

# *Urinary Casts*

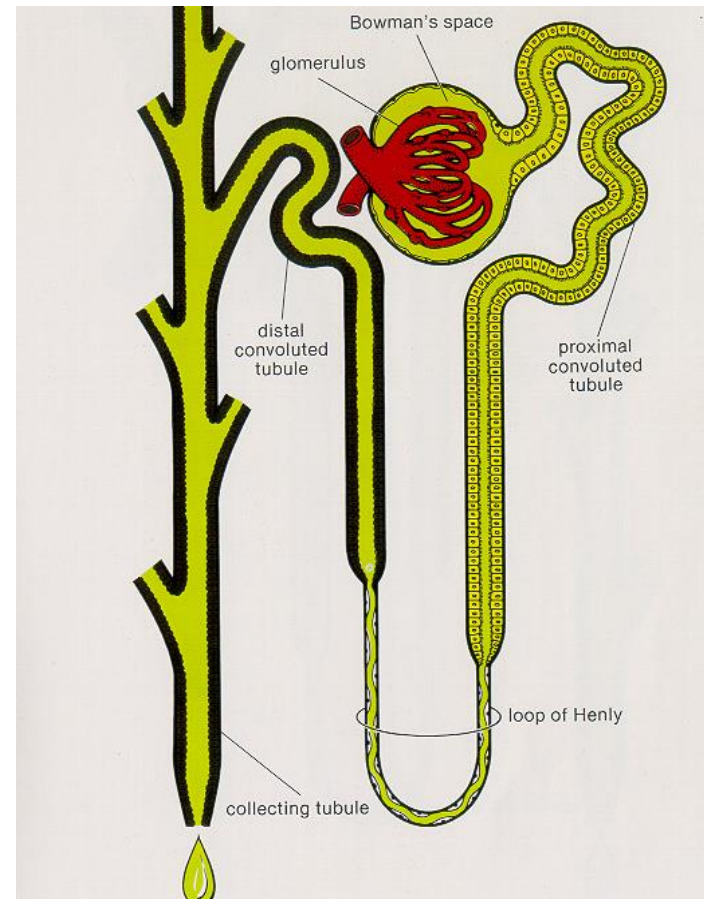
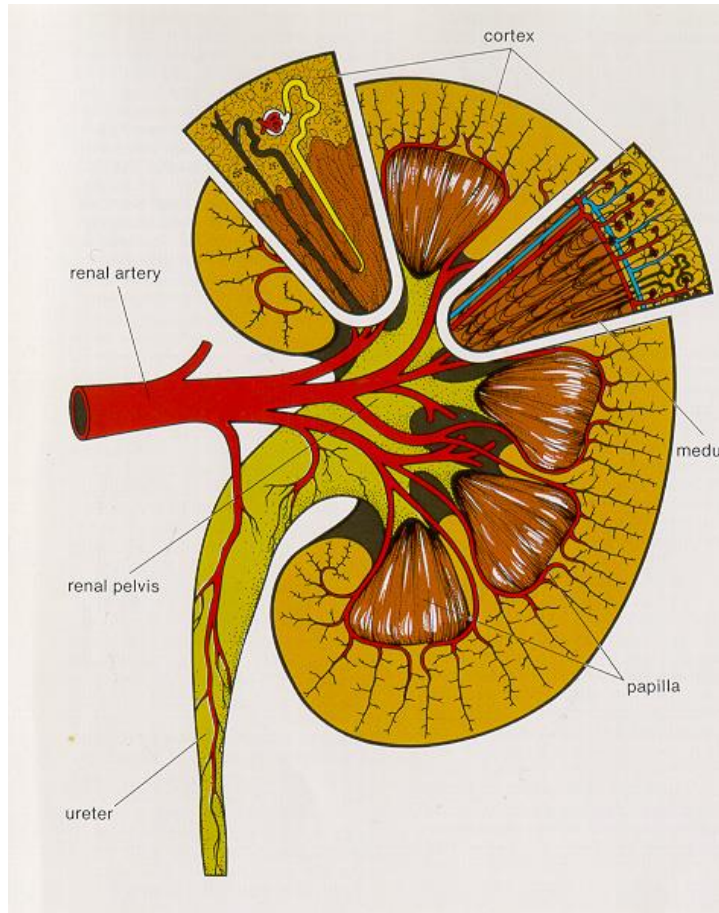
*Prepared by:*

