DIAGNOSTIC PARASITOLOGY

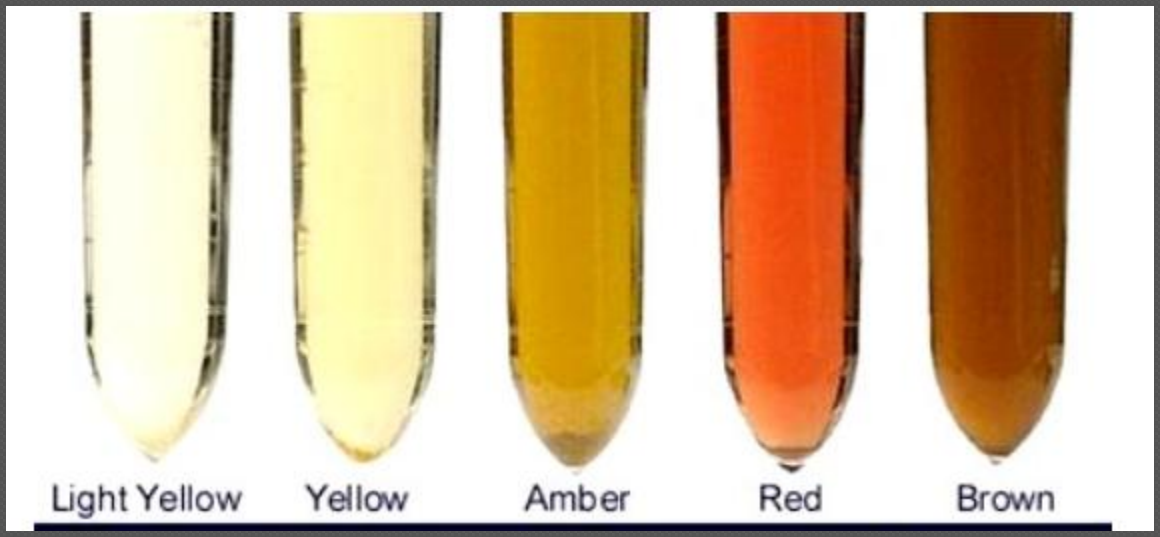
Urine

ASSIST . PROF. DR. MUNTAHA M. ALOUCI

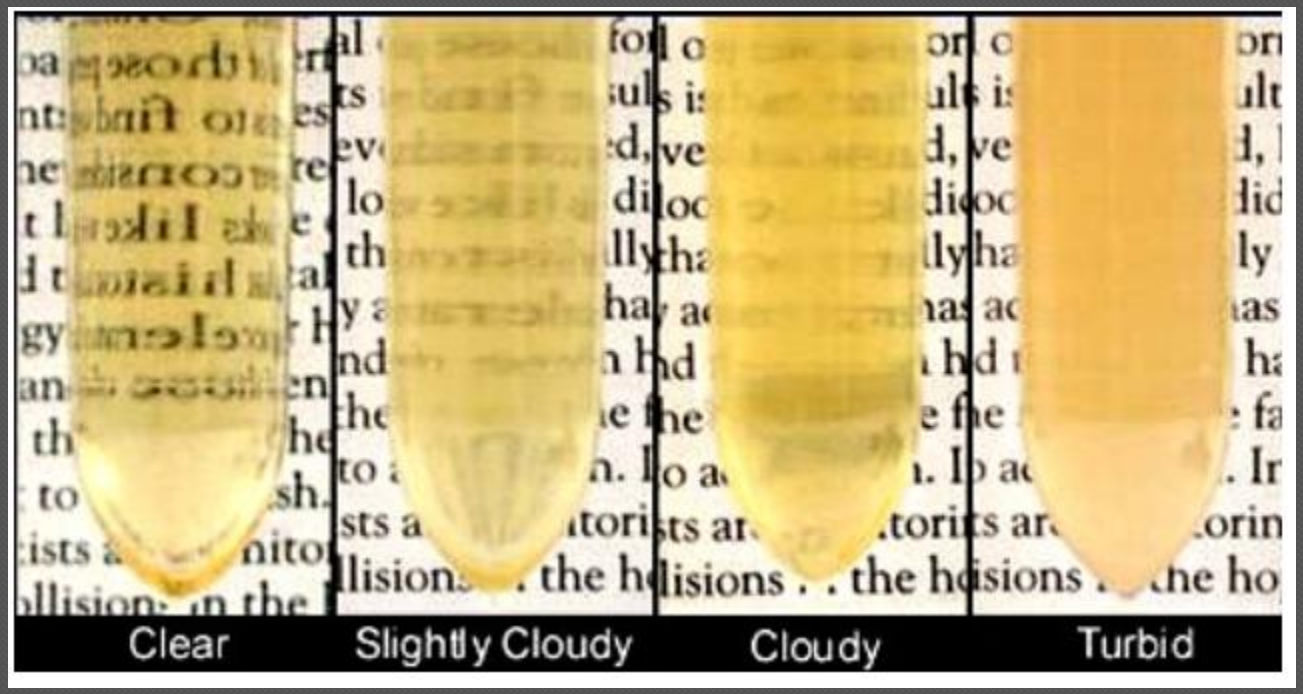
- **Urine**: A liquid containing multiple waste products of metabolism, especially urea and other nitrogenous compounds, is a typically sterile liquid that are filtered from the blood by the kidneys. Urine is stored in the urinary bladder and is excreted from the body through the urethra.
- **Urinalysis:** Is the routine urine examination. Most useful tool for the clinicians as an indicator for health or disease. Particularly, used in renal metabolic disorders. Often done for patients admitted to the hospital.

- The routine urine analysis is divided into four main groups:

- **1. Physico-Chemical properties.**
- **Color**: Normal urine color ranges from pale yellow to deep amber.
  • it is the result of a pigment called urochrome .
  B vitamins turn urine an eye -popping neon yellow BUT may also indicate liver disease. Most changes in urine color are harmless and temporary and may be due to:
  – Certain foods – beets may turn urine red
  – Dyes in foods/drinks
  – Supplements – vitamins
  – Prescription drugs
  • Unusual urine color can indicate an infection or serious illness .


Light Yellow
