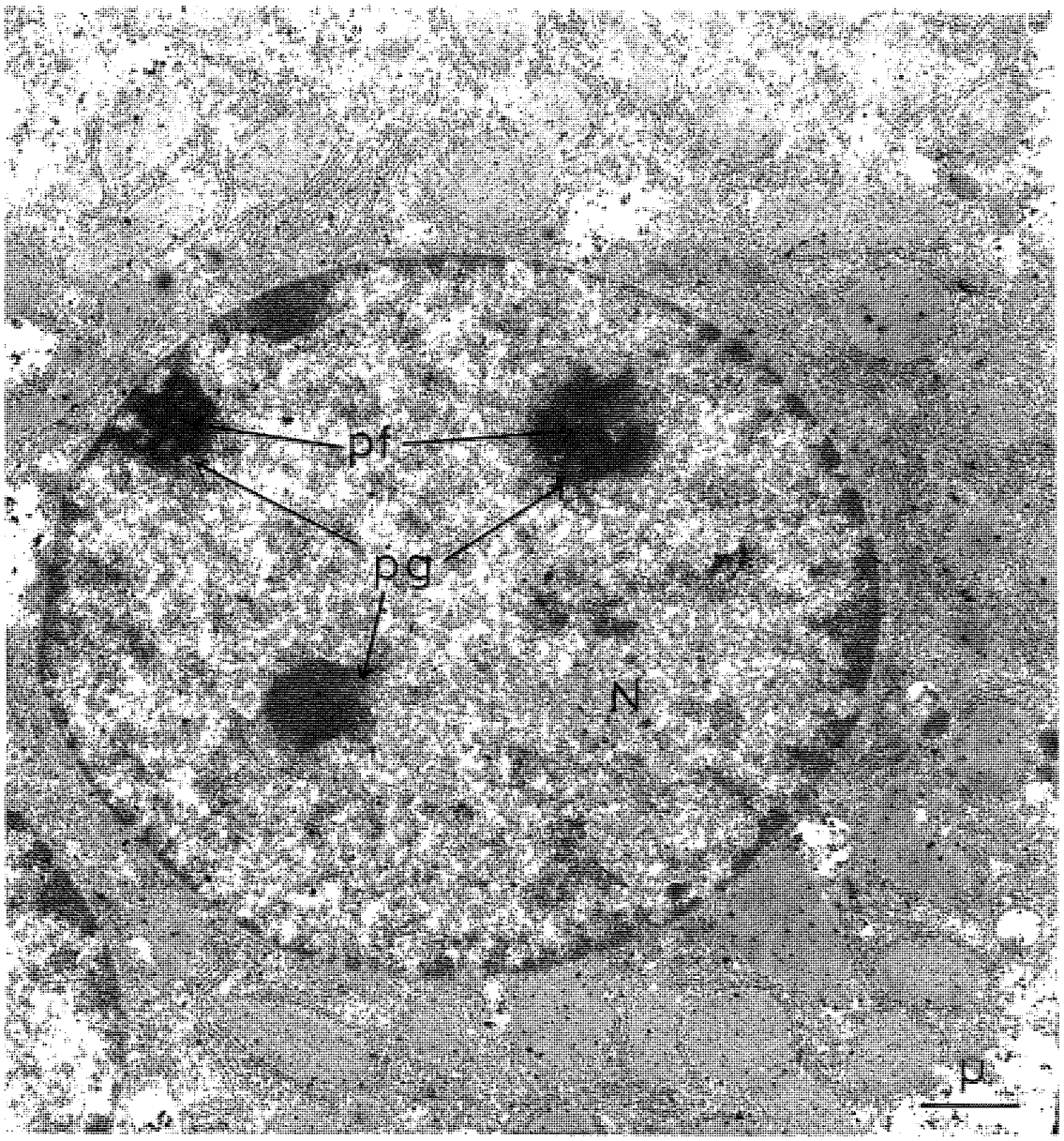
Thyroidectomised animal.

There is an obvious reduction in the contrast of the pars fibrosa and in the amount and density of silver deposits associated with the pars granulosa.



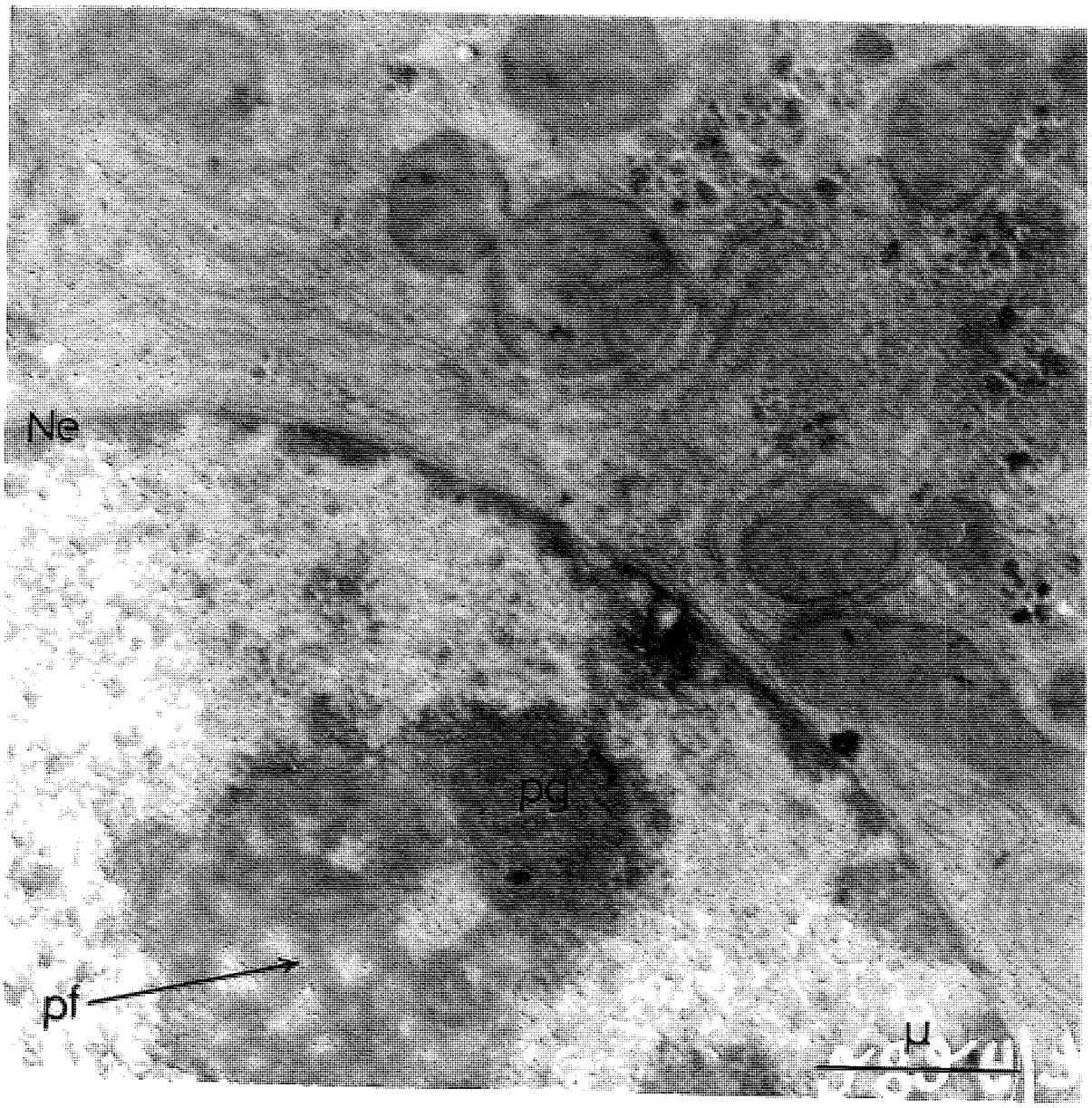
Mouse liver fixed in acrolein and stored in cold buffer before section staining with silver nitrate.

There is a reduction in the contrast of the pars fibrosa and a reduction in the amount of material with associated silver deposits in the pars granulosa.



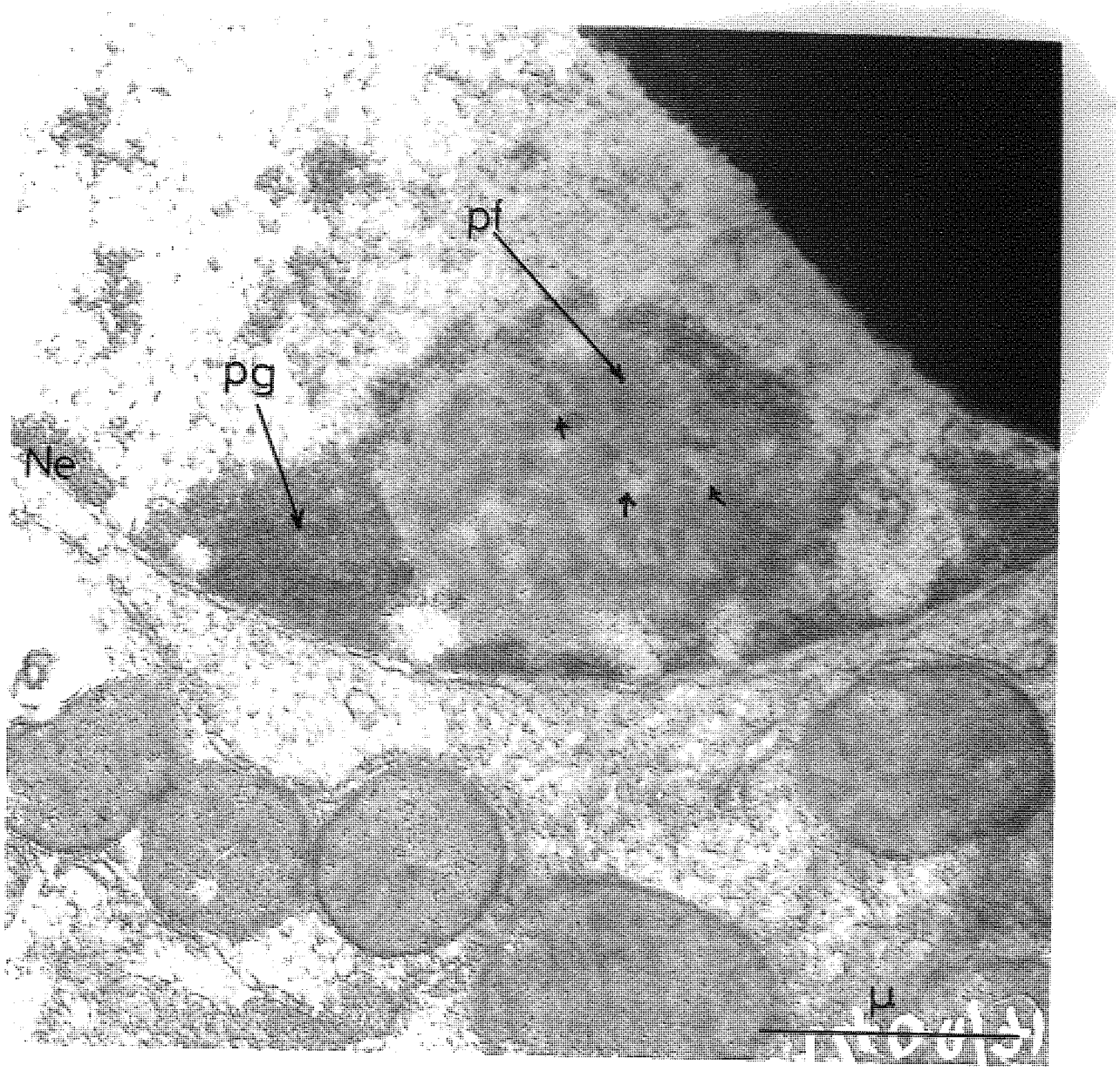
Mouse liver fixed in acrolein and stored in cold buffer before section staining with silver nitrate.

Again the massive reduction in the density of silver deposits associated with the pars granulosa is obvious although the reduction in the contrast of the pars fibrosa is not as marked.



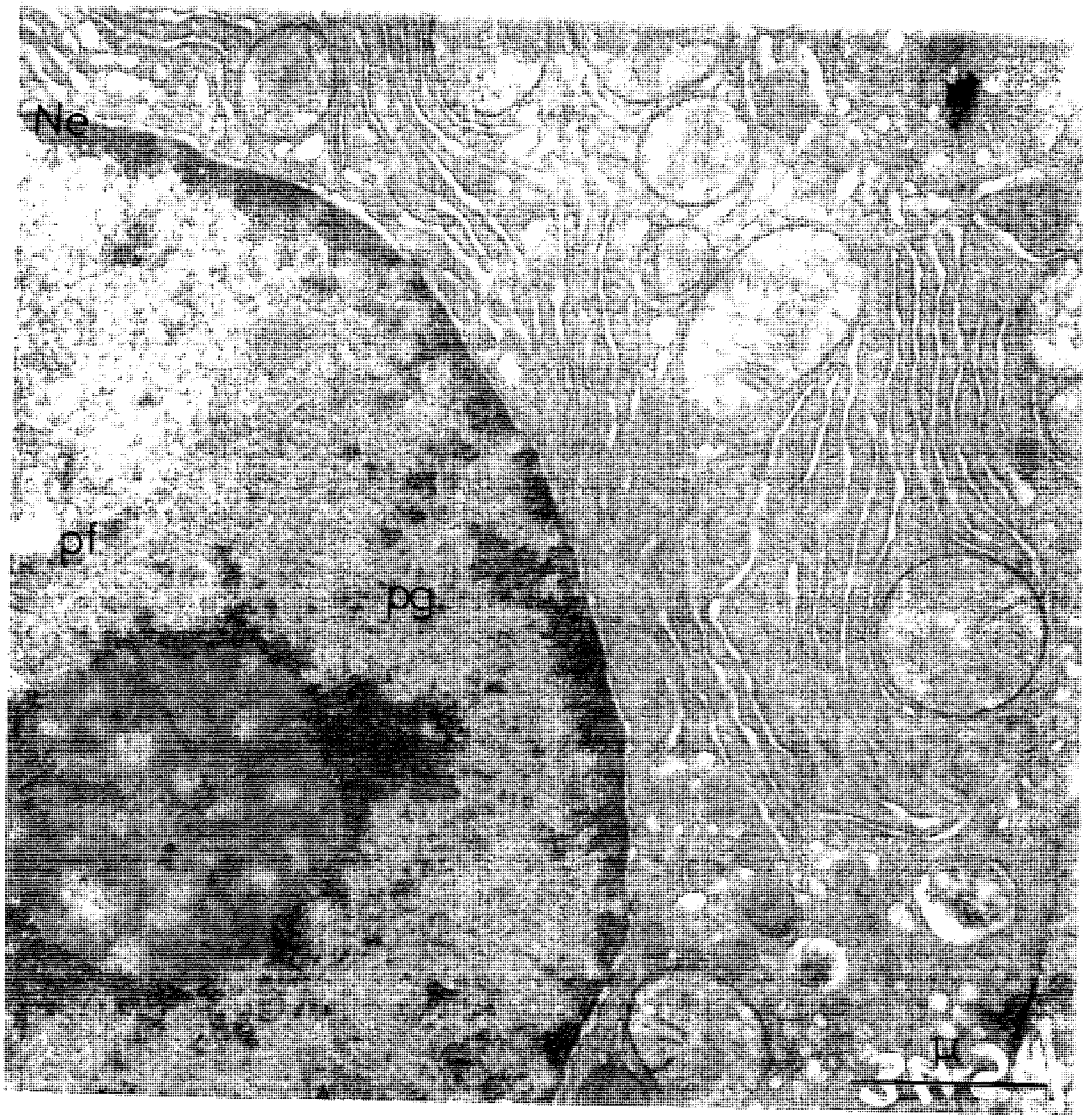
Mouse liver digested with ribonuclease.

There is a distinct reduction in the contrast of the pars fibrosa. Athough this was organised into a well developed nucleolonema the presence of dark vacuoles was unusual, most vacuoles were light.



Mouse kidney digested with ribonuclease.

There is an obvious reduction in the contrast of the pars fibrosa, although the pars granulosa was relatively unaffected. The presence of granulosa material within the ramifications of the pars fibrosa is obvious (arrows), although this material appears to be unaffected by the ribonuclease digestion.

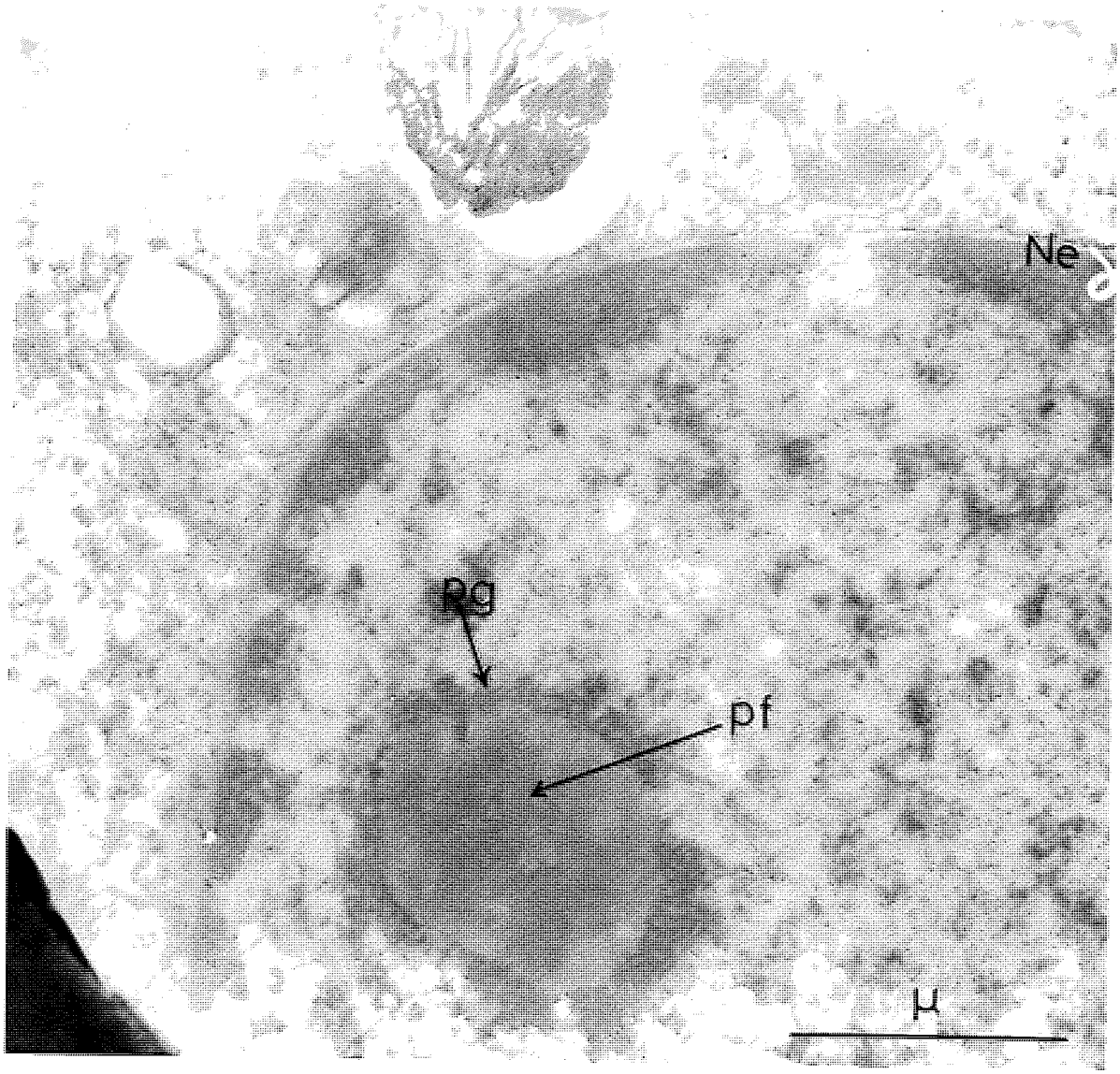


Mouse liver digested with pepsin.

Nucleoli resembled those of material prepared with routine glutaraldehyde fixation followed by osmium, although there was a loss of structure of most of the granular components of the pars granulosa.

Plate 51.

207A/71



Mouse kidney digested with pepsin.

Again there was little difference in nucleolar morphology compared to those of routinely prepared material, although there was a loss of structure of the components of the pars granulosa.

Plates 52 - 66

Nuclear Morphology

Key

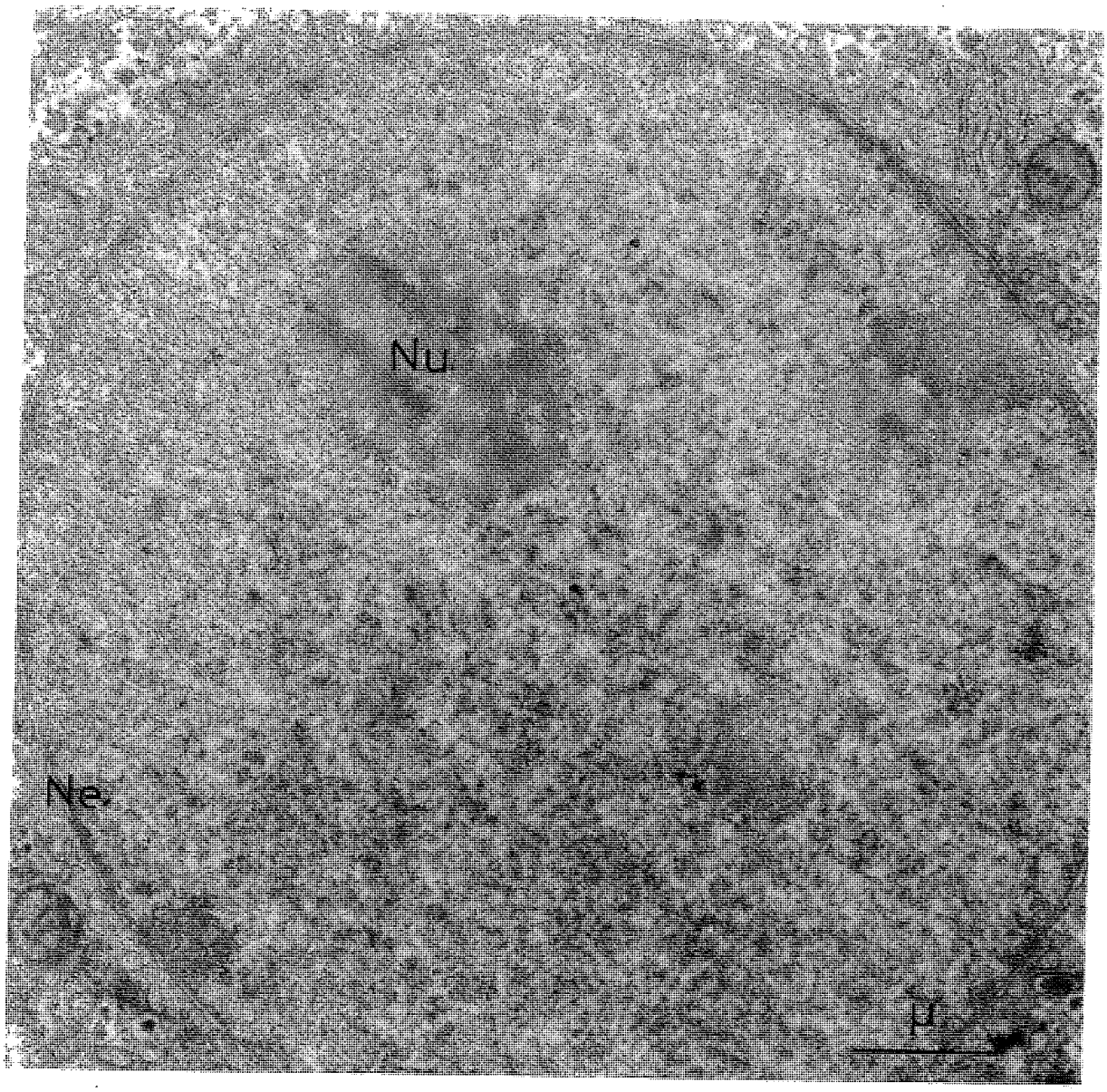
N	–	Nucleus
Nu	–	Nucleolus
Ne	–	Nuclear envelope

Classification of nuclei into categories.

Plates 52 - 56 The appearance of the five type categories after routine fixation with glutaraldehyde and osmium.

Plate 52.

781/69



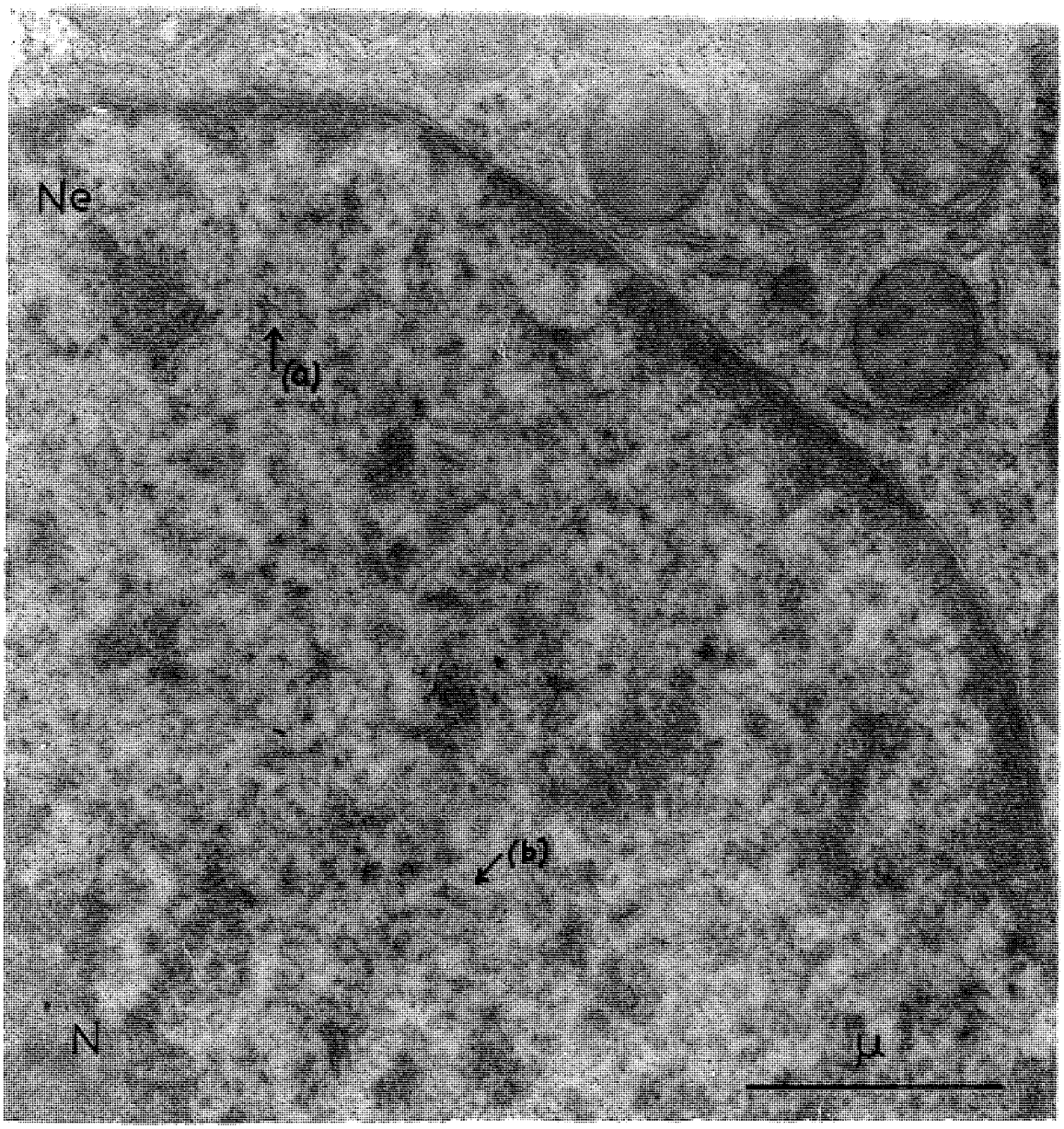
Nuclear Category 1.

Mouse liver fixed in glutaraldehyde and osmium.

There is little or no dark staining material present, that that is present is fairly evenly distributed thoughout the nucleoplasm.

