DOWNLOAD PDF BRAIN, SYSTEM, MODEL : THE AFFECTIVE TURN

Chapter 1 : Interactive Brain | BrainLine

Characteristics of Brain Wave Changes by Affective Pictures Ruoyu Du1 1and Hyo Jong Lee, 2 1Division of Computer Science and Engineering, Chonbuk National University, Jeonju, Korea.

Jaak Panksepp, Department of Integrative Physiology and Neuroscience, College of Veterinary Medicine, Washington State University How affective feelings evolved in human and animal brains remains one of the central scientific mysteries of our field. To illuminate such deeply psychological question, we have few strategic options but to seek relevant neuroscientific evidence from other animals. There remain barriers to this. Clearly, these effects do not arise from neocortical read-out processes such as working memory, but rather directly from deep subcortical networks which generate instinctual emotional behaviors e. Thus, the affective neuroscience perspective is that animal research provides abundant evidence for the subcortical sources of emotional feelings in all mammals Panksepp, , , This argument has been laid out simplest in Panksepp It is important to note that the capitalizations are meant to highlight that what is being referred to are primary-process affective systems of the brain, which are next to impossible to study incisively in humans. Indeed, to sustain conceptual clarity, I divide the evolved brain mechanisms critical for understanding affective phenomena into a tripartite level of analysisâ€”primary raw instinctual-affective , secondary unconscious learning and memory related processing and tertiary higher cognitive manifestations levels. Figure 1 Nested hierarchies of control within the brain. Primary-processes are depicted as squares red; e. The color-coding aims to convey the manner in which lower brain functions are integrated into higher brain functions to eventually exert top-down regulatory control. The figure shows the bottom-up and top-down circular causation that is proposed to operate in every primal emotional system of the brain As highlighted in Figure 1, each of these levels needs distinct nomenclatures for clear discourse to emerge, which remains especially difficult in areas such as emotion research where few scientifically agreed upon definitions exist. Human PET-based brain imaging more appropriate for envisioning affective states than fMRI has seen such systems in human brains see Figure 2, based on work by Damasio, et al. Work on these, and other affective systems e. Claims that primary-process emotional arousals are not experienced in animals need to be cashed out with demonstrations that rewards and punishments can work effectively in humans without any associated experienced affective changes. Figure 2 An overview of brain arousals reds and yellows and inhibitions purples depicted on lateral surfaces of the right and left hemispheres top of each panel and medial surfaces of the corresponding hemispheres bottom of each panel , while humans experience various basic emotions evoked by autobiographical reminiscing. To highlight the directionality of changes, as monitored by changes in blood flow, inhibitions are indicated by downward arrows predominating in neocortical regions , while arousals are depicted by upward arrows predominantly in subcortical regions where emotional behaviors can be evoked by brain stimulation in animals The fact that the primary-process level of analysis can only be well pursued in animal models makes the need for clear functional neuronal-circuit based discourse essential. There are many reasons to believe that the higher mental apparatus depends critically on the foundation of primary and secondary brain-mind processes that are best illuminated through cross-species brain research. It is understandable why human psychology has remained unenthused by discussions of primary-process emotional systemsâ€”it has little direct access to such brain mechanisms. Conversely, animal investigators have no access to tertiary-process higher mental processes. Such conundrums make any discourse between different levels of analysis difficult e. My own work has explicitly sought to clarify cross-species, primary-process emotional systems and the feelings they generate. The critical fact that has permitted this is our ability to evoke coherent emotional response patterns with Deep Brain Stimulation. The affective evaluation of those evoked states is achieved with traditional operant learning procedures conditioned approach and escape , which can at the very least tell us whether the feelings are positive or negative, with the possibility of discriminating different rewarding feelings Stutz, et al. It also explains the failure of animal research to yield new psychiatric medicines, all of which, since the initial breakthrough starting 60 years ago, have been discovered by chance. The subsequent widespread use of animal behavioral models of psychiatric disorders

has yet to yield any new psychiatric medicines. I predict we can do better when we begin to scientifically understand our own primal emotional feelings through cross-species research. Indeed, that was my main reason for investing in primary-process affective neuroscience strategies. Based on this understanding, we are currently evaluating three new interventions for human depression: With an understanding of the opioid neurochemistries of separation-distress and social-bonding, some progress has also been made in treating autism Bouvard, et al. At the beginning there emerged raw affects, whose function was to anticipate survival issues: All positive affects inform organisms, unconditionally, that they are proceeding on paths of survival. All negative feelings inform organisms, also unconditionally, about probable paths of destruction. This vision can diminish disagreements among people working on different levels of analysis of psychological processes of common interest. A cross-species affective neuroscience allows us to integrate findings from basic animal brain research and constructivist views of the human mind, by recognizing how investigators are working on common interests at different levels of brain-mind organization. That these views are often at odds reflects a failure of our educational enterprises to integrate scientifically meaningful images of bottom-up developmental processes with maturation of top-down, thought-laden regulatory processes. One of the finest, and least appreciated, pieces of good news is that the neocortex at birth resembles a tabula rasa more than a conglomerate of evolutionarily specialized modules. All neocortical specializations, even our capacity for vision, arise through early sensory experiences and epigenetic moldings of higher brain functions. Constructivism works best in our understanding of higher mental functions, and hence what makes humans unique; evolutionary perspectives work best in understanding the subcortical specializations that all mammals share. It may be wise for emotion-science to wholeheartedly welcome the good news: We can finally comprehend the general neural principles that undergird our emotional affects by studying homologous processes in other animals. This knowledge has allowed us to develop new biological ways to understand and treat psychiatric disorders. If that mind medicine, which may facilitate the progression of psychotherapy, by facilitating learning i. This was facilitated by the first validated psychoassay for positive social affectâ€”namely systematic tickling of rats to generate an ancestral form of laughter.

Chapter 2 : Drug Seeking and Cravings: Addictionsâ€™ Effect on the Brainâ€™s Reward System

ASynopsis of Affective Neuroscience emotional system of the brain. This schematic summarizes the hypothesis Animals turn such emotion-evoking brain stimulations on and off.

