1. Describe the location of the following: (1.5)
   (a) the dorsal root ganglion of the 1st lumbar spinal nerve
   (b) the ligamentum flavum
   (c) the 1st sacral segment of the spinal cord

2. On the right is a lettered list of different functional types of neurons. On the left is a list of structures. In the blank following each named structure, enter the letters of the types of axons within it. For any given blank, your list must be entirely correct to generate any credit. (2)
   (a) pudendal n. _________________
   (b) the T2 thoracic sympathetic cardiac nerve _________________
   (c) gray ramus communicans of S4 _________________
   (d) white ramus communicans of T11 _________________
   (e) a lumbar splanchnic n. _________________
   (f) anterior vagal trunk _________________
   (g) a pelvic splanchnic n. _________________
   (h) greater occipital n. _________________

3. Name two types of injury, insult, or pathological processes that elicit somatic pain but not visceral pain. If none, write none. (2)

   ___________________________________

Name two types of injury, insult, or pathological processes that elicit visceral pain but not somatic pain. If none, write none.

   ___________________________________

What general pathways do visceral pain axons follow from a visceral structure back to the spinal cord? At what sites outside the CNS do these axons synapse?
4. What is its most common anatomical injury (specify site) allowing anterior slippage of the L5 body on the S1 body? (1.5)

   What is this slippage called? ____________________________________

   What nerves are compressed when it occurs? ____________________________

5. At what vertebral level does the spinal cord end in an average adult? _________________________ (2.5)

   In the average newborn? _______________________________________

   At what level does the subarachnoid space end in an average adult? ________________

   What structures occupy the subarachnoid space between these levels?

   Give one reason that the above information might be clinically important.

6. What is the anatomical change that occurs when an intervertebral disc “slips”? (2)

   If there is a slipped C7/T1 disc, which spinal nerve is most likely to be affected? ________________

   If there is a slipped L5/S1 disc, which spinal nerve is most likely to be affected? ________________

   If the L4/L5 disc undergoes a midline slip, what structures are at risk and why is this of particular concern?

7. Open surgery to repair an aneurysm of the aorta requires that the vessel be clamped both proximal and distal to the aneurysm. Provide an anatomical explanation for the fact that an anesthesiologist specially trained to monitor spinal cord function is invaluable during such an open repair of a thoracic aortic aneurysm. (1)

8. Give an anatomic explanation for the following observations made during surgery on patient T.L.: (1)

   (a) her right hepatic artery was tied off but her quadrate lobe did not experience ischemic damage

   (b) her left hepatic artery was tied off but the left lobe of her liver did not die
9. Ms. Jones comes to your office reporting a small dimple on the surface of her left breast. During palpation of this breast, you note a small hard lump deep to the dimple. Biopsy confirms this is breast cancer. What is the most likely anatomical explanation for the dimple? (2.5)

At surgery, you want to determine if the cancer has spread to the level 1 nodes. You inject a radioactive tracer and blue dye into the breast in the vicinity of a tumor. Where should you look in order to search for the most likely sentinel node (i.e., the first one to pick up the blue dye or the radioactive colloid) and, thus, the first to which cancer is likely to have spread?

What percentage of breast lymph goes to the nodal group of which this a member? ____________

Where does the rest of the breast lymph go? ___________________________

What is the likelihood (expressed quantitatively) that cancer has spread to this second group of nodes if it has not spread to the first? _______________

10. An accident victim is brought into the emergency room with no lung sounds on the left side. He has distended neck veins and a rapid heart beat. You believe he has a tension pneumothorax and decide to place a large bore needle in the anterior second intercostal space in the left midclavicular line. Precisely where within the space do you pass the needle, and why? (1)

11. Provide an anatomical explanation for the following: (4)

(a) cancer of the head of the pancreas reveals itself by painless jaundice, whereas cancer of the tail does not

(b) a man that underwent resection of the rectum for treatment of rectal cancer is impotent following the surgery

(c) cirrhosis of the liver may cause death by vomiting blood

(d) infant boys are far more likely to have an inguinal hernia than infant girls

12. Premature onset of menopause is a possible untoward effect of hysterectomy in older women even if the ovaries are not simultaneously removed. Give an anatomical explanation for this fact. (1)
13. A resident performs an epidural anesthesia on your patient who is about to have a baby. Your tests reveal that the anterior abdominal wall is insensitive from the xiphoid process down to the umbilicus. Will your patient experience any labor pains? Give a reason for your answer. (1)