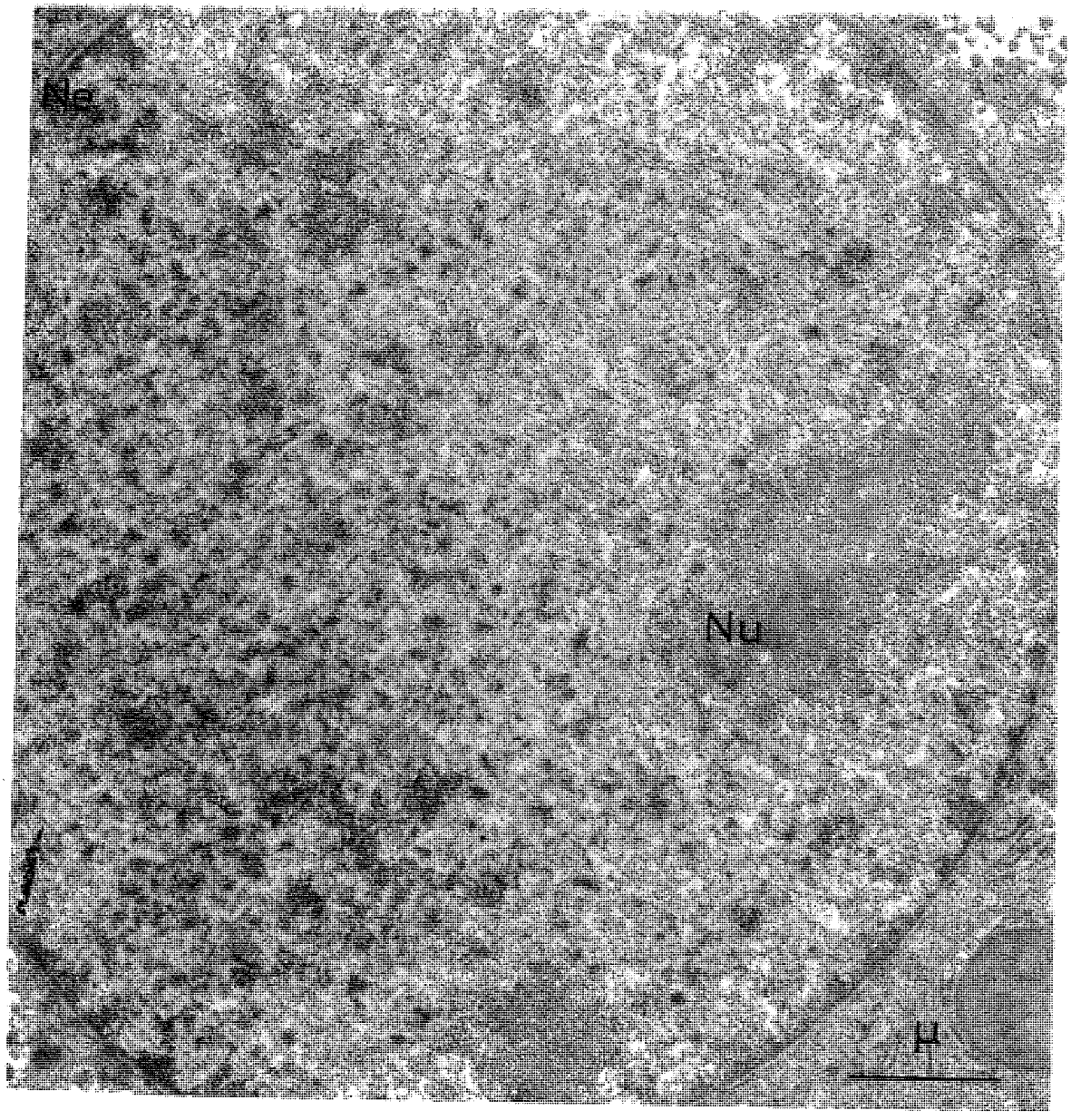
Plate 53.

963/69



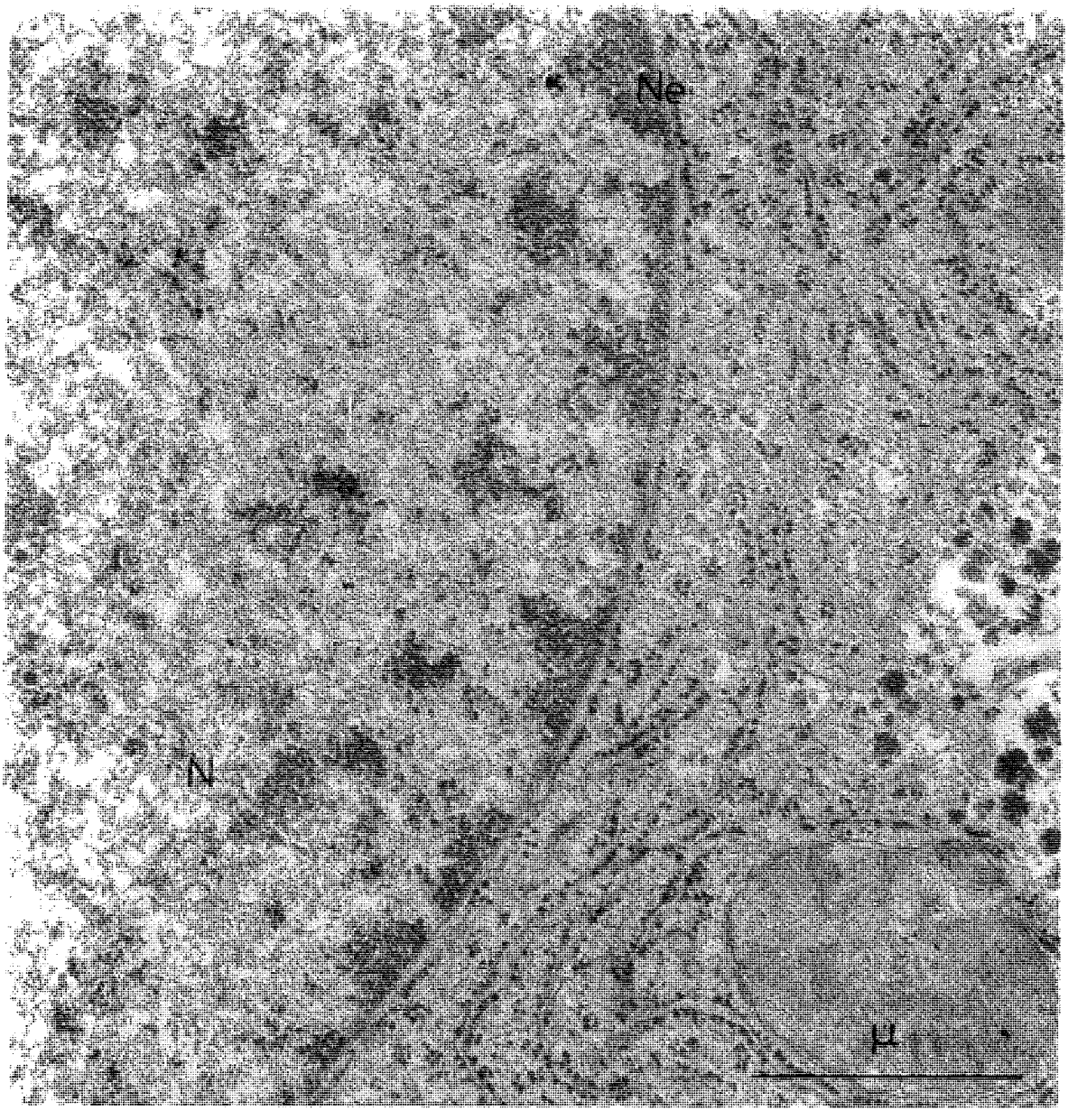
Nuclear Category 2.

There is an increased amount of dark staining material present as a sub-peripheral zone, there are few deposits within the massoof the nucleoplasm. An underlying network of fine fibrilsscan be distinguished which is occasionally aggregated into 'nodules' (arrows b.) Courser fibrils can also be discerned in places, associated with granular material (arrows a.)



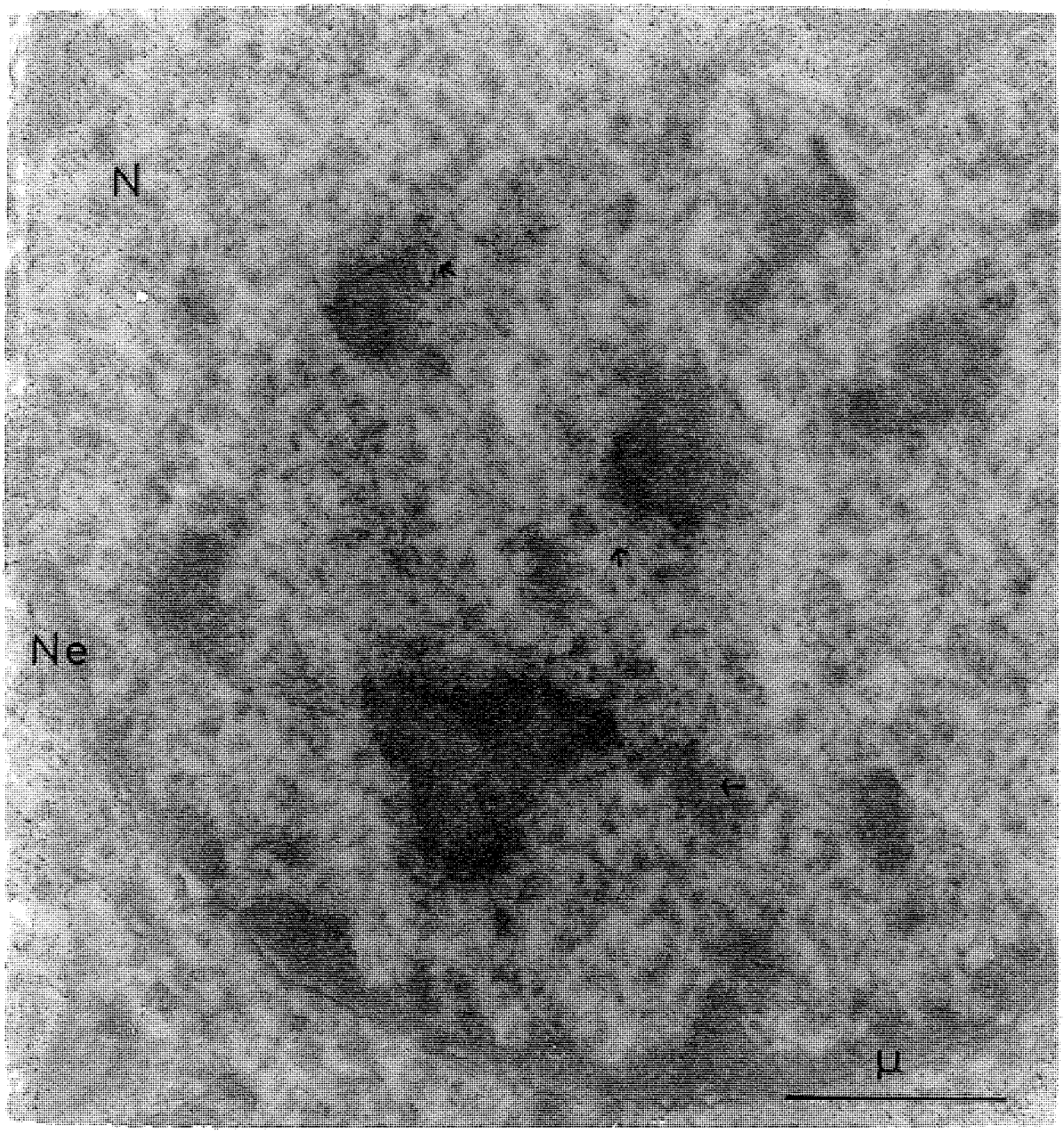
Nuclear Category 3.

Nuclear dark staining material is aggregated into small, loosely arranged groups of granules.



Nuclear Category 4.

Nuclear dark staining material is aggregated into small, but densely packed groups of granules.

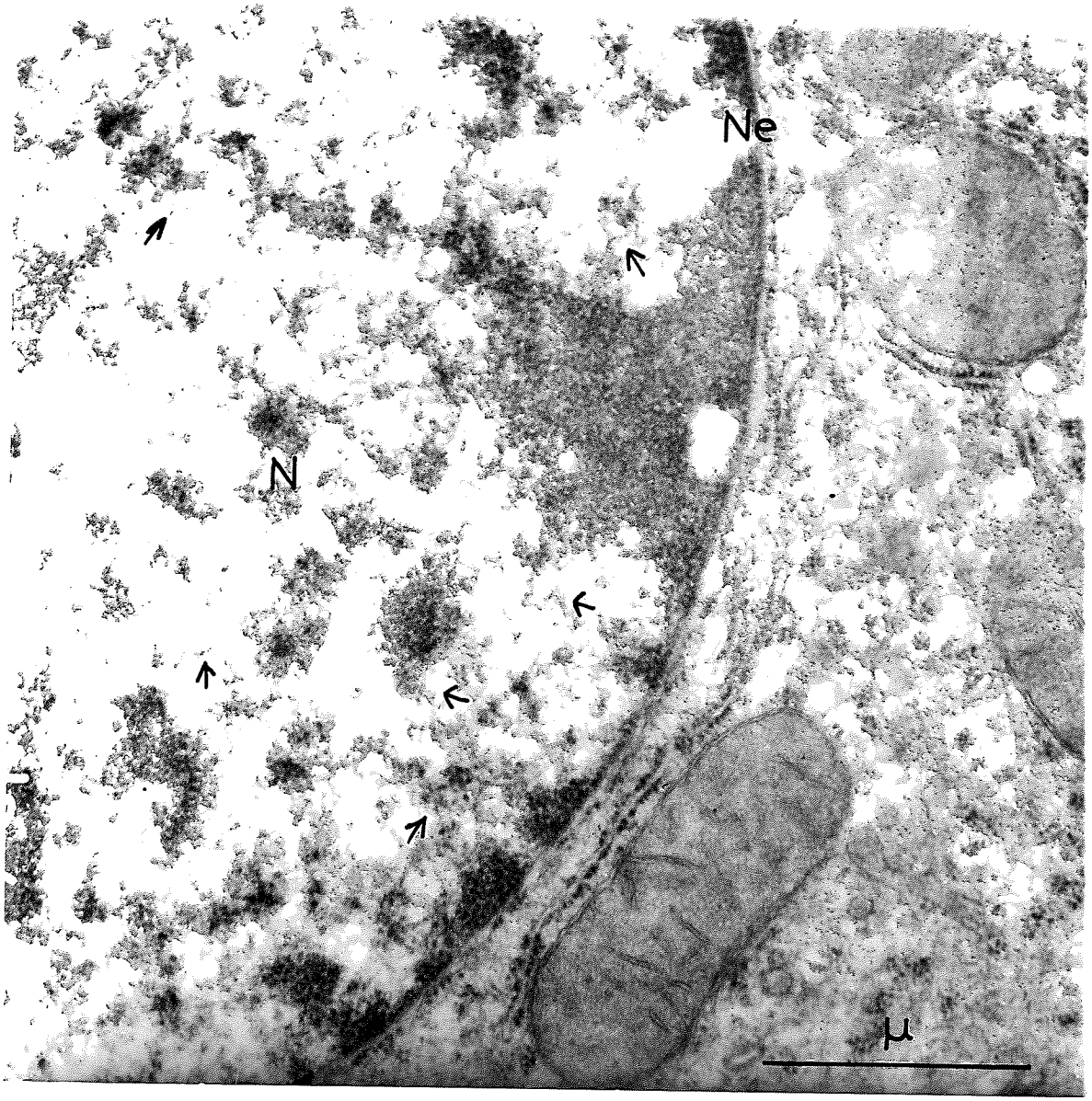


Nuclear Category 5.

Ther are extensive aggregations of dark staining material. The underlying fine fibrillar network is clearly visible. Fragments of courser fibrils can also be distinguished associated with the granular material (arrows).

Plate 57.

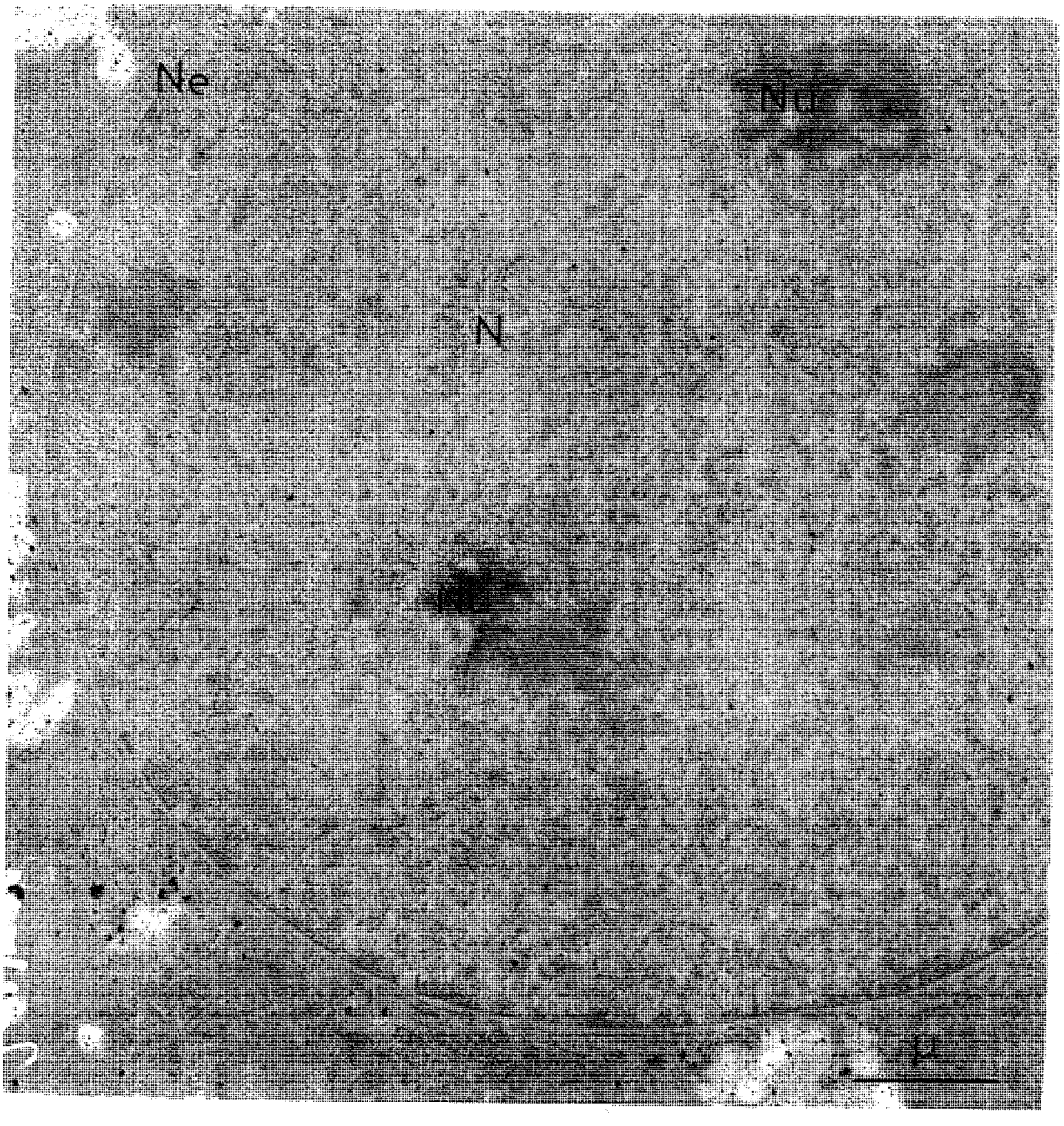
933/69



Mouse liver from a normal animal fixed in glutæraldehyde and osmium. The relationship of the fine fibrillar network to aggregations of granules can be seen clearly (arrows).

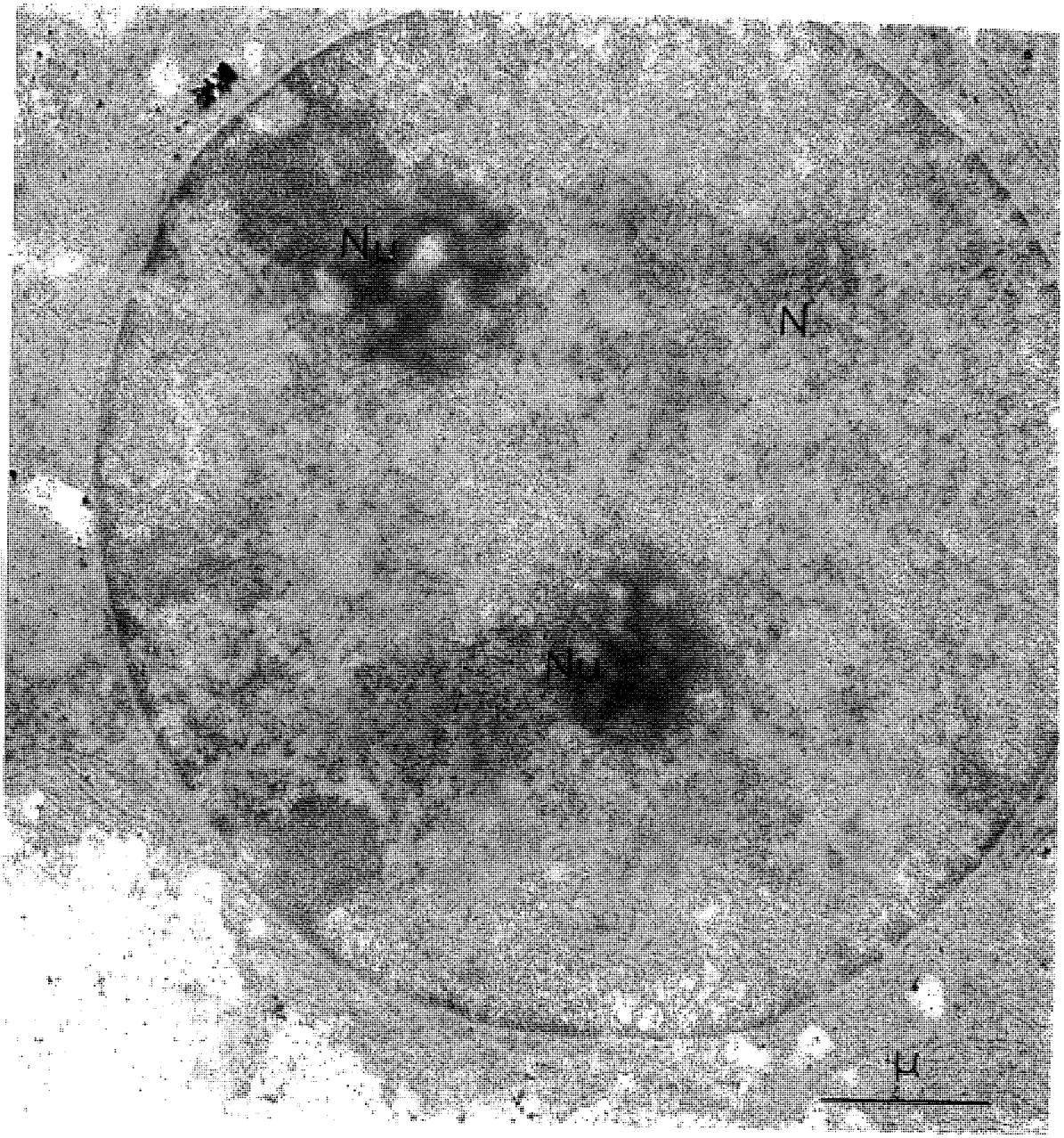
Classification of nuclei into categories.

Plates 58 - 62 The appearance of the six type categories after fixation with acrolein and section staining with silver nitrate.



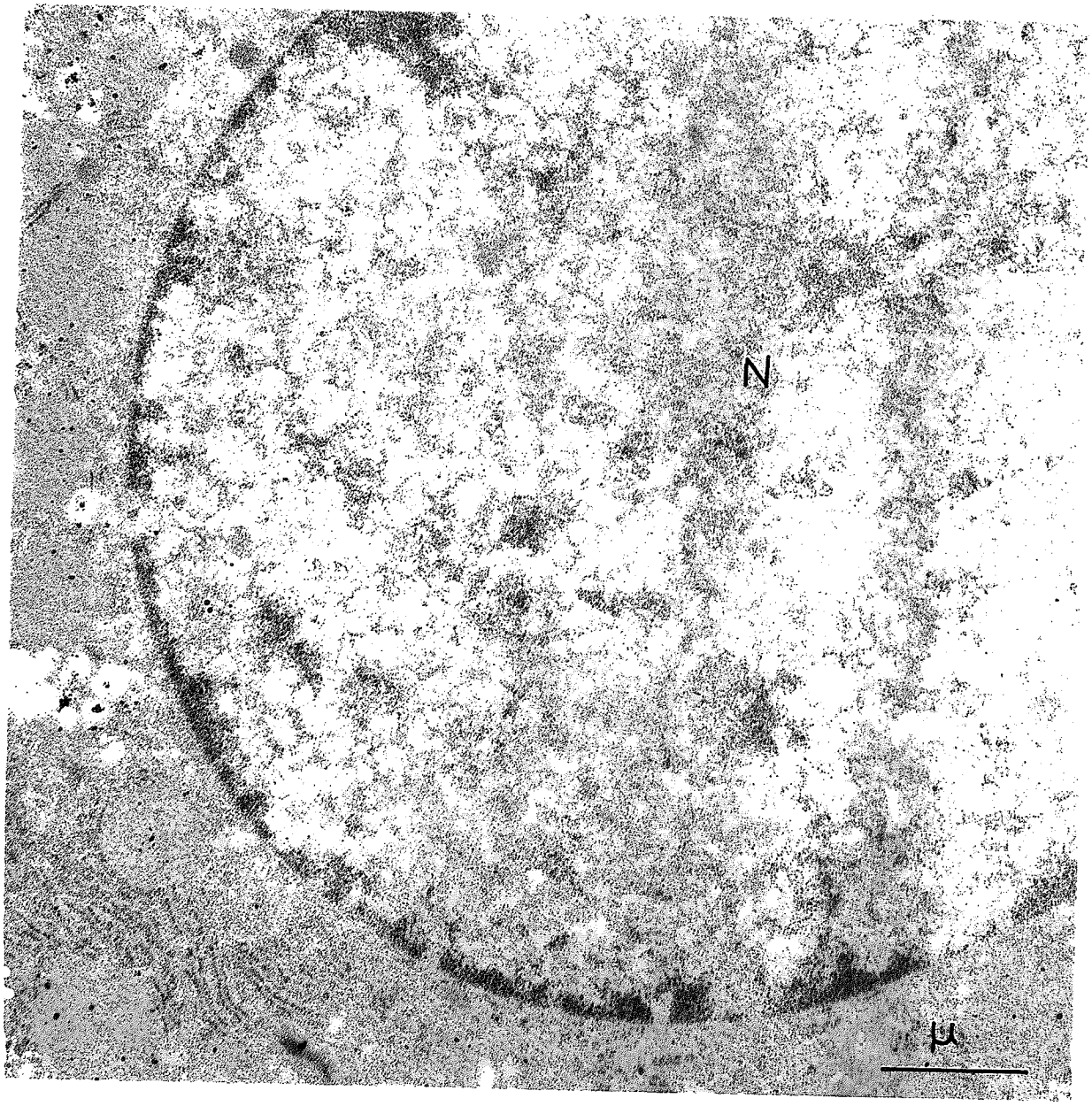
Nuclear Category 1.

There is little dark staining material present. That that is present is evenly distributed throughout the nucleoplasm.



Nuclear Category 2.

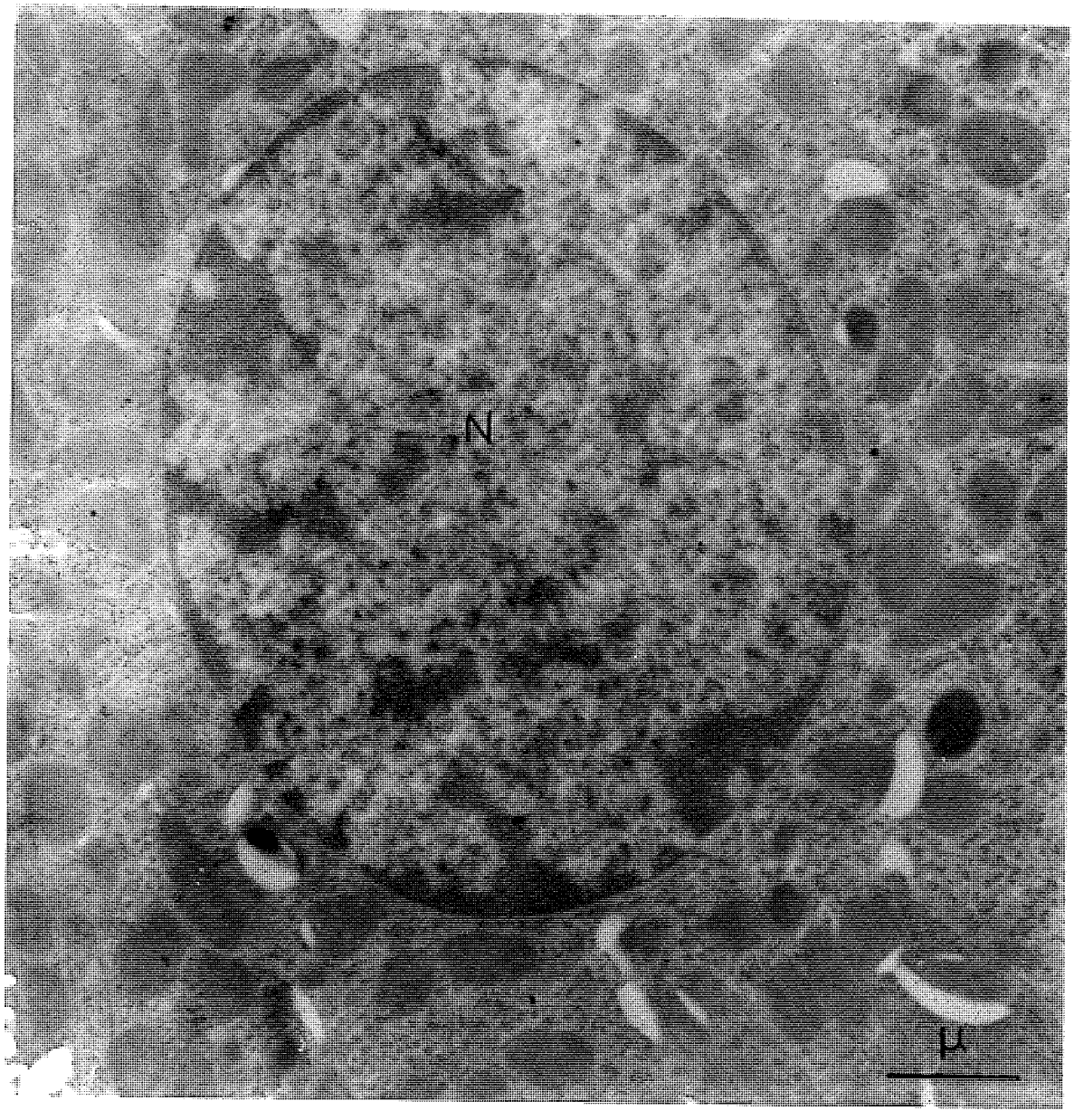
Mouse liver fixed in acrolein and stained with silver nitrate. There is an increased amount of dark staining material present, particularly in a narrow sub-peripheral zone.



Nuclear Category 3.

Mouse liver fixed in acrolein and stained with silver nitrate.