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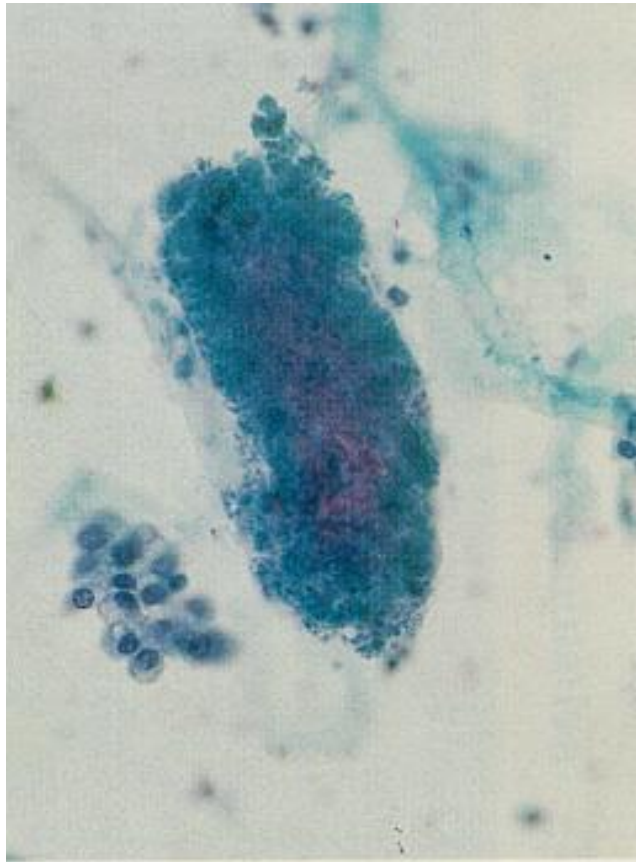
**Newcastle, Australia**

**1998**

# Urinary Casts: Histology



# Urinary Casts: General Properties



## *Formation:*

- proteins (plasma, tubular cellular debris) precipitate and gel in tubular lumina

## *Origin:*

- originate in the parenchyma of the kidney

## *Shape:*

- shaped by the tubular lumen of the nephron
- may be straight or convoluted
- parallel sides and round blunted ends

## *Urinary Casts:* Types

Two broad categories:

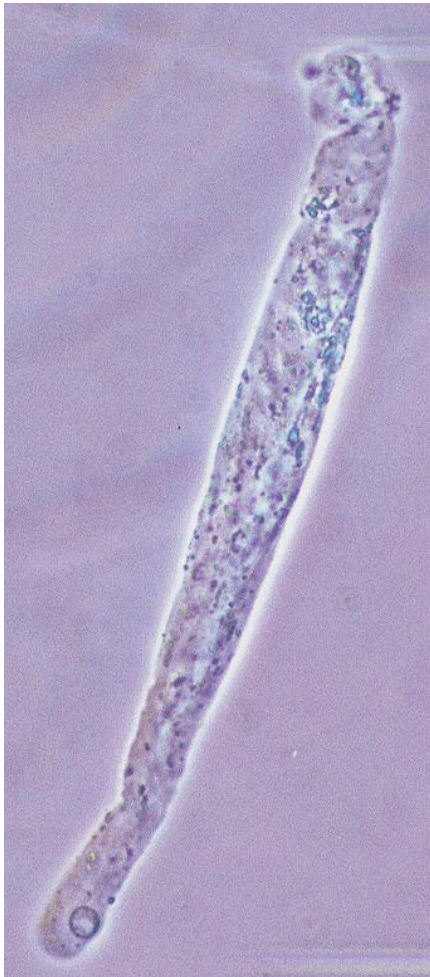
*Physiologic casts:*

- excreted by healthy volunteers after administration of diuretics or strenuous physical exertion .
- generally do not have pathological significance.