Affective neuroscience of the emotional BrainMind: This article has been cited by other articles in PMC. Abstract Cross-species affective neuroscience studies confirm that primary-process emotional feelings are organized within primitive subcortical regions of the brain that are anatomically, neurochemically, and functionally homologous in all mammals that have been studied. Emotional feelings affects are intrinsic values that inform animals how they are faring in the quest to survive. To understand why depression feels horrible, we must fathom the affective infrastructure of the mammalian brain. These networks are of clear importance for understanding psychiatric disorders and advancing psychiatric practice. Psychiatric disorders commonly reflect affective imbalances within the brain. Accordingly, a key question in psychiatric research is the neural nature of emotional feelings. For instance, in depression research, one of the most important unanswered questions is: Why does depression feel so bad? Exactly the same affective issues confront us when we study addictions. Here we explore the possibility that chronic affective changes may arise from functional changes in basic emotional systems of the brain. For example, diminished arousability of specific positive affective systems along with elevated activation of distinct negative affective networks may be the fundamental source of depressive affect. But what systems are they? Vernacular terms have excess meanings, and thus will not suffice for clear discourse. Thus, drug addictions share some important affective features with depression; for instance, the dysphoric feelings that accompany both addictive drug withdrawal and depression which reflect diminished SEEKING urges. We are just beginning to understand the underlying innate, genetically determined, and epigenetically refined aspects of emotional feelings. Emotional nomenclature can be confusing. Here primary-process ie, basic or primordial emotional networks are defined in terms of neural and behavioral criteria. Basic emotional networks can be defined by six criteria: Affects are the subjectively experienced aspects of emotions, commonly called feelings. Levels of control in brain emotion-affective processing 1. Primary-process, basic-primordial affects sub-neocortical i Emotional affects emotion action systems; intentions-in-actions ii Homeostatic affects hunger, thirst, etc via brain-body interoceptors iii Sensory affects sensorially triggered pleasurable-displeasurable feelings 2. Secondary-process emotions learning via basal ganglia i Classical conditioning ii Instrumental and operant conditioning iii Emotional habits 3. Because of striking cross-species homologies in mammalian primary-process emotional systems, animal models may provide optimal guidance for deciphering brain affective mechanisms that also operate in our species. This review will delve into various levels of emotional control, especially the first: It is among the inherited subcortical primary-process instinctual tools for living that the foundations of human emotional lives reside, and neurochemical imbalances there can lead to persistent affective imbalances of psychiatric significance. The mammalian brain is clearly an organ where evolutionary layering remains evident at both the anatomical and chemical levels, and striking cross-species homologies exist in the more ancient primary-process neural regions. Such neuroevolutionary facts allow us to envision primary emotional processes in humans that are homologous across mammals, permitting animal models to effectively illuminate how primordial emotional feelings - ancestral states of consciousness - emerge from human brain activities. Here, some of the cross-species primary -process emotional systems that help us decipher the foundations of emotions in normal human mental life, as well as psychiatric conditions, will be described. However, evidence that affective feelings arise directly from medial subcortical networks is consistent and substantial. The subcortical locus of affect generation strongly suggests that the foundational principles of human emotions can be understood by studying these brain structures and functions in other animals. Because of the immaturity of neuroscience, this eventually led to the study of the mind without a brain - a top-down speculative perspective with little scientific basis. The second half of the century, after the discovery of several highly effective psychiatric medications, was framed more in a Krapelinian context - psychiatric diagnostic categories were linked to diverse brain mechanisms, which were studied objectively. This has now led to abundant ruthless

reductionism, where mental experienced aspects of brain functions are inadequately considered in the genesis of psychiatric disorders, especially when preclinical models are used to clarify underlying principles. This has led to the increasing study of living brains without feelings - without a mind. This is ontologically unsatisfactory. The above traditions can now be blended, illuminating how our ancestral affective BrainMind contributes to and often causes psychiatric problems. But the absence of a general solution to how emotional feelings are created in the brain continues to impede development of neuroscientifically coherent psychiatric nosologies reflected in the current discussions regarding DSM-5 definitions. Detailed understanding of primary emotional systems in animal models may yield psychologically relevant endophenotypes for psychiatry. They were my commentary in italics: This is surely so, but many current emotion-free genetic-psychiatric linkage studies are providing few insights. Perhaps more the-oretically focused studies that include affective issues can lead to faster progress. The rest of this article will highlight: Emotion theory - old beliefs and new realities Primary-process emotion approaches to the BrainMind are not well represented in modern psychology, psychiatry, or even neuroscience. This has promoted the misleading belief that emotions are just a subset of cognitive process. If one defines cognitive processes as neural handling of incoming sensory stimuli, a disciplined distinction can be made between cognitive and primaryprocess emotional processes, with the former consisting of externally sourced information processing and the latter being internal state-control processes, as done here. When one moves to higher levels of processing, secondary learning , and tertiary processes thought levels of analysis, cognitive and emotional issues do get more conflated. Another bias impeding progress is the fact that many psychologists believe that emotions arise not from brain evolution but from social-developmental learning based on primal gradients dimensions of arousal and valence. Such dimensional approaches effectively focus on the diverse languages of emotion ie, tertiary processes with no compelling strategy for unraveling primary-process emotional networks. The study of primary-process brain mechanisms of emotions, best pursued in animal models, provides a bridge that can help settle such debates. In other words, such debates may simply reflect investigators working at different levels of control. The Affective Neuroscience 3 strategy relies on preclinical evidence for the existence of a variety of primaryprocess emotional networks in mammalian brains. These networks are identified by distinct emotional behaviors evoked with highly localized electrical stimulation of the brain ESB sites which exist almost exclusively in subcortical regions. In other words, animals care whether such emotional states are evoked. But can the neocortex generate emotional feelings on its own? No scientist who has worked on primary-process brain emotional systems has ever subscribed to the JamesLange conjecture that affective feelings are only experienced when unconscious sensory information about bodily arousals reaches the neocortex. The emotional-behavioral coherence of organisms is fully formed in subneocortical regions of the brain - eg, just consider that physical PLAY, the most complex basic social emotion, persists after neodecortication. Accordingly, we can use a dual-aspect monism strategy to study emotional feelings - ie, ESB evoked RAGE behaviors reflect angry-type feelings animals turn off such ESB 20 , while evoked PLAY behaviors reflect joyful-type feelings - ESB evoking play-vocalizations sustain self-stimulation reward, 21 etc. In the present view, the affective states generated by primordial brain emotional networks may have been among the first experiences that existed in brain evolution. Without them, higher consciousness frontal neocortical executive functions may not have evolved. In sum, affective neuroscientific analysis of basic emotions is based on several highly replicable facts: When negative emotions are aroused - RAGE, FEAR, GRIEF - animals escape the stimulation; iii The above behavioral and affective changes are rarely, if ever, evoked from higher prefrontal neocortical regions, suggesting that higher brain areas may not have the appropriate circuitry to generate affective experiences, although the neocortex can clearly regulate eg, inhibit emotional arousals and, no doubt, prompt emotional feelings by dwelling on life problems. The emotional primes are summarized in several monographs, with another appearing soon. When fully aroused, SEEKING 25 fills the mind with interest and motivates organisms to effortlessly search for the things they need, crave, and desire. In humans, this system generates and sustains curiosity from the mundane to our highest intellectual pursuits. This system becomes underactive during addictive drug withdrawal, chronic stress, and sickness, and with accompanying feelings of depression. Overactivity of this system can promote excessive and impulsive behaviors, along with