Yellow
Amber
Red
Brown

- **Appearance**: Substances that cause cloudiness but that are not considered unhealthy include:
  – mucous,
  – sperm and prostatic fluid,
  – cells from the skin, – normal urine crystals
  – contaminants (like body lotions and powders)


Clear
Slightly Cloudy
Cloudy
Turbid

- **Volume:** Normal volume is 750 –2000ml/24H
  • Under 750 ml (oligouria) - dehydration, infection, obstruction, renal stones, kidney, failure, etc).
  • Over 2000ml (polyuria) - diabetes, hypertension, nephrotic syndrome, ingestion of alcohol or drugs, endocrinal disorders.
  • Absent of urine (anuria) - obstruction, kidney failure, stenosis.

- **Specific gravity**: Specific gravity reflects kidney's ability to concentrate.
  • Want concentrated urine for accurate testing, best is first morning sample.
  • Low – specimen not concentrated, kidney disease.
  • High – first morning, certain drugs
  • Random specimen (1.003 to 1.032)
  • 24 hours specimen (1.015 to 1.025)

- **Odor**: Healthy urine may have a mild smell but generally does not have a foul odor.
  • In some cases, an unusual or strong urine odor may be due to benign conditions that are not harmful, such as eating certain foods or taking certain medications and volatile acids.