*Pathological casts:*

- excreted by patients with kidney disease
- contain various protein fractions derived from blood as well as mucoprotein.

## *Physiologic Casts:* Hyaline (1)



### *Description:*

- cylindrical, semisolid, transparent-formed elements
- scarcely visible with conventional brightfield microscopy & requires: condenser lowered and iris diaphragm nearly closed
- appear more distinctly with phase contrast microscopy

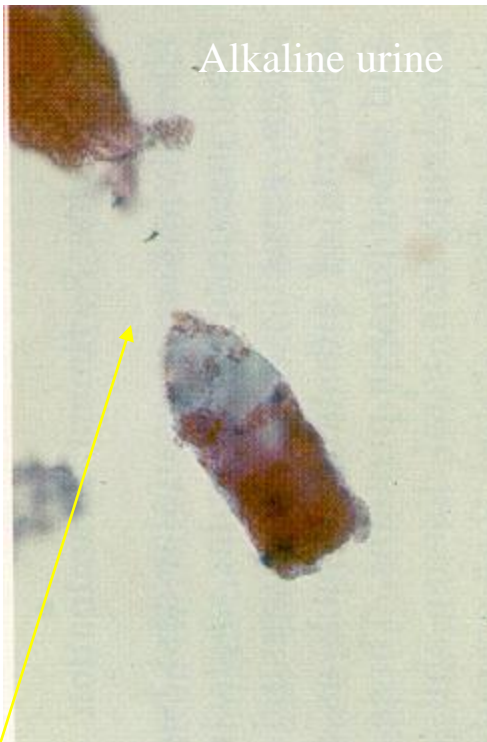
### *Differential diagnosis:*

- often confused with mucous threads, which are
  - narrower, and
  - frequently twisted.

### *Formation:* Predisposing factors include:

- decreased urine flow
- low pH
- high solute concentration
- high protein concentration

## *Physiologic Casts: Hyaline (2)*



### *Caution:*

- alkaline urine, resulting from bacterial proliferation, will dissolve casts

### *Refrigeration:*

- remain visible in urine if specimens
  - stored at 4C
  - for periods of up to 48hr

### *Clinical Significance:*

- excretion do not accompany with proteinuria
- excretion in response to hard physical exercise