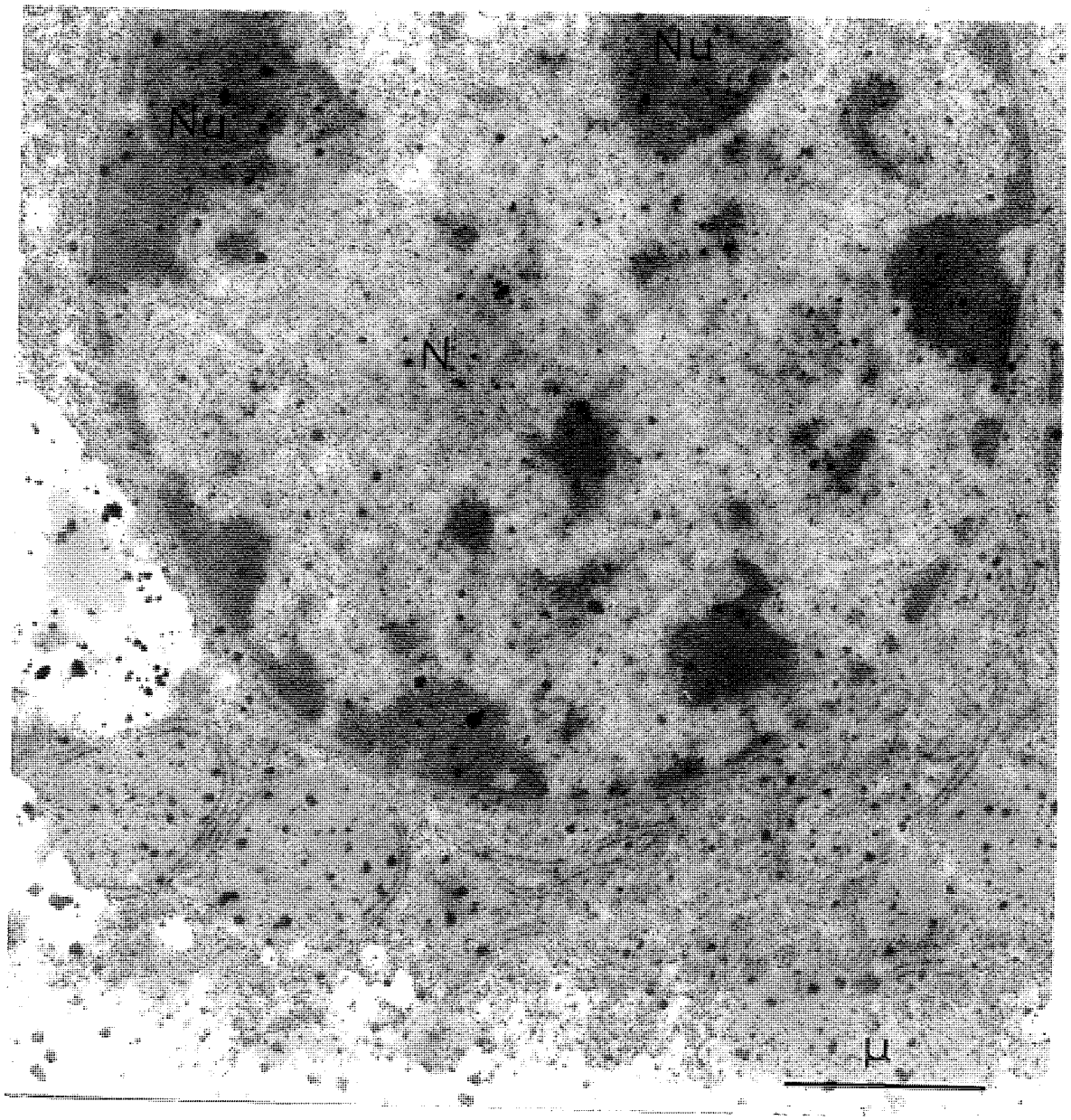
Dark staining material is present throughout the nucleoplasm as small loosely arranged aggregates of particles.



Nuclear Category 4.

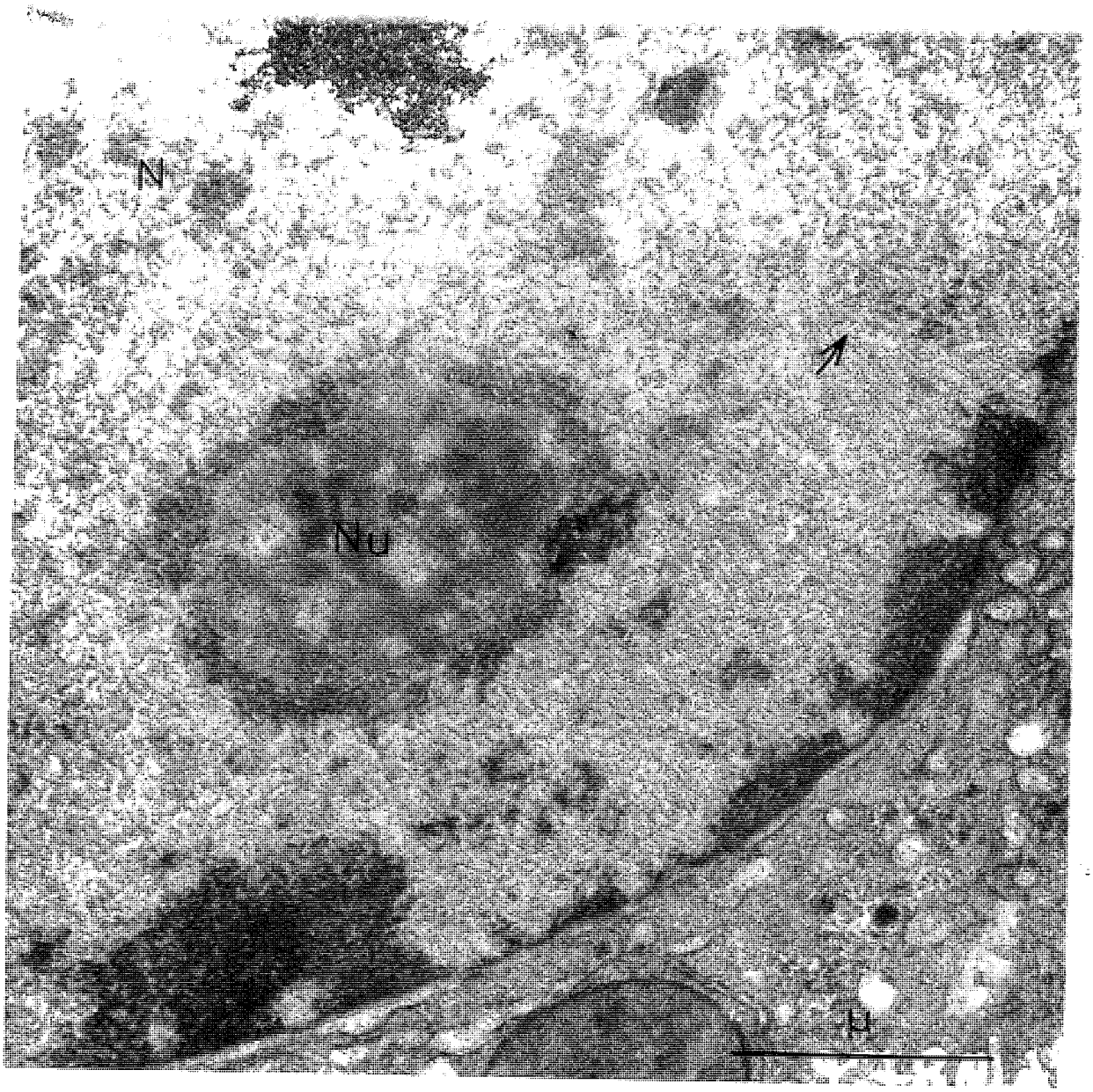
Mouse kidney fixed in acrolein and stained with silver nitrate.

Dark staining material is arranged in small densely packed aggregates within the nucleoplasm.



Nuclear Category 5.

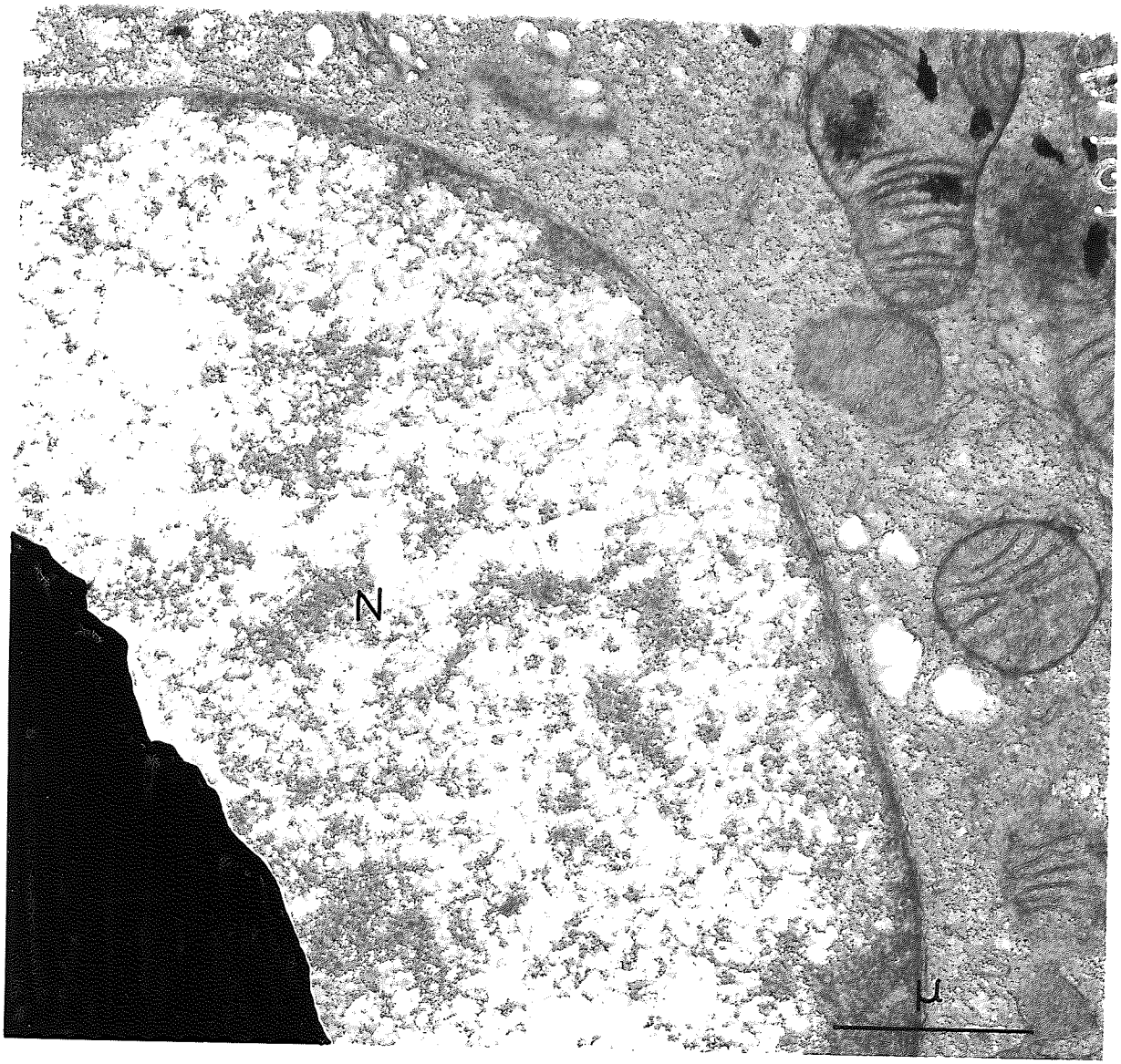
Mouse liver fixed in acrolein and stained in silver nitrate. Dark staining material is present as extensive, densely packed aggregates of granules.



Mouse liver digested with ribonuclease. The tissue was taken from a normal animal. Ribonuclease digestion resulted in a loss of the underlying fine fibrillar network of the nucleoplasm. Interchromatin granules are clearly visible (arrows).

Plate 64.

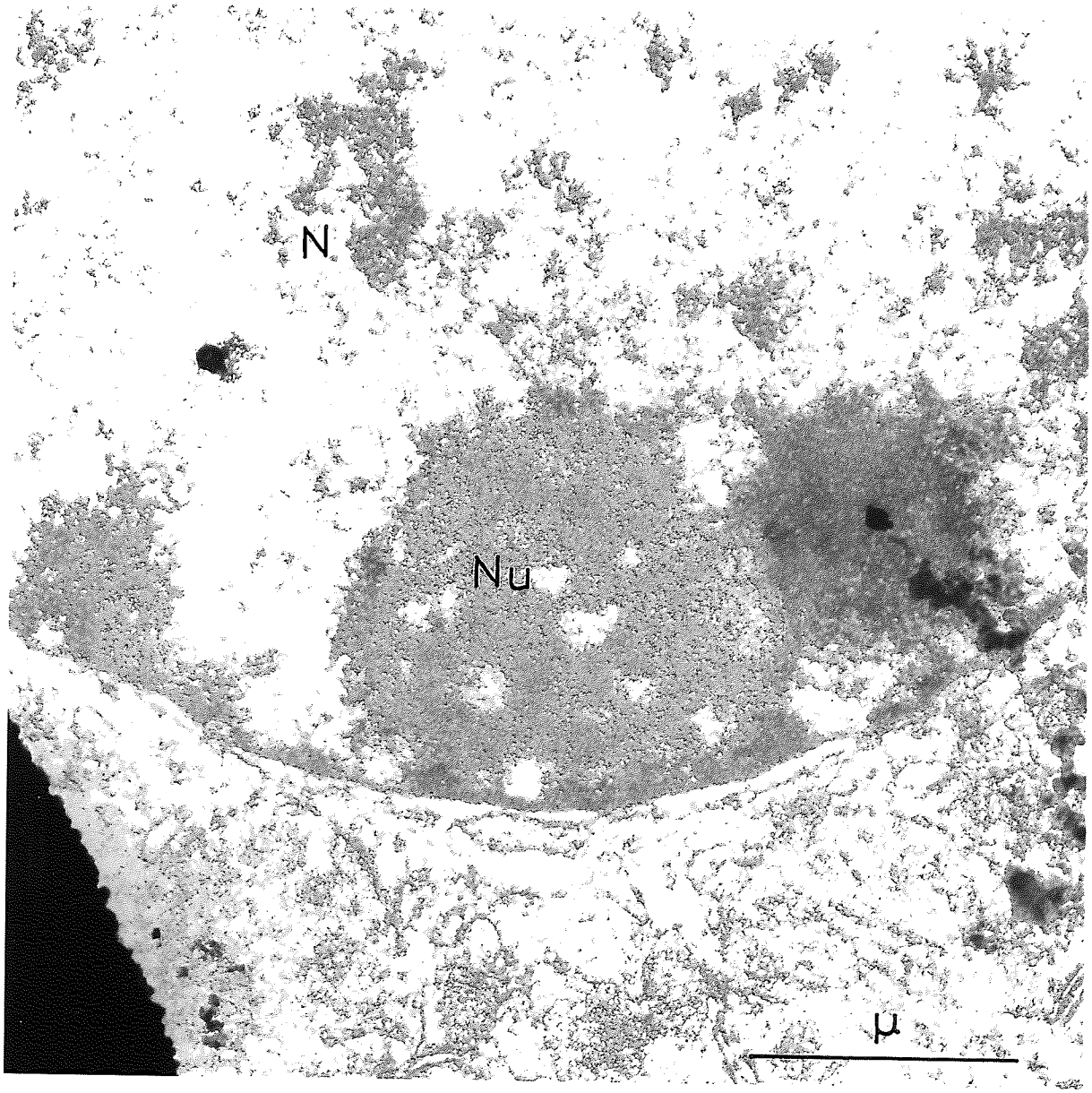
161A/71



Mouse liver from an animal treated with triiodothyronine, and digested with ribonuclease.

Again the loss of the fine fibrillar network of the nucleoplasm is clear, but not as extensive as in the nucleus shown in the previous Plate.

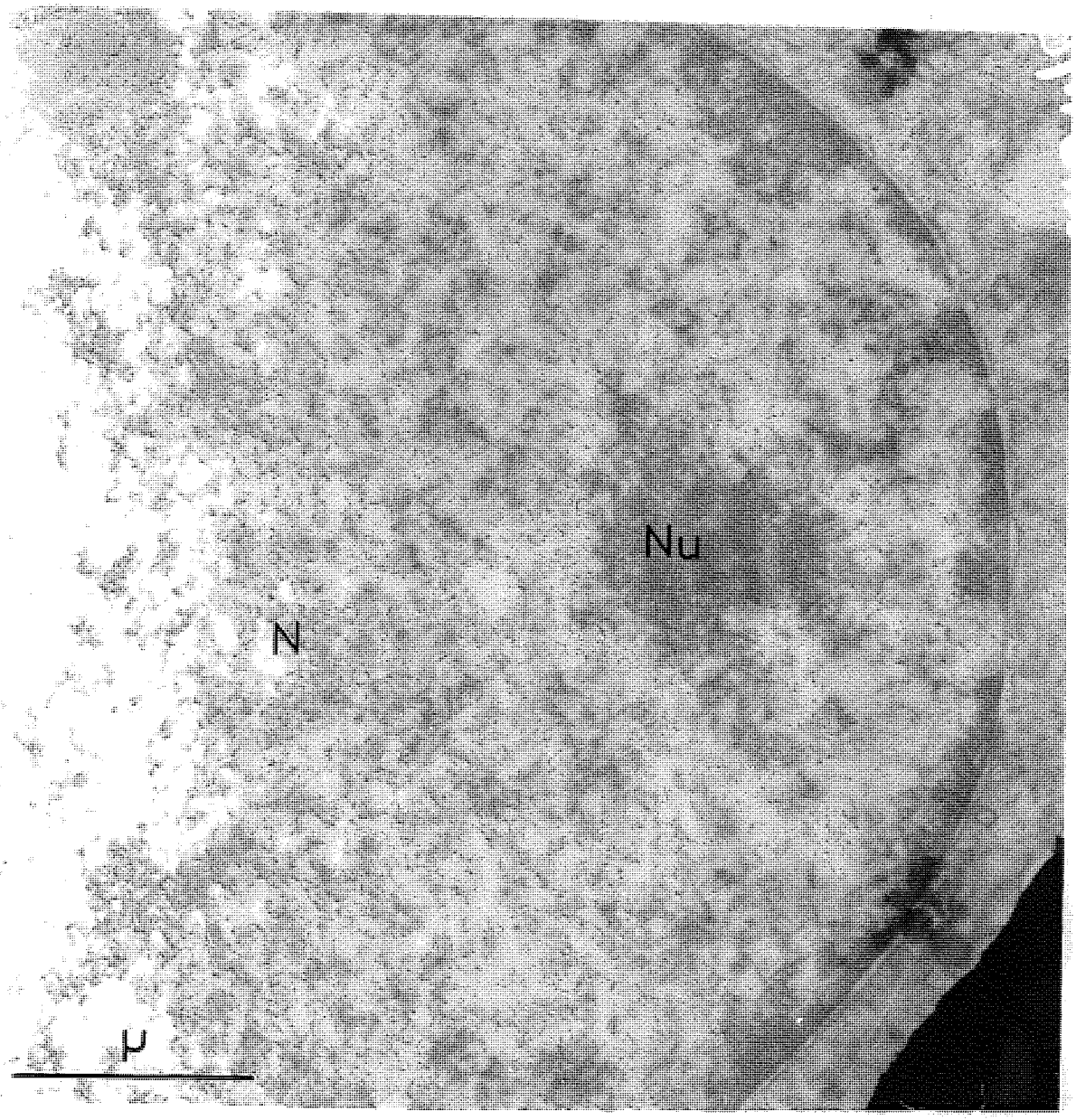
Plate 65.



Mouse liver from an animal treated with triiodothyronine, digested with pepsin. There is a reduction in the contrast of the matrix material, and of the components of the fine fibrillar network. There is also a reduction in the clarity with which the granular components can be distinguished.

Plate 66.

213A/71



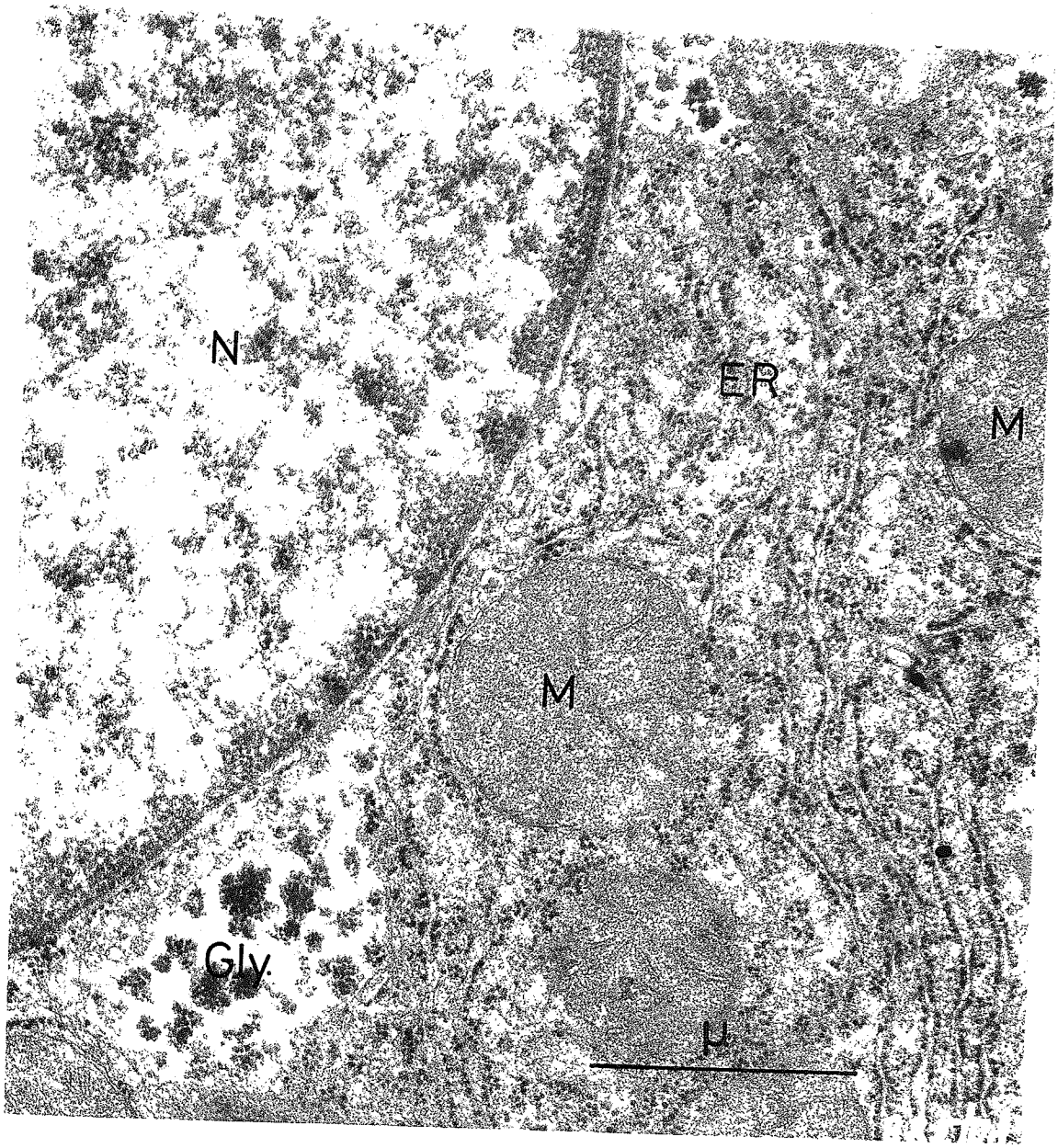
Mouse kidney from an animal treated with triiodothyronine, digested with pepsin. Again the loss of the detailed structure of the granular components of the nucleoplasm is obvious.

Chapter 4.

The Effects of Thyroid Hormones upon the Morphology of the Nuclear Envelope.

Key

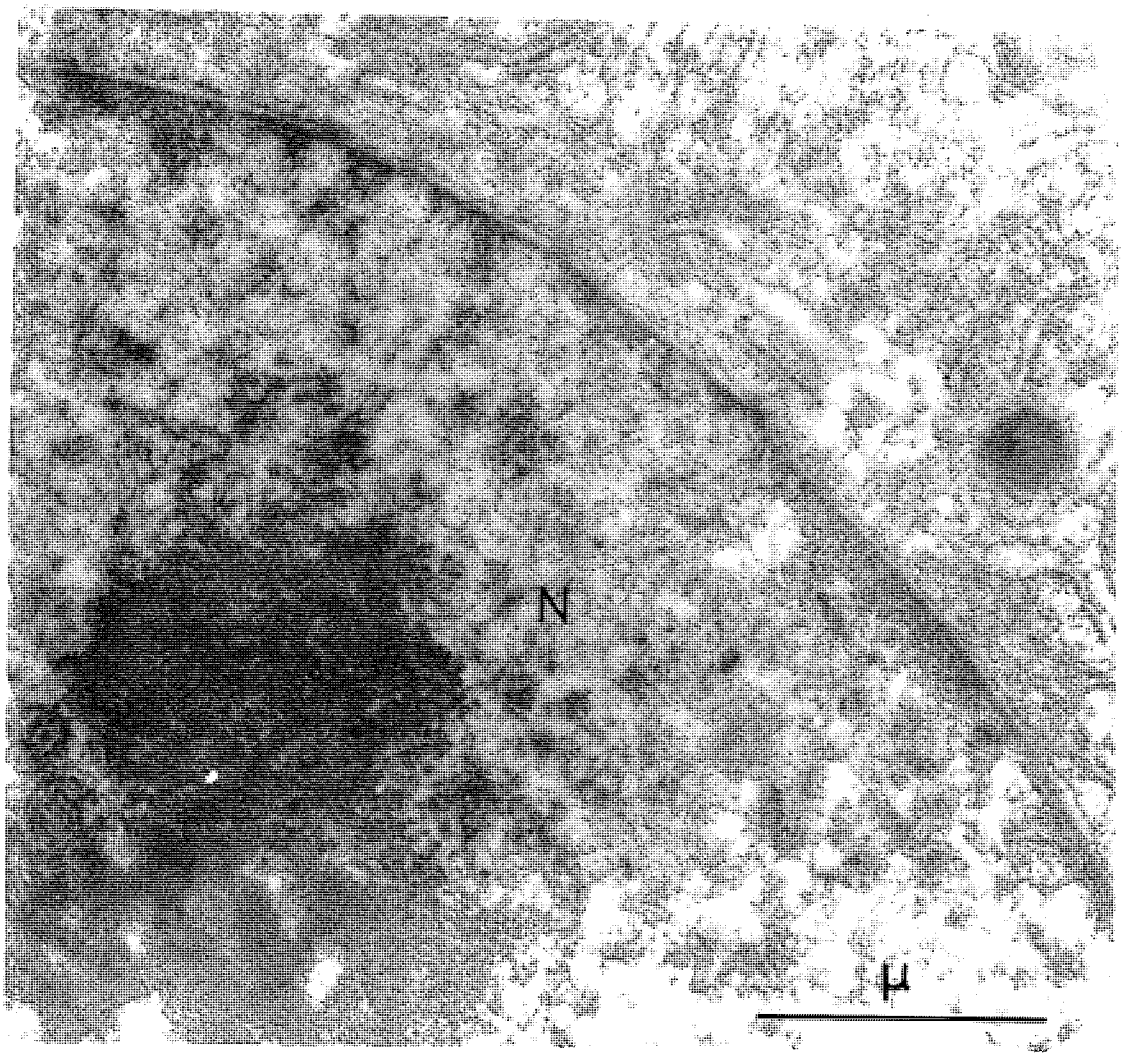
N	–	Nucleus
M	–	Mitochondrion
ER	–	Endoplasmic reticulum
Gly	–	Glycogen
PM, Plm	–	Plasma membrane
G	–	Golgi apparatus
Bc	–	Bile canaliculus.



Mouse liver from a thyroidectomised animal, fixed in glutaraldehyde and osmium and stained with uranium and lead. The double membrane structure of the nuclear envelope is obvious, the membrane elements are regular and evenly separated.

Plate 68.

