1-6 Match the following structures
1. Primary cell bodies for extrapyramidal dopamine
2. Primary cell bodies for norepinephrine
3. Primary cell bodies for serotonin
4. Primary cell bodies for mesocortical dopamine
5. Primary cell bodies for Acetylcholine
6. Principal site of action for cocaine
   - a. locus ceruleus
   - b. ventral tegmental area
   - c. substantia nigra
   - d. nucleus basalis of Meynert
   - e. nucleus accumbens
   - f. dorsal raphe

7-12 Match the corresponding structure with the most appropriate letter on figures 1a-c
7. Primary cell bodies for extrapyramidal dopamine
8. Primary cell bodies for norepinephrine
9. Primary cell bodies for serotonin
10. Primary cell bodies for mesolimbic dopamine
11. Primary cell bodies for Acetylcholine
12. Principal site of action for cocaine

13-19 Match the following (select the best match, answers may be used more than once)
13. Parkinson’s disease
14. Depression
15. Cocaine use
16. Schizophrenia
17. Dementia
18. OCD
19. Panic Disorder
   - a. increased dopaminergic activity in the nucleus accumbens
   - b. abnormal brainstem-medial temporal norepinephrine
   - c. usually responds to serotonin reuptake inhibitors
   - d. associated with excess mesolimbic dopamine
   - e. decline in cholinergic activity
   - f. loss of dopamine in the striatum

For Question 20-21
A 35 year old man has a history of chronic recurrent episodes of paranoid thoughts that the CIA is engaged in a manhunt for him and persistent symptoms of voices commenting on his behavior. He lives alone and is unemployed and only rarely interacts with others, usually only family members. He is currently more paranoid than usual, the voices are occurring with greater frequency, his speech is sparse and when he does speak, his thoughts are difficult to follow. He describes that he currently has little interest or energy for any activity and finds no pleasure in anything but smoking cigarettes (2 packs/day). He speaks with little emotional expression or gesturing.

20. Which of the following symptoms do NOT describe his negative symptoms of schizophrenia?
   - a. anergia
   - b. loosening of associations
   - c. anhedonia
   - d. alogia
   - e. blunted affect
21. Which of the following brain imaging findings are most consistent with his diagnosis?
   a. Increases in dopamine D2 receptor radioligand binding in the basal ganglia on positron emission tomography
   b. Encephalopathy on electroencephalogram
   c. Lacunar infarcts in thalamus on magnetic resonance imaging
   d. Enlargement of frontal cortical brain regions on computerized tomography
   e. Decreases in dopamine D2 receptor radioligand binding in the basal ganglia on positron emission tomography

22. True or False
   The positive symptoms of schizophrenia are related to hyperactivity of mesolimbic dopaminergic neurons and the negative symptoms are related to hypoactivity of mesocortical dopaminergic neurons.

23. Atypical neuroleptics such as clozapine treat both the positive and negative symptoms of schizophrenia but the high potency D-2 blockers treat only the positive symptoms.

24. Data from neuroimaging studies in schizophrenia and neuroanatomical reasoning suggest that auditory hallucinations are most likely related to dysfunction in
   a. visual association cortex in the occipital lobe
   b. heteromodal dorsolateral prefrontal cortex
   c. auditory association cortex in the temporal lobe
   d. auditory association fibers in the medial geniculate
   e. fronto-striatal-thalamic circuits

25. Which of the following agents is NOT likely to induce positive psychotic symptoms in a schizophrenic patient
   a. ketamine
   b. amphetamine
   c. phencyclidine
   d. benzodiazepines
   e. levodopa

26. Which of the following brain imaging findings have been demonstrated in schizophrenia?
   a. Decreased activation of the dorsolateral prefrontal cortex during tests of executive function
   b. Increased atrophy and ventricular size in some patients
   c. Decreased size of the hippocampus and amygdala in the affected twin in twins discordant for schizophrenia
   d. Increases in the volume of the midbrain ventral tegmental area
   e. a, b, and c
   f. a and c
27. Which of the following receptor effects is hypothesized to make antipsychotic drugs atypical, that is improved negative symptom effects with less extrapyramidal side effects?
   a. Alpha-adrenergic receptor blockade
   b. Histaminic receptor blockade and D2 dopamine receptor blockade
   c. Muscarinic cholinergic receptor blockade and D2 dopamine receptor blockade
   d. Serotonin 5HT2 receptor blockade and D2 dopamine receptor blockade
   e. Serotonin reuptake inhibition and D2 dopamine receptor blockade