psychotic delusions and manic thoughts. It promotes learning by mediating anticipatory eagerness, partly by coding predictive relationships between events. It promotes a sense of engaged purpose in both humans and animals, and is diminished in depression and the dysphoria of withdrawal from addictive drugs. This is further highlighted by the simple fact that bilateral lesions of the system produce profound amotivational states in animals all appetitive behaviors are diminished and the elevated threshold for self-stimulation reward probably reflects the dysphoria state. It invigorates aggressive behaviors when animals are irritated or restrained, and also helps animals defend themselves by arousing FEAR in their opponents. Human anger may get much of its psychic energy from the arousal of this brain system; ESB of the above brain regions can evoke sudden, intense anger attacks, with no external provocation. Key chemistries which arouse this system are the neuropeptide Substance P and glutamate, while endogenous opioids and y-aminobutyric acid GABA inhibit the system. A prediction is that glutamate and Substance P receptor antagonists eg, aprepitant may help control human anger. Humans stimulated in these same brain regions report being engulfed by an intense free-floating anxiety that appears to have no environmental cause. Key chemistries that regulate this system are Neuropeptide Y and corticotrophin releasing factor CRF ; anti-anxiety agents such as the benzodiazepines inhibit this system by facilitating GABA transmission. These brain chemistries help create gender-specific sexual tendencies. Oxytocin promotes sexual readiness in females, as well as trust and confidence, and vasopressin promotes assertiveness, and perhaps jealous behaviors, in males. Distinct male and female sexual tendencies are promoted by these steroid hormones early in life, with sexual activation by gonadal hormones at puberty. Because brain and bodily sex characteristics are independently organized, it is possible for animals that are externally male to have female-typical sexual urges and, others with female external characteristics to have maletypical sexual urges. The dopamine-driven SEEKING system participates in the search for sexual rewards just as for all other types of rewards, including those relevant for the other social-emotional systems described below. Some of the chemistries of sexuality, for instance oxytocin, have been evolutionarily redeployed to mediate maternal care - nurturance and social bonding - suggesting there is an intimate evolutionary relationship between female sexual rewards and maternal motivations. This collection of hormonal and associated neurochemical changes also help assure strong maternal bonds with offspring. In any event, young socially dependent animals have powerful emotional systems to solicit nurturance. They exhibit intense crying when lost, alerting caretakers to attend to their offspring. ESB mapping of this separation-distress system has highlighted circuitry running from dorsal PAG to anterior cingulate, and it is aroused by glutamate and CRF and inhibited by endogenous opioids, oxytocin, and prolactin - the major social-attachment, socialbonding chemistries of the mammalian brain. These neurochemicals are foundational for the secure attachments that are so essential for future mental health and happiness. It is still worth considering that panic attacks may reflect sudden endogenous spontaneous loss of feelings of security acute separation-distress rather than sudden FEAR. We predict that these circuits are tonically aroused during human grief and sadness, feelings that accompany low brain opioid activity. One key function of social play is to learn social rules and refine social interactions. Subcortically concentrated PLAY 31 urges may promote the epigenetic construction of higher social brain functions, including empathy. Further studies of this system may lead to the discovery of positive affect promoting neurochemistries that may be useful in treating depression. For preclinical modeling, these emotional systems provide a variety of affectively important BrainMind networks to guide not only psychiatrically relevant research, but as already highlighted, the development of more specifically acting psychiatric medicines. To highlight one concrete possibility, there will follow a brief focus on how such systems may help us understand the genesis and better treatment of depression. Emotional networks and depression A key research question for affective disorders is why depression feels so bad. Specifically, which negative affect generating networks within mammalian brains helps generate depressive pain that leads to chronic despair? For an extensive discussion, along with expert commentaries, see ref This vision allows investigators to focus on specific network analyses as opposed to the nonspecific stress models most commonly employed.

Chapter 3 : Cognitive-affective personality system - Wikipedia

Cross-species affective neuroscience studies confirm that primary-process emotional feelings are organized within primitive subcortical regions of the brain that are anatomically, neurochemically, and functionally homologous in all mammals that have been studied.

The brain structures that compose the reward system are located primarily within the cortico-basal ganglia-thalamo-cortical loop ; [11] the basal ganglia portion of the loop drives activity within the reward system. The reward system includes the ventral tegmental area , ventral striatum i. These LHb projections are activated both by aversive stimuli and by the absence of an expected reward, and excitation of the LHb can induce aversion. While GABA receptor agonists are capable of eliciting both "liking" and "wanting" reactions in the nucleus accumbens, glutaminergic inputs from the basolateral amygdala , ventral hippocampus, and medial prefrontal cortex can drive incentive salience. Furthermore, while most studies find that NAcc neurons reduce firing in response to reward, a number of studies find the opposite response. This had led to the proposal of the disinhibition or depolarization hypothesis, that proposes that excitation or NAcc neurons, or at least certain subsets, drives reward related behavior. Regions include the lateral hypothalamus and medial forebrain bundles, which are especially effective. Stimulation there activates fibers that form the ascending pathways; the ascending pathways include the mesolimbic dopamine pathway , which projects from the ventral tegmental area to the nucleus accumbens. There are several explanations as to why the mesolimbic dopamine pathway is central to circuits mediating reward. First, there is a marked increase in dopamine release from the mesolimbic pathway when animals engage in intracranial self-stimulation. Pleasure centers [edit] Pleasure is a component of reward, but not all rewards are pleasurable e. The posterior ventral pallidum also contains a hedonic hotspot, while the anterior ventral pallidum contains a hedonic coldspot. Microinjections of opioids , endocannabinoids , and orexin are capable of enhancing liking in these hotspots. Furthermore, inhibition of one hotspot results in the blunting of the effects of activating another hotspot. Incentive salience Tuning of appetitive and defensive reactions in the nucleus accumbens shell. Above AMPA blockade requires D1 function in order to produce motivated behaviors, regardless of valence, and D2 function to produce defensive behaviors. GABA agonism, on the other hand, does not requires dopamine receptor function. Below The expansion of the anatomical regions that produce defensive behaviors under stress, and appetitive behaviors in the home environment produced by AMPA antagonism. This flexibility is less evident with GABA agonism. In the NAcc, such a dichotomy is not as clear cut, and activation of both D1 and D2 MSNs is sufficient to enhance motivation, [37] [38] likely via disinhibiting the VTA through inhibiting the ventral pallidum. To explain increasing contact with a certain stimulus such as chocolate, there are two independent factors at work â€” our desire to have the chocolate wanting and the pleasure effect of the chocolate liking. According to Robinson and Berridge, wanting and liking are two aspects of the same process, so rewards are usually wanted and liked to the same degree. However, wanting and liking also change independently under certain circumstances. For example, rats that do not eat after receiving dopamine experiencing a loss of desire for food act as though they still like food. In another example, activated self-stimulation electrodes in the lateral hypothalamus of rats increase appetite, but also cause more adverse reactions to tastes such as sugar and salt; apparently, the stimulation increases wanting but not liking. Such results demonstrate that our reward system includes independent processes of wanting and liking. The wanting component is thought to be controlled by dopaminergic pathways , whereas the liking component is thought to be controlled by opiate-benzodiazepine systems. The same animals do not work to obtain the opiates if the dopaminergic neurons of the mesolimbic pathway are inactivated. In this perspective, animals, like humans, engage in behaviors that increase dopamine release. Kent Berridge , a researcher in affective neuroscience , found that sweet liked and bitter disliked tastes produced distinct orofacial expressions , and these expressions were similarly displayed by human newborns, orangutans, and rats. This was evidence that pleasure specifically, liking has objective features and was essentially the same across various animal species. Most neuroscience studies have shown that the more dopamine released by the reward, the more effective the

reward is. This is called the hedonic impact, which can be changed by the effort for the reward and the reward itself. Berridge discovered that blocking dopamine systems did not seem to change the positive reaction to something sweet as measured by facial expression. In other words, the hedonic impact did not change based on the amount of sugar. This discounted the conventional assumption that dopamine mediates pleasure. Even with more-intense dopamine alterations, the data seemed to remain constant. It explains the compulsive use of drugs by drug addicts even when the drug no longer produces euphoria, and the cravings experienced even after the individual has finished going through withdrawal. Some addicts respond to certain stimuli involving neural changes caused by drugs. This sensitization in the brain is similar to the effect of dopamine because wanting and liking reactions occur. Human and animal brains and behaviors experience similar changes regarding reward systems because these systems are so prominent. Associative learning Rewarding stimuli can drive learning in both the form of classical conditioning Pavlovian conditioning and operant conditioning instrumental conditioning. In classical conditioning, a reward can act as an unconditioned stimulus that, when associated with the conditioned stimulus, causes the conditioned stimulus to elicit both musculoskeletal in the form of simple approach and avoidance behaviors and vegetative responses. In operant conditioning, a reward may act as a reinforcer in that it increases or supports actions that lead to itself. Model free learning involves the simple caching and updating of values. In contrast, model based learning involves the storage and construction of an internal model of events that allows inference and flexible prediction. Although pavlovian conditioning is generally assumed to be model-free, the incentive salience assigned to a conditioned stimulus is flexible with regard to changes in internal motivational states. Although classical conditioning is not limited to the reward system, the enhancement of instrumental performance by stimuli i. Habitual and goal directed instrumental learning are dependent upon the lateral striatum and the medial striatum, respectively. The intracellular cascade activated by D1 receptors involves the recruitment of protein kinase A , and through resulting phosphorylation of DARPP , the inhibition of phosphatases that deactivate ERK. They discovered that rats would perform behaviors such as pressing a bar, to administer a brief burst of electrical stimulation to specific sites in their brains. This phenomenon is called intracranial self-stimulation or brain stimulation reward. Typically, rats will press a lever hundreds or thousands of times per hour to obtain this brain stimulation, stopping only when they are exhausted. While trying to teach rats how to solve problems and run mazes, stimulation of certain regions of the brain where the stimulation was found seemed to give pleasure to the animals. They tried the same thing with humans and the results were similar. The explanation to why animals engage in a behavior that has no value to the survival of either themselves or their species is that the brain stimulation is activating the system underlying reward. When rats were tested in Skinner boxes where they could stimulate the reward system by pressing a lever, the rats pressed for hours. Pavlov used the reward system by rewarding dogs with food after they had heard a bell or another stimulus. Pavlov was rewarding the dogs so that the dogs associated food, the reward, with the bell, the stimulus. Thorndike used the reward system to study operant conditioning. He began by putting cats in a puzzle box and placing food outside of the box so that the cat wanted to escape. The cats worked to get out of the puzzle box to get to the food. Although the cats ate the food after they escaped the box, Thorndike learned that the cats attempted to escape the box without the reward of food. Thorndike used the rewards of food and freedom to stimulate the reward system of the cats. Thorndike used this to see how the cats learned to escape the box.