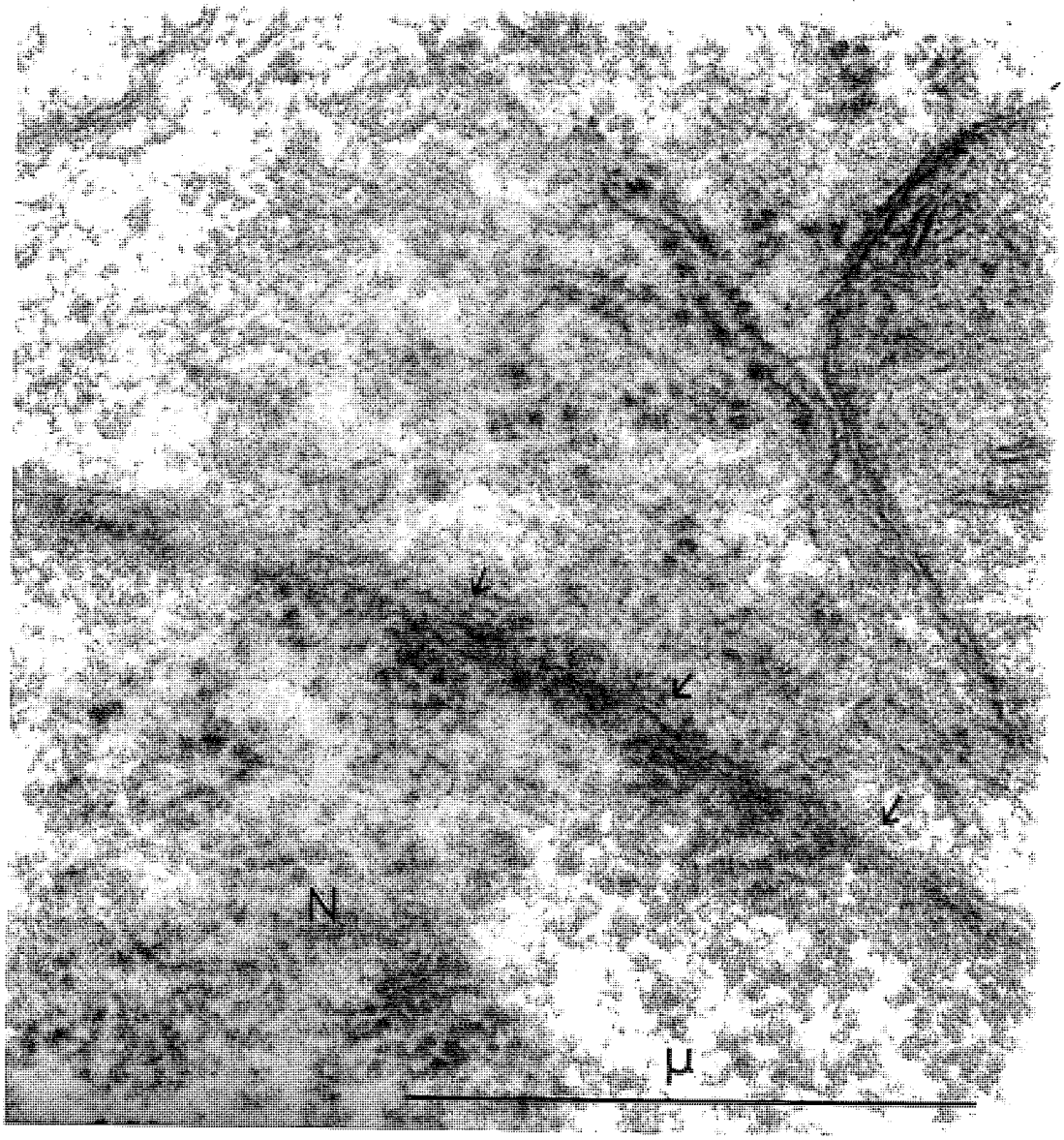
942/69



Mouse liver from a normal animal fixed in glutaraldehyde and osmium and stained with uranium, showing the clear double structure of the nuclear envelope.

Plate 69.

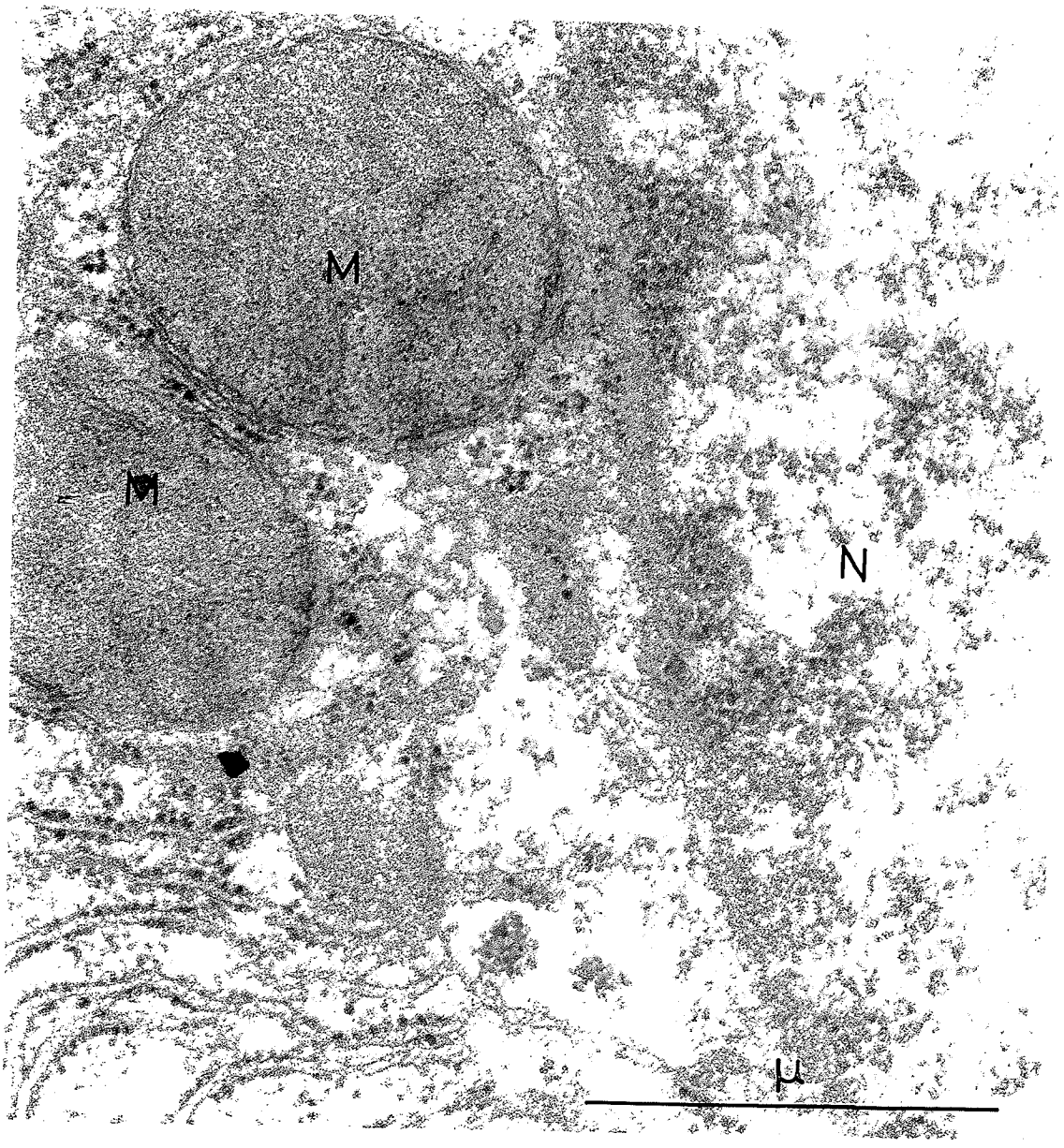
654/69



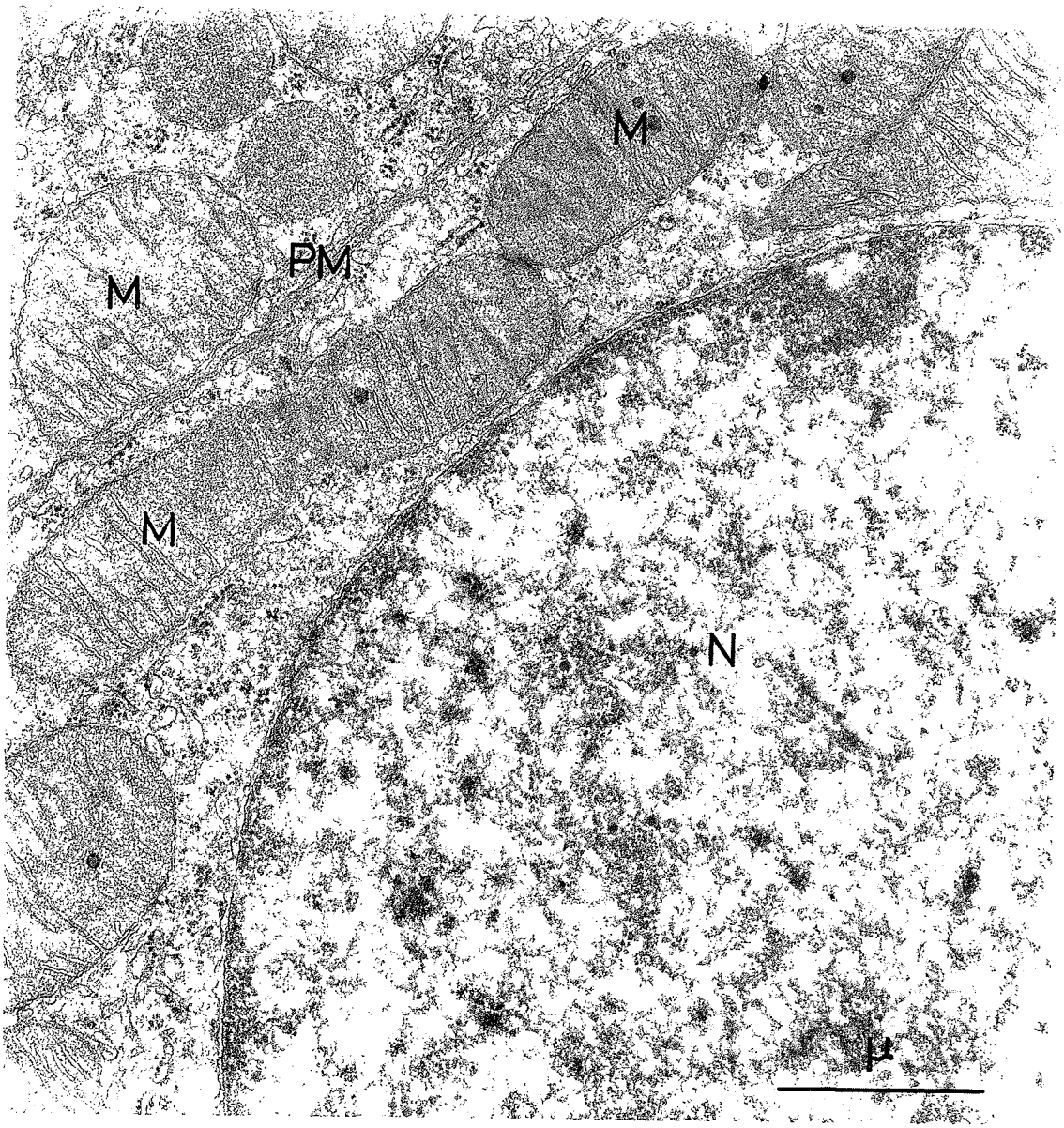
Mouse liver from an animal treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium. The nuclear envelope is obscured by a zone of electron dense material, although the double membrane structure of the envelope can be discerned in places (arrows).

Plate 70.

894/69



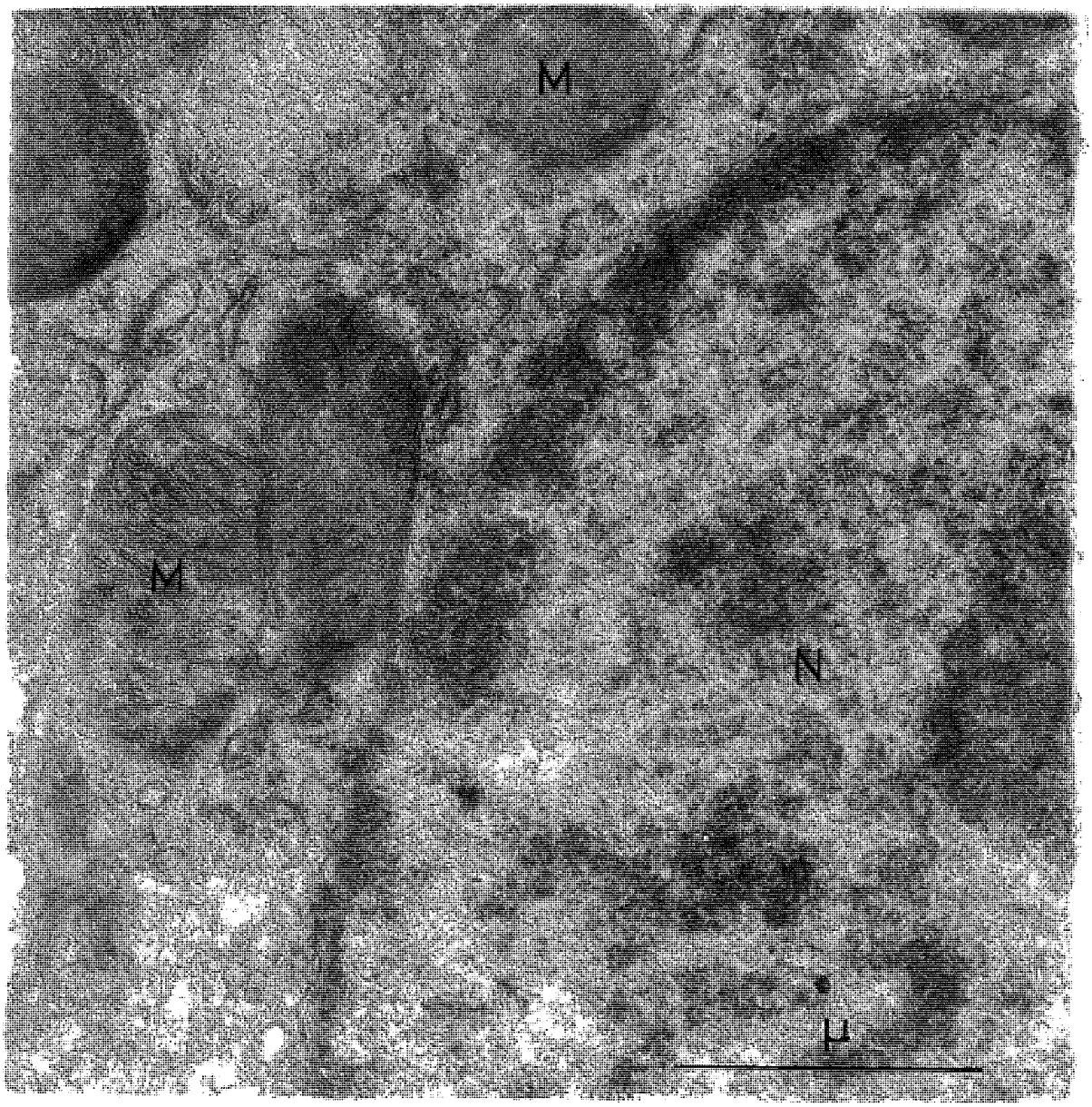
Mouse liver from an animal treated with thyroxine fixed in glut-araldehyde and osmium and stained with uranium and lead. The nuclear envelope is obscured with some diffuse electron dense material.



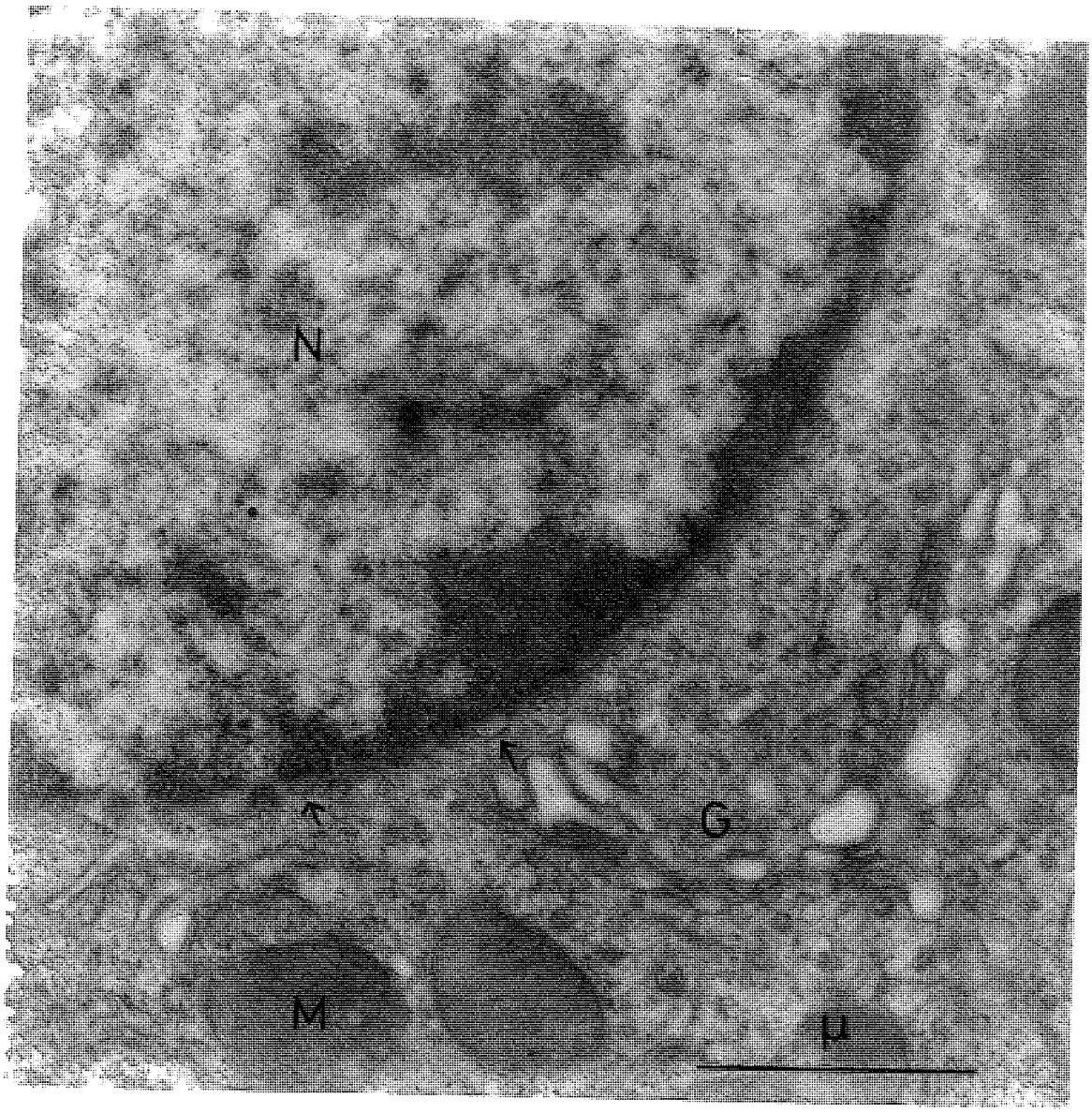
Mouse kidney from a normal animal fixed in glutaraldehyde and osmium and stained with uranium and lead. The nucleus is bounded by a distinct nuclear envelope of obvious double structure.

Plate 72.

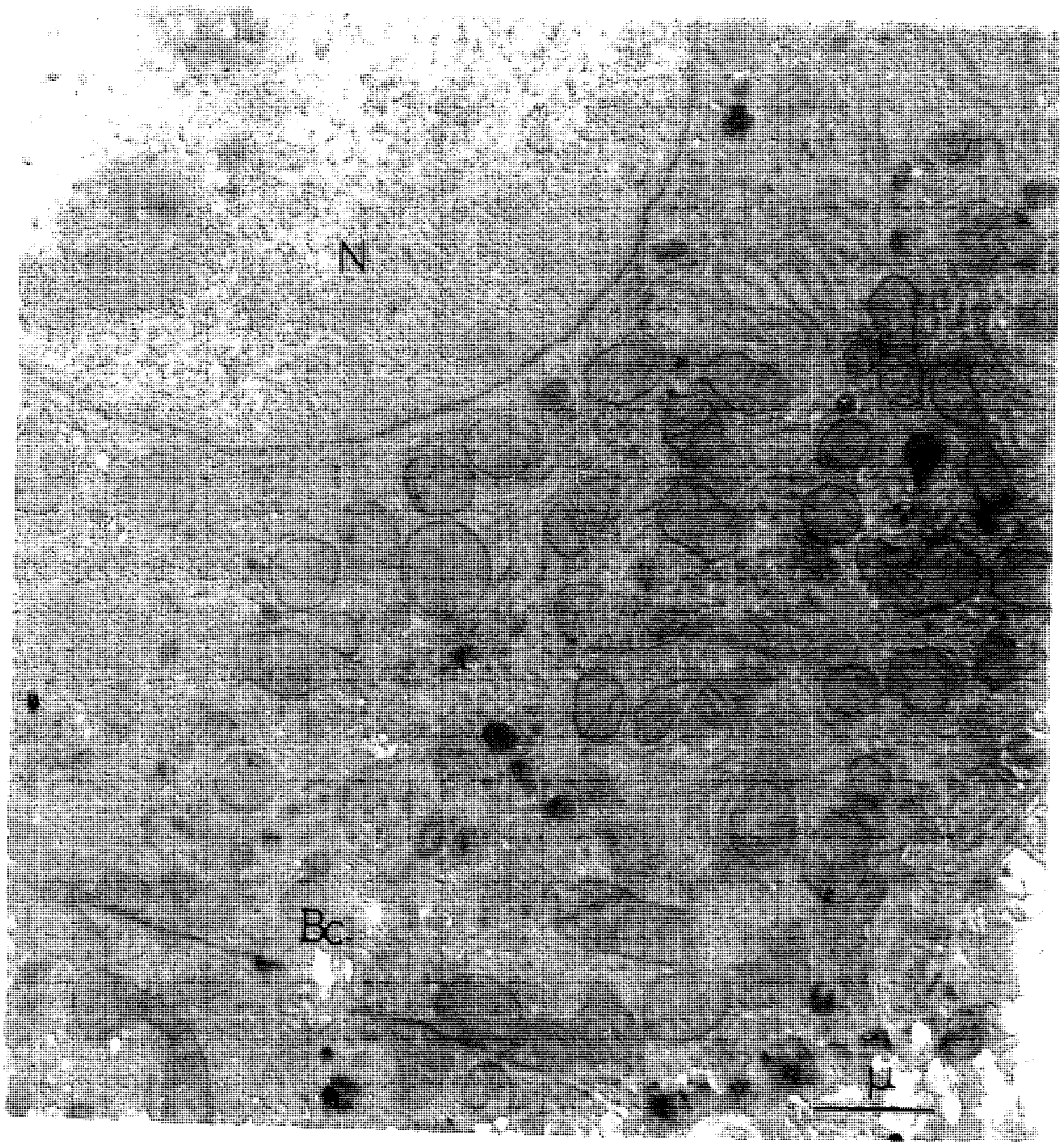
243/69



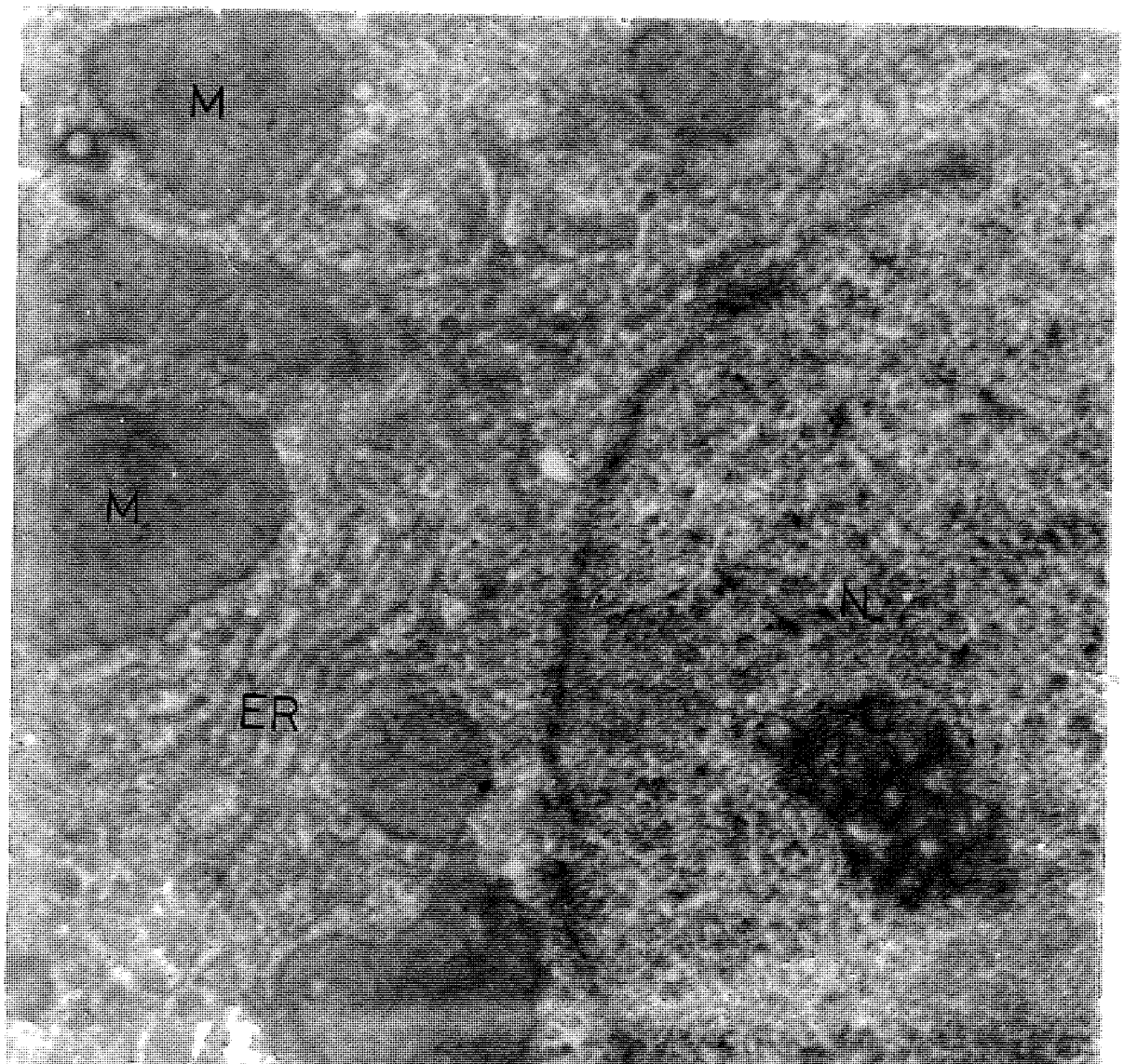
Mouse kidney from an animal treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium. The nuclear envelope is obscured by a diffuse electron dense material.



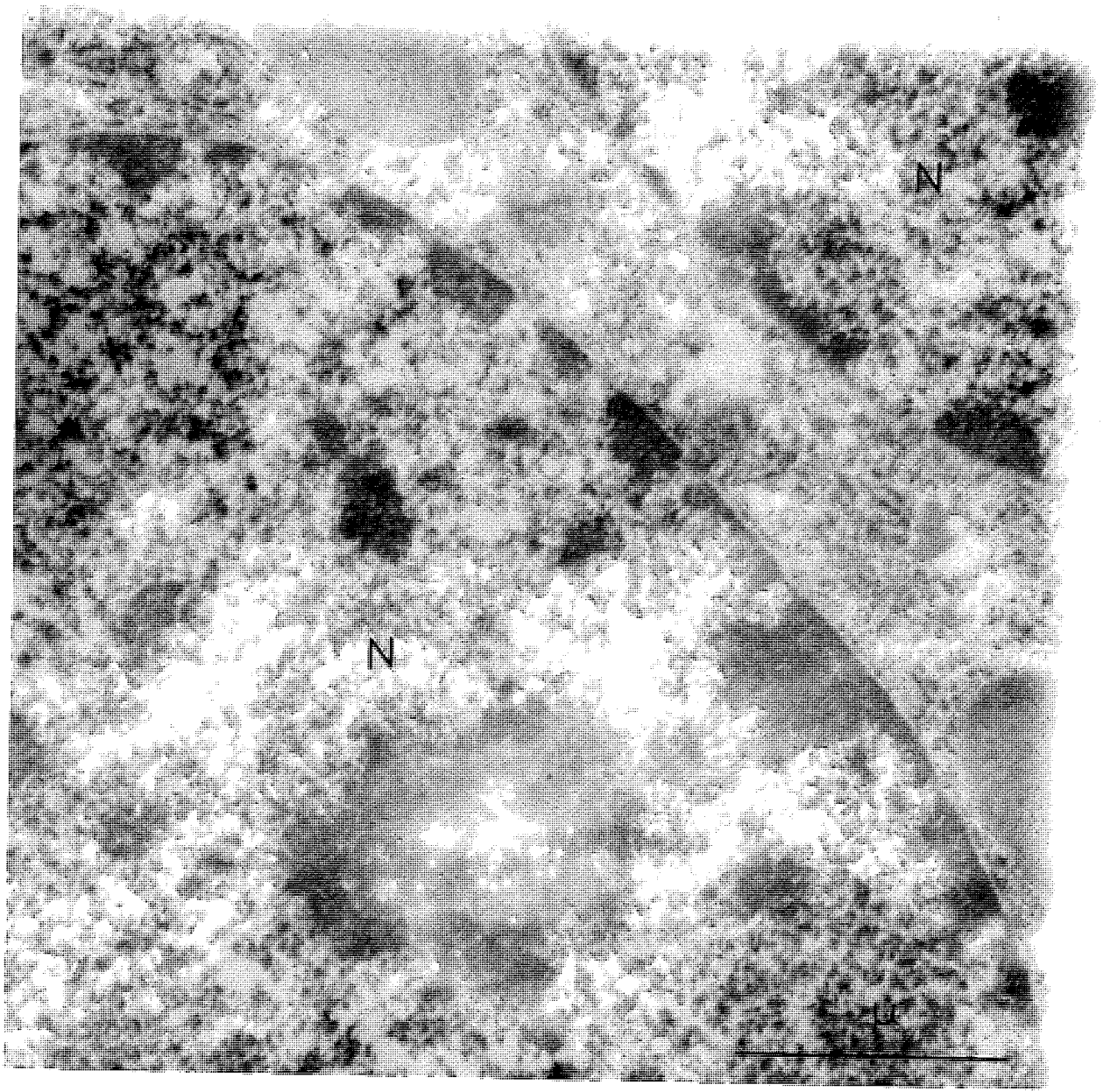
The kidney of a mouse treated with thyroxine, fixed with glutaraldehyde and osmium and stained with uranium. The nuclear envelope is not visible around much of its circumference due to the presence of obscuring material, although the double membrane structure can be discerned in places (arrows).