*Cast dissolving (Papanicolaou stain)*



## *Physiologic Casts:* Granular (1)



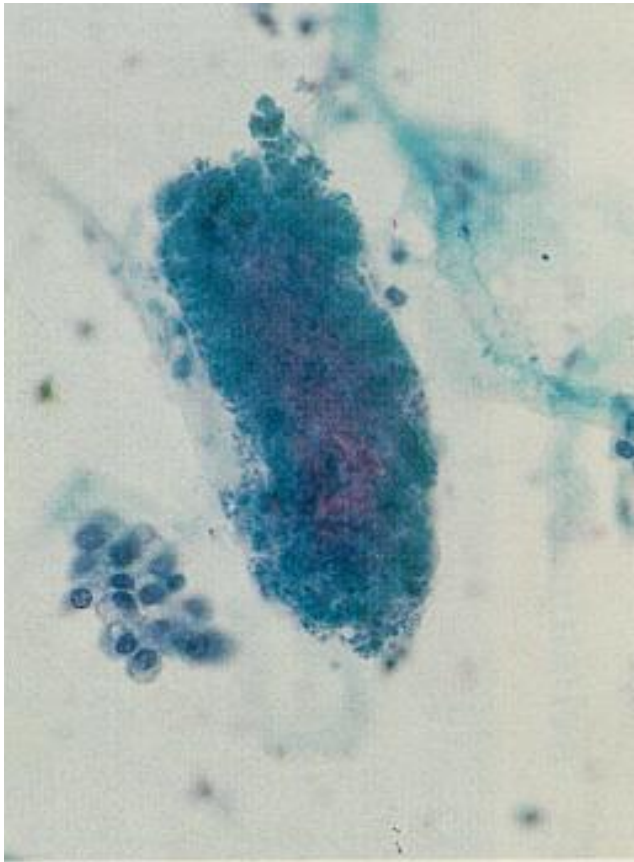
### *Description:*

- granules in a hyaline cast matrix
- granules derived either from plasma proteins or from degenerating cellular components.
- Can be recognized under bright light microscopy

### *Formation:*

- originate within the nephron
- form from 2 major sources:
  - breakdown of cellular material
  - direct aggregation of serum proteins

## *Physiologic Casts: Granular (2)*



### *Caution:*

- alkaline urine will dissolve casts

### *Refrigeration:*

- remain visible in urine if specimens
  - stored at 4C
  - for periods of up to 48hr

### *Clinical Significance:*

- In small numbers, they are generally regarded as physiological
- excretion in response to hard physical exercise
- In large numbers, can be associated with renal parenchymal disease.



## *Pathological Casts:* Epithelial



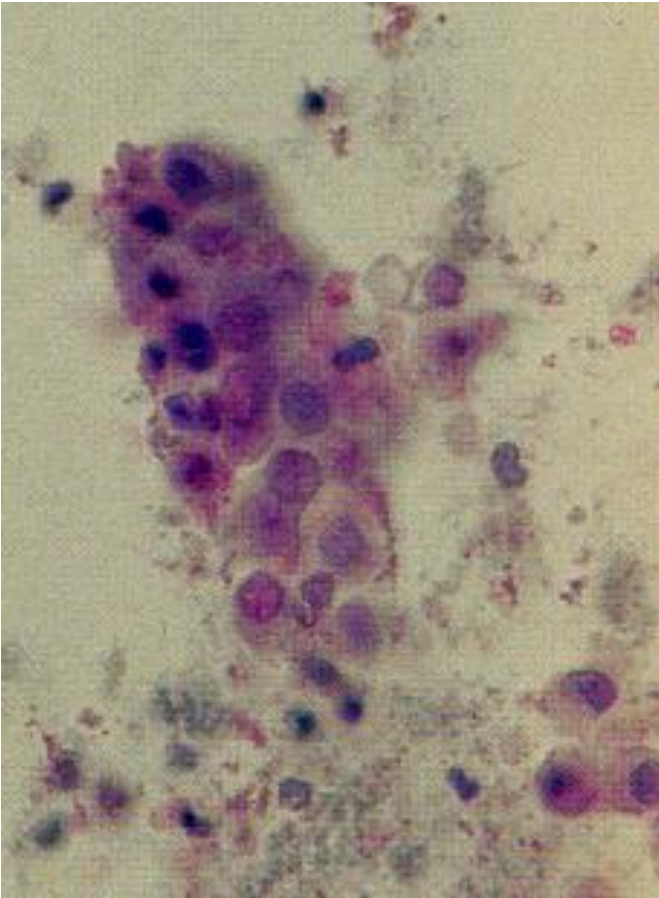
### *Description:*

- often mistaken as white cell casts
- usually contains two parallel rows of cells implies origin in one segment of damaged tubule

### *Formation:*

- exfoliation or desquamation of renal lining cells
- cells remain stasis in tubules which conform to the tubular mold.