28. Functional imaging studies have potentially implicated dysfunction in which of the following structures in OCD?
   a. prefrontal cortex
   b. basal ganglia
   c. thalamus
   d. cingulate gyrus
   e. all of the above

29. In a preliminary study, rTMS significantly affected compulsive urges when stimulation was delivered over:
   a. left prefrontal cortex
   b. right prefrontal cortex
   c. parieto-occipital cortex
   d. basal ganglia bilaterally

30. Which of the following neurotransmitter systems is most strongly implicated in the pathogenesis and treatment of depression?
   a. GABA  b. serotonin  c. dopamine  d. glutamate  e. acetylcholine

31. Which of the following neuropeptide systems is most strongly implicated in the pathogenesis of depression?
   a. growth hormone (and GNRH, somatostatin)
   b. neurohypophyseal hormones (vasopressin, oxytocin)
   c. endogenous opioids (endorphins, enkephalins)
   d. gonadotrophins (estrogen, progesterone, and metabolites)
   e. hypothalamic-pituitary-adrenal (HPA) axis

32-38 True or False
32. Glutamate is involved in the long-term memory potentiation in the hippocampus.
33. Glutamate is not involved in the development of psychosis.
34. High dose Vitamin E is currently recommended as an adjunct treatment for Alzheimer’s disease because of its proven memory-enhancing effects.
35. In a recent paper in Science substance P antagonists were shown to be have potent antidepressant activity.
36. Peak nicotine concentration in plasma from cigarettes is seen about 30-40 minutes after smoking a single cigarette.
37. Nicotine accumulates over 6-8 hours of smoking, so smokers do not have to work to maintain blood nicotine levels within a tight boundary.

38. Unlike cocaine, the acute effect of nicotine is not mediated through the dopaminergic systems in the nucleus accumbens.

39. According to PET studies by Mayberg hypoactivation in which brain region predicted poor response to antidepressant treatment
a. orbitofrontal cortex
b. anterior cingulate gyrus

c. dorsolateral prefrontal cortex
d. head of the caudate
e. putamen

40-45 Matching (Select the best answer, answers may be used more than once)

Neuropharmacologic effects of nicotine
40. Norepinephrine  
41. Acetylcholine  
42. Glutamate  
43. GABA  
44. Endogenous opioids  
45. Serotonin

a. memory, cognition  
b. analgesia  
c. mood, appetite  
d. stimulation, arousal  
e. relaxation, anxiolytic

46-50 True or False

46. Stimulation in the lateral hypothalamic nucleus produces satiety and stimulation of the ventromedial nucleus of the hypothalamus increases feeding behavior.

47. Infusion of intravenous insulin inhibits feeding while infusion of intravenous glucose stimulates feeding.

48. Leptin, secreted by the gut in response to ingestion of food, stimulates sensory nerves in the vagus to induce satiation.

49. Leptin inhibits the feeding stimulation induced by neuropeptide Y.

50. Leptin, known as the OB protein, is missing in genetically obese mice.

51. Which of the following is NOT one of the short-term control signals for feeding
a. taste and smell  c. bowel distention  e. CCK
b. blood glucose  d. leptin

52. Which of these conceptual views of behavioral organization of the brain is not in the correct chronological order from earliest to most recent?


d. Mesulam-neural networks  e. McLean-limbic system

53. Which of the following is NOT part of Papez limbic memory circuit?

a. hippocampus  c. fornix
b. amygdala  
d. mammillary bodies  e. anterior cingulate gyrus  
f. cingulum
54. CT scan can be useful in the following conditions. Which of the following conditions usually do NOT require the use of IV contrast?

a. brain tumor  
b. abscess  
c. Alzheimer's disease  
d. subdural hematoma  
e. c and d  
f. b and c

55-62 True or False

55.Severity of brain atrophy on CT or MRI is a reliable diagnostic indicator of Alzheimer's disease.

