MODULE LECTURE QUESTIONS

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NEUROSCIENCE

Lecture 1/2

1. What are the different divisions of the peripheral nervous system? The different functions?
    a. Sensory, motor and autonomic. Sensory receives input (touch/pain fibres) and motor is output.
    b. Autonomic – non-voluntary systems
        i. Sympathetic – flight/fight
        ii. Parasympathetic – rest/recuperation
2. What are the different forms of protection offered to the C.N.S?
    a. Bone
    b. Meninges
        i. Durra mater
        ii. Arachnoid
        iii. Pia mater
    c. Blood Brain Barrier
        i. Constricts chemicals
3. What are the fluid-filled cavities in our brain and why are they there?
    a. Ventricles and are essentially used as the brains sewage system. Filled with cerebrospinal fluid
4. What does the brainstem do? What can happen to it after a head injury and why is that dangerous?
    a. Life supporting functions such as heartbeat and breathing
    b. Damage can lead to death because pressure builds and stem gets squashed.
5. What is the cerebellum and what does it do?
    a. Small brain - On top of brainstem (behind)
    b. More than 50% located here
    c. Skilled precise movement – speech, fine tuned contractions
    d. A lot of sensory input
    e. Required learning
6. What structures sit at the very centre of the brain, at the top of the brain stem? What are their functions?
    a. Thalamus
    b. Hypothalamus (below/underneath)
        i. Motivational behaviours (feeding, sexual
        ii. Production and release of hormones
    c. Two bulbs on top of each hemisphere
    d. Important for relaying sensory information to brain. Sent to thalamus before passed into different parts.
    e. Eyes – thalamus – rest of brain
    f. Allows brain to filter what info is coming into it. Also regulating signal
7. What parts of the brain make up the limbic system and the basal ganglia? What aspects of behaviour do they contribute to?
    a. Limbic system = hippocampus and the amygdala. Wraps around thalamus. Emotional and memory. Emotional experiences are important for survival/goals. Education is bland and therefore hard to remember.
    b. Basal Ganglia – wrapped around thalamus. Involved in action and thought. Amongst limbic structure. Involved with movement.
        i. Candate – wrapping tail
        ii. Putamen – outside thalamus
        iii. Globus pallidus – in between
8. Why is your cortex so wrinkled? What are the different lobes, and what different functions are they specialised for?
    a. Neo cortex is convoluted to increase total surface area
    b. Parietal lobe – Touch, body sensations, visual, attention, multi-sensory convergence zones
    c. Occipital - vison
    d. Temporal – auditory, processing, memory, language, vision, multi-sensory integration
    e. Frontal – motor planning, language, judgment, decision making
9. What connects your two hemispheres?
    a. Corpus Callosum
10. How has the brain changed during the course of evolution?
    a. Vertebrates have separation between PNS and CNS
    b. Among vertebrates, large differences in relative size of different regions of brain, reflecting complexity of behaviour. Large increase in size of forebrain across vertebrates; enlargement of neocortex in mammals.

Lecture 3

1. What is the primary job of a neuron?

MODULE LECTURE QUESTIONS

2. What sort of signals do neurons send and what direction do they travel along a neuron?
    a. Binary signals from the soma (cell body) down the axon to terminals
3. What is the resting state of a neuron? What charge does it have?
    a. Resting state is polarised (off). Nat+ ions are on the outside and negative on inside.
    b. Lipid membrane cover neurons and are semipermeable. Controls the concentration of +/- ions.
4. What happens when a neuron is depolarised?
    a. Chanels open, and ions enter. Neuron is on. Can only remain on for short amount of time. Action potential. Hyperpolarisation after AP prevents itself from moving back onto itself.
5. How many states can neuron have? What does this tell us about the sort of signalling they are capable of?
    a. Can only be in two states, polarised and depolarised. This binary system is very unambiguous and allows sophistication of the brain.
6. What is myelin? What does it do?
    a. Prevents potential and depolarisation but signal can jump the gap and allows for faster signal transportation to the brain. Meaning depolarisation can only occur at the gaps between the myelin sheath
7. How do neurons communicate with one another? Where does this communication occur?
    a. In small junctions called "Synapses"
    b. Dendrites receive signals
8. How might a transmitter from one neuron affect another neuron?
    a. NT comes to terminal of 1st neuron and then released into synapse then diffuse to receptors on 2nd neuron. Pre-synaptic to post synaptic.
9. What stops the effects of neurotransmitters in the synapse?
    a. NTs can be excitatory or inhibitory. Enzymes destroy excess NT and allow re-uptake of NT into pre-synaptic terminal
10. Where do most psychoactive drugs work in the nervous system?
11. In what ways can drugs interact with neurotransmitters
    a. Mimic – fit
    b. Block – on top but don't activate. Opioids – heroin, morphine
    c. Anti-schizophrenic block dopamine
    d. Antidepressant – enhance serotonin by blocking re-uptake