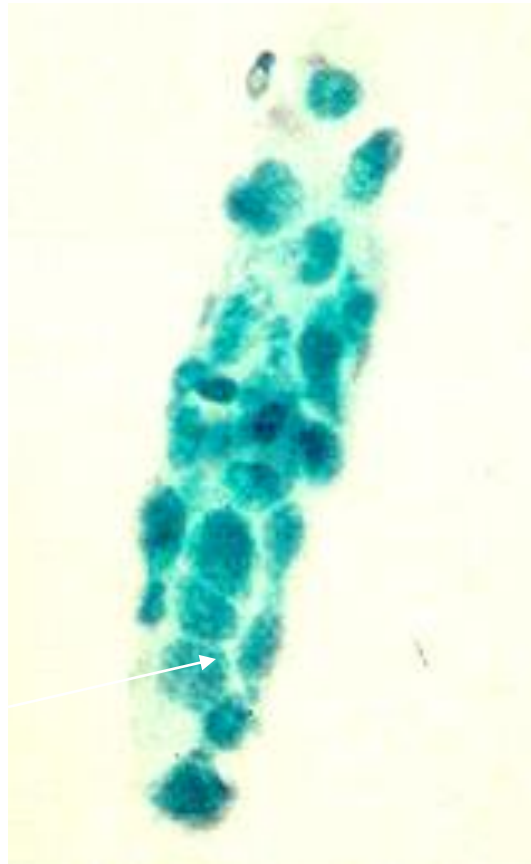
## *Pathological Casts: Epithelial (2)*



### *Pathological Significance:*

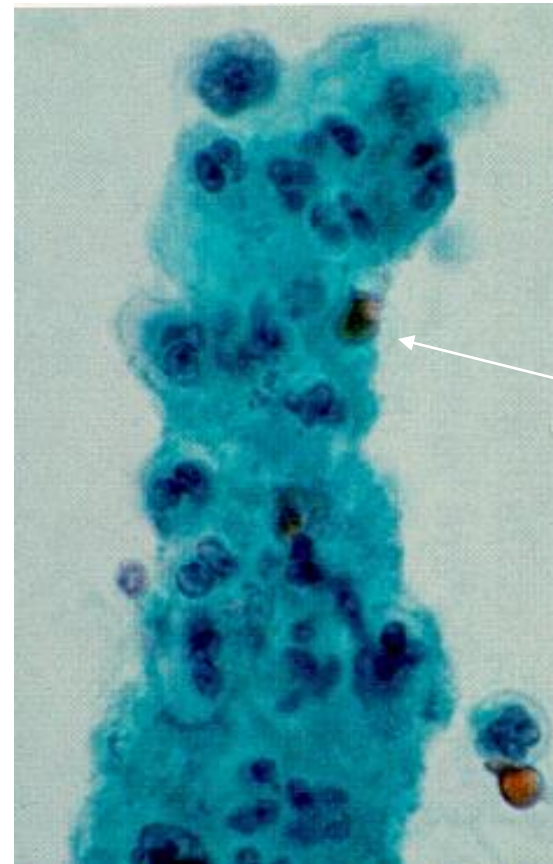
- parenchymal disease
  - acute tubular necrosis,
  - interstitial nephritis
  - eclampsia
  - amyloidosis
- viral diseases (e.g. CMV)
- heavy metal poisoning
- ethylene glycol & salicylate intoxication
- In renal transplantation; commonly seen during renal allograft rejection

## *Epithelial* vs *White Cell cast*



2 Parallel rows  
of cells

*Epithelial cast*



Cells  
irregularly  
spaced

*White cell cast*

## *Pathological Casts:* White cell (1)



### *Description:*

- white cells adhering to hyaline cast, or
- white cell clot in the shape of a tubular mold

### *Formation:*

- White cell enter through and between tubular epithelial cells.
- As a result of interstitial inflammation in the kidney