56. The entorhinal cortex degenerates early in Alzheimer's disease.

57. Calcification in the hippocampus is a normal age-related finding on CT.

58. Pick's Disease usually shows focal atrophy on CT or MRI.

59. The typical SPECT pattern in Alzheimer's disease is decreased perfusion to the frontal lobes bilaterally.

60. The lesions in gamma knife capsulotomy for OCD (Figure 2) are complete approximately 5 days after the procedure when the edema subsides and symptoms usually respond within a week.

61. The frontal lobes are the largest lobes of the brain making up more than one-third of the total cortical surface.

62. Having a patient copy a pattern of +++0 ++0 ++0 ++0 and then continue the pattern on their own without the stimulus can be a good test of dorsolateral prefrontal function.

63. Mr. Jones had his cerebral aneurysm clipped following a subarachnoid hemorrhage last year. You are the medical student on call for surgery when Mr. Jones comes in because of a bowel perforation. The Chief Resident says order a stat MRI of his belly and then runs to the OR. You remember from Biomed 370 that people with metal implants can't have an MRI. You should

a. order the test to avoid getting chewed out by the Chief Resident  
b. contact the radiologist to see if his clip is MRI compatible  
c. order a CT scan instead which you know is safe  
d. go on line and ask Mr. Wizard  
e. consult your hoscope

64. Which of the following does NOT fit with dorsolateral prefrontal dysfunction

a. perseveration  
b. impersistance  
c. poor sequencing  
d. socially inappropriate behavior  
e. difficulty shifting set

65. The prevalence of Alzheimer's disease in the United States in people 85 and over is

a. 5%  
b. 10%  
c. 20%  
d. 30-50%  
e. more than 50%

66-69 Match the patient vignette on the left with the pattern of memory impairment most likely to be seen

66. 40 year old with closed head injury  
67. 85 year old with 5 years of gradual decline in memory  
68. 55 year old with Huntington's disease B  
69. 70 year old with a stroke in the anterior thalamus  

a. impaired episodic memory  
b. impaired procedural memory  
c. impaired episodic and semantic memory  
d. impaired memory retrieval
70. A 60 year old woman whose husband died 15 months ago has poor appetite, psychomotor retardation, insomnia, anhedonia and feels that life is not worth living. Her condition can best be described as:
   a. complicated bereavement
   b. melancholic depression
   c. uncomplicated bereavement
   d. seasonal affective disorder
   e. psychotic depression

71. Letter d. in Figure 3 is:
   a. 4th ventricle
   b. third ventricle
   c. cerebral aqueduct
   d. frontal horn
   e. quadrigeminal cistern

72. The part of the ventricular system on the medial surface of letter c. in Figure 3 is:
   a. frontal horns
   b. body of the lateral ventricle
   c. occipital horns
   d. 3rd ventricle
   e. 4th ventricle

73. Letter c. in Figure 3 is:
   a. putamen
   b. head of the caudate
   c. thalamus
   d. insula

74. Which structures in Figure 3 are most likely to degenerate in Huntington’s disease:
   a. a
   b. b
   c. c
   d. e
   e. a and c

75. The area of high signal on the T-2 weighted MRI scan in the 40 year old in Figure 4 is the:
   a. Sylvian fissure
   b. temporal cortex
   c. hippocampus
   d. Heschel’s gyrus
   e. gyrus rectus

76. The most likely cause of this high signal abnormality in this patient is:
   a. Alzheimer’s disease
   b. herpes encephalitis
   c. posterior cerebral artery infarction
   d. frontotemporal dementia

77. The non-contrast CT in figure 5 shows:
   a. moderate diffuse hypodense signal in the frontal lobes
   b. moderate diffuse hyperdense signal in the frontal lobes
   c. diffuse cortical atrophy
   d. punctate areas of low signal in the white matter

78. The most likely cause of the abnormalities in the CT in figure 5 is:
   a. bilateral anterior cerebral artery infarction
   b. Alzheimer’s disease
   c. multiple sclerosis
   d. cerebral hemorrhage
   e. frontotemporal dementia