- **2. Chemical examination.**
- pH
  Sugar
  Protein
  Ketone bodies
  Bilirubin
  Urobilinogen
  Occult blood
  Nitrite

- **Normal Values**
  • Negative results for glucose, ketones, bilirubin, nitrites, leukocyte esterase and blood.
  • Protein negative or trace.
  • pH 5.5-8.0
  • Urobilinogen 0.2-1.0 Ehrlich units

- **3. Microscopic examination.**
- **Microscopic Urinalysis Methodology**
  - A sample of well-mixed urine (usually 10-15 ml) is centrifuged in a test tube at relatively low speed (about 2-3,000 rpm) for 5-10 minutes until a moderately cohesive button is produced at the bottom of the tube.
  - The supernatant is decanted and a volume of 0.2 to 0.5 ml is left inside the tube.
- The sediment is re_ suspended in the remaining supernatant by flicking the bottom of the tube several times. A drop of re-suspended sediment is poured onto a glass slide and cover slipped

- **Examination**
  The sediment is first examined under low power to identify most crystals, casts, squamous cells, and other large objects. The numbers of casts seen are usually reported as number of each type found per low power field (LPF). Example: 5-10 hyaline casts/LPF.
  Next, examination is carried out at high power to identify crystals,
  cells, and bacteria. The various types of cells are usually described
  as the number of each type found per average high power field (HPF). Example: 1-5 WBC/HPF.

- **1- Red Blood Cells**
  Hematuria is the presence of abnormal numbers of red cells in urine due to:
  - glomerular damage.
  - kidney trauma.
  - urinary tract stones.
  - upper and lower urinary tract infections.
  - nephrotoxins.
  - physical stress.

- **• Red cells may also contaminate the urine from the vagina in menstruating women.**
  Theoretically, no red cells should be found, but some find their way into the urine even in very healthy individuals.

- RBC's may appear normally shaped, swollen by dilute urine (in fact, only cell ghosts and free hemoglobin may remain). Both swollen, partly hemolyzed RBC's and are sometimes difficult to distinguish from WBC's in the urine.

- The presence of dysmorphic RBC's in urine suggests a glomerular disease such as a glomerulonephritis.

- Dysmorphic RBC's have odd shapes as a consequence of being distorted via passage through the abnormal glomerular structure

- **WBCs: White blood cells**
  - Pyuria refers to the presence of elevated number of leukocytes (granulocytes) :
  - Upper or lower UT infection
  - Glomerulonephrosis
  - Vaginal & cervical infections
  - External urethral meatus (men & women)

  Normal range:
  0-2 /HPF (5+ indicates an infection and 10+ indicates more severe conditions).

- **Epithelial cells**: Normal urine – not present/un quantified
  - Renal tubular epithelial cells, usually larger than granulocytes, contain a large round or oval nucleus are normally slough into the urine in small amounts.
  - Positive – nephrotic syndrome, condition leading to tubular degeneration.

- **Casts**: Formed at the distal convoluted tubule or the collecting duct (distal nephron).
  - Protein based cylindrical molds of the renal tubule
  - Result of damage to the renal tubule
  - Can contain cells and other material
  - Dehydration and acidic urine especially predisposes to cast formation.

- **Types of casts**
  - Protein
  - RBC
  - WBC
  - Other Nature example Crystals

- **Bacteria**: Abundant normal microbial flora of the vagina or external urethral metus.
  • Ability to rapidly multiply in urine standing room temperature.
  • However, it should be interpret in view of clinical symptoms.
  • Bacterial culture must be done in case of bacteriuria

- **Yeasts**: Yeast cells may be contaminants or represent a true yeast infection.
  • Often difficult to distinguish from red cells and amorphous crystals but can be distinguished by their tendency to bud.
  • Most often they are candida, which may colonize bladder, urethra or vagina

- **4. Bacterial screening:** Gram staining Colony count

- **Urine collection**
  • Urine must be collected in a sterile bottle.
  • The routine urine examination must be conducted within 30 min.
  • **In case of delay, urine must be refrigerated**.
  • Delay in sample examination will result in:
  1- Decreased pH by the utilization of glucose by bacteria.
  2-Increased pH by the conversion of urea to ammonia by bacteria.
  3-In increased pH, the tendency of phosphates to precipitate will increase.
  4- Oxidation of urobilinogen to urobilin. It may give false negative result for jaundice.