*Birch et al. Urine Microscopy, 1994*

## *Pathological Casts:* White cell (2)

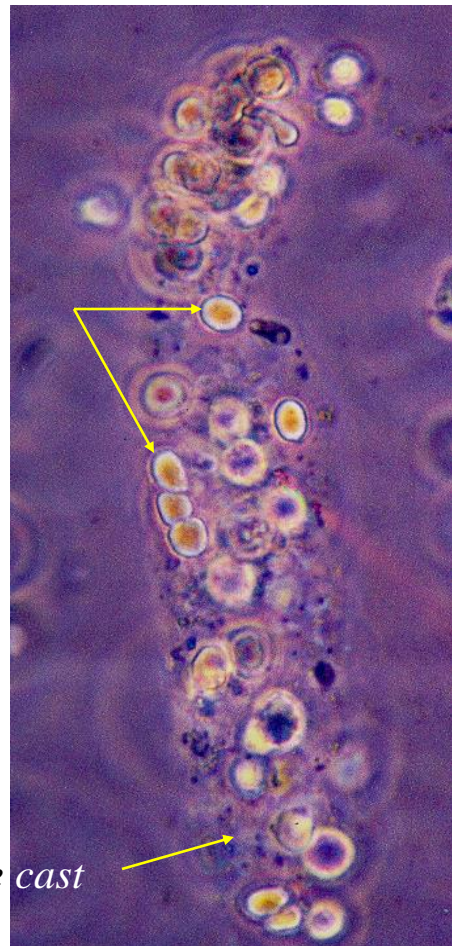


### *Pathological Significance:*

- diagnostic for
  - bacterial infections e.g. pyelonephritis
  - non-infective inflammatory disease:
    - Lupus nephritis
    - glomerulonephritis
    - interstitial nephritis
    - nephrotic syndrome



## *Pathological Casts: Red cell (1)*



*Red cells*

*Hyaline cast*

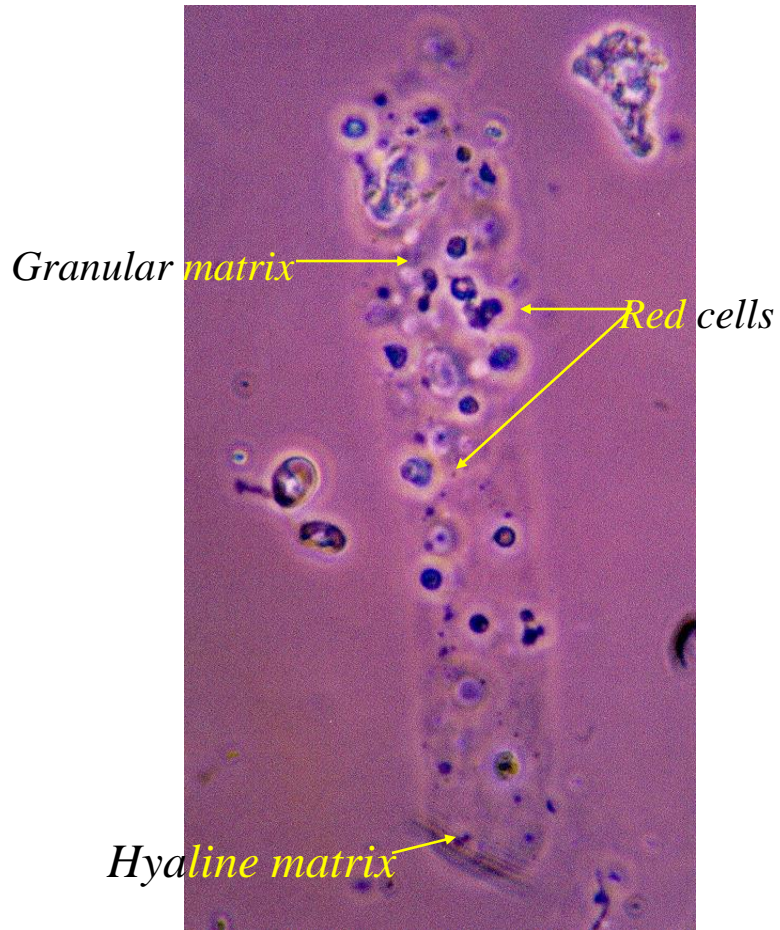
*Description :*

Prerequisite for the identification of red cell cast is :

- (1) red cell outlines can be sharply defined in at least part of the hyaline cast matrix



