Urine Sediments

A review of normal findings
Red Blood Cells

* Smooth biconcave discs
* Can be crenated, swollen or 'ghost like'
* ~ 7 microns
* Normal finding if <3/hpf
* Increased number (Hematuria) seen in:
  - menstruation
  - strenuous exercise
  - vascular injury
  - glomerular membrane damage
White Blood Cells

* Round cells with granules in cytoplasm and lobed nuclei (Neutrophils) or mononucleated (Lymphocytes or Monocytes)
* Also known as 'Glitter Cells'
  - Brownian movement of granules seen in swollen cells (hypotonic urine)
* ~ 12 microns (neutrophils)
* Normal finding if <8/hpf
* Increased number (Pyuria) in:
  - Pyelonephritis
  - UTI
Squamous Epithelial Cells

- Large flat cells with a small nucleus and a large amount of cytoplasm (Flagstone like)
- "Fried egg" appearance
- ~30 - 60 microns
- Most common and largest cell found in the urine
- Normal sloughing from vaginal wall and urethra
- Increased number found in improperly collected specimen (not a clean catch UA)
Transitional Epithelial Cells

- Round or oval to pear-shaped with large nucleus
- "Poached egg" appearance
- ~ 20-40 microns (2-4 WBC)
- N/C ratio is ~ 1:2 or greater (nucleus to cytoplasm ratio)
- May appear SWOLLEN
- Normal sloughing from bladder, ureters, and renal pelvis
- Increased number in:
  - Catheterization
  - Cystitis (bladder infection)
Hyaline Casts

* Most commonly observed cast
* Matrix of Uromodulin protein
  Also known as Tamm-Horsfall
* Formed in renal tubules
* Hard to see because of low refractive index
* Normal finding: < 3/LPF
* Increased number in:
  (not pathological)
  - strenuous exercise
  - dehydration
* Also seen with pathological cast in renal disease
Uric Acid Crystals (acidic pH)

* Pleomorphic appearance:
  - flat diamond shaped
  - rosettes
  - barrels
  - rhombic
  - needles

* Will polarize (multicolored)

* Normal finding

* Increased numbers in:
  - gout
  - chemotherapy
Amorphous Material (acidic, neutral or alkaline pH)

* Appearance:
  - sand-like granules, may be clumping, making identification of bacteria difficult

* Amorphous phosphates - alkaline pH
  - white precipitate
  - soluble in acid (acetic acid)

* Amorphous urates - acid pH
  - pink precipitate
  - soluble in alkali (NaOH)

* Normal finding, especially when urine has been refrigerated
Calcium Oxalate Crystals
(acidic or neutral pH)

* Appearance:
  - octahedral 'envelope'
  - ovoid or dumbbell - which can be confused with RBC
* CaOx will polarize, RBC won't
* Most commonly seen crystal in urine
* Normal finding
* 75% of renal calculi consist of CaOx
* Increased number with ingestion of:
  - foods high in oxalates (tomatoes, asparagus, etc.)
  - vitamin C
  - ethylene glycol
Triple Phosphate Crystals (alkaline pH)

* Appearance:
  - prisms with 3 to 6 sides called 'coffin lids'
  - feathery form like a fern leaf

* Normal finding

* Increased number with:
  - renal calculi formation
  - UTI's because of the alkaline pH of the urine due to the bacterial breakdown of urea
Ammonium Biurate Crystals (alkaline pH)

* Appearance:
  - yellow - brown spheres with striations and/or spicules
  - also known as the 'thorny apple'

* Normal finding in old urine

* Rarely found in fresh urine
Calcium Carbonate Crystals (alkaline pH)

* Appearance:
  - very small granules that are usually found in pairs giving them a 'dumbbell' shape
  - often misidentified as bacteria (calcium carbonate will polarize, bacteria won't)

* Not frequently found

* Normal finding
Mucus Threads

* Appearance: Long thin wavy threads of ribbon like structures which may show faint longitudinal striations
* Made of a protein (Uromodulin) material secreted by glands in the lower urinary tract and vagina
* Low refractive index
* May be misidentified as hyaline cast (cast have rounded ends, mucus have irregular ends)
* Increased number seen with irritation or inflammation of the urinary tract
Sperm

* Appearance:
  - oval bodies (head)
    ~3 - 5 microns
  - long, thin, delicate tail
    ~ 40 - 60 microns
* Can be motile or stationary
* Normal finding
* Seen in:
  - Males - ejaculation or nocturnal emission
  - Females - contaminant by vaginal contents
Glass Fragments (Artifact)

* Appearance:
  - colorless
  - highly refractile
  - pleomorphic fragments

* May be misidentified as uric acid crystals (which will polarize, glass will not)

* Contamination from glass tubes or cover slips
Starch (Artifact)

* Appearance:
  - granule not perfectly round with a scalloped edge and a centrally located “dimple” or slit
  - varies greatly in size
* Highly retractile
* Will form imperfect maltese cross when polarized. “Beach Ball” appearance when viewed with compensated polarized light
* Seen in urine contaminated with body or glove powder
Fibers
(Artifact)

* Appearance:
  - moderately to highly refractile
  - often large with distinct edges and blunt (torn) ends
  - tend to be flat, twisted, and thicker at their margins
* Will polarize
* May be misidentified as casts (casts don't polarize)
* Seen in urine contaminated with fibers from clothing, diapers, toilet paper, or lint from the air
References

* Strasinger, Susan King, Urinalysis and Body Fluids, F.A. Davis, edition 3, 1994
* Haber, Meryl H., A Primer of Microscopic Urinalysis, ICL Scientific, 1978
* Free, Helen M., editor, Modern Urine Chemistry, Ames Division, Miles Laboratories, Inc., fifth printing, 1987