Case 1 – Summarize the normal gross kidney findings. Describe the external surface. Identify the renal cortex, medulla, major calyx, minor calyx.

Case 1

H&E Low power – Distinguish the cortex from the medulla. What structures are each composed of?
Case 1 – Identify glomeruli, tubules, interstitium (H&E 20x)

Case 1 H&E 40x

Identify:
- Bowman Space
- Parietal Layer of Bowman Capsule
- Glomerular Capillaries and Red Blood Cells
- Identify tubular lumen, lining epithelial cells

Case 1 – Identify the arteriole and glomerular capillaries.
Identify the tubules, epithelial brush border
Case 1 – Identify the labels on this diagram of a normal glomerulus

---

Case 2

**CHIEF COMPLAINT:** “My back hurts.”
**HISTORY:** A 32-year-old woman presents to the emergency department with acute onset of fever, chills, and left flank pain. She has also had nausea and vomiting and has been unable to keep any food down for the last day. On further questioning she notes that she developed dysuria and urinary frequency several days prior.

---

Case 2

**PHYSICAL EXAMINATION:**
Temp 102.1°F, BP 92/56, P 112
Lungs and heart exams are normal, aside from tachycardia.
On abdominal exam there is suprapubic tenderness to palpation.
There is marked tenderness in the following area:
Case 2

Develop a differential diagnosis based on the history and physical exam

---

Case 2 - Urinalysis

<table>
<thead>
<tr>
<th>UA w/Micro</th>
<th>Color</th>
<th>pH</th>
<th>Spec Gravity</th>
<th>Protein</th>
<th>Blood</th>
<th>Glucose</th>
<th>Ketones</th>
<th>Bilirubin</th>
<th>Urobilinogen</th>
<th>Nitrite</th>
<th>Leukocyte esterase</th>
<th>RBC</th>
<th>WBC</th>
<th>WBC cast</th>
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<tbody>
<tr>
<td></td>
<td>Amber</td>
<td>6.0</td>
<td>1.030</td>
<td>Neg</td>
<td>Trace</td>
<td>Neg</td>
<td>Neg</td>
<td>NEG</td>
<td>0.2</td>
<td>POS</td>
<td>POS</td>
<td>2.5</td>
<td>&gt;150</td>
<td>few</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Case 2

What is your diagnosis?
What is your rationale? Correlate with the findings on the urinalysis.
Case 2 - Normal A. Our patient B Describe the histologic findings on 20x. Compare A and B

Case 2 - Patient histology. Describe the findings on the 40x image.

Case 2

Summarize how urine microscopy (examination of urine sediment under the microscope) is performed.
Case 2 – Which slide below represents red blood cells on microscopy? Which represents white blood cells?

Case 2 – What is the finding on our patient’s urine microscopy?

Case 2

Correlate the urine microscopy findings with the histologic findings.

Do these findings support your clinical diagnosis?
Case 2

The patient states that she has never felt this “lousy” before. She wants to know how and why she got this. She wants to know if there are any potential complications that could develop. How would you answer her questions?

Case 3

**CHIEF COMPLAINT**: “I’m here for my check-up.”

**HISTORY**: The patient is a 69-year-old man with a history of hypertension, diabetes mellitus type 2, and coronary artery disease. He has known proteinuria and chronic kidney disease. He has no specific issues of concern during the visit.

**PHYSICAL EXAMINATION**: BP 150/72; Pulse 60. Heart, lung, and abdominal exams are unremarkable. He has decreased sensation and proprioception of his feet.

Case 3 - Laboratory

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUN</td>
<td>36 mg/dl</td>
</tr>
<tr>
<td>Creatinine</td>
<td>2.7 mg/dl</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>3+ protein</td>
</tr>
</tbody>
</table>
Case 3

Name the most common macrovascular diseases which occur as a result of diabetes mellitus.

Name the most common microvascular diseases which occur as a result of diabetes mellitus.

Case 3 - Contrast the gross findings of this patient’s kidney (B) vs the normal kidney (A)

Case 3 - Compare and contrast a normal kidney in A with our patient’s in B. What does (1) represent?
Case 3 - Describe the histologic findings. What does (2) represent? Comment on the appearance of the mesangium.

Case 3 – Identify arteriole(s) and describe their findings.

Case 3 - Describe the histologic findings on PAS stain.
Case 3

What is your diagnosis?