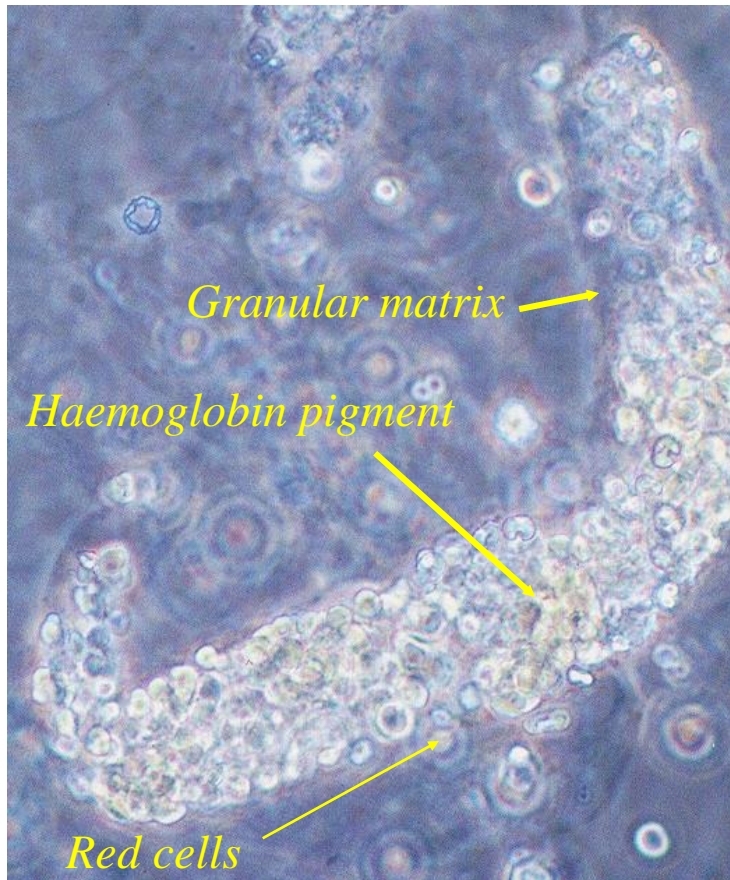
## *Pathological Casts:* Red cell (2)



### *Description (continued):*

- (2) red cell in one end of the granular matrix and hyaline matrix at the opposite end of the same cast

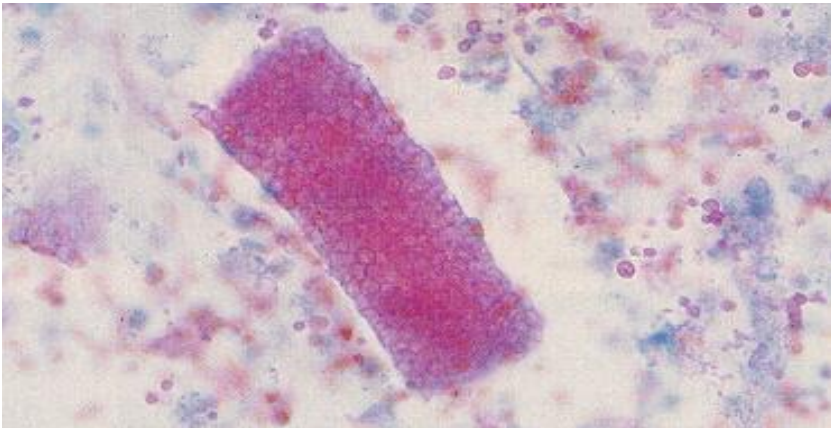
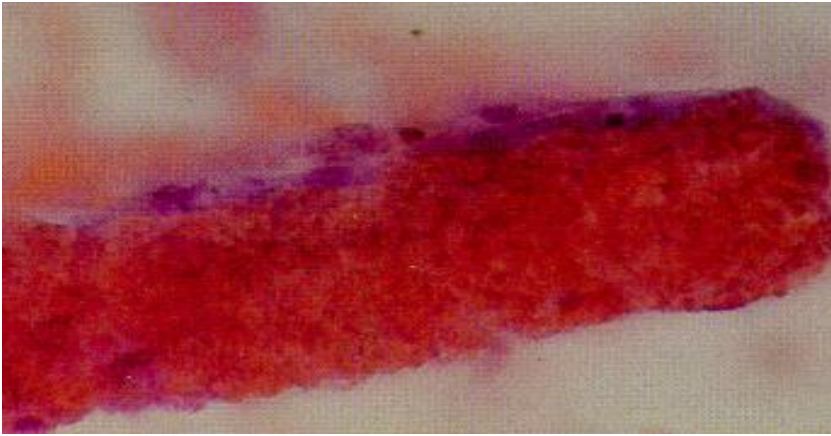
## *Pathological Casts:* Red cell (3)