Lecture 4

1. What methods can be used to show a specific part of the brain is necessary for a given function?
2. What four methods can be used to obtain functional maps of the human brain?
3. What is EEG? Pros and cons?
    a. Electrode plates against skull record electrical fields.
    b. Pro – good temporal resolution. Over time. Activity changes on fine time scales
    c. Con – poor spatial resolution
4. How does PET work? Pros and cons?
    a. Positron emission
    b. Measures changes in blood flow.
    c. Pro – spatial resolution
    d. Con – less temporal resolution
5. What does fMRI measure? Pros and cons?
    a. Measures changes in o2 in blood via magnetic properties
    b. Pro – good spatial resolution
    c. Con – temporal resolution cus of lag
6. MEG? Pros and cons?
    a. Magnetic fields emitted from brain.
    b. Pro – accurate temporal resolution as good as eeg. Non-invasive, and good spatial resolution
    c. Con – hella expensive and sensitive
7. What three regions of the hypothalamus are involved in feeding? What does each area do?
    a. Lateral hypothalamus
        i. Destruction of this reduces eating.
        ii. Because of LH rats like food and pay attention to it and have normal insulin levels
    b. Ventromedial hypothalamus
        i. Destruction causes overeating. Not because they lack satiety.
        ii. Each meal is normal size but stomach empties faster and have excessive insulin.

c. Paraventricular nucleus
    i. Controls satiety (CKK) Hor.
    ii. Destruction causes eating bigger meals

Lecture 5

1. List some of the known impacts of sleep deprivation (less than 7 hrs/night)
    a. Increase in appetite and weight gain
    b. Reduction in cognitive functions
    c. Increases sympathetic NS activity (increase in heart attacks)
2. What areas of the brain are responsible for keeping us aroused? What neurotransmitters are involved?
    a. Noradrenaline in locus coeruleus
    b. Serotonin in raphe nuclei
    c. Acetylcholine in pons
    d. NT in brainstem are off when we are asleep
    e. Disconnecting the forebrain from stem causes almost continuous sleep
3. What system controls our circadian cycle? What causes jetlag?
    a. Suprachiasmatic nucleus controls melatonin release from pineal gland
    b. Melatonin = signal for night time
    c. Jetlag = want to sleep because body clock is still on old time
4. What is "sleep pressure" and what is responsible for it?
    a. Adenosine builds when awake
    b. Inhibits altertness centres and stimulates sleep centers. Caffeine blocks adenosine receptors
5. What happens if you skip a night's sleep?
    a. Melatonin rises during night and falls in the morning while adenosine continues building up.
6. What area and neurotransmitter is implicated in the onset of sleep?
7. What happens to EEG activity during sleep? What areas are responsible for it?
    a. Slow-wave sleep
    b. Slower large fluctuations
    c. Thalamus simultaneously conducts synchronisation
8. What are the characteristics of REM sleep? What causes it? How does it change within a night and across the lifespan? What reduces REM sleep?
    a. Characteristics – eye movements, desynchronised brain waves, dreams, paralysed. Activation of the limbic system, deactivation of prefrontal cortex
    b. Increases over time in the night
    c. Decreases over age
    d. Alcohol reduces it.
9. What is the brains primary reward pathway? How was it discovered? What neurotransmitter is involved? What behavioural disorder might involve this pathway.
    a. Neural mechanism of reward
    b. Discovered – rat accidentally had electrode attached in dopamine fibres of the medial forebrain bundle
    c. Dopamine addiction, rat kept returning to place of electrical brain stimulation

Lecture 6

1. What is lateralisation? What function is the most strikingly lateralised? Which hemisphere is dominant for this function?
    a. Lateralisation – difference between the hemispheres.
    b. Language is most lateralised and left hemisphere controls this
2. What is the dichotic listening task? What does it show about lateralisation of language?
    a. People understand a word faster if presented to right ear. It shows the left hemisphere is dominant for language.
3. What is aphasia? What causes it?
    a. Problems with production and comprehension of speech
    b. Stroke in left brain
4. What are the two forms of aphasia? Difference? What neurological damage causes each type?
    a. Expressive aphasia – difficulty speaking but can understand speech. Can sing. Can't write but can draw. Cant sign.
        i. Caused by Broca's area
    b. Receptive/fluent aphasia – difficulty with comprehension of speech. Produce fluent but meaningless speech. Can't read
    c. Wernicke's Area – Left temp. Love
5. What has happened to a split brain patient?
    a. Corpus Collosum is cut.