Chapter 4 : Brain anatomy - the hippocampus, hypothalamus, thalamus, amygdala, and basal ganglia.

Temporal Lobe, particularly Superior Temporal region changes,can affect the personality dramatically and the victims can be left without personality,or with extreme irrational anger outbursts,or unable to correctly read and interpret situations and therefor over reacting with much anger etc inappropriate to the situation.

MacLean [5] suggested that emotion is related to a group of structures in the center of the brain called the limbic system , which includes the hypothalamus , cingulate cortex , hippocampi , and other structures. Research has shown that limbic structures are directly related to emotion, but non-limbic structures have been found to be of greater emotional relevance. The following brain structures are currently thought to be involved in emotion: The amygdalae are involved in detecting and learning what parts of our surroundings are important and have emotional significance. They are critical for the production of emotion, and may be particularly so for negative emotions, especially fear. The thalamus also plays an important role in regulating states of sleep and wakefulness. It works to form new memories and also connecting different senses such as visual input, smell or sound to memories. The hippocampus allows memories to be stored long term and also retrieves them when necessary. It is this retrieval that is used within the amygdala to help evaluate current affective stimulus. It has been identified as a main region in controlling spatial memory functions, episodic memory and executive functions. They are involved in olfaction , the perception of odors. The different parts of the cingulate gyrus have different functions, and are involved with affect, visceromotor control, response selection, skeletomotor control, visuospatial processing, and in memory access. This region of the brain may also play an important role in the initiation of motivated behavior. Basal ganglia play an important role in motivation, [20] action selection and reward learning. It appears to play a critical role in the regulation of emotion and behavior by anticipating the consequences of our actions. The prefrontal cortex may play an important role in delayed gratification by maintaining emotions over time and organizing behavior toward specific goals. One part of the ventral striatum called the nucleus accumbens is thought to be involved in the experience pleasure. The insula is implicated in empathy and awareness of emotion. Lesion studies [27] have shown that cerebellar dysfunction can attenuate the experience of positive emotions. While these same studies do not show an attenuated response to frightening stimuli, the stimuli did not recruit structures that normally would be activated such as the amygdala. Rather, alternative limbic structures were activated, such as the ventromedial prefrontal cortex , the anterior cingulate gyrus, and the insula. This may indicate that evolutionary pressure resulted in the development of the cerebellum as a redundant fear-mediating circuit to enhance survival. It may also indicate a regulatory role for the cerebellum in the neural response to rewarding stimuli, such as money, [28] drugs of abuse, [29] and orgasm. Scientific theory regarding the role of the right hemisphere has developed over time and resulted in several models of emotional functioning. Mills was one of the first researchers to propose a direct link between the right hemisphere and emotional processing, having observed decreased emotional processing in patients with lesions to the right hemisphere. The right hemisphere hypothesis[edit] The right hemisphere hypothesis asserts that the right hemisphere of the neocortical structures is specialized for the expression and perception of emotion. The mode of processing of the two hemispheres has been the discussion of much debate. One version suggests the lack of a specific mode of processes, stating that the right hemisphere is solely negative emotion and the left brain is solely positive emotion. The distinction between non-emotional and emotional processes is now thought to be largely artificial, as the two types of processes often involve overlapping neural and mental mechanisms. In fact, anxious participants in some studies show the Stroop interference effect for both negative and positive words, when the words are matched for emotionality. Participants are usually asked to respond quickly with the name of the displayed emotion. An emotional stimulus and a neutral stimulus appear side by side, after which a dot appears behind either the neutral stimulus incongruent condition or the affective stimulus congruent condition. Participants are asked to indicate when they see this dot, and response latency is measured. Dots that appear on the same side of the screen as the image the participant was looking at will be identified more quickly. Thus, it is possible to discern which object the participant was attending to by subtracting the reaction time to

respond to congruent versus incongruent trials. For example, those with social phobia selectively attend to social threats but not physical threats. Participants with obsessive-compulsive disorder symptoms initially show attentional bias to compulsive threat, but this bias is attenuated in later trials due to habituation to the threat stimuli. For example, healthy participants tend to show enhanced startle responses while viewing negatively valenced images and attenuated startle while viewing positively valenced images, as compared with neutral images. In laboratory studies, the threat of receiving shock is enough to potentiate startle, even without any actual shock. Recently, affective neuroscience has done much to discover this role. Deep, emotional attachment to a subject area allows a deeper understanding of the material and therefore, learning occurs and lasts. Someone who is feeling sad will understand a sad passage better than someone feeling happy. Neuroimaging studies using fMRI have demonstrated that the same area of the brain being activated when one is feeling disgust is also activated when one observes another person feeling disgust. Showing a fearful facial expression when reading passages that contain fearful tones facilitates students learning of the meaning of certain vocabulary words and comprehension of the passage. Several meta-analyses examining the brain basis of emotion have been conducted. In each meta-analysis, studies were included that investigate healthy, unmedicated adults and that used subtraction analysis to examine the areas of the brain that were more active during emotional processing than during a neutral control condition. The meta-analyses to date predominantly focus on two theoretical approaches, locationist approaches and psychological construction approaches. It is being debated regarding the existence of the neurobiological basis of emotion. Because emotions emerge from more basic components, there is heterogeneity within each emotion category; for example, a person can experience many different kinds of fear, which feel differently, and which correspond to different neural patterns in the brain. Thus, this view presents a different approach to understanding the neural bases of emotion than locationist approaches. All studies used fMRI or PET techniques to investigate higher-order mental processing of emotion studies of low-order sensory or motor processes were excluded. For each brain region, statistical chi-squared analysis was conducted to determine if the proportion of studies reporting activation during one emotion was significantly higher than the proportion of studies reporting activation during the other emotions. Two regions showed this statistically significant pattern across studies. Studies included in the meta-analysis measured activity in the whole brain and regions of interest activity in individual regions of particular interest to the study. This pattern of consistently activated, regionally specific activations was identified in four brain regions: Other regions showed different patterns of activation across categories. In this review, the authors examined the locationist hypothesis by comparing the consistency and specificity of prior meta-analytic findings specific to each hypothesized basic emotion fear, anger, sadness, disgust, and happiness. Consistent neural patterns were defined by brain regions showing increased activity for a specific emotion relative to a neutral control condition , regardless of the method of induction used for example, visual vs. Specific neural patterns were defined as architecturally separate circuits for one emotion vs. In general, the results supported consistency among the findings of Phan et al. Consistency was determined through the comparison of chi-squared analyses that revealed whether the proportion of studies reporting activation during one emotion was significantly higher than the proportion of studies reporting activation during the other emotions. Specificity was determined through the comparison of emotion-category brain-localizations by contrasting activations in key regions that were specific to particular emotions. Increased amygdala activation during fear was the most consistently reported across induction methods but not specific. Both meta-analyses also reported increased activations in regions of the anterior cingulate cortex during sadness, although this finding was less consistent across induction methods and was not specific to sadness. Both meta-analyses also found that disgust was associated with increased activity in the basal ganglia, but these findings were neither consistent nor specific. Neither consistent nor specific activity was observed across the meta-analyses for anger or for happiness. This meta-analysis additionally introduced the concept of the basic, irreducible elements of emotional life as dimensions such as approach and avoidance. This dimensional approach involved in psychological constructionist approaches is further examined in later meta-analyses of Kober et al. This meta-analysis used multilevel kernal density analysis MKDA to examine fMRI and PET studies, a technique that prevents single studies from dominating the results particularly if they report multiple nearby