Discuss ways to help slow disease progression in this patient.

Case 4

CHIEF COMPLAINT: “My feet and legs are swelling.”

HISTORY: A 71-year-old woman presents with concerns of foot and leg swelling gradually worsening over the past month. She also notices that she is “puffy around the eyes” after waking up in the morning.

PHYSICAL EXAMINATION: BP 140/88, Pulse 80. There is bilateral lower extremity edema extending to the thighs and bilateral hand edema. Remainder of the physical exam is unremarkable.

Case 4

Develop a differential diagnosis based on the information provided.
Case 4 – Laboratory

BUN 18 mg/dl
Creatinine 1.7 mg/dl
Albumin 1.9 mg/dl

Case 4 - Urinalysis

<table>
<thead>
<tr>
<th>UA w/Micro</th>
<th>Color</th>
<th>pH</th>
<th>Spec Gravity</th>
<th>Protein</th>
<th>Blood</th>
<th>Glucose</th>
<th>Ketones</th>
<th>Bilirubin</th>
<th>Urobiligen</th>
<th>Nitrite</th>
<th>Leukocyte</th>
<th>RBC</th>
<th>WBC</th>
<th>Fatty bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>UA w/Micro</td>
<td>Yellow</td>
<td>6.0</td>
<td>1.030</td>
<td>4+</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>0.2</td>
<td>Neg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>[0-2] /hpf</td>
</tr>
<tr>
<td></td>
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<td>[4.5-8.0]</td>
<td>[1.003-1.035]</td>
<td>[NEG]</td>
<td>[NEG]</td>
<td>[NEG]</td>
<td>[NEG]</td>
<td>[0.2-1.0]</td>
<td>[NEG]</td>
<td>[0-2] /hpf</td>
<td>[0-2] /hpf</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24-hour estimated urine protein excretion: 6 grams

Case 4

Interpret the laboratory data. Comment on the finding of oval fat bodies (depicted in the images below) on urine microscopy.
Case 4

What is your preliminary diagnosis? Explain your rationale.

What diseases are included in the differential diagnosis of this entity?

Case 4 – Kidney Biopsy

Compare and contrast a normal glomerulus in A with our patient’s in B.

Case 4 - Describe the findings on Congo Red Stain

Congo red stained slide viewed under normal (bright, non-polarized) light
Case 4 - Describe the findings

Congo red stained slide viewed under partially polarized light

Case 4

What is your diagnosis?

Case 4

The patient underwent further evaluation and was diagnosed with multiple myeloma.

Define multiple myeloma.
Case 4

How did multiple myeloma lead to the patient’s kidney pathology?

Case 5

CC: My urine keeps on turning red

HISTORY OF PRESENT ILLNESS
A 17-year-old male presents to his physician with the chief concern of red urine. Six months ago he developed a “cold” and 1 day later he noticed that his urine was red. The urine cleared after 2 days. He did not tell his parents. He noticed reddish urine for several days about 3 months ago but then the urine returned to a normal color. He again developed red urine 1 day ago. Now concerned, he told his parents who brought him in for evaluation.

Case 5 cont.

HPI cont.
He has not had any recent trauma and has not strenuously exercised during the past week. He has had no change in his urine output. He has had no gum bleeding, nose bleeds, hematochezia or melena. He has no abdominal or flank pain.
He feels well. He takes no medications.
His mother, father, and 3 siblings are all healthy.
Case 5

PHYSICAL EXAM
Normally developed male BP 108/62, pulse 72, afebrile
Heart and lung exams are normal.
Abdominal exam is normal; there is no suprapubic
tenderness.
There is no flank mass or tenderness.
Genital exam is normal.
There are no skin rashes.

Case 5 - Urinalysis

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Red</td>
</tr>
<tr>
<td>pH</td>
<td>6.0</td>
</tr>
<tr>
<td>Spec Gravity</td>
<td>1.020</td>
</tr>
<tr>
<td>Protein</td>
<td>1+</td>
</tr>
<tr>
<td>Blood</td>
<td>Large</td>
</tr>
<tr>
<td>Glucose</td>
<td>Neg</td>
</tr>
<tr>
<td>Ketones</td>
<td>Neg</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>Neg</td>
</tr>
<tr>
<td>Urobilinogen</td>
<td>0.2</td>
</tr>
<tr>
<td>Nitrite</td>
<td>Neg</td>
</tr>
<tr>
<td>Leukocyte</td>
<td>Neg</td>
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<td>RBC</td>
<td>&gt;100</td>
</tr>
<tr>
<td>WBC</td>
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</table>

Case 5 - Laboratory

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUN</td>
<td>12 mg/dl</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.8 mg/dl</td>
</tr>
<tr>
<td>CBC, PT, PTT</td>
<td>normal</td>
</tr>
</tbody>
</table>

What is the main clinical problem?