14. Both colon cancer and rectal cancer may enter the bloodstream and metastasize to the liver and/or the lung. What is the anatomical reason that the presence of metastases in the lung without any in the liver more common in the case of rectal cancer than colon cancer. (1)

15. An automobile accident victim is brought to the emergency room with obvious signs of trauma to the right lower rib cage. A CT scan indicates trauma to the liver and the patient is rushed to surgery. You discover a deep laceration of the liver. Your first goal is to control bleeding. The chief surgeon asks you to perform a Pringle maneuver. What do you do, and if the bleeding stops what have you learned? (2)

16. Where are Bartholin’s glands located and where do they empty? (1)

17. You have two patients, a man and a woman, both of whom you believe to have gonorrhea. In which is there the least risk of spread to the peritoneal cavity, and why? (1)

18. The DIEP (Deep Inferior Epigastric Perforator) flap has become increasingly popular for reconstructing the breast following a mastectomy. In this procedure, the inferior epigastric artery and the skin that it supplies through perforating branches is harvested while the muscle it supplies is left intact. What keeps this muscle alive? (2)

The procedure involves partial transverse incisions through the muscle normally supplied by the inferior epigastric artery. Will this denervate the muscle. How will this affect the innervation of this muscle? Give a reason for your answer.

19. The spleen is the abdominal organ most commonly injured by blunt trauma. At what site will a blow to the body most likely injure the spleen? (1.5)

If injured, will this bleed into the pleural cavity, peritoneal cavity, or retroperitoneally?

Provide a complete anatomical explanation for why an injured spleen might lead to pain in the left shoulder.
20. On the drawing of the chest shown below are placed 6 possible locations of a stethoscope. In each case name the structure best heard. BE SPECIFIC

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21. What is the clinical significance of the fact that Colle’s fascia is attached to the posterior edge of the perineal membrane and to the ischiopubic rami.

22. One diagnostic test performed on certain persons with fecal incontinence involves stimulating the pudendal nerve and observing the evoked electric potentials in the external anal sphincter. If the stimulating electrode is placed over the tip of a gloved the finger, how could you place the electrode as close as possible to the nerve in a male? (Name any palpable landmarks and state how they would guide your placement of the electrode.)

23. You are operating on a patient with an infrarenal abdominal aortic aneurysm. In order to obtain adequate exposure you decide to transect and tie off the vessel that crosses anterior to the aorta immediately inferior to the origin of the SMA. What is this vessel? What are the anticipated consequences of your action? Why?

After clamping the aorta above and below the aneurysm, you incise the wall of the aneurysm. Blood still flows into this region of the aorta, albeit slowly, and not from the sites of the clamps. What are the two most significant sources of this blood?

What happens if you tie them off where they attach to the aorta?
24. When looking within the peritoneal cavity with a laparoscope, there are three clues that a piece of bowel is colon, not small intestine. What are these three clues? (1.5)

25. In some cases of inoperable pancreatic cancer, alcohol is injected around the celiac ganglia. The alcohol stops axonal functioning. Provide an anatomical explanation for how this might benefit the patient. (1)

26. Cancer of the stomach may enter blood capillaries of the stomach and spread hematogenously, or it may enter lymphatic capillaries of the stomach and spread lymphatically, or it may simply travel along structures that directly connect the stomach to other organs. (1.5)
   (a) To which major organ will such cancer spread if it moves inferiorly along a connecting structure: ____________________________
   (b) To which major lymph nodes will such cancer spread: ____________________________
   (c) To which major structure will such cancer spread if travels hematogenously: ____________________________

27. What is the infundibulopelvic fold? (1.5)

What is its relationship to the ureter?

What is the relationship of the ureter to the uterine cervix and uterine artery?

28. Name the structure with the following relationships: (5)
   (a) running from lateral toward medial
      immediately posterior to the ligamentum arteriosum ____________________________
   (b) running vertically along the right side of the superior vena cava ____________________________
   (c) in the mediastinum, passing supero-inferiorly anterior to the root of the right lung ____________________________
   (d) running transversely, posterior to begining of superior mesenteric artery ____________________________
   (e) anterior to splenic vein ____________________________
   (f) posterior to prostate gland ____________________________
   (h) immediately anterior to the lower half of the vagina ____________________________
   (i) anterior to left coronary artery ____________________________
   (j) anterior to formation of portal vein (be specific) ____________________________
   (k) running vertically along the right side of the trachea ____________________________
29. What muscles must be paralyzed to cause retrograde ejaculation? (1)

Where can you injure nerves such that retrograde ejaculation is the outcome but penile erection is unaffected?