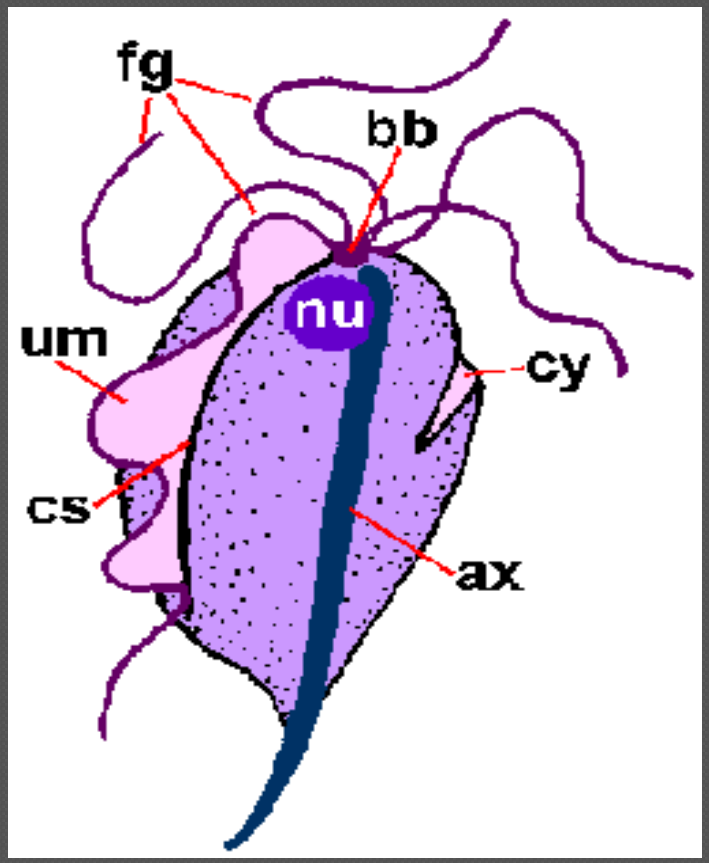
Types of specimen

Afternoon **Taken between 2 ◊ 4 pm** **Best for detecting urobilinogen**	**First morning** **Specimen of choice** **Most concentrated**	**Random** **Chemical & microscopic examination** **Taken any time after first morning urine**	**24 hours** **Used for clearance test of kidney** **Samples are collected for 24 hours (for eg, 8am to next day 8 am).** **It is to avoid any changes in the dilution of various suspended constituents of urine**
Postprandial Taken after 2 hours of meal	Night All urine samples are collected in 12 hour of night (for eg, 8pm to 8am)	**Day** All urine samples are collected in 12 hour of day (for eg, 8am to 8pm)	

Parameter	Normal	Abnormal
Colour	Yellow straw, amber, transparent	•Dark amber - concentrated urine insufficient of fluid intake •Cloudy - infectious process •Dark orange – drug, eg: pyridium •Red or dark brown - disease process causing blood in
Consistency	Clear liquid	Mucous plug, viscid, thick - infectious process
Odor	Faint aromatic	Offensive - infectious process
Sterility	No microorganism present	Microorganism present - infectious of UT
pH	4.5-8.0	•Over than 8.0 - UT infection •Under 4.5 - uncontrolled diabetes, starvation, dehydration
Specific gravity	1.010 to 1.025	•Over 1.025 – diabetes mellitus, under hydration •Under 1.01 – diabetes insipidus, kidney disease, over hydration
Urine glucose	Not present	Present – diabetes mellitus
Urine ketone bodies (eg: acetone)	Not present	Present – diabetic coma, starvation, prolonged vomiting
Urine blood	Not present	Occult –kidney disease Bright red - hemorrhage

Common parasites found in urine'Trichomonas vaginalis'