Develop a differential diagnosis for the most common causes of this problem in a 17-year old male.

A urinalysis is repeated and immediately brought to the lab for performance of urine microscopy. What is the finding?

What does this finding imply?
On the biopsy, the pathologist notes “mesangial proliferation”. Point out this finding on the PAS stained glomerulus:

Case 5 - Immunofluorescence, IgA. Describe the findings

Case 5

correlate the clinical data and the pathology findings. What is your diagnosis?

The patient and his parents want to know his prognosis. What will you tell them?
Case 5 – Point out on this diagram where the primary pathologic changes in this disease process are found

Case 6

**CHIEF COMPLAINT:** “I’m having pain in my side for the past 3 months.”

**HISTORY:** A 63-year-old man presents with right flank pain that has been ongoing for the past several months. He has felt more tired than usual, but otherwise feels “ok”. He has a 30-pack year smoking history and he currently smokes. He has no known chronic medical problems.

**PHYSICAL EXAMINATION:** The abdomen is soft and non-tender. He has right costovertebral tenderness on palpation. There is no vertebral tenderness.

Case 6 - Urinalysis

<table>
<thead>
<tr>
<th>UA w/Micro</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color</strong></td>
<td>Yellow [YELLOW]</td>
<td></td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>6.0</td>
<td>4.5-8.0</td>
</tr>
<tr>
<td><strong>Spec-Gravity</strong></td>
<td>1.020</td>
<td>1.003-1.035</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>Neg [NEG]</td>
<td></td>
</tr>
<tr>
<td><strong>Blood</strong></td>
<td>Mod [NEG]</td>
<td></td>
</tr>
<tr>
<td><strong>Glucose</strong></td>
<td>Neg [NEG]</td>
<td></td>
</tr>
<tr>
<td><strong>Ketones</strong></td>
<td>Neg [NEG]</td>
<td></td>
</tr>
<tr>
<td><strong>Bilirubin</strong></td>
<td>Neg [NEG]</td>
<td></td>
</tr>
<tr>
<td><strong>Urobilinogen</strong></td>
<td>0.2</td>
<td>0.3-1.0 eu/dl</td>
</tr>
<tr>
<td><strong>Nitrite</strong></td>
<td>Neg [NEG]</td>
<td></td>
</tr>
<tr>
<td><strong>Leukocyte</strong></td>
<td>Neg [NEG]</td>
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</tr>
<tr>
<td><strong>RBC</strong></td>
<td>25-50 [0-2] /hpf</td>
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</tr>
<tr>
<td><strong>WBC</strong></td>
<td>2-5 [0-5] /hpf</td>
<td></td>
</tr>
</tbody>
</table>

Serum BUN and creatinine are normal.
Case 6
Interpret the urinalysis.

Develop a differential diagnosis integrating the clinical findings and those on urinalysis.

Case 6
An ultrasound of the kidneys and bladder is performed which shows a mass of the right kidney.
The patient undergoes nephrectomy.

Case 6 - Describe the gross findings. What do “A” and “B” represent?
Case 6 - Nephrectomy specimen bisected. Describe the gross findings. What do “A” and “B” represent?

Case 6 - Describe the histologic findings. From what part of the gross specimen was the section likely obtained?

Case 6

What is your pathologic diagnosis?

Correlate the pathologic findings with the clinical findings.

What is the characteristic triad with respect to presentation of this disease process?
## Case 6

Interpret the patient's CBC. Relate the findings to the disease process.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC</td>
<td>11.3</td>
<td>[4.0-10.0] k/ul</td>
</tr>
<tr>
<td>Hgb</td>
<td>17.1</td>
<td>[12.0-16.0] gm/dl</td>
</tr>
<tr>
<td>Hct</td>
<td>51.4</td>
<td>[34.0-48.0] %</td>
</tr>
<tr>
<td>Plt Count</td>
<td>305</td>
<td>[150-400] k/ul</td>
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