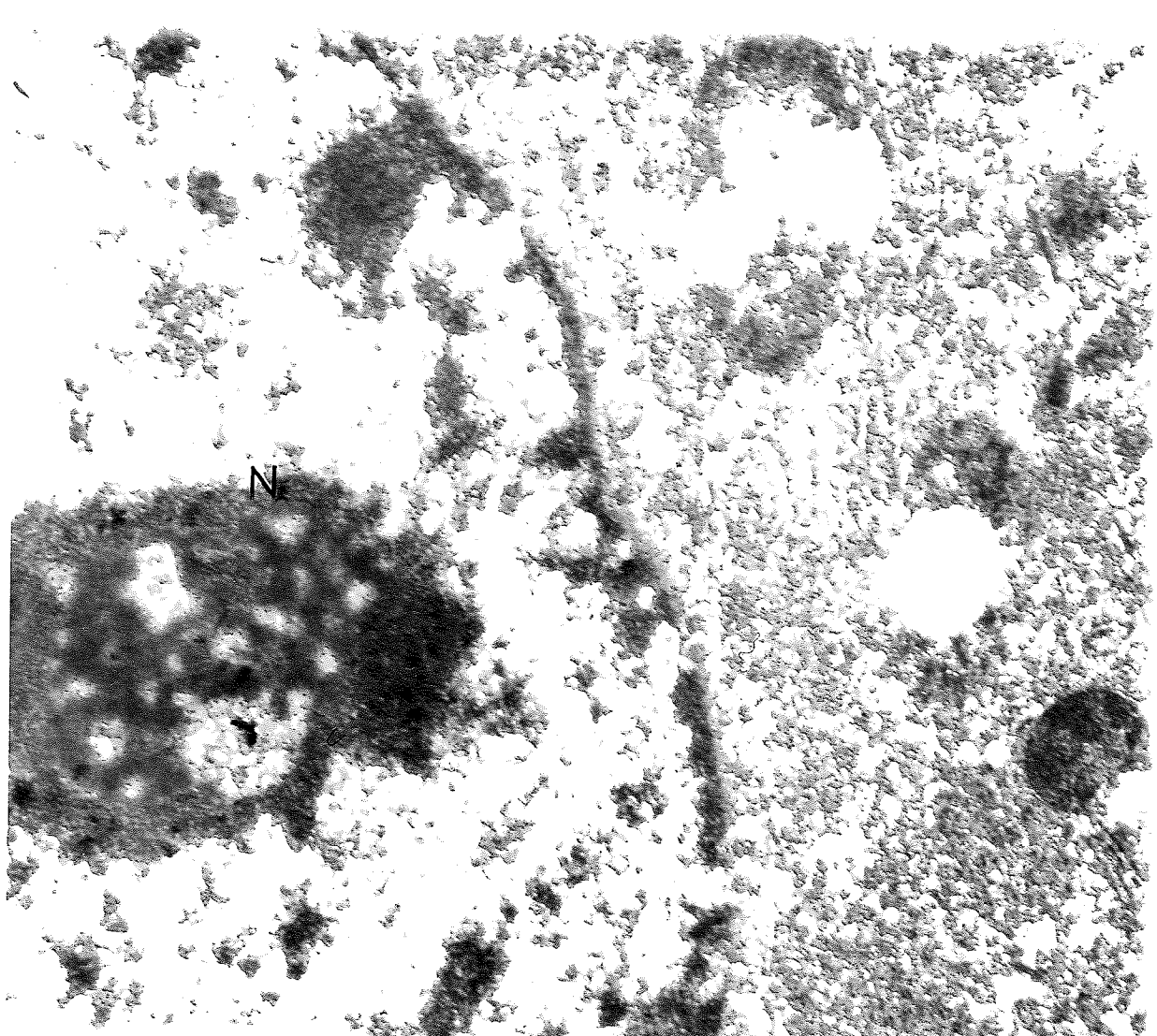
The liver of a normal mouse fixed in osmium and stained with uranium. The appearance of the membranes, after osmium fixation, is such that the double nature of the nuclear envelope is not obvious except at very high magnifications.



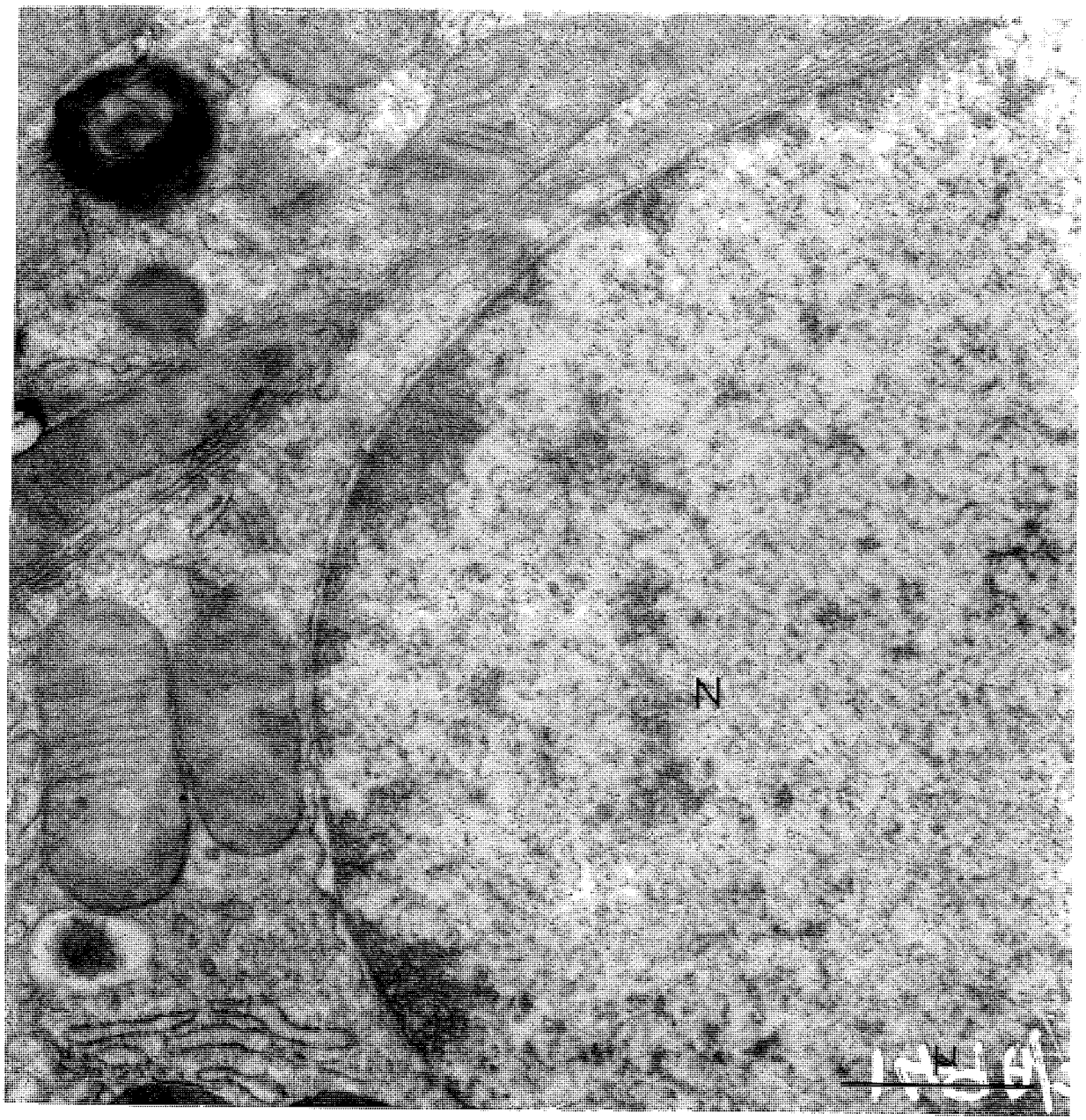
The liver from a mouse treated with triiodothyronine, fixed in osmium and stained with uranium. Although it was difficult to assess the percentage of nuclei with obscured envelopes, according to the criterion of clarity at x10,000, some nuclei were observed where obvious accumulations of material obscured the nuclear envelope, as is shown here.



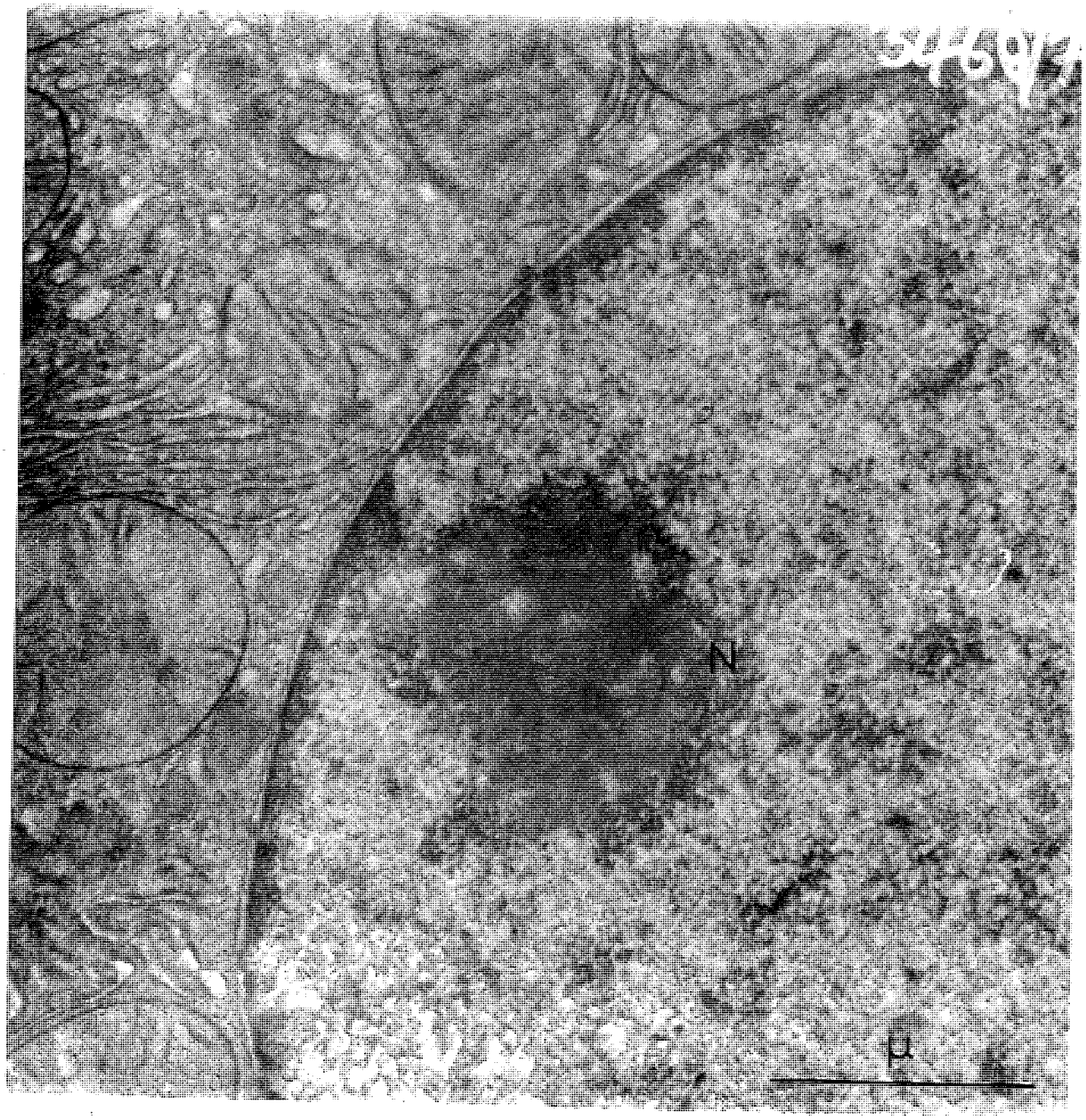
Mouse liver from a normal animal fixed in glutaraldehyde and stained with uranium and lead. The membranes of the nuclear envelope are not themselves visible, but their presence is obvious.



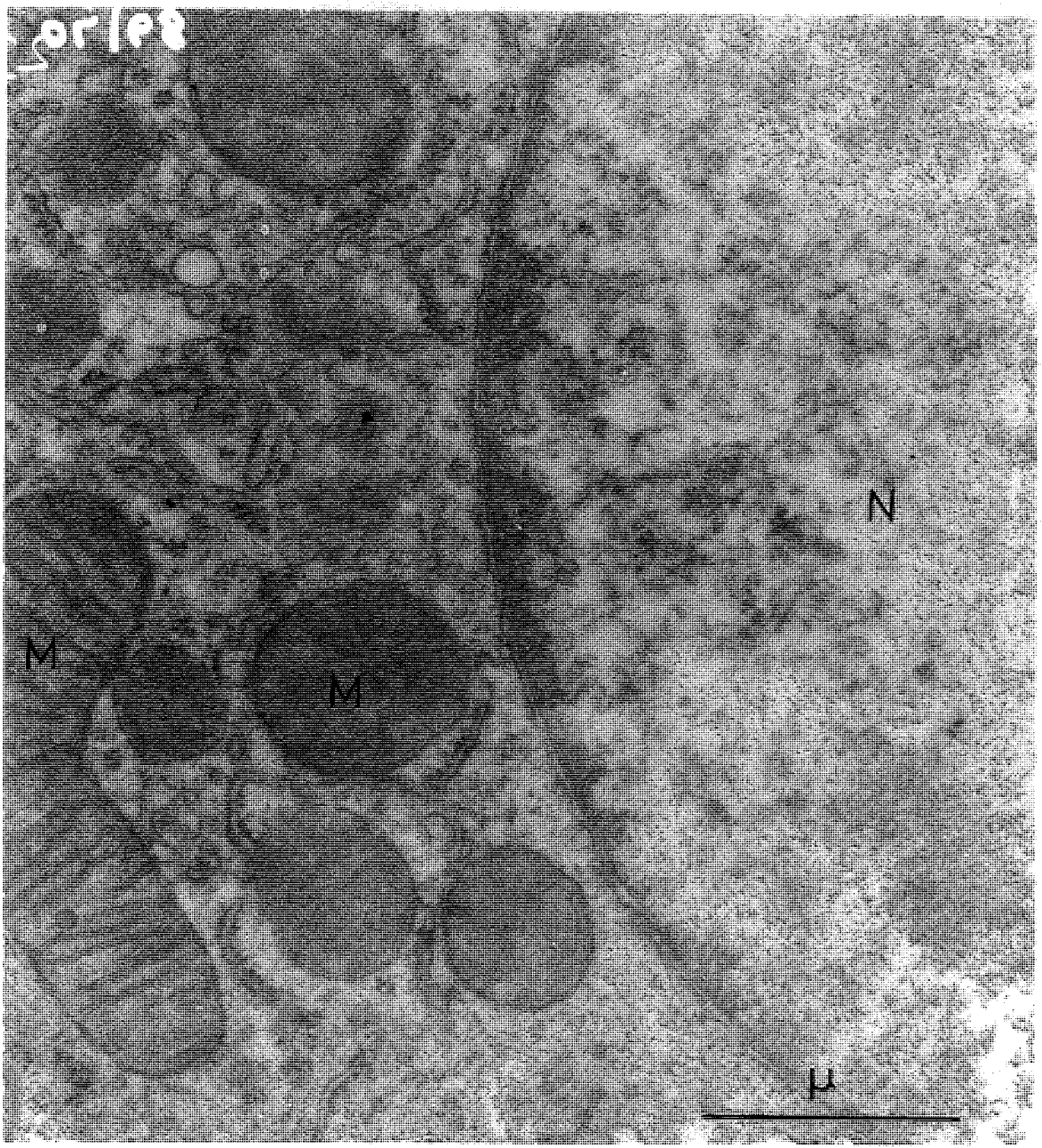
Liver from a mouse treated with triiodothyronine, fixed in glutaraldehyde and stained with uranium and lead. The presence of obscuring material associated with the nuclear envelope is obvious from the indistinct nuclear margin, although the membranes of the nuclear envelope are not visible.



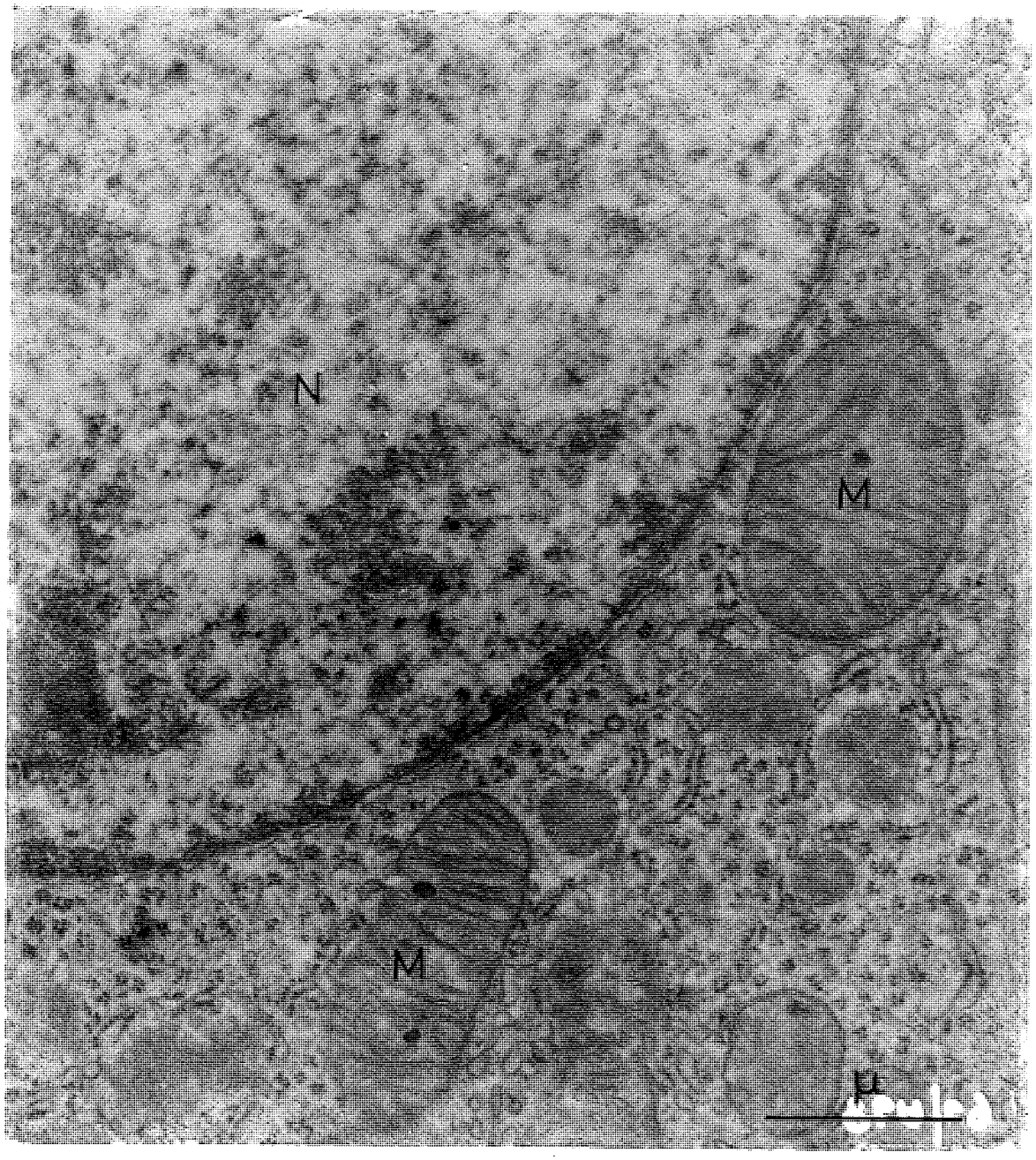
Mouse kidney from a normal animal, digested with ribonuclease. Appart from the absence of ribosomes attached to the outer membrane, the nuclear envelope resembles those of normally prepared material. Obscuring material was rarely observed after digestion with ribonuclease,



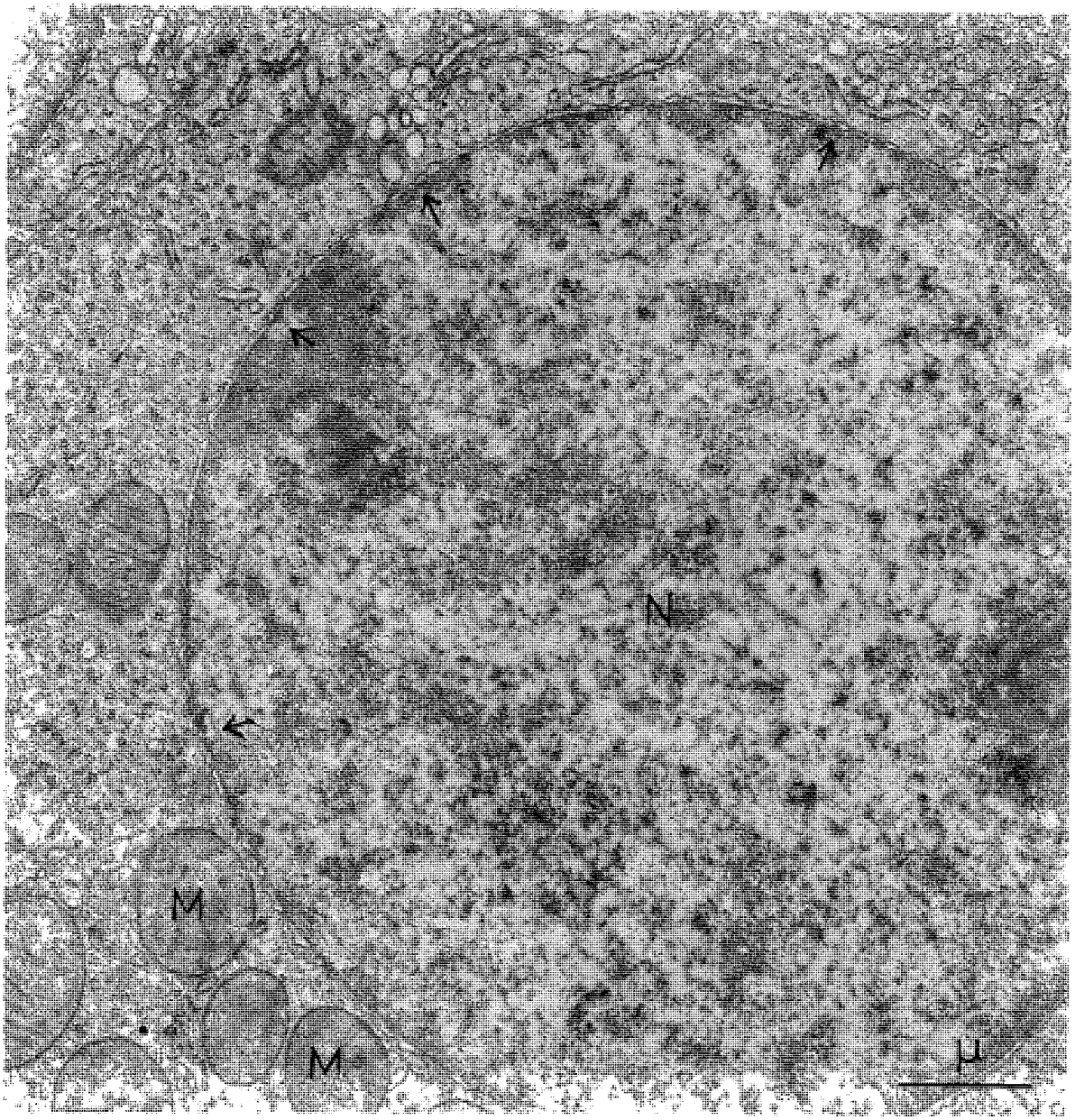
Mouse liver from an animal treated with triiodothyronine, digested with pepsin. The nuclear envelopes generally resemble those of routinely prepared material, although the electron density of the perinuclear space was often reduced. Obscuring material was rarely observed after pepsin digestion.



Mouse kidney from a thyroidectomised animal, fixed in glutaraldehyde and osmium and stained with uranium and lead. The nuclear envelope clearly consists of two membrane elements which are regular and parallel around most of the nucleus.

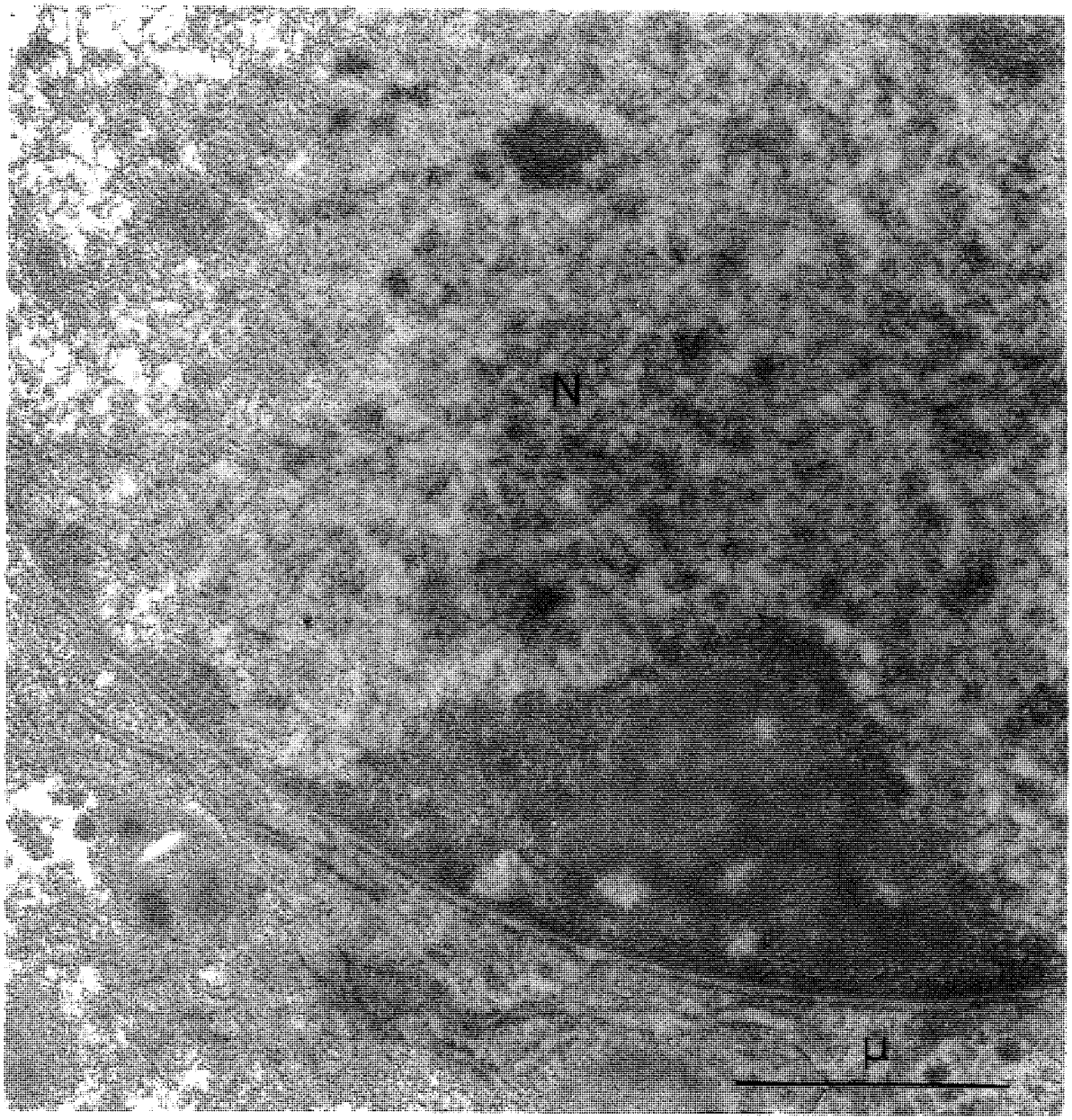


Mouse kidney from a normal animal, fixed in glutaraldehyde and osmium and stained with uranium and lead. The nuclear envelope, again, consists of a double membrane system. The outer element is somewhat irregular, being puckered and indented.