- Morphology
- The *T. vaginalis* trophozoite is oval as well as flagellated. It is slightly larger than a white blood cell, measuring 9 X 7 µm. Five flagella arise near the cytostome; four of these immediately extend outside the cell together, while the fifth flagellum wraps backwards along the surface of the organism. The functionality of the fifth flagellum is not known.
- In addition, a conspicuous barb-like axostyle projects opposite the four-flagella bundle; the axostyle may be used for attachment to surfaces and may also cause the tissue damage noted in trichomoniasis infections. The cytoplasm shows prominent granules which are most numerous alongside the axostyle and costa.
- The trophozoite has short undulating membrane reaching up to the middle of the body. While *T. vaginalis* does not have a cyst form, organisms can survive for up to 24 hours in urine, semen, or even water samples. It has an ability to persist on fomities with a moist surface for 1 to 2 hour.


fg
bb
nu
um
cy
cs
ax

- Diagnosis is confirmed by the demonstration of trophozoites in vaginal, urethral, prostatic secretions, or urine sediment (following prostate massage). Microscopic examination of wet mounts of fresh vaginal discharge, preferably collected with a speculum on a cotton-tipped applicator, is the most practical method of diagnosis.
- Specimens should be diluted in saline and examined immediately. *T. vaginalis* is recognized by its characteristic morphological features and its rapid jerky motility. Specimens can also be fixed and stained with Giemsa or fluorescent dyes. However, the organism may be difficult to recognize on stained slides.

- The sensitivity of direct observation ranges from 40-80%. Therefore, in vitro culture is considered the gold standard for diagnosis despite some limitations.
- For example, access to facilities is needed and organisms require 2-7 days of growth before they are detected. The accessibility issue is partly resolved by the InPouch™TV culture system (Biomed Diagnostics). This is a commercially available self-contained system for the detection of *T. vaginalis* in clinical specimens.
- Antibody and DNA-based tests with high sensitivity and specificity are being developed.