peaks and that enables studies with large sample sizes those involving more participants to exert more influence upon the results. MKDA was used to establish a neural reference space that includes the set of regions showing consistent increases across all studies for further discussion of MDKA see Wager et al. Consistent with a psychological construction approach to emotion, the authors discuss each functional group in terms more basic psychological operations. The authors suggest that these regions play a joint role in visual processing and attention to emotional stimuli. Consistency analyses identified brain regions that were associated with a given emotion. Discriminability analyses identified brain regions that were significantly, differentially active when contrasting pairs of discrete emotions. This meta-analysis examined PET or fMRI studies that reported whole brain analyses identifying significant activations for at least one of the five emotions relative to a neutral or control condition. The authors used activation likelihood estimation ALE to perform spatially sensitive, voxel-wise sensitive to the spatial properties of voxels statistical comparisons across studies. This technique allows for direct statistical comparison between activation maps associated with each discrete emotion. Thus, discriminability between the five discrete emotion categories was assessed on a more precise spatial scale than what had been accomplished in prior meta-analyses. Consistency was first assessed by comparing the ALE map generated across studies for each emotion for example, the ALE map identifying regions consistently activated by studies inducing fear to ALE map generated by random permutations. Discriminability was then assessed by pair-wise contrasts of individual emotion ALE maps for example, fear ALE map vs. Consistent and discriminable patterns of neural activation were observed for the five emotional categories. Happiness was consistently associated with activity in 9 regional brain clusters, the largest located in the right superior temporal gyrus. For the first time, happiness was discriminated from the other emotional categories, with the largest clusters of activity specific to happiness vs. Sadness was consistently associated with 35 clusters the largest activation cluster located in the left medial frontal gyrus and was discriminated from the other emotion categories by significantly greater activity in left medial frontal gyrus, right middle temporal gyrus, and right inferior frontal gyrus. Anger was consistently associated with activity in 13 clusters the largest of which was located in the left inferior frontal gyrus , and was discriminated from the other emotion categories by significantly greater activity in bilateral inferior frontal gyrus, and in right parahippocampal gyrus. Fear was consistently associated with 11 clusters the largest activation cluster in the left amygdala and was discriminated from the other emotion categories by significantly greater activity in the left amygdala and left putamen. The studies included in this meta-analysis used induction methods that elicit emotion experience or emotion perception of fear, sadness, disgust, anger, and happiness. The goal was to compare locationist approaches with psychological constructionist approaches to emotion. Similar to Kober et al. The density analysis was then used to identify voxels within the neural reference space with more consistent activations for a specific emotion category anger, fear, happiness, sadness, and disgust than all other emotions. Chi-squared analysis was used to create statistical maps that indicated if each previously identified and consistently active regions those identified during density analysis were more frequently activated in studies of each emotion category versus the average of all other emotions, regardless of activations elsewhere in the brain. Chi-squared analysis and density analysis both defined functionally consistent and selective regions, or regions which showed a relatively more consistent increase in activity for the experience or perception of one emotion category across studies in the literature. Thus, a selective region could present increased activations relatively more so to one emotion category while also having a response to multiple other emotional categories. A series of logistic regressions were then performed to identify if any of the regions that were identified as consistent and selective to an emotion category were additionally specific to a given category. Regions were defined as specific to a given emotion if they showed increased activations for only one emotional category, and never showed increased activity during instances of the other emotional categories. In other words, a region could be defined as consistent, selective and specific for e. However, the same region would be defined as only consistent and selective and not specific to fear perception if it additionally displayed increased activations during anger perception. Strong support for the locationist approach was defined as evidence that basic emotion categories anger, disgust, fear, happiness and sadness consistently map onto areas of the brain that specifically activate in response to instances of only one

emotional category. Strong support for the constructionist approach was defined as evidence that multiple psychological operations some of which are not specific or selective to emotion consistently occur across many brain regions and multiple emotional categories.

Chapter 5 : How Light Deprivation Causes Depression - Scientific American

The use of the computer as a model, metaphor, and modelling tool has tended to privilege the 'cognitive' over the 'affective' by engendering theories in which thinking and learning are viewed as information processing and affect is ignored or marginalised.

Anatomy of the Brain There are different ways of dividing the brain anatomically into regions. The forebrain or prosencephalon is made up of our incredible cerebrum, thalamus, hypothalamus and pineal gland among other features. Neuroanatomists call the cerebral area the telencephalon and use the term diencephalon or interbrain to refer to the area where our thalamus, hypothalamus and pineal gland reside. The midbrain or mesencephalon , located near the very center of the brain between the interbrain and the hindbrain, is composed of a portion of the brainstem. The hindbrain or rhombencephalon consists of the remaining brainstem as well as our cerebellum and pons. Neuroanatomists have a word to describe the brainstem sub-region of our hindbrain, calling it the myelencephalon, while they use the word metencephalon in reference to our cerebellum and pons collectively. Histology Brain cells can be broken into two groups: Neurons, or nerve cells, are the cells that perform all of the communication and processing within the brain. Sensory neurons entering the brain from the peripheral nervous system deliver information about the condition of the body and its surroundings. Interneurons send signals to motor neurons, which carry signals to muscles and glands. Neuroglia, or glial cells, act as the helper cells of the brain; they support and protect the neurons. In the brain there are four types of glial cells: Astrocytes protect neurons by filtering nutrients out of the blood and preventing chemicals and pathogens from leaving the capillaries of the brain. Oligodendrocytes wrap the axons of neurons in the brain to produce the insulation known as myelin. Myelinated axons transmit nerve signals much faster than unmyelinated axons, so oligodendrocytes accelerate the communication speed of the brain. Microglia act much like white blood cells by attacking and destroying pathogens that invade the brain. Ependymal cells line the capillaries of the choroid plexuses and filter blood plasma to produce cerebrospinal fluid. The tissue of the brain can be broken down into two major classes: Gray matter is made of mostly unmyelinated neurons, most of which are interneurons. The gray matter regions are the areas of nerve connections and processing. White matter is made of mostly myelinated neurons that connect the regions of gray matter to each other and to the rest of the body. Myelinated neurons transmit nerve signals much faster than unmyelinated axons do. The white matter acts as the information highway of the brain to speed the connections between distant parts of the brain and body. Hindbrain Rhombencephalon Brainstem Connecting the brain to the spinal cord, the brainstem is the most inferior portion of our brain. Many of the most basic survival functions of the brain are controlled by the brainstem. The brainstem is made of three regions: A net-like structure of mixed gray and white matter known as the reticular formation is found in all three regions of the brainstem. The reticular formation controls muscle tone in the body and acts as the switch between consciousness and sleep in the brain. The medulla oblongata is a roughly cylindrical mass of nervous tissue that connects to the spinal cord on its inferior border and to the pons on its superior border. The medulla contains mostly white matter that carries nerve signals ascending into the brain and descending into the spinal cord. Within the medulla are several regions of gray matter that process involuntary body functions related to homeostasis. The medullary rhythmicity center controls the rate of breathing to provide oxygen to the body. Vomiting, sneezing, coughing, and swallowing reflexes are coordinated in this region of the brain as well. The pons is the region of the brainstem found superior to the medulla oblongata, inferior to the midbrain, and anterior to the cerebellum. Together with the cerebellum, it forms what is called the metencephalon. About an inch long and somewhat larger and wider than the medulla, the pons acts as the bridge for nerve signals traveling to and from the cerebellum and carries signals between the superior regions of the brain and the medulla and spinal cord. Cerebellum The cerebellum is a wrinkled, hemispherical region of the brain located posterior to the brainstem and inferior to the cerebrum. The outer layer of the cerebellum, known as the cerebellar cortex, is made of tightly folded gray matter that provides the processing power of the cerebellum. The arbor vitae connects the processing regions of cerebellar cortex to the rest of the brain and body. The