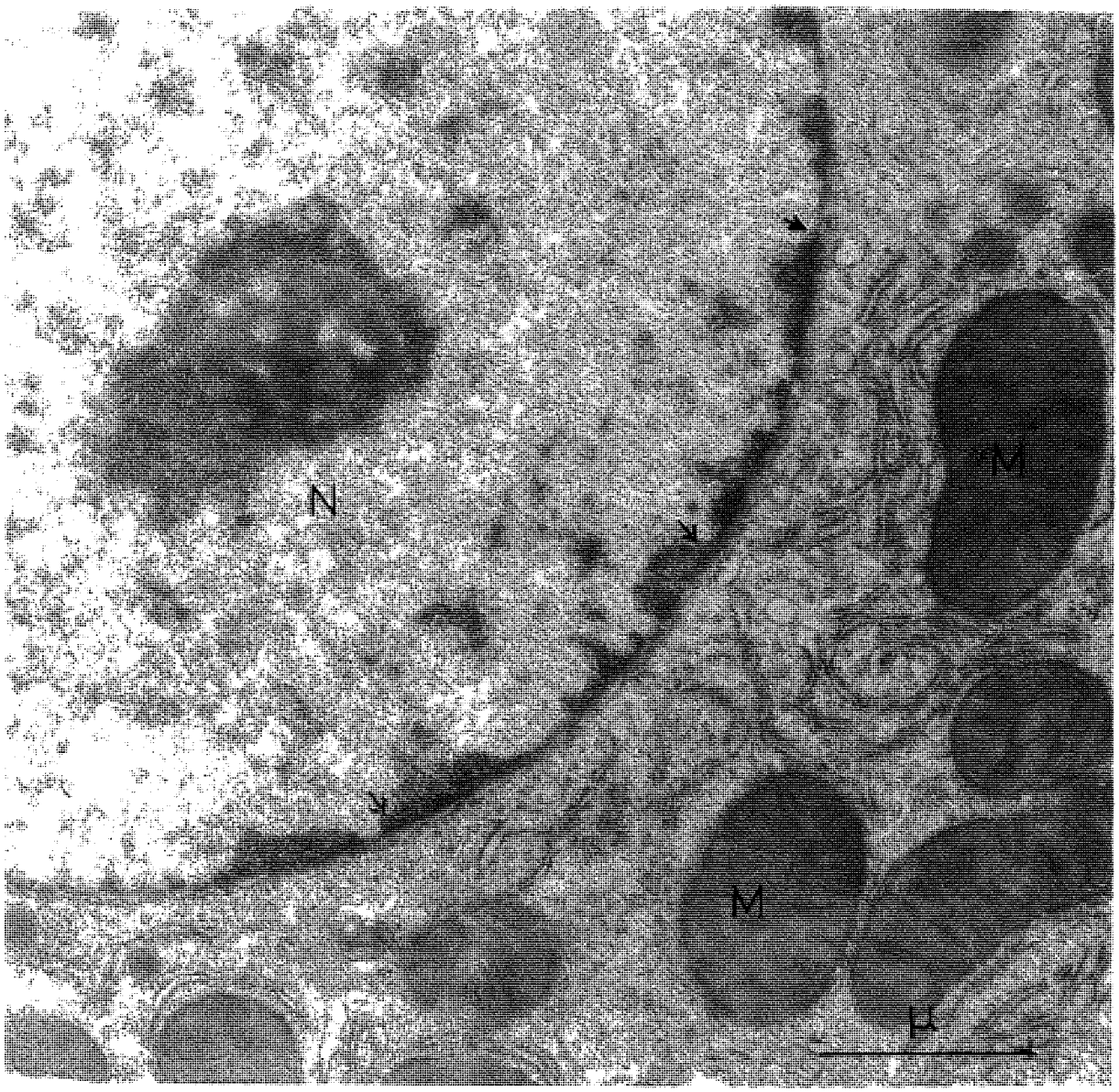


Mouse kidney from an animal treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium and lead. The double nature of the nuclear envelope is again obvious. The outer element is greatly indented, the irregularities often being associated with the production of small, single membrane bound vesicles. (arrows)

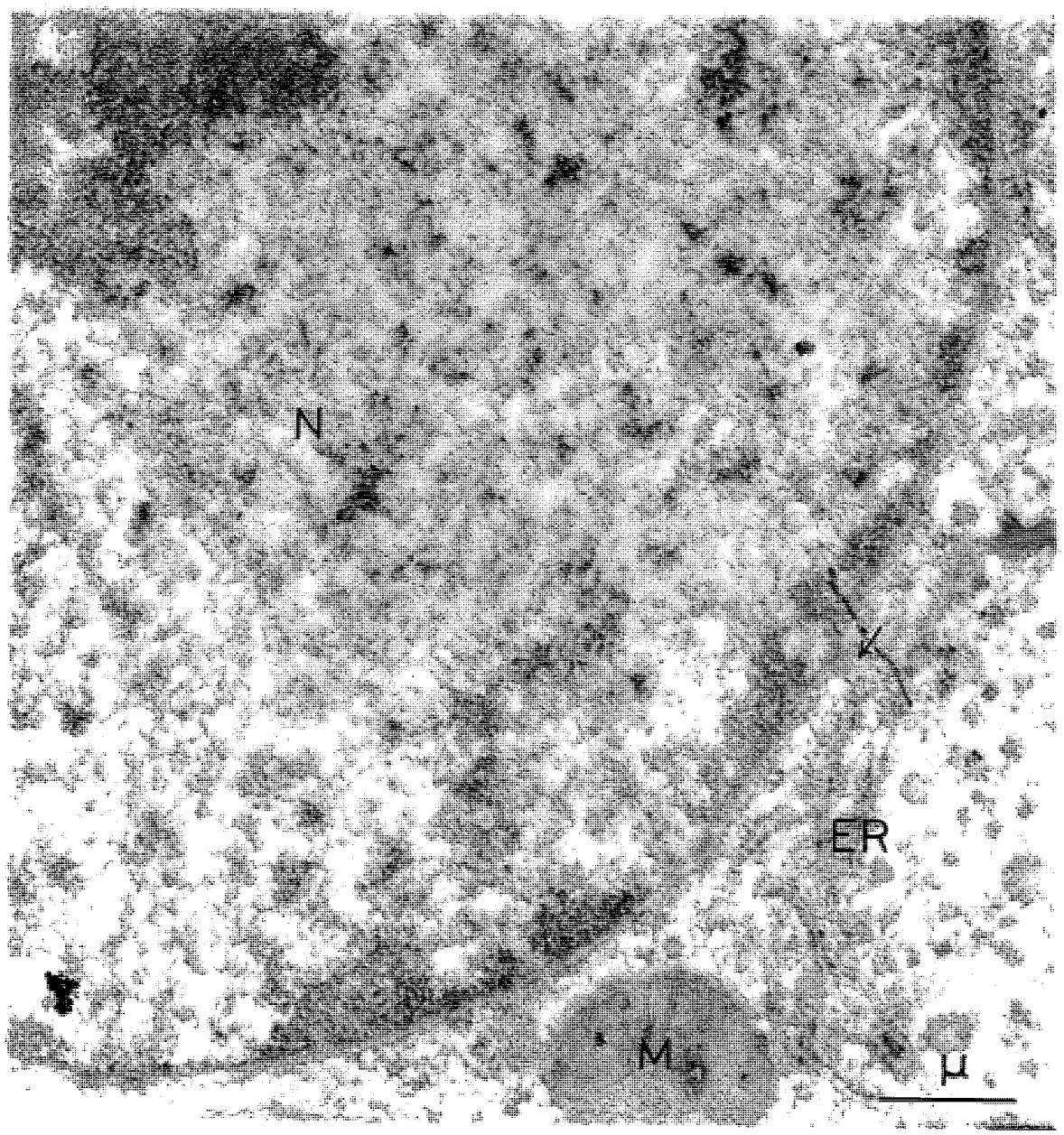
Mouse kidney from an animal treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium. Again, the outer element of the nuclear envelope is very irregular, puckers frequently being associated with the production of small, single membrane bound vesicles (arrows).



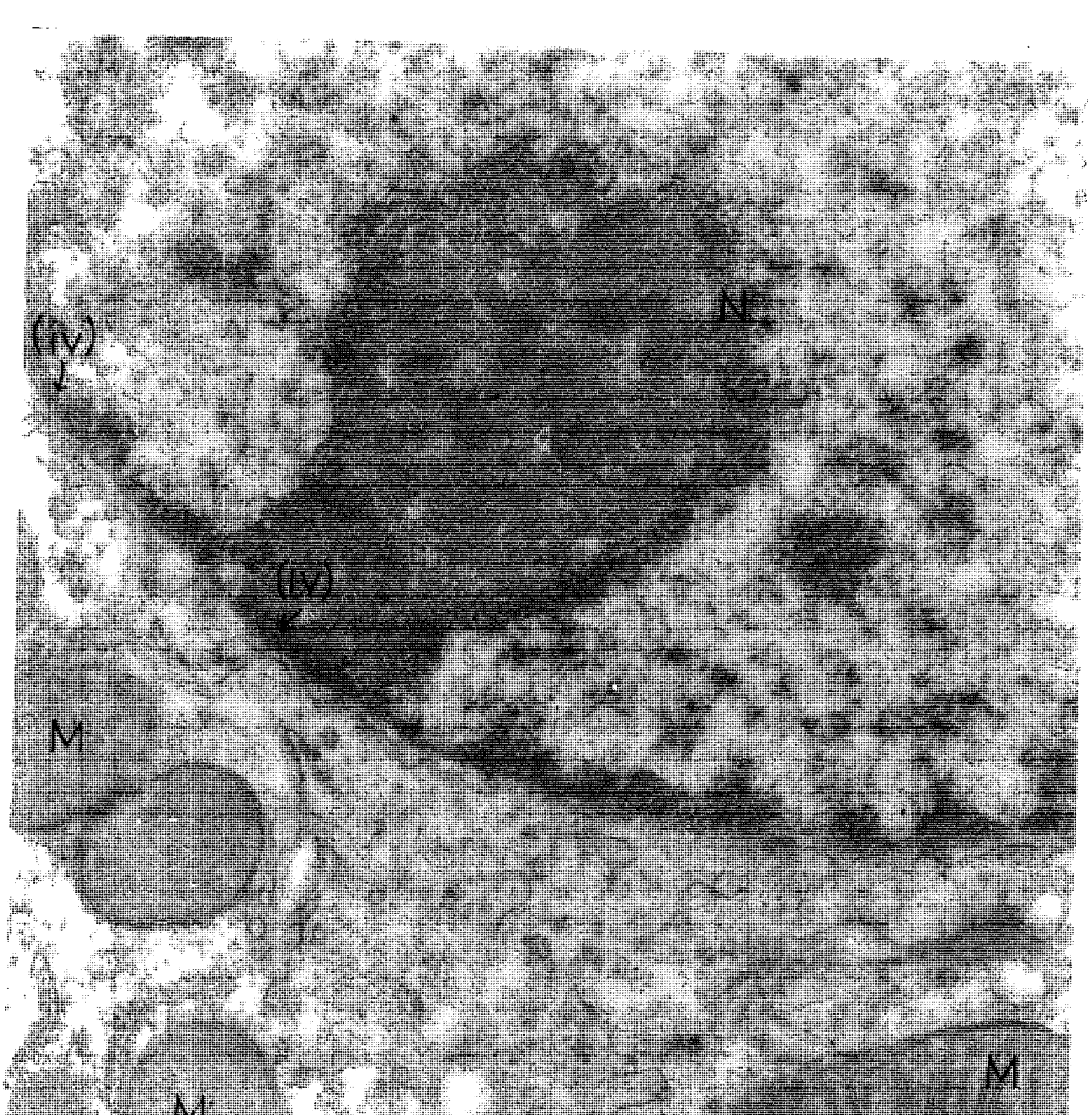
Mouse liver from a normal animal, fixed in glutaraldehyde and osmium and stained with uranium. The nuclear envelope, lacking in obscuring material is clearly composed of a double membrane, which is very regular in profile.



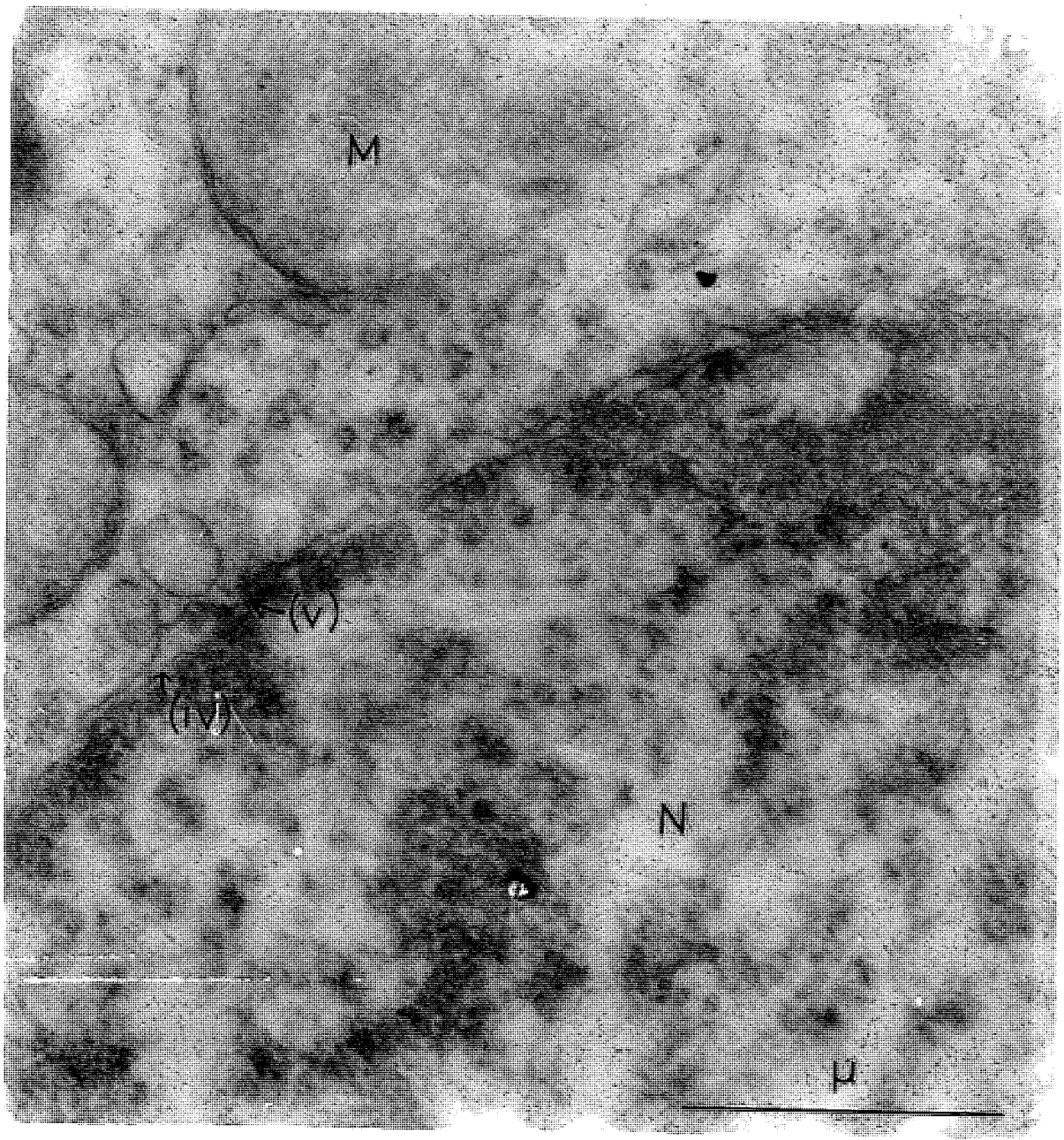
Mouse liver from an animal treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium and lead. Inspite of the presence of some diffuse material associated with the nuclear envelope irregularities in the outer element can be distinguished, which are associated with the production of small vesicles (arrows).



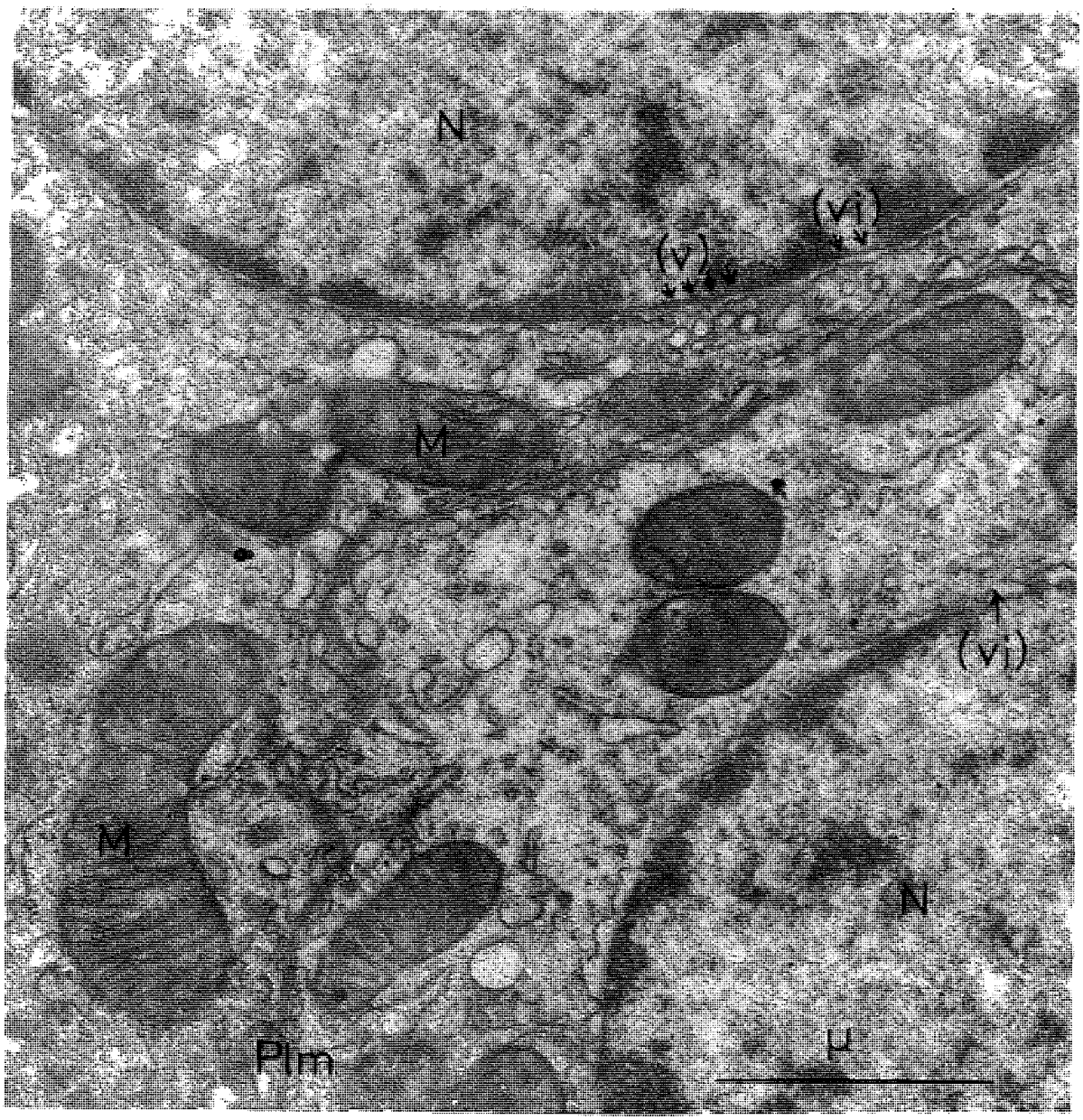
Mouse liver from an animal treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium. Again small vesicles can be distinguished associated with irregularities in the outer element of the nuclear envelope.



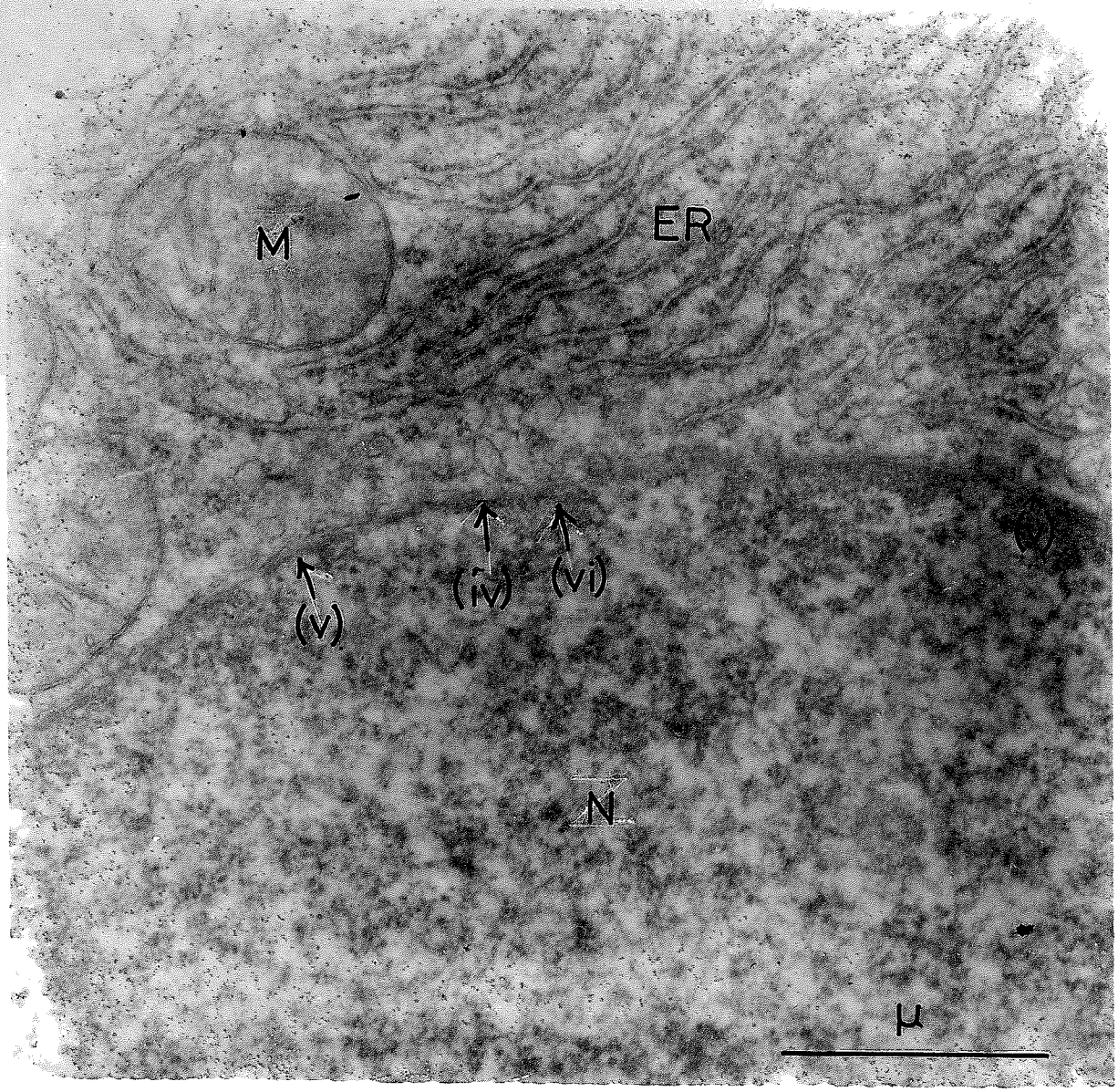
Mouse kidney from an animal treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium. Developmental stages in the production of small vesicles can be discerned. A protrusion can be seen pinching-off from the outer element of the nuclear envelope, this represents the stage (iv)shown in Figure 44.



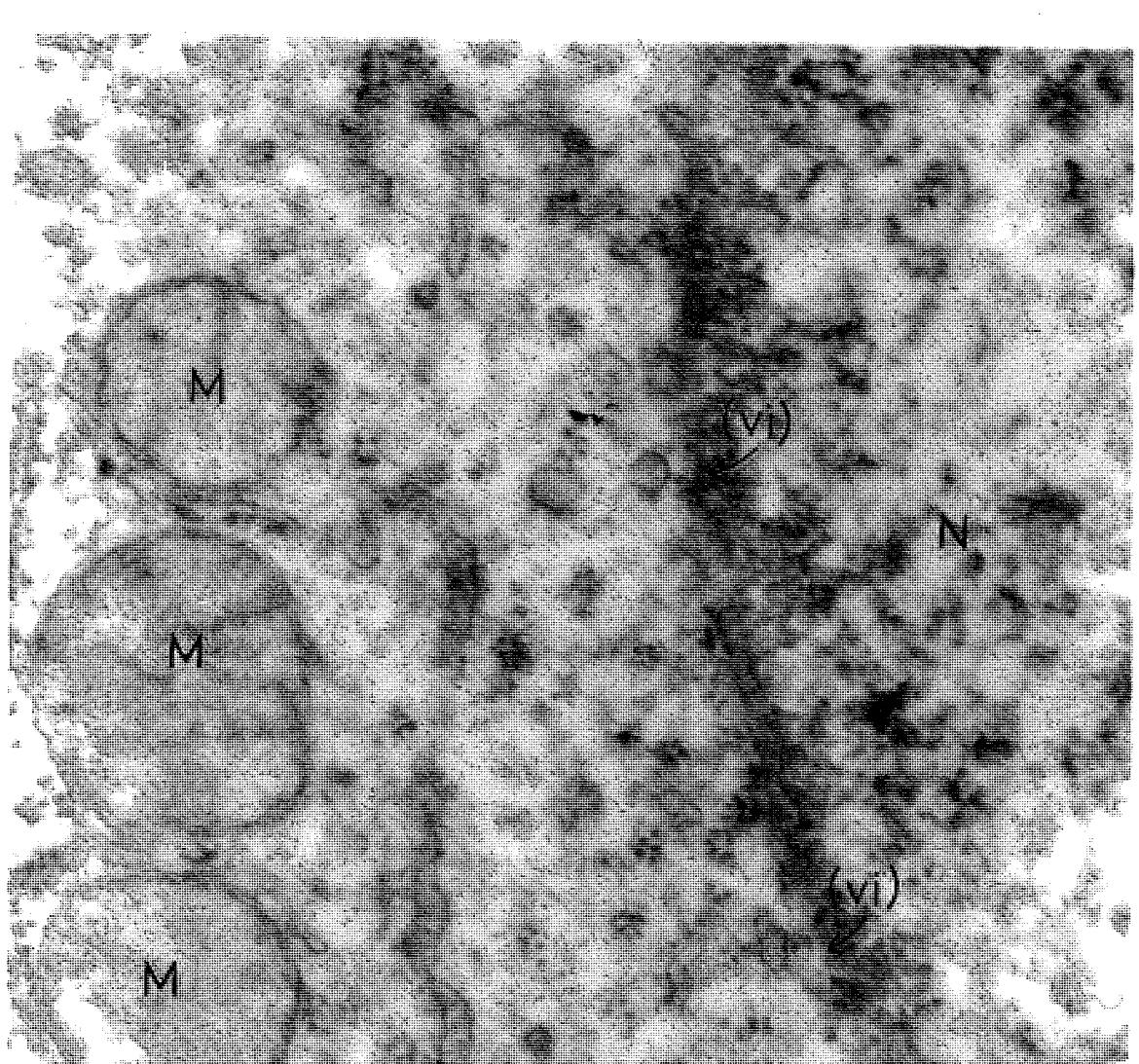
Mouse kidney from an animal treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium. Two stages in the development of a small vesicle are shown, representing stages (iv) and (v) in Figure 44.



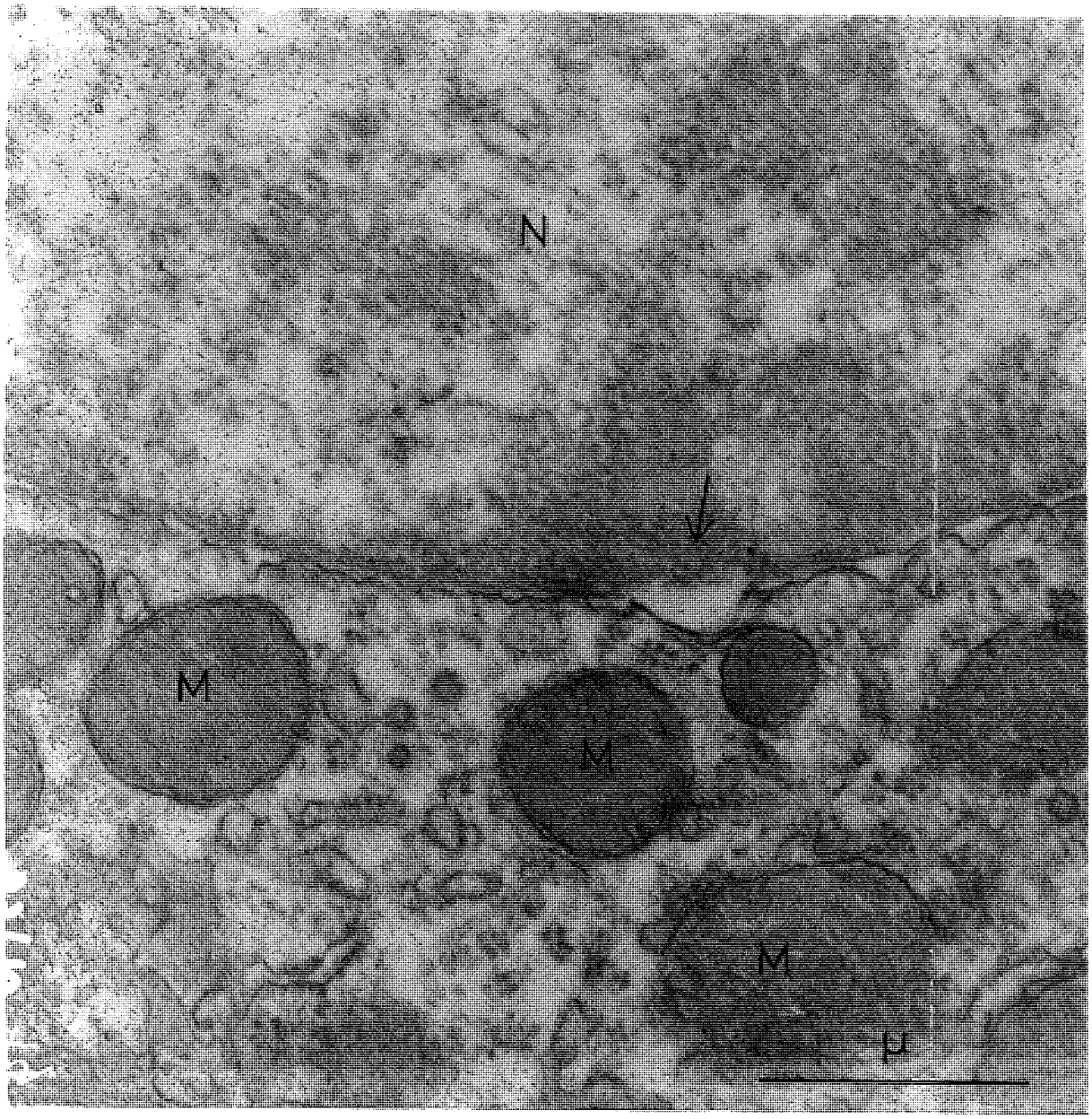
Mouse kidney from an animal treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium and lead. Small vesicles representing stages (v) and (vi) in Figure 44, can be distinguished associated with thenuclear envelope.