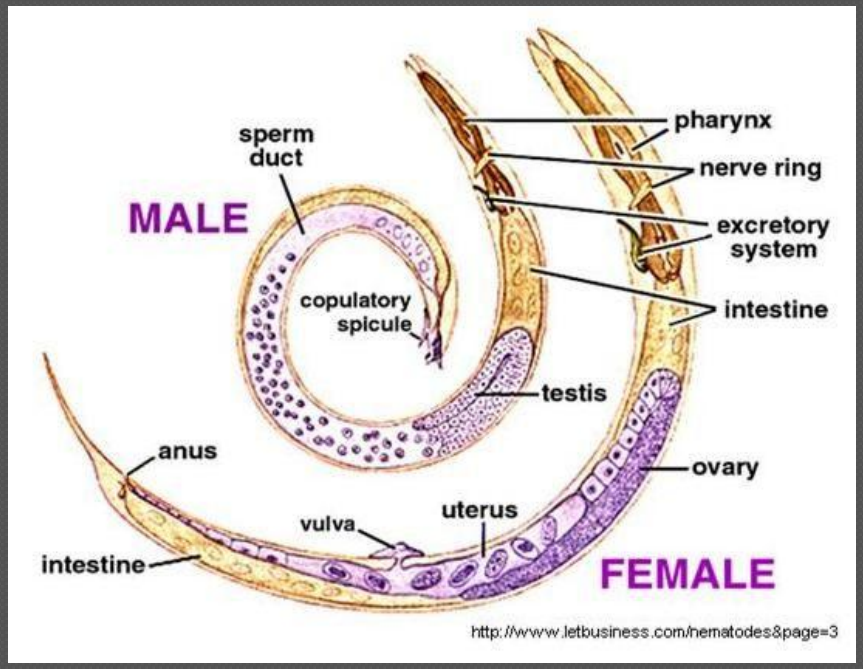
Schistosoma haematobium

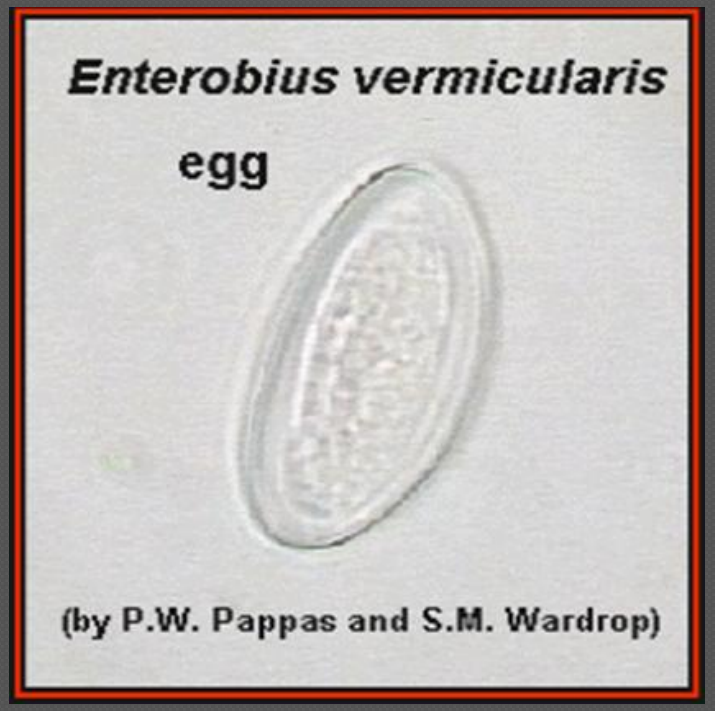
- The mature worms live in copula mainly in the vesical and pelvic plexuses of veins
- and the females deposit their eggs in the walls of the bladder and finally making their way into the urine. The life cycle is very similar to that of *S. mansoni*, with sexual maturity being reached within 4–5 weeks, but eggs may not appear in the urine until 10–12 weeks or even later.

- **Morphology**
- The adult worms are longer than those of *S. mansoni*. The tegument of male is finely tuberculated and the number of testis are 4-5 in cluster arrangement. . The ova are relatively large, measuring 110-170µm in length and 40-70µm in width. They have an elongated ellipsoid shape with a prominent terminal spine.
- Vesical and pelvic venous plexuses constitute the habitat of Schistosoma haematobium. In some cases the parasite may be retain in the haemorrhoidal plexus of veins or terminal tributaries of inferior mesenteric vein.

- **Laboratory Diagnosis**
- The definitive diagnosis of urinary schistosomiasis is made by finding the characteristic ova of *S. haematobium* in urine.
- Terminal urine should be collected as the terminal drops contain a large proportion of the eggs. The urine can either be centrifuged and the deposit examined microscopically for ova. Eggs can sometimes be found in seminal fluid in males.
- A bladder biopsy is infrequently necessary to make the diagnosis. A rectal snip may show the presence of ova as they sometimes pass into the rectal mucosa

- ***Enterobius vermicularis***
- Enterobius infection is endemic in tropical countries with the prevalence of up to 46% in some areas. Most common site of infection is gastrointestinal tract.
- Uncommon sites for infestation include vulva, vagina, uterus, fallopian tubes, ovary, and even peritoneum through fallopian tube in females.
- Transmigration of intestinal flora to urinary tract with Enterobius has been cited as one of the reasons for recurrent urinary tract infection (UTI) in areas with high prevalence of enterobiasis


sperm duct
MALE
copulatory spicule
pharynx
nerve ring
excretory system
intestine
testis
anus
ovary
uterus
vulva
intestine
FEMALE
http://www.letbusiness.com/nematodes&page=3


Enterobius vermicularis
egg
(by P.W. Pappas and S.M. Wardrop)

- ***Wuchereria bancrofti***
- Identification of microfilariae in the sediment smears of urine has been infrequently documented .
- The present case is a rare instance of filariasis that presented as a clinical mimicker of urinary bladder malignancy