cerebellum helps to control motor functions such as balance, posture, and coordination of complex muscle activities. The cerebellum receives sensory inputs from the muscles and joints of the body and uses this information to keep the body balanced and to maintain posture. The cerebellum also controls the timing and finesse of complex motor actions such as walking, writing, and speech. Midbrain Mesencephalon The midbrain, also known as the mesencephalon, is the most superior region of the brainstem. Found between the pons and the diencephalon, the midbrain can be further subdivided into 2 main regions: The tectum is the posterior region of the midbrain, containing relays for reflexes that involve auditory and visual information. The pupillary reflex adjustment for light intensity , accommodation reflex focus on near or far away objects , and startle reflexes are among the many reflexes relayed through this region. Forming the anterior region of the midbrain, the cerebral peduncles contain many nerve tracts and the substantia nigra. Nerve tracts passing through the cerebral peduncles connect regions of the cerebrum and thalamus to the spinal cord and lower regions of the brainstem. The substantia nigra is a region of dark melanin-containing neurons that is involved in the inhibition of movement. Forebrain Prosencephalon Diencephalon Superior and anterior to the midbrain is the region known as the interbrain, or diencephalon. The thalamus, hypothalamus, and pineal glands make up the major regions of the diencephalon. The thalamus consists of a pair of oval masses of gray matter inferior to the lateral ventricles and surrounding the third ventricle. Sensory neurons entering the brain from the peripheral nervous system form relays with neurons in the thalamus that continue on to the cerebral cortex. In this way the thalamus acts like the switchboard operator of the brain by routing sensory inputs to the correct regions of the cerebral cortex. The thalamus has an important role in learning by routing sensory information into processing and memory centers of the cerebrum. The hypothalamus is a region of the brain located inferior to the thalamus and superior to the pituitary gland. In response to changes in the condition of the body detected by sensory receptors, the hypothalamus sends signals to glands, smooth muscles, and the heart to counteract these changes. For example, in response to increases in body temperature, the hypothalamus stimulates the secretion of sweat by sweat glands in the skin. The hypothalamus also sends signals to the cerebral cortex to produce the feelings of hunger and thirst when the body is lacking food or water. These signals stimulate the conscious mind to seek out food or water to correct this situation. The hypothalamus also directly controls the pituitary gland by producing hormones. Some of these hormones, such as oxytocin and antidiuretic hormone, are produced in the hypothalamus and stored in the posterior pituitary gland. Other hormones, such as releasing and inhibiting hormones, are secreted into the blood to stimulate or inhibit hormone production in the anterior pituitary gland. The pineal gland is a small gland located posterior to the thalamus in a sub-region called the epithalamus. The pineal gland produces the hormone melatonin. Light striking the retina of the eyes sends signals to inhibit the function of the pineal gland. In the dark, the pineal gland secretes melatonin, which has a sedative effect on the brain and helps to induce sleep. This function of the pineal gland helps to explain why darkness is sleep-inducing and light tends to disturb sleep. Babies produce large amounts of melatonin, allowing them to sleep as long as 16 hours per day. The pineal gland produces less melatonin as people age, resulting in difficulty sleeping during adulthood. Cerebrum The largest region of the human brain, our cerebrum controls higher brain functions such as language, logic, reasoning, and creativity. The cerebrum surrounds the diencephalon and is located superior to the cerebellum and brainstem. A deep furrow known as the longitudinal fissure runs midsagittally down the center of the cerebrum, dividing the cerebrum into the left and right hemispheres. Each hemisphere can be further divided into 4 lobes: The lobes are named for the skull bones that cover them. The surface of the cerebrum is a convoluted layer of gray matter known as the cerebral cortex. Most of the processing of the cerebrum takes place within the cerebral cortex. The bulges of cortex are called gyri singular: Deep to the cerebral cortex is a layer of cerebral white matter. White matter contains the connections between the regions of the cerebrum as well as between the cerebrum and the rest of the body. A band of white matter called the corpus callosum connects the left and right hemispheres of the cerebrum and allows the hemispheres to communicate with each other. Deep within the cerebral white matter are several regions of gray matter that make up the basal nuclei and the limbic system. The basal nuclei, including the globus pallidus, striatum, and subthalamic nucleus, work together with the substantia nigra of the midbrain to regulate and control muscle movements.

Specifically, these regions help to control muscle tone, posture, and subconscious skeletal muscle. The limbic system is another group of deep gray matter regions, including the hippocampus and amygdala, which are involved in memory, survival, and emotions. The limbic system helps the body to react to emergency and highly emotional situations with fast, almost involuntary actions. With so many vital functions under the control of a single incredible organ - and so many important functions carried out in its outer layers - how does our body protect the brain from damage? Our skull clearly offers quite a bit of protection, but what protects the brain from the skull itself? Meninges Three layers of tissue, collectively known as the meninges, surround and protect the brain and spinal cord. The dura mater forms the leathery, outermost layer of the meninges. Dense irregular connective tissue made of tough collagen fibers gives the dura mater its strength. The dura mater forms a pocket around the brain and spinal cord to hold the cerebrospinal fluid and prevent mechanical damage to the soft nervous tissue. The arachnoid mater is found lining the inside of the dura mater. Much thinner and more delicate than the dura mater, it contains many thin fibers that connect the dura mater and pia mater. Beneath the arachnoid mater is a fluid-filled region known as the subarachnoid space. As the innermost of the meningeal layers, the pia mater rests directly on the surface of the brain and spinal cord. The pia mater also helps to regulate the flow of materials from the bloodstream and cerebrospinal fluid into nervous tissue. Cerebrospinal Fluid Cerebrospinal fluid CSF â€” a clear fluid that surrounds the brain and spinal cord â€” provides many important functions to the central nervous system. Rather than being firmly anchored to their surrounding bones, the brain and spinal cord float within the CSF.

Chapter 6 : Reward system - Wikipedia

Brain's water system and stroke treatment a target for medical treatment and turn down the inflow of water to the brain to reduce intracranial pressure. a structural model of a transporter.