79. The structure at the arrow in figure 6 is:
   a. Sylvian fissure
   b. temporal cortex
   c. hippocampus
   d. Heschel’s gyrus
   e. gyrus rectus
80. The most likely cause of gradual, progressive decline in short-term memory in this 70 year old with the MRI in figure 6 is
a. Alzheimer's disease  
  b. herpes encephalitis  
  c. posterior cerebral artery infarction  
  d. frontotemporal dementia

Choose the best answer
81. A 30 year old woman from India presents with headache. Her non-contrast CT in figure 7 shows
a. A large area of low density in the right basal ganglia. In the center of this hypodense area is a faint ring-like area of high signal surrounding a low-density core  
  b. A large area of high density in the right basal ganglia. In the center of this hyperdense area is a faint ring-like area of high signal surrounding a low-density core  
  c. A small, but dramatic area of low signal surrounding a high-density core  
  d. A large area of low signal in the right basal ganglia

82. Her contrast study is most likely to show
a. A small area of ring enhancement because this is likely to be a small abscess with surrounding edema  
  b. No enhancement because this is a basal ganglia infarct  
  c. A large area of ring-enhancement because this is a tumor  
  d. Patchy areas of enhancement throughout the lesion

83. A 72 year old man with hypertension presents with abrupt onset of stiffness in the right arm and leg. His non-contrast CT scan in figure 8 shows
a. moderate sized, low density lesion, right basal ganglia  
  b. moderate-sized, high density lesion, right basal ganglia  
  c. moderate-sized, high density lesion, left basal ganglia  
  d. ventriculomegaly

84. The lesion is located in the
a. putamen  
  b. caudate  
  c. internal capsule  
  d. globus pallidus

85. The lesion is most likely caused by
a. calcified tumor  
  b. subarachnoid hemorrhage  
  c. hypertensive hemorrhage  
  d. tumor with hemorrhage  
  e. arteriovenous malformation

86. The T-2 weighted non-contrast MRI in figure 9 shows
a. multiple punctate areas of high signal in the periventricular and deep white matter bilaterally  
  b. multiple punctate areas of low signal in the periventricular and deep white matter bilaterally  
  c. a large area of low density in the right frontal lobe  
  d. a large area of high density in the right frontal lobe

87. In an otherwise healthy 30 year old woman this scan is most consistent with
a. HIV encephalitis  
  b. tuberculoma  
  c. multiple sclerosis  
  d. cocaine vasculitis
Questions 88-90

88. A 56 year old man reported "loss of vision in the right eye" after waking up from surgery for mitral valve replacement. His non-contrast CT scan in figure 10 shows
a. moderate hypodense area in the left occipital lobe
b. moderate hypodense area in the right occipital lobe
c. large area of high signal in the right occipital lobe
d. large area of high signal in the left occipital lobe

89. You are on call again for surgery (every other night, you might want to think about a dermatology residency) and are sent to examine the patient. You find
a. optic neuritis
b. bitemporal hemianopsia
c. right homonymous hemianopsia
d. poor visual acuity in the right eye