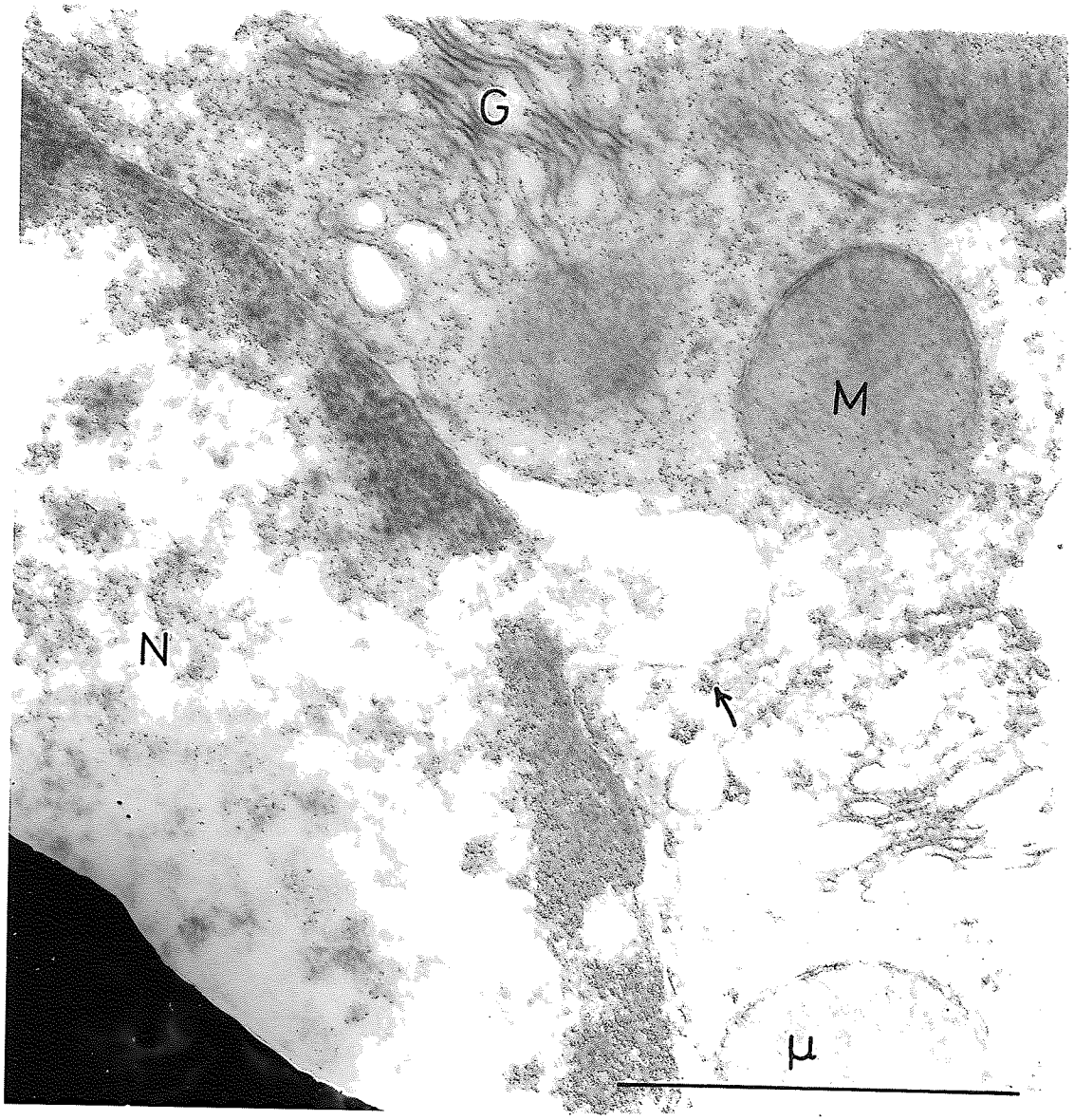
Mouse liver from an animal treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium. Vesicles representing stages (iv), (v) and (vi) in Figure 44 can be distinguished through the obscuring material associated with the nuclear envelope. Here, the sites of vesicle production appear to be related to the concentrations of endoplasmic reticulum profiles.



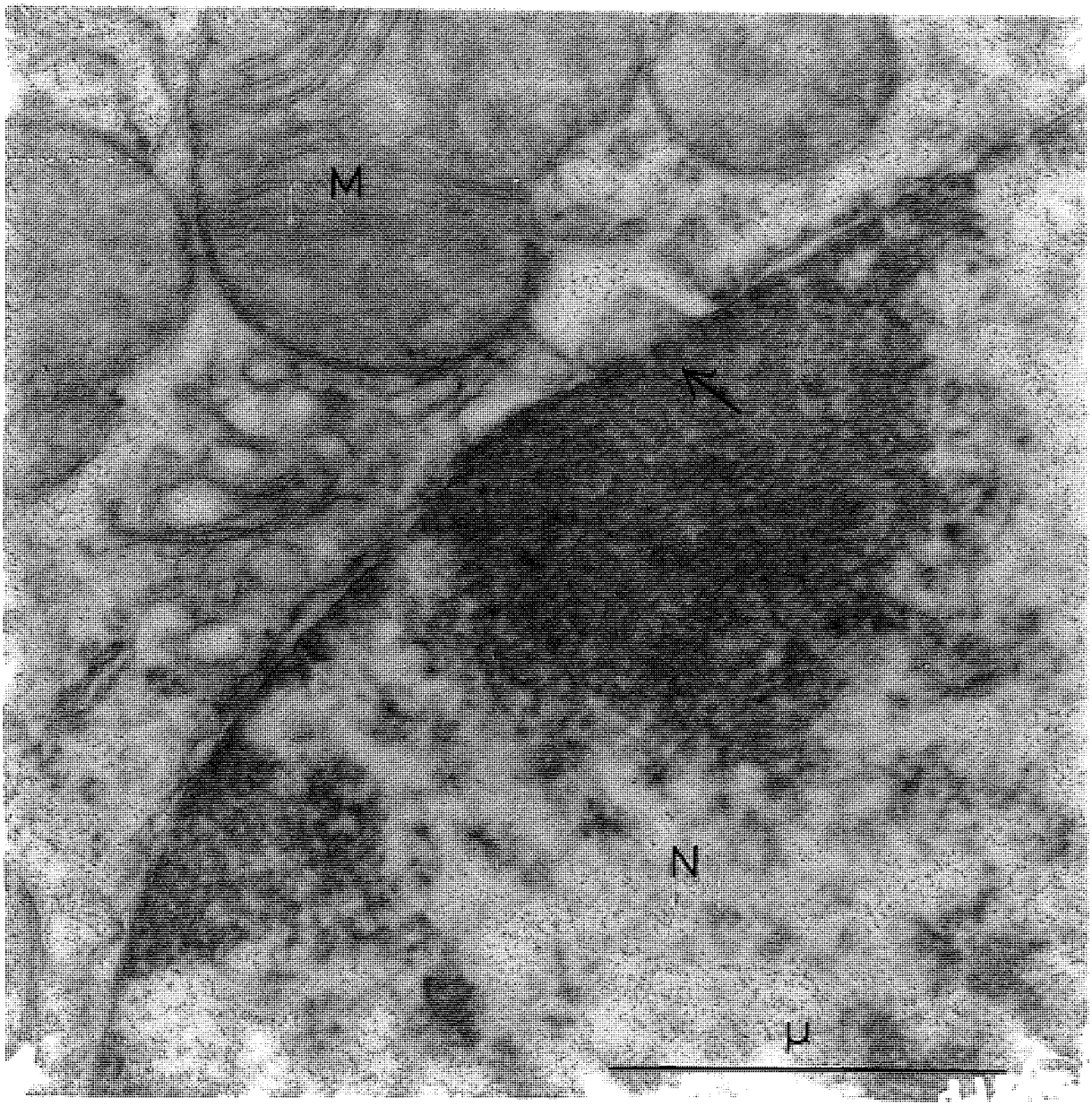
Mouse liver from an animal treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium. Again small vesicles, representing stage (vi) in Figure 44, can be distinguished through the obscuring material associated with the nuclear envelope.



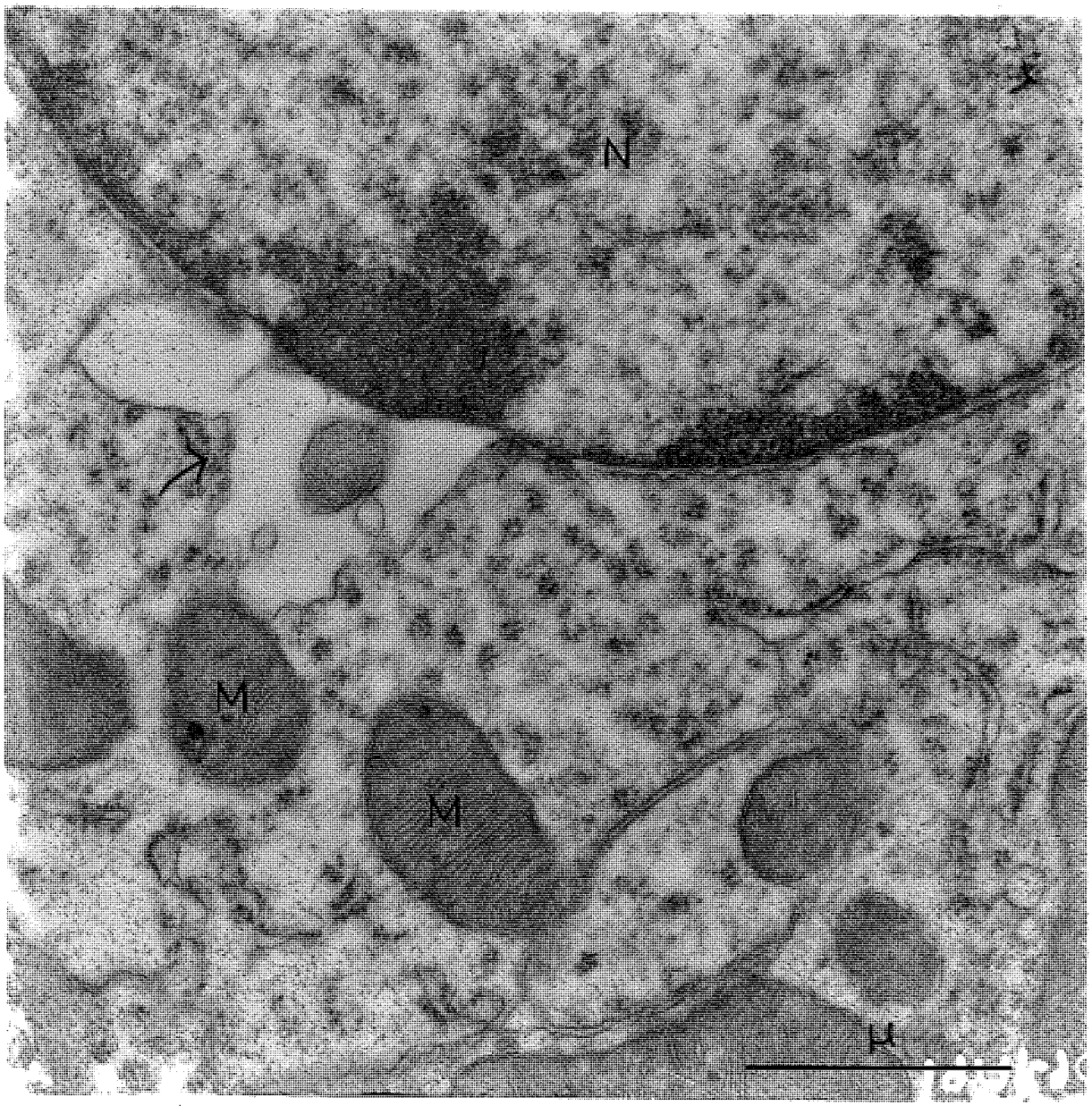
Mouse kidney from a thyroidectomised animal, fixed in glutaraldehyde and osmium and stained with uranium and lead. The outer element of the nuclear envelope is pushed outwards to form a local expansion of the perinuclear space, in a structure such as that represented by stages (iii) and (iv) in Figure 47.



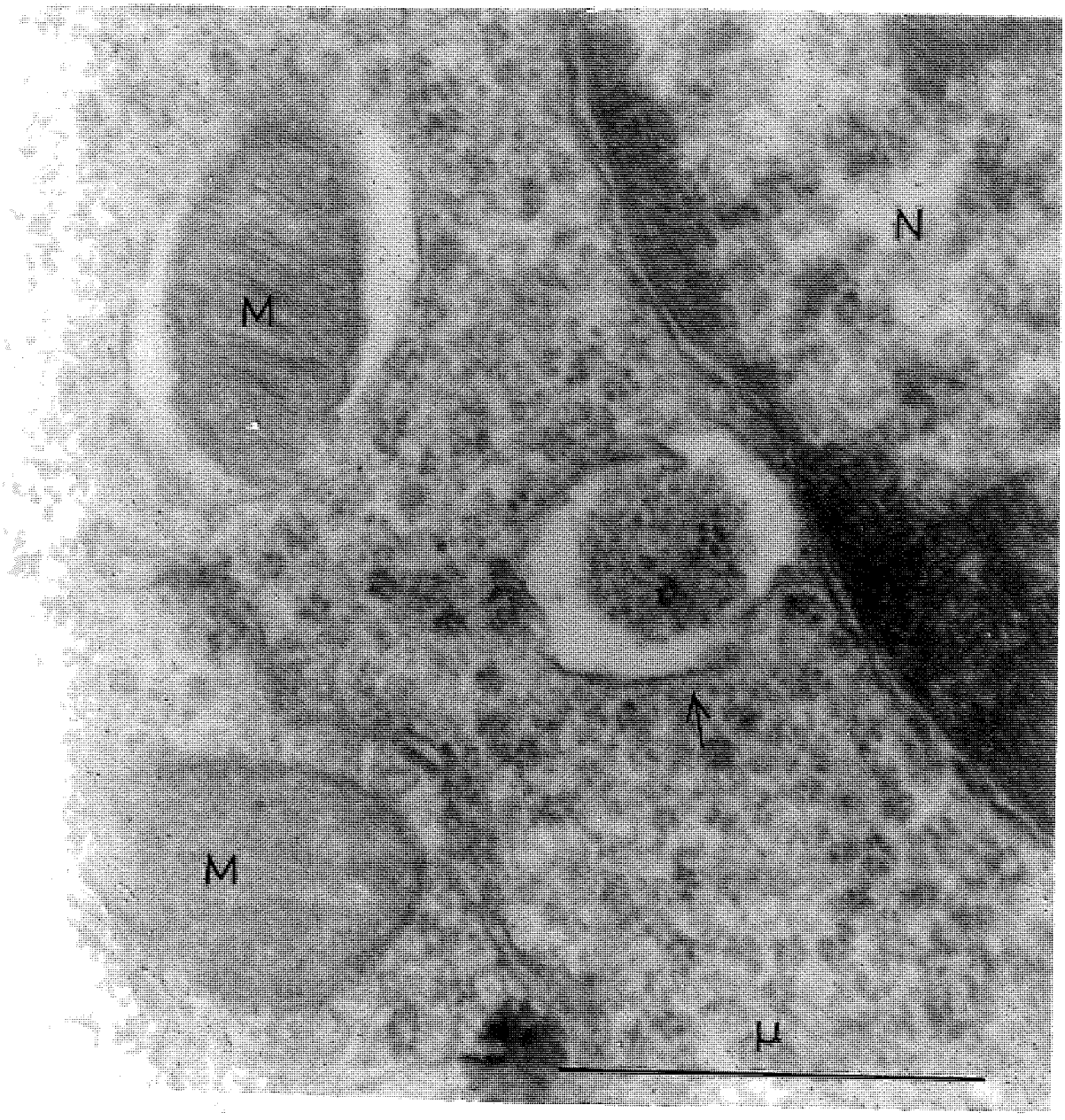
Kidney from a mouse treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium. Again material can be seen passing into the local expansion of the perinuclear space from the underlying nucleoplasm.



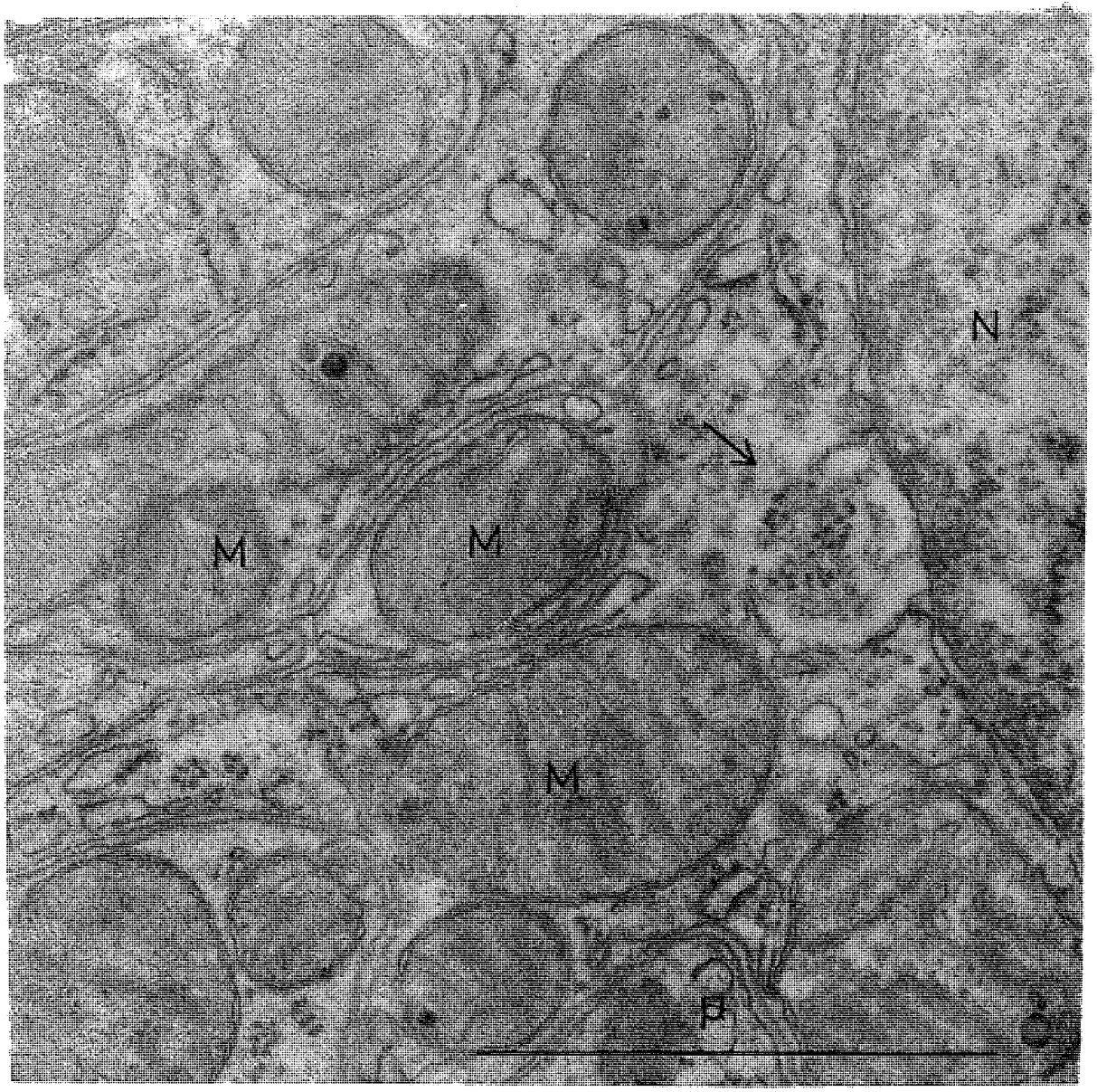
Kidney from a mouse treated with triiodothyronine, fixed in glutaraldehyde and osmium and stained with uranium. Material from the nucleoplasm can be seen passing into the local expansion of the perinuclear space to give the appearance of a structure such as that shown by stage (v) in Figure 47.



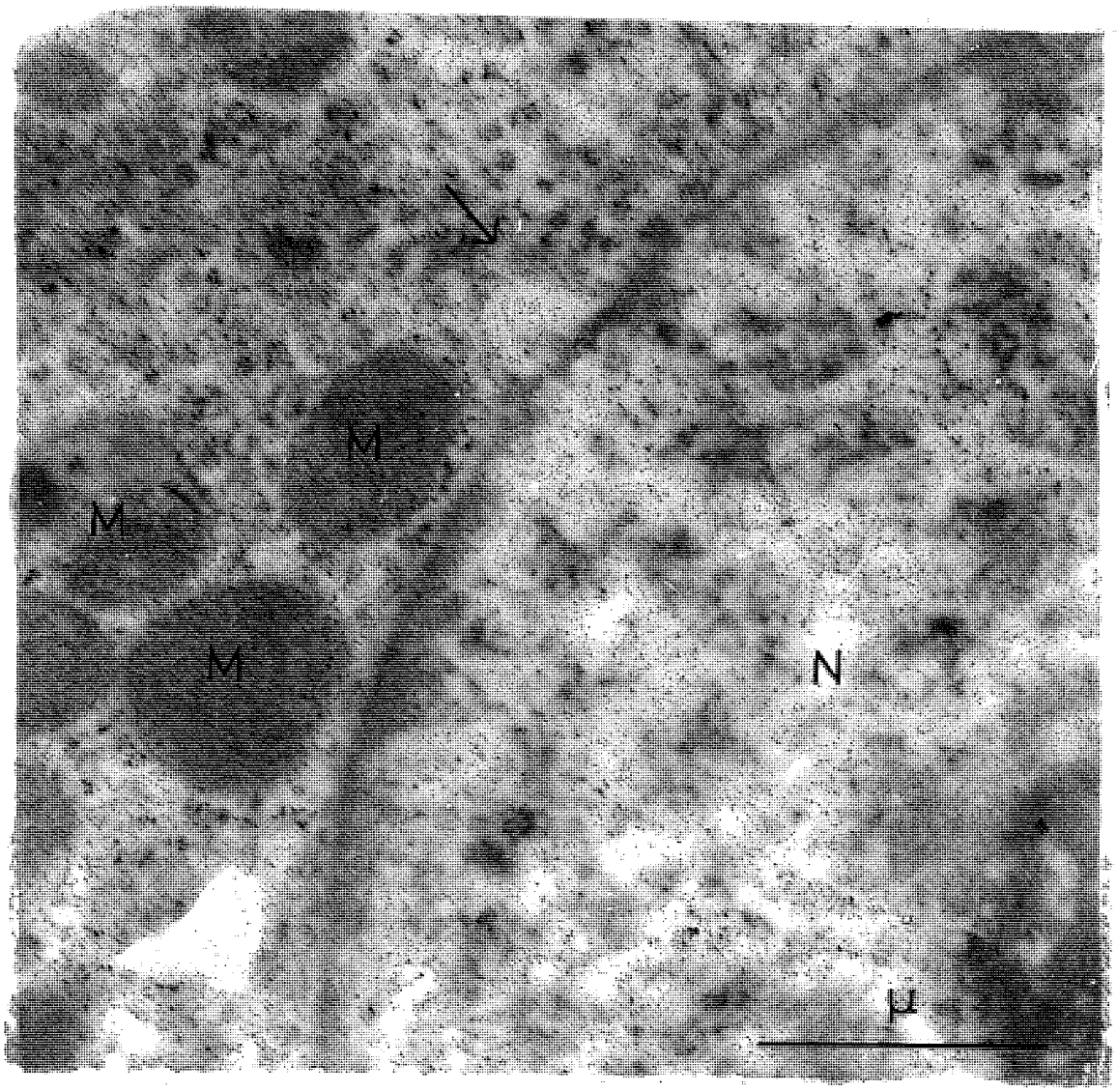
Kidney from a mouse treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium. The locally expanded perinuclear space contains a membrane bound mass of material, apparently derived from the inner element of the nuclear envelope and the nucleoplasm, respectively. Such a structure is represented by stages (vii) and (x) in Figure 47.



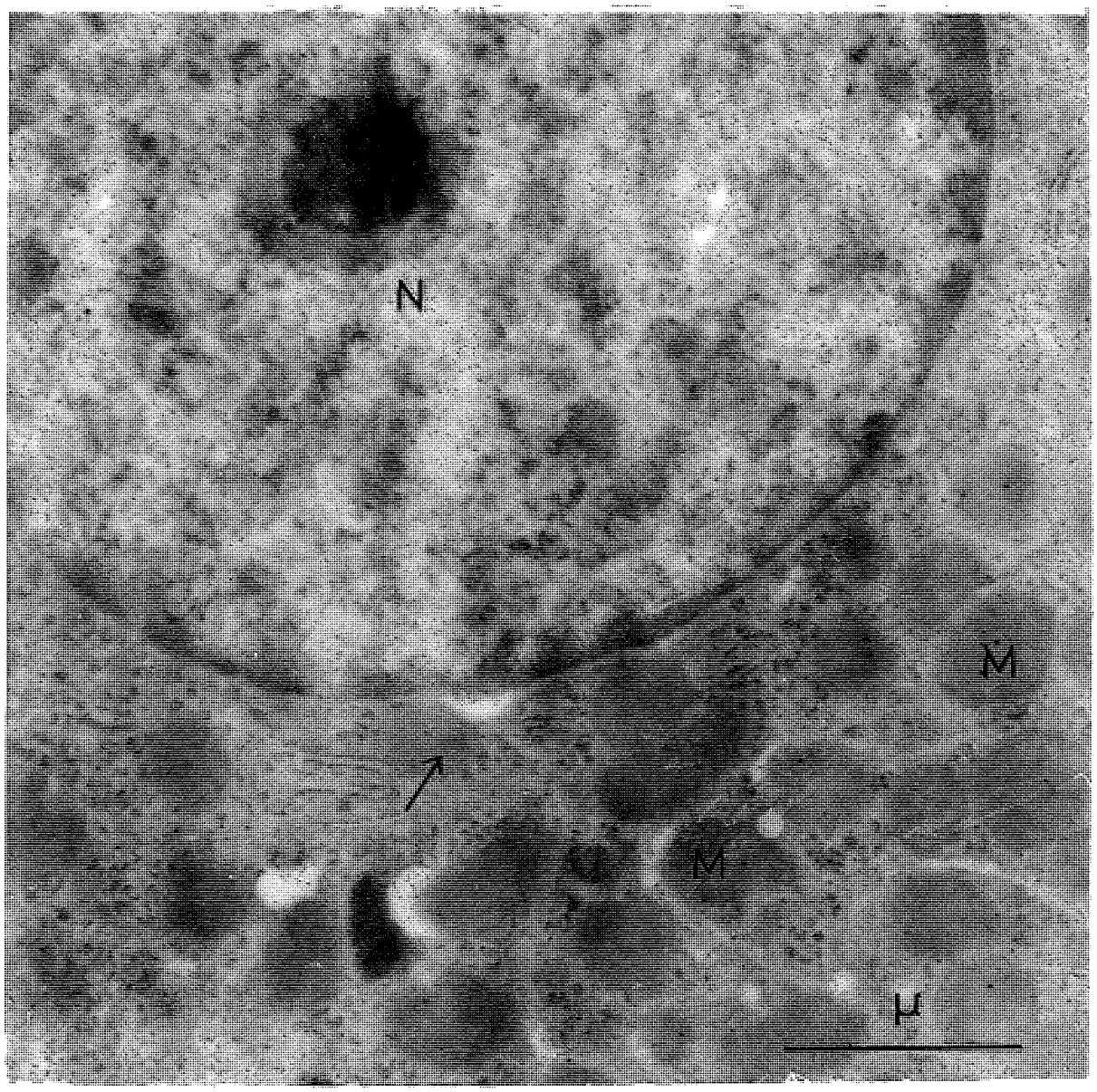
Kidney from a mouse treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium and lead. A large vesicle structure, such as that represented by stage (ix) in Figure 47 can be seen separated from the nuclear envelope. The inner membrane surrounding the included material appears tp have already broken down.



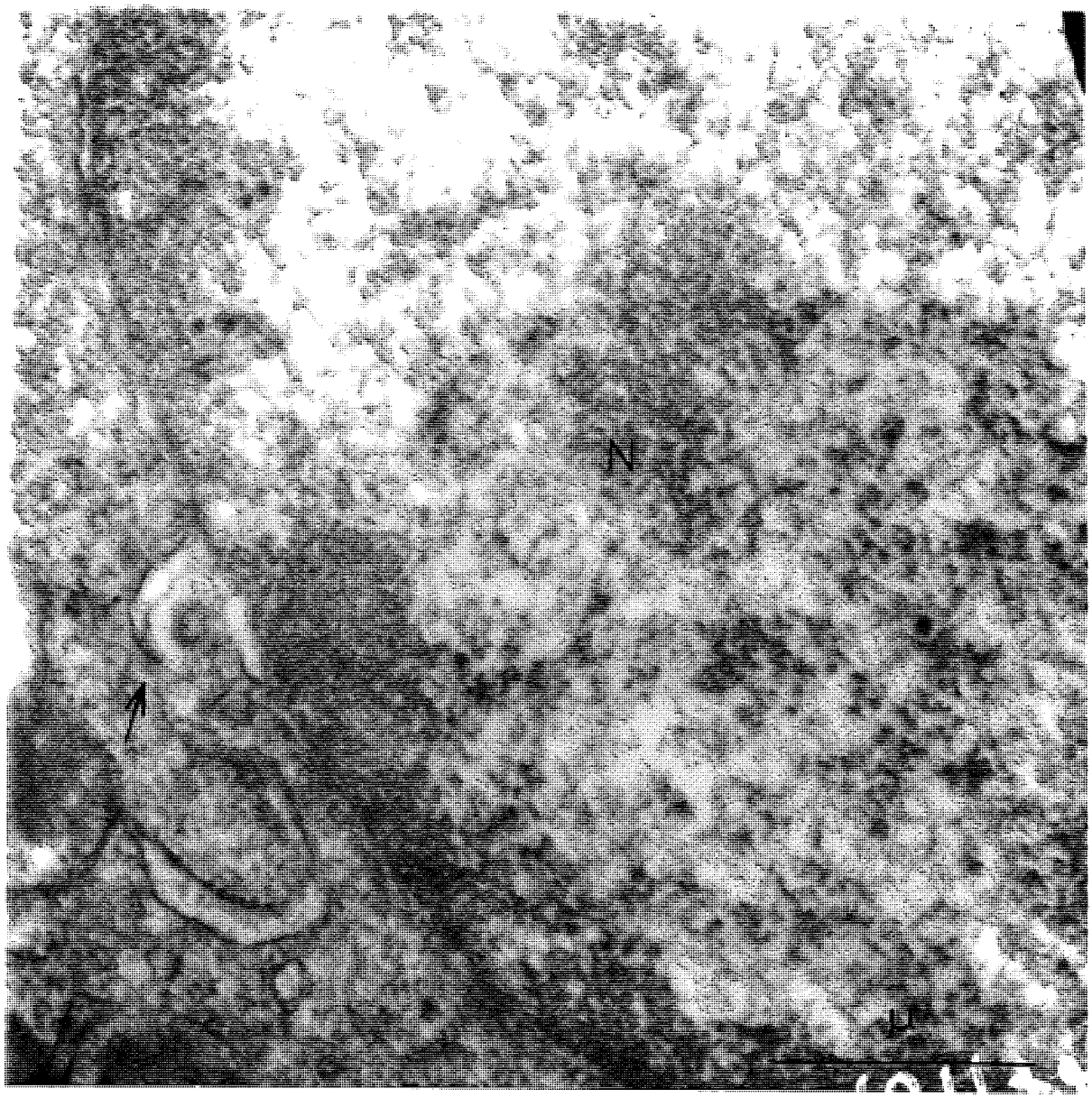
Kidney from a mouse treated with thyroxine, fixed in glutaraldehyde and osmium and stained with uranium and lead. A structure such as that represented by stage (xi) in Figure 47, can be seen developed from the nuclear envelope. The outer margin of the nuclear envelope around the 'vesicle' appears to have broken down and material is seen passing out into the cytoplasm as soon as the inner element of the nuclear envelope has been restored across the surface of the nucleus.