The Foundations of Human and Animal Emotions , Jaak Panksepp boldly and insightfully asserts that "the failure of psychology to deal effectively with the nature of the many instinctual systems of human and animal brains remains one of the great failings of the discipline. The converse could be said for neuroscience. The subcortical structures of the human brain, our ancestral brain, are pictured below links to source. Beal of Louisiana State University provides this image. Over time and through evolution, the neurons in our ancestral brain have extended to innervate the larger human neocortex, wherein our language abilities are generated. It is important to remember, however, that without our subcortical nuclei, which are so similar in appearance and function to the nuclei of lower mammals, we humans would have no motivation, no behavior of any sort. In Part 1 of MyBrainNotes. Authors Temple Grandin and Catherine Johnson write: So all brain damage ends up looking like frontal lobe damage, whether the frontal lobes were injured or not. Regarding our animal brain, Panksepp writes: In fact, all mammals share remarkably similar anatomical distributions of most neurochemical systems within their brains. In Animals in Translation, Grandin and Johnson write: In the brain logic and reason are never separate from emotion. Even nonsense syllables have an emotional charge, either positive or negative. Stimulating different subcortical areas via electrodes produces emotional reactions in animals. In contrast, "We cannot precipitate emotional feelings by artificially activating the neocortex either electrically or neurochemically," writes Panksepp. He points out, however, that "emotionality is modified by cortical injury. Real world experience can, however, effect the natural expression of primal emotional systems. For example, Panksepp writes: Nonetheless, scientists have been able to elicit discrete responses from seven different emotional systems within the paleomammalian brain. Panksepp has created great short names for these seven systems and uses all capital letters as designations. In some cases, however, I have made edits to his original terminology to add clarity given that we discuss the systems here only in brief. Any errors are my own. He is speaking of neurocircuitry that can be defined precisely in terms of 1 location within brain structures, and 2 function evoked in a "coherent pattern" by "localized electrical or chemical stimulation. To delineate circuitry, electricity is channeled into implanted electrodes and an evoked response is observed. Chemicals can also be injected into brain circuits to evoke a response. Since we all benefit from the research these experiments produce, I think we should all pull out our pocketbooks and open our homes to provide compassionate retirements for these animals whenever possible. I cannot change the hierarchy. Obviously, humans rule and scientific research is important. And since I eat meat, how can I criticize the scientists who try to solve important problems using animals in research, especially when ethical guidelines are in place and observed? Morrison, in An Odyssey with Animals: I can only hope that everyone, when they look into the eyes of any kind of mammal, will see a living relative fully capable of experiencing pain and deserving of comfort. I would like to acknowledge here the enormous contribution Jaak Panksepp has made with his book, Affective Neuroscience: Click on his photograph to learn more about him or click on the link above to buy his book from Amazon. To continue exploring MyBrainNotes. Or, you may Explore the Site Outline. Thanks for visiting my site. If you would like be informed about new features and improvements as they are added to MyBrainNotes.

Chapter 7 : Brain â€“ Human Brain Diagrams and Detailed Information

Introduction. Pain is a complex, biopsychosocial phenomenon that arises from the interaction of multiple neuroanatomic and neurochemical systems with a number of cognitive and affective processes.

Our ancestral brain is not nearly as simple as the following short discussions might imply. The Foundations of Human and Animal Emotions , referring to the instinctual emotional processing that goes on in our subcortical brain structures, Jaak Panksepp notes the likelihood that, "in a deep evolutionary sense, many of the complex information-processing potentials of the cortex are servants often unconscious, automatized servants to the dictates of the affective forces that ruled behavior prior to cortical evolution. Morrison provides a great description of just how mammalian we humans are. We humans share common subcortical brain structures with all other mammals. My cat, Buster, and I both flinch and yowl or curse at a sudden painful stimulus, and our legs both jerk in response to a tap on the patellar tendon of the knee. The spinal organization of the neurons responsible for these activities is the same in cats as it is in humans. Moving forward into the lowest part of the brain, in both Buster and me the same neurons control basic bodily functions, such as regulation of breathing, heart rate, and vomiting. At the base of the cerebral hemispheres is the almond-shaped amygdala, where mechanisms leading to fear and anxiety in people and animals operate. Monkeys and rats have contributed much to our understanding of the amygdala. The overlying cerebral cortex is where all of us mammals analyze the sensations coming from the skin, muscles and joints via the spinal cord, or eyes and ears in the cases of vision and hearing. Where we depart from our animal brethren is in the great development of the front part of our cerebral cortex, the frontal lobes, and the greater proportion of cerebral tissue, called association areas, which integrate the information obtained from the regions that directly receive sensory information. These latter regions are called the primary sensory and motor areas because they receive simple, pure sensations and direct the movement of the body. It is within the frontal lobes that we humans mull over the past, prepare for the future, and reflect on its implications. Animals do not have this last capability in particular, as far as we can discern. Animals prepare for the future in a limited, instinct-driven way: Think of squirrels gathering and burying nuts for the winter. The pig brain and the human brain looked exactly alike. But when I looked at the neocortex the difference was huge. In the illustration, you can see the amygdala, hippocampus, and corpus striatum. Remember that both the left and right hemispheres contain each of these structures, which are mirror images of each other. The pair of structures called the corpus striata has, in the past, been referred to as the basal ganglia. The corpus striata play a key role in generating obsessions and compulsions. We will discuss the corpus striata structures in more detail in Parts 2 and 3 of MyBrainNotes. In the picture to the right, all of the strangely shaped subcortical nuclei are nestled within the much larger and more consistently formed neocortex. What has traditionally been called the basal ganglia, and what I will call the corpus striatum, is labeled 1 and 2. The thalamus is labeled 5 and the hypothalamus is labeled 7. Czerner, in What Makes You Tick? The Brain in Plain English , describes the amygdalae as "almond shaped" structures. The amygdalae are nestled and protected within each temporal lobe. The temporal lobe is located behind the temples, thus its name. Although this patient had normal vision and could perceive faces, she was unable to discriminate the emotional content in the negative facial expressions of fear and anger. Thus all faces appeared to be smiling or neutral to her, even those which were actually frightened or angry. This image appears in an article on post-traumatic stress disorder PTSD. In addition to depicting the amygdala, the illustration depicts the location of the prefrontal cortex. The prefrontal cortex is often referred to simply as the frontal lobe or frontal cortex. This area of the neocortex lies in front of cortical motor areas. We will discuss the frontal cortex and cortical motor areas later in this narrative. For now, suffice to say that the frontal cortex or prefrontal cortex is involved in executive functions and the expression of personality. The Wikipedia entry for prefrontal cortex explains that this area of the brain orchestrates "thoughts and actions in accordance with internal goals. Such potentiated activity can exacerbate symptoms of mental illness, including obsessions and compulsions. Sapolsky emphasizes that while the glucocorticoids released during stressful episodes may disrupt hippocampal function and the memory-forming processes, those same glucocorticoids make