30. Name the subgroups of lymph nodes that comprise “pelvic” nodes. (2)

Below are listed the names of structures. Circle the names of those that drain directly (i.e., first) to pelvic nodes. All must be correct to earn any credit.

- skin of glans penis
- skin of labia minora
- skin of labia majora
- skin of scrotum
- uterine cervix
- ovary
- prostate gland
- seminal vesicle
- urinary bladder
- lower third of rectum
- uterine body
- testis

31. What nerve(s) does the superior limb of the ansa cervicalis branch from? (3)

From what nerve(s) do the axons within the superior limb of the ansa derive? 

From what nerve(s) do the axons within the inferior limb of the ansa derive? 

What do the branches of the ansa cervicalis do?

What are the relationships of the superior and inferior limbs of the ansa cervicalis to the carotid sheath and its contents?

32. What named structure is at risk of injury during surgical procedures of the root of the neck on the left side that is not at risk by the same procedures on the right side? (1)

33. Describe the best location for an emergency entry to the airway in a choking person and explain why it is best. (1)

34. Hyperextension of the neck is most likely to injure which ligament(s)? (1)

35. A. H. has symptoms suggesting hypercalcemia. Sestamibi-technetium subtraction scintigraphy identifies an adenoma in the left inferior parathyroid gland. Trace the blood supply from the aortic arch to the left inferior parathyroid gland. (2)

- aortic arch →
- → l. inf. parathyroid

What nerve is crossed by last named artery to the gland?
36. Distinguish a subdural hematoma from an epidural hematoma with respect to following traits: (1.5)

SUBDURAL
(a) vessels that are torn
(b) layers between which blood accumulates
(c) most likely direction of, and location of, blow to the head

EPIDURAL

37. What are emissary veins, and what is their clinical significance? (1)

38. What aspects of skull development mitigate against placing forceps posterior the ear during delivery of a baby? Why? (1)

39. To the right are a superior and lateral view of the head of a young child. What is the name of this condition and what has gone wrong? (1)

40. What is the anterior fontanelle? (2)

Briefly discuss one instance where knowledge of its existence or location is clinically significant.

41. In the normal course of performing a carotid endarterectomy, you clamp the left common carotid 2 cm inferior to its bifurcation, then make a linear excision superiorly through the walls of the common and internal carotid arteries. You are pleased to observe considerable backflow of blood spilling into your field from the open left internal carotid. Starting at the heart, trace one route that can account for this observation. (2)

heart ⚡

→ l. internal carotid a.
42. Below are series of axial CT images of the chest. In the upper left corner of each is a number. Every unit increase in this number represents a 5mm inferior shift of the section. Below the images are a series of statements followed by blanks. Into each blank write the letters or numbers of the labeled structures that satisfy the statement. There may be one correct entry, or more than one, or none. Partial credit will not be given for any blank. (8)

(a) carry(ies) lymph from the stomach _________
(b) vein(s) that carry(ies) blood from subcostal veins _________
(c) supplied by the LAD in a right dominant heart _________
(d) carry(ies) food to the stomach __________
(e) supplied by the right coronary artery in a right dominant heart _________
(f) will be consolidated in left upper lobe pneumonia _________
(g) artery(ies) supplying both the left atrium and left ventricle ________
(h) innervate(s) the diaphragm _________
(i) artery(ies) supplying blood to the lungs __________
(j) most likely recipient(s) of inhaled foreign matter in a supine person _________
(k) formed by confluence of the internal jugular and subclavian veins _________
(l) carry(ies) lymph from the right lung _________
(m) artery(ies) sending blood to the head _________
(n) carry(ies) venous blood from heart muscle _________
(o) enter(s) or come(s) from the abdomen _________
(p) is innervated by the greater splanchnic nerve _________
43. Presented below is a series of eight coronal CT images of the abdomen and pelvis. The most anterior of the sections is at the upper left. The sections that follow are progressively more posterior. Every unit decrease in the image number represents a 3mm posterior shift of the section. Identify the structures (A - N) to which lines are drawn. (6)

A: _____________________________
B: _____________________________
C: _____________________________
D: _____________________________
E: _____________________________
F: _____________________________
G: _____________________________
H: _____________________________
I: _____________________________
J: _____________________________
K: _____________________________
L: _____________________________
M: _____________________________
N: _____________________________