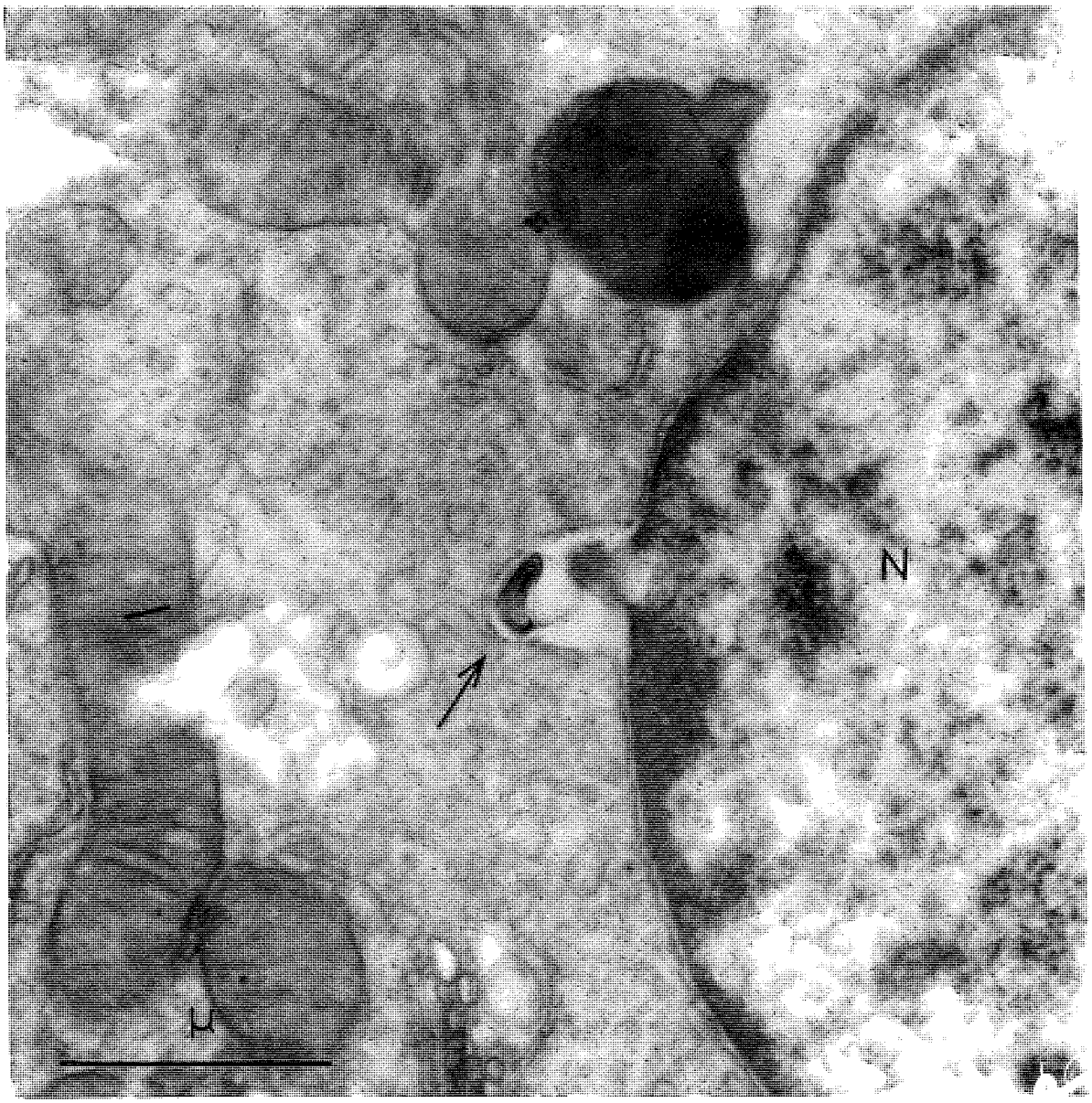
Kidney from an animal treated with triiodothyronine, fixed in acrolein and stained with silver nitrate. Material of similar appearance to the fibrillar components of the nucleus can be seem passing into a local expansion of the perinuclear space.



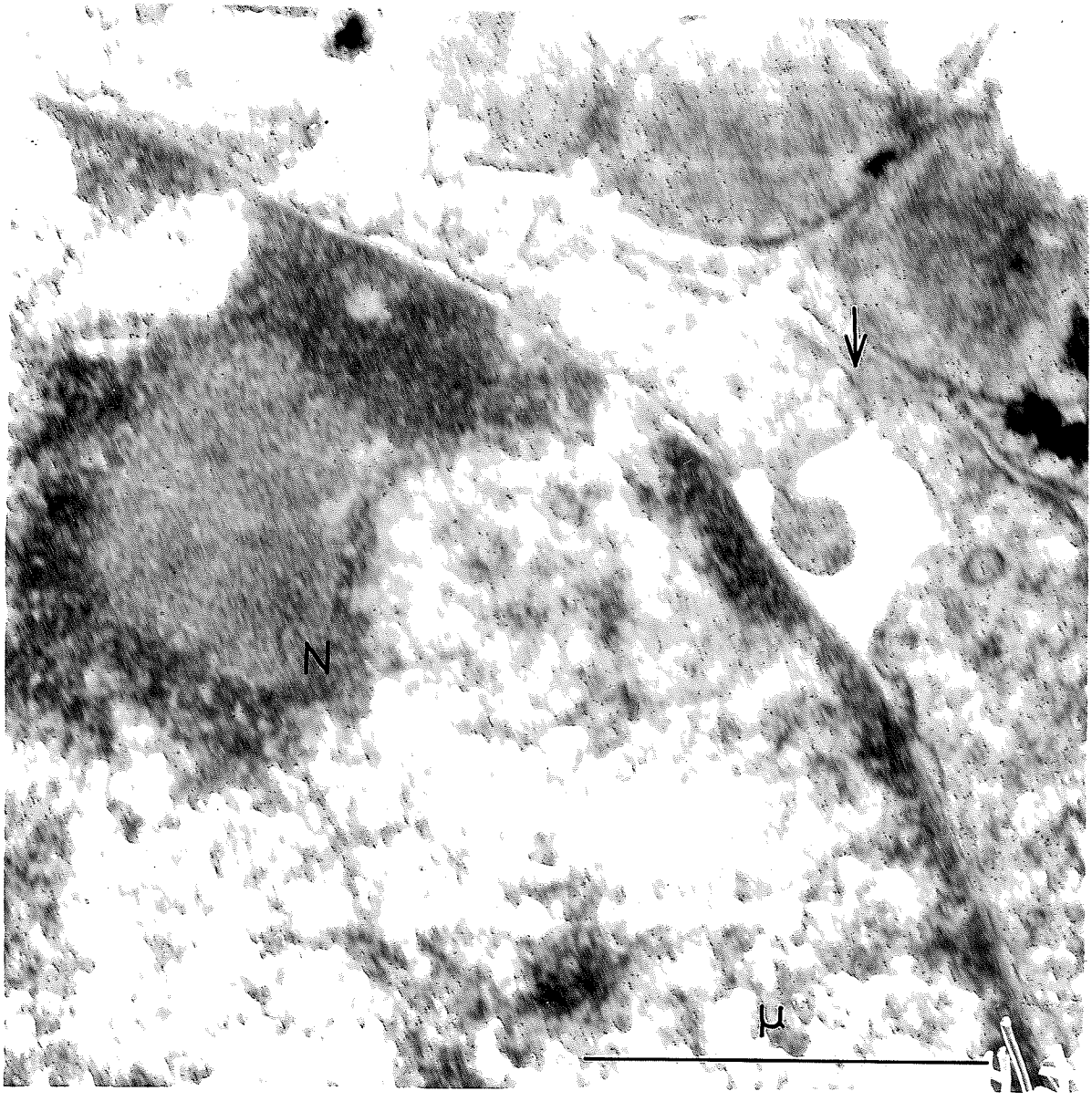
Kidney from a thyroidectomised mouse, fixed in acrolein and stained with silver nitrate. The nuclear envelope is expanded to form a local enlargement of the perinuclear space. Chromatin, with its overlying silver deposits, is continued across the enlargement of the perinuclear space.



Mouse kidney from an animal treated with triiodothyronine, digested with ribonuclease. The contents of the vesicle structure has little apparent structure, although some granular material can be distinguished.



Kidney from a mouse treated with thyroxine, digested with ribonuclease. The contents of the large vesicle, are indistinct, with no distinguishable fibrillar or granular component.



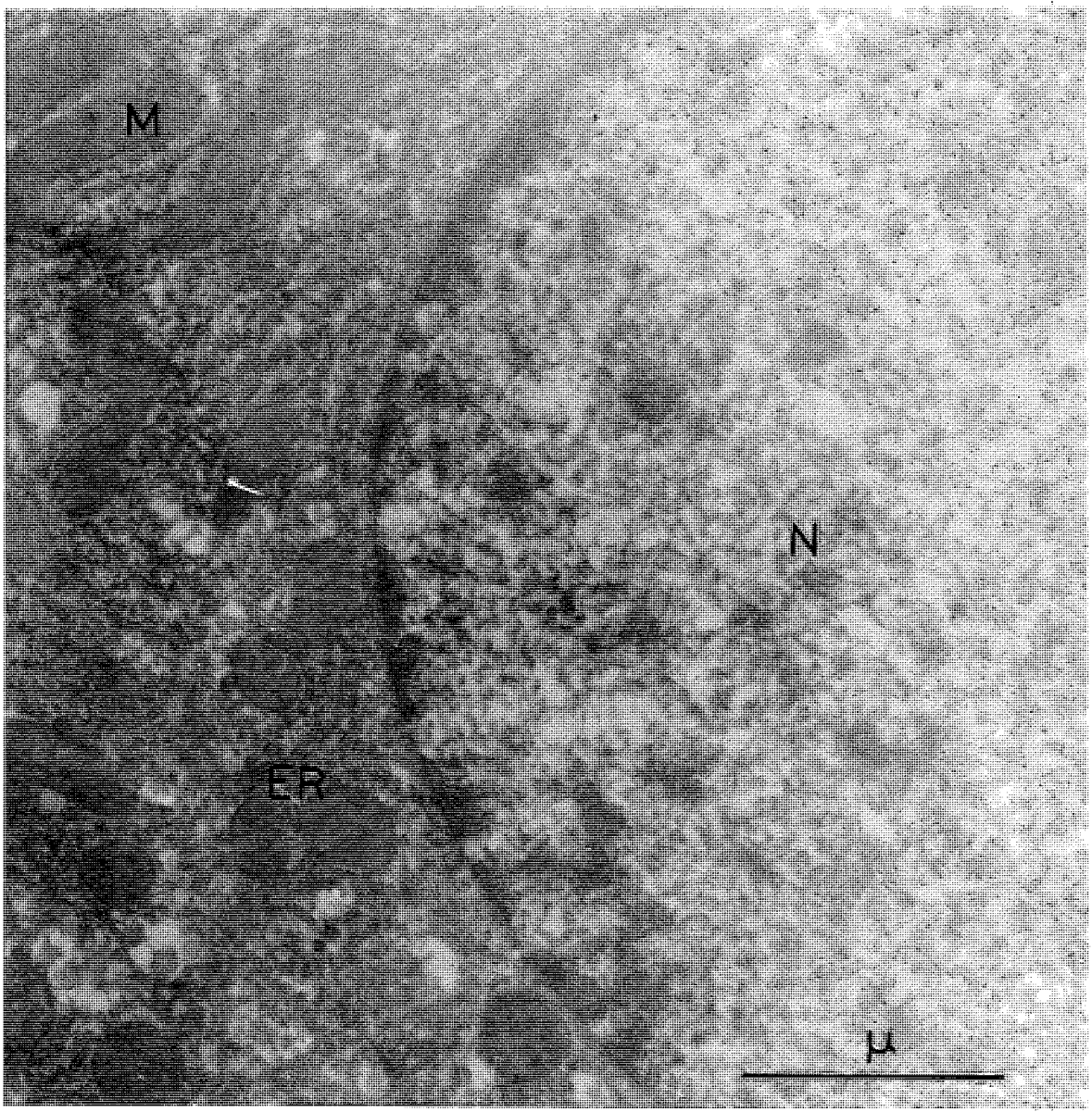
Kidney from a mouse treated with triiodothyronine, digested with pepsin. The contents of the large vesicle resemble those of normally prepared material.

Appendix I.

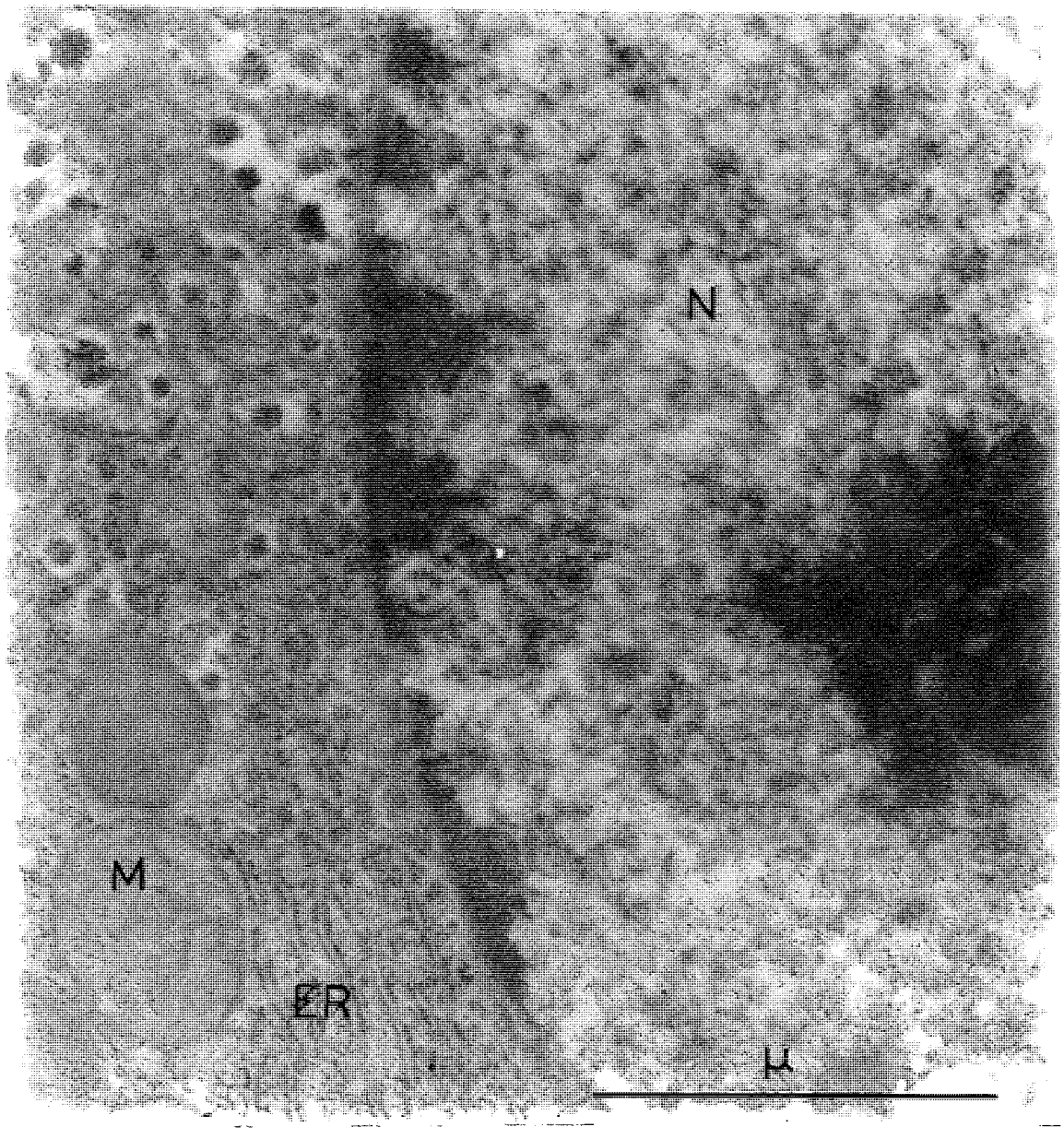
Morphological Changes in the Nuclear Envelope of the Liver, Kidney and Uterus of the Rat During the Oestrous Cycle.

Key

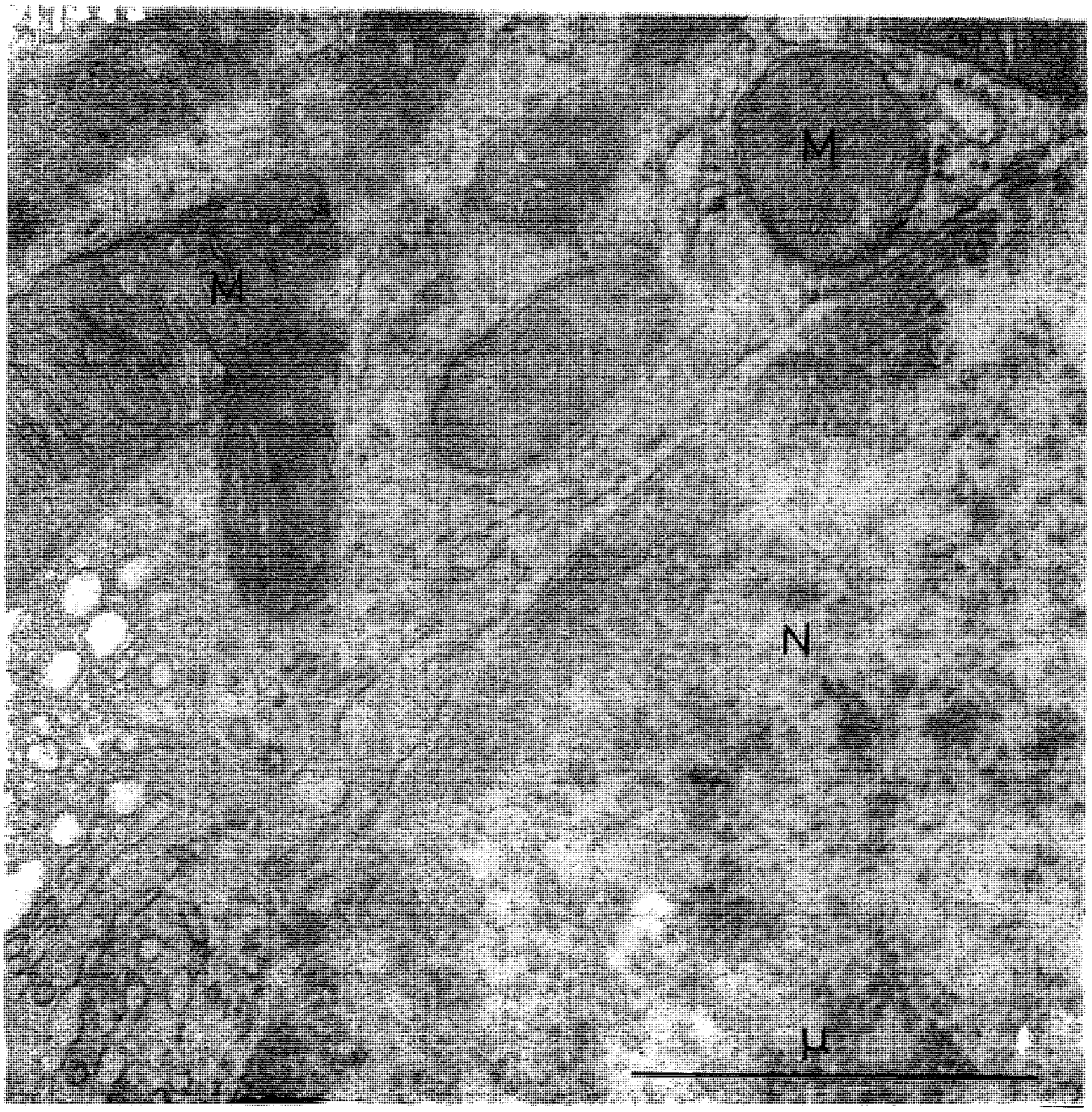
N	–	Nucleus
M	–	Mitochondrion
ER	–	Endoplasmic reticulum



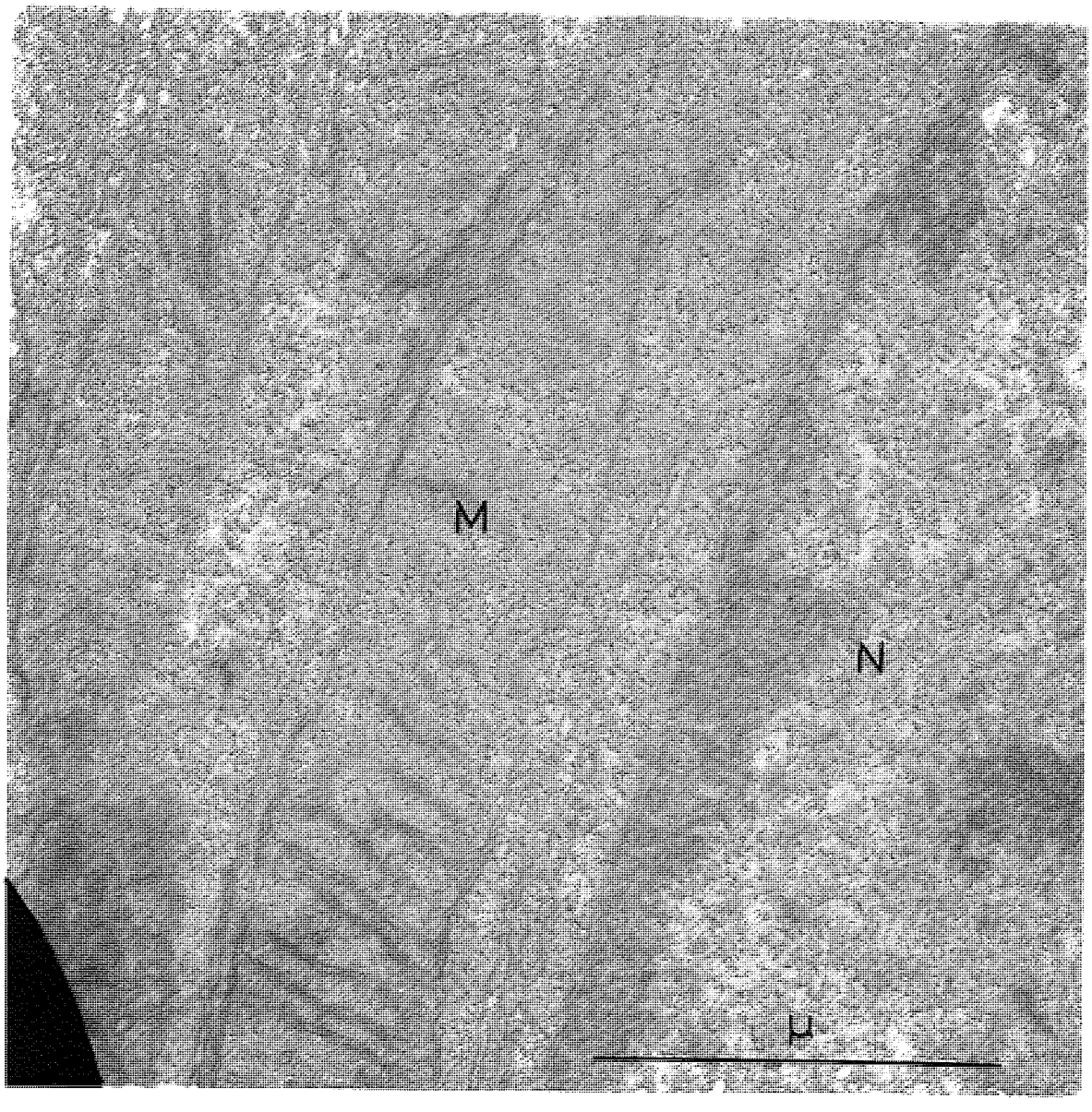
Liver from a di-oestrous rat, fixed in glutaraldehyde and osmium and stainedowith uranium and lead. Membranes of the nuclear envelope are well defined, regular and evenly separated.



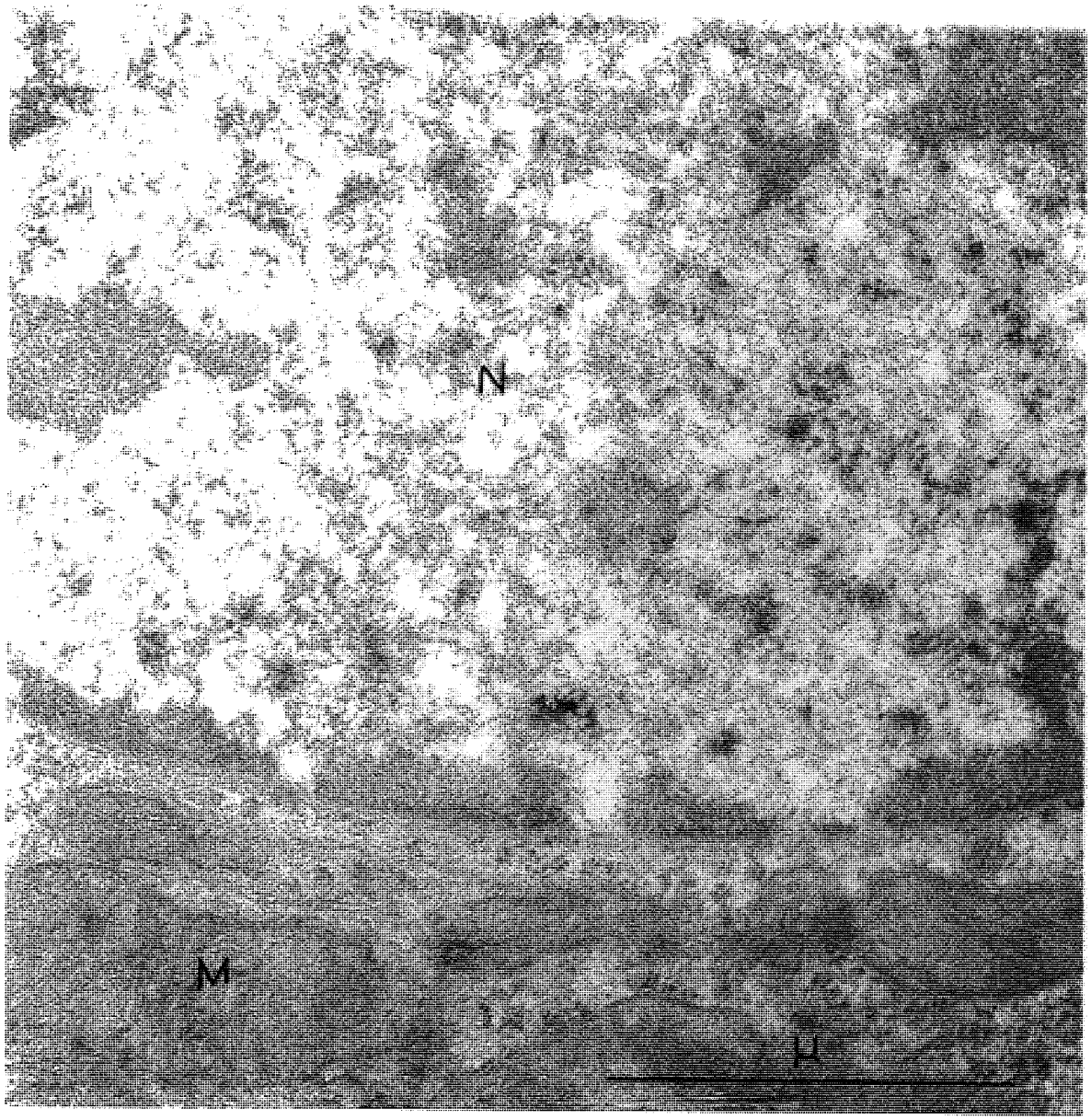
Liver from a pro-oestrous rat, fixed in glutaraldehyde and osmium and stained in uranium and lead. The nuclear envelope is obscured by some indistinct electron dense material,



Proximal convoluted tubule of a kidney from a di-oestrous rat, fixed in glutaraldehyde and osmium and stained with uranium and lead. The nuclear envelope is crisp and regular with clearly defined, evenly separated membranes which did not vary in appearance during pro-oestrus.



Distal convoluted tubule of a rat kidney during pro-oestrus, fixed in glutaraldehyde and osmium and stained with uranium and lead. The membrane constituents of the nuclear envelope are very irregular with the frequent development of small vesicles from the outer element.



Distal convoluted tubule from the kidney of a rat in di-oestrus, fixed in glutaraldehyde and osmium and stained with lead and uranium. The nuclear envelope is clear, withthe membrane elements evenly separated with no associated small vesicle structure.