amygdalae synapses more excitable, allowing neurons to grow more of the cables that connect the cells to each other. Preclinical and Clinical Evidence. Denys, Zohar, and Westenberg write: Especially regarding PTSD, past experience is a key. Neuroscientists have found that experience shapes amygdala processing over time. You could say that the amygdalae learn, over time, the level of danger that should be associated with any particular stimulus. In defining incentive salience, authors Vilayanur S. Ramachandran and Lindsay M. Oberman expertly describe the process by which amygdalae can predict danger. Messages cascade from the amygdala to the rest of the limbic system and eventually reach the autonomic nervous system, which prepares the body for action. If the person is confronting a burglar, for example, his heart rate will rise and his body will sweat to dissipate the heat from muscular exertion. The autonomic arousal, in turn, feeds back into the brain, amplifying the emotional response. In The Emotional Brain: Each object is transferred to the mouth and then discarded if not edible. Is it possible that chronic stress, through a process called kindling, can create hard-wired, hypersensitive neural networks capable of dictating and automating symptoms from a wide range of instinctual behavior patterns? In his video course, Biology and Human Behavior: Sapolsky examines how communication between neurons is strengthened as a result of experience. When the dendritic spines of neurons are stimulated rapidly, the synapses between the communicating neurons become "hyper-responsive or potentiated" due to chemical changes within the neural environment. In Listening to Prozac: Kramer writes, "Kindling rewires the brain. The expression of the disorder becomes more complex over time. Recent developments bearing on the Papez theory of emotion " , Paul D. Maclean theorized about the kindling process. Such a mechanism would provide for one variety of enduring memory in a way that is remotely analogous to a wire recorder. These hypothetical considerations suggest how oft-repeated childhood emotional patterns could persist to exert themselves in adult life. Over time, repeated stressful experiences can literally, not just figuratively, alter the nervous systems of the temperamentally vulnerable. When a temperamentally vulnerable person is constantly bombarded with upsetting stimuli, Gold says, the genes that get turned on are those involved in the cellular components of the stress response. Under normal circumstances, this could be construed as a survival instinct. Under extreme stress, however, especially when an outlet for pent-up energy is not available, these behaviors may turn into obsessions or compulsions. We will discuss such neurotransmission in greater detail in Part 3 of MyBrainNotes. Sapolsky describes how monkeys release dopamine in anticipation of a food reward. They get most excited when a light first comes on signaling that they may now perform a learned task and upon completion, will receive food. Their excitement does not peak when the food finally appears; it peaks well before that point. The term hippocampus is derived from the Greek word meaning "sea-horse," which might somehow describe the shape of each hippocampal nucleus, although frankly, I do not see the resemblance. In the illustration to the left, I have added pink color to the hippocampus for clarity. You can see that it adheres to the curve of nerve fibers that curve once again to become the body of the fornix nerve pathway. This image links to its source, which includes a YouTube video on the anatomy of the hippocampus and surrounding structures. In the illustration to the right from the Journal of Neuroscience links to source , the amygdala is colored red and the hippocampus is colored blue. The MRI sagittal view to the left links to source shows the amygdala labeled "A" and the hippocampus labeled "H". Restak explains that "Fibers from all four lobes, along with association fibers uniting these separate connections into one unified experience, converge into the hippocampal region. So one can experience all the autonomic consequences of fear at the mere memory of a traumatic event. Goleman quotes Robert Sapolsky, who explains that glucocorticoids "may be neurotoxic to the hippocampus at the massive levels that are released under extreme stress or during trauma. The atrophy emerges as a result of the depression rather than precedes it , and the longer the depressive history, the more atrophy and the more memory problems. Sapolsky calls attention to the work of Joseph LeDoux of New York University, "who pretty much put the amygdala on the map when it comes to anxiety. In "Determining Nature vs. A field called epigenetics has finally begun to address some of these issues. These tiny molecules are known as methyl and acetyl groups and their presence or absence at target sites controls whether particular genes can generate proteins, the workhorses of most physiological processes. Then researchers proved that epigenetic changes are indeed at work in mature cells. Now studies are starting to show how environmental cues can stimulate epigenetic changes that could

contribute to several psychiatric diseases. Systematic measurement of those changes could eventually indicate how the environment influences the genetic chemistry underlying many human behaviors. Steinberg points to the work of Eric J. Nestler has proposed a model of depression that includes "epigenetic changes in the hippocampus, a memory-storing brain region that actually shrinks in some cases of human depression. Meaney, a psychiatry professor at McGill University. Steinberg explains that Meaney "has found that when a rat pup receives less licking and grooming from its mother, it is more fearful and more reactive to stressors as it matures. An adoption experiment proved that licking triggers these events: Steinberg calls attention to the work of Dr. In an on-line article Bremner writes: The hippocampus also works closely with the medial prefrontal cortex, an area of the brain that regulates our emotional response to fear and stress. PTSD sufferers often have impairments in one or both of these brain regions.

Chapter 8 : Affective neuroscience - Wikipedia

The dual systems model holds that, to the extent that decision-making occurs under conditions that arouse the socioemotional system (e.g., conditions that are relatively more thrilling), differences between adolescent and adult decision-making and, hence, risk taking will be more pronounced.

The brain has evolved over time in a way that ensures our survival. We experience an urgent need for food when we are hungry and generally have a powerful desire for sex. Unfortunately, drugs of abuse operate within these reward systems. This leads people to experience an urgent need or powerful desire for drugs or addictive activities. Food, water, and sex activate the reward system. Dopamine creates a pleasing, enjoyable sensation. Thus, we are likely to repeat these behaviors that are necessary for survival. This is because dopamine rewarded us with a pleasurable feeling. From an evolutionary standpoint, it is very helpful to have a reward system that works like this. For example, imagine that food is scarce and I am wandering about looking for food. When I eventually find food and eat it, this triggers my reward system. This pleasing feeling dopamine "reward" will become associated with whatever behavior led me to that food. This causes me to want to repeat that behavior. Furthermore, the reward system is closely tied to emotional and subjective memories. If I was successful and found food in a particular place, in the future I might want to look for food in the same location. This reward system increases the likelihood I will be successful finding food. This is because my brain chemicals are rewarding me with a pleasing sensation. It also helps me to remember how and where this pleasant feeling occurred. Unfortunately, the very same reward system that ensures our survival also rewards drug use. Addictive substances and activities trigger the release of dopamine. Dopamine rewards us with a pleasant sensation. This serves to motivate us to repeat these harmful behaviors. We know that people with addictions will go to any lengths to obtain their drug of choice. Similarly, they continue with their addiction despite the harm they cause to themselves or those they love. The circuit most associated with pleasure and reward is the mesolimbic pathway. The mesolimbic pathway is located in the brainstem. This area of the brain is primarily concerned with basic survival. Within the mesolimbic pathway is an area called the ventral tegmental area VTA. The VTA projects to the nucleus accumbens thought to be the reward center. The neurotransmitter most commonly linked with the mesolimbic system is dopamine. Many people consider dopamine to be the driving force behind the human pursuit of pleasure. The release of dopamine is a pleasurable sensation. The release of dopamine motivates us to repeat behaviors or activities that prompted this release. All addictive drugs and activities release varying amounts dopamine into the nucleus accumbens. However, stimulant drugs release the most. Stimulant drugs include drugs such as cocaine and methamphetamine. Although different addictions have different effects in the nucleus accumbens, they all activate the reward system. This is turn motivates us to repeat those behaviors, even though they may be harmful. For simplicity purposes, we have discussed the concepts of reward, pleasure, and craving together. However, there is a difference between "pleasure-seeking and "drug seeking. Drug-seeking refer to the craving aspect of addiction. Dopamine may be more involved in drug-seeking craving component of addiction. The opiate endorphin , GABA, or glutamatergic systems may be more involved in pleasure-seeking aspect of addiction. Pleasure-seeking and drug-seeking cravings are inter-related, yet distinct. Research has indicated that natural rewards food, water, sex typically lessen their influence on the reward system over time. As a behavior occurs more often, dopamine levels tend to decrease as a result. Psychologists call this habituation. Then I would be eating too much, or too much of one type of food. Another way of putting this is that novelty influences the dopamine release. As the novelty wears off, the dopamine release declines; i. Habituation and the resultant decrease of dopamine explain why drug users usually increase their "dose" over time. As the body gets used a certain amount of a drug, the dopamine decreases. Therefore, to achieve the same pleasurable effect, the dose needs to increase. Activity addicts increase the frequency or intensity of the activity. Addiction professional call this tolerance. Tolerance can subsequently lead to increased cravings for a drug or activity. This drives the addictive process forward. Once tolerance begins, powerful cravings gradually replace pleasure-seeking. This prompts the characteristic drug-seeking associated with addiction. In contrast to

pleasure-seeking, cravings represent an attempt to avoid, or relieve, unpleasant symptoms. Stated more simply, the pursuit of pleasurable sensations characterizes the initial stages of addiction. In contrast, efforts to avoid uncomfortable sensations characterize the later stages of addiction. We discuss craving more thoroughly in the next section.