90. The vascular territory involved is
a. middle cerebral artery
b. posterior cerebral artery
c. watershed between anterior and posterior cerebral arteries
d. basilar artery
<table>
<thead>
<tr>
<th>Number</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>c</td>
</tr>
<tr>
<td>2</td>
<td>d</td>
</tr>
<tr>
<td>3</td>
<td>e</td>
</tr>
<tr>
<td>4</td>
<td>a</td>
</tr>
<tr>
<td>5</td>
<td>c</td>
</tr>
<tr>
<td>6</td>
<td>d</td>
</tr>
<tr>
<td>7</td>
<td>a</td>
</tr>
<tr>
<td>8</td>
<td>e</td>
</tr>
<tr>
<td>9</td>
<td>c</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
</tr>
<tr>
<td>11</td>
<td>b</td>
</tr>
<tr>
<td>12</td>
<td>d</td>
</tr>
<tr>
<td>13</td>
<td>b</td>
</tr>
<tr>
<td>14</td>
<td>b</td>
</tr>
<tr>
<td>15</td>
<td>a</td>
</tr>
<tr>
<td>16</td>
<td>a</td>
</tr>
<tr>
<td>17</td>
<td>e</td>
</tr>
<tr>
<td>18</td>
<td>a</td>
</tr>
<tr>
<td>19</td>
<td>a</td>
</tr>
<tr>
<td>20</td>
<td>a</td>
</tr>
<tr>
<td>21</td>
<td>c</td>
</tr>
<tr>
<td>22</td>
<td>a</td>
</tr>
<tr>
<td>23</td>
<td>c</td>
</tr>
<tr>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>c</td>
</tr>
<tr>
<td>30</td>
<td>c</td>
</tr>
<tr>
<td>31</td>
<td>d</td>
</tr>
<tr>
<td>32</td>
<td>a</td>
</tr>
<tr>
<td>33</td>
<td>b</td>
</tr>
<tr>
<td>34</td>
<td>e</td>
</tr>
<tr>
<td>35</td>
<td>e</td>
</tr>
<tr>
<td>36</td>
<td>d</td>
</tr>
<tr>
<td>37</td>
<td>ab</td>
</tr>
<tr>
<td>38</td>
<td>aq</td>
</tr>
<tr>
<td>39</td>
<td>bc</td>
</tr>
<tr>
<td>40</td>
<td>b</td>
</tr>
<tr>
<td>41</td>
<td>a</td>
</tr>
<tr>
<td>42</td>
<td>f</td>
</tr>
<tr>
<td>43</td>
<td>g</td>
</tr>
<tr>
<td>44</td>
<td>a</td>
</tr>
<tr>
<td>45</td>
<td>d</td>
</tr>
<tr>
<td>46</td>
<td>e</td>
</tr>
<tr>
<td>47</td>
<td>b</td>
</tr>
<tr>
<td>48</td>
<td>a</td>
</tr>
<tr>
<td>49</td>
<td>d</td>
</tr>
<tr>
<td>50</td>
<td>c</td>
</tr>
<tr>
<td>51</td>
<td>c</td>
</tr>
<tr>
<td>52</td>
<td>b</td>
</tr>
<tr>
<td>53</td>
<td>c</td>
</tr>
<tr>
<td>54</td>
<td>a</td>
</tr>
<tr>
<td>55</td>
<td>b</td>
</tr>
<tr>
<td>56</td>
<td>b</td>
</tr>
<tr>
<td>57</td>
<td>t</td>
</tr>
<tr>
<td>58</td>
<td>f</td>
</tr>
<tr>
<td>59</td>
<td>f</td>
</tr>
<tr>
<td>60</td>
<td>t</td>
</tr>
<tr>
<td>61</td>
<td>f</td>
</tr>
<tr>
<td>62</td>
<td>f</td>
</tr>
<tr>
<td>63</td>
<td>f</td>
</tr>
<tr>
<td>64</td>
<td>a</td>
</tr>
<tr>
<td>65</td>
<td>c</td>
</tr>
<tr>
<td>66</td>
<td>b</td>
</tr>
<tr>
<td>67</td>
<td>a</td>
</tr>
<tr>
<td>68</td>
<td>d</td>
</tr>
<tr>
<td>69</td>
<td>c</td>
</tr>
<tr>
<td>70</td>
<td>e</td>
</tr>
<tr>
<td>71</td>
<td>b</td>
</tr>
<tr>
<td>72</td>
<td>a</td>
</tr>
<tr>
<td>73</td>
<td>c</td>
</tr>
<tr>
<td>74</td>
<td>d</td>
</tr>
<tr>
<td>75</td>
<td>b</td>
</tr>
<tr>
<td>76</td>
<td>c</td>
</tr>
<tr>
<td>77</td>
<td>b</td>
</tr>
<tr>
<td>78</td>
<td>b</td>
</tr>
<tr>
<td>79</td>
<td>c</td>
</tr>
<tr>
<td>80</td>
<td>c</td>
</tr>
<tr>
<td>81</td>
<td>d</td>
</tr>
<tr>
<td>82</td>
<td>b</td>
</tr>
<tr>
<td>83</td>
<td>c</td>
</tr>
<tr>
<td>84</td>
<td>d</td>
</tr>
</tbody>
</table>