### *Description (continued):*

- (3) red cell cast composed of degenerated red cells and granular appearing haemoglobin pigment

## *Pathological Casts:* Red cell (4)



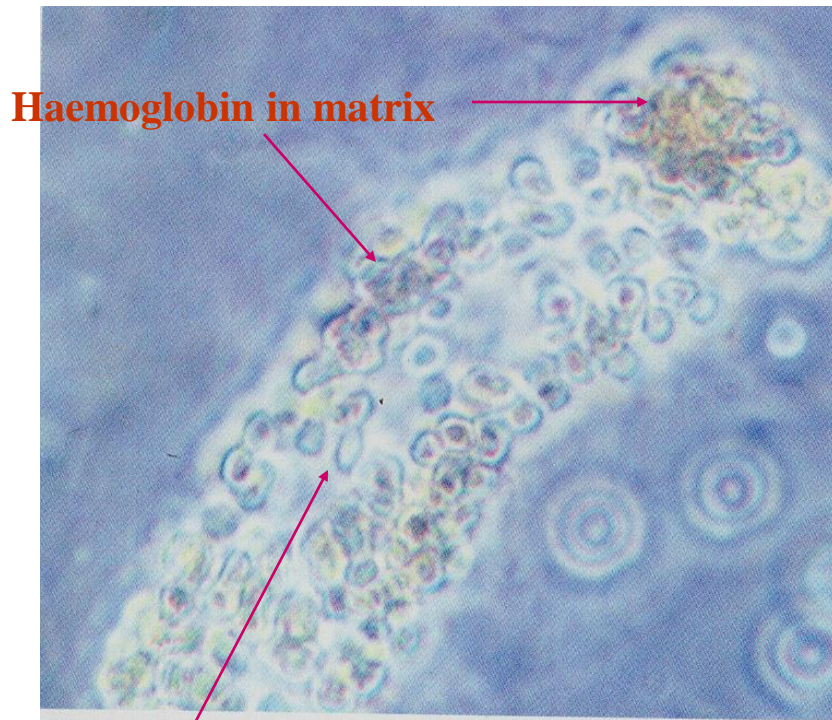
### *Description (continued):*

#### (4) Red cell clots:

- fibrinogen enters the tubule from damaged glomeruli is converted to fibrin
- red cell cast is formed when red cells are trapped within the fibrin matrix.



## *Pathological Casts:* Red cell (4)



**Haemoglobin in matrix**

**Red cells**

### *Pathological Significance:*

- blood in a renal cast is an indication of bleeding within the nephron associated with active glomerulitis

### *Formation:*

- glomerular damage related to immune injury
- allows red cells to escape into the tubule.
- concomitant proteinuria are optimal for cast formation.

## *Pathological Casts:* Waxy Cast



### *Description:*

- can be seen under brightlight microscopy
- highly refractive
- homogeneously pale yellow in appearance
- margins are sharp
- ends are blunt and cracks

### *Formation:*

- final phase of granular (fine) casts

### *Pathological Significance*

- represent tubular inflammation & degeneration
- end stage of degeneration of finely granular casts
- most frequently seen in patients with chronic renal failure.