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# A Tribute to Jaak Panksepp (1943–2017)

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**Abstract**

This article gives a short overview on the life and achievements of Jaak Panksepp. Jaak Panksepp dedicated his life to the study of mammalian emotions. By means of electrical stimulation of the brain and psychopharmacological challenges he carved out seven primary emotional systems being highly conserved across different species of mammals including homo sapiens. The primary emotional systems are called SEEKING, CARE, LUST, PLAY (positive emotions), and FEAR, RAGE, SADNESS (negative emotions). While his early career was characterized by the direct study of these primary emotions in mammals, in his late career he invested more and more time in applying his knowledge to different fields of psychology including personality neuroscience and psychiatry.

## On the life of Jaak Panksepp

Jaak Panksepp, a founding member of the Editorial Board of *Personality Neuroscience*, died on April 18, 2017. Born in Estonia on June 5, 1943, his family escaped the ravages of post-WWII Russian occupation by moving to the United States when Jaak was still very young. Much later in 2011, Jaak was honored by the President of Estonia personally presenting him with the Order of the White Star.

Jaak started his college education as an engineering student at the University of Pittsburgh but soon switched to clinical psychology. To help finance his college education, he took a job on a psychiatric hospital ward where he had the opportunity to study patients first hand by interacting with them as well as reviewing their clinical files. It was such experience that gave this gifted student the insight that the key to understanding psychopathology and human behavior was first to understand emotions, an insight more likely to be made by an idealistic young mind given the behavioristic and learning theory zeitgeist prevailing in American psychology at that time. His insight led him to pursue a graduate career in (what today would be called) the neuroscience of emotions at the University of Massachusetts. However, Jaak's further insight was that the way to understand human emotions was to begin with animal experimental brain research. He realized that brain science techniques had developed the tools to support "preclinical" research that could help clinical psychology escape the orbit of traditional speculation-based clinical theory into a new sphere in which psychiatric treatments could be based on brain research—this was very much in the tradition of Ivan Pavlov.

This was the mindset that the young Jaak took into graduate school where Jay Trowill, his major professor, gave him the space to explore his insights through experimental brain research. In this setting, Jaak began building on the work of pioneers like Hess (1957) to understand what emotional insights could be revealed by probing the rat hypothalamus. Among other things, he discovered that two kinds of aggression could be elicited through the electrical stimulation of the brain to discrete regions of the rat hypothalamus: the first type was an anger-type attack (RAGE) provoked in nature by bodily restraint (like when captured by a predator), or the protection of resources necessary for living (such as food); the second type would later be called a quiet-biting attack that was a function of the SEEKING system and in this case an extension of dopaminergic foraging behavior manifested as predation (Panksepp & Trowill, 1971). Electrical stimulation of the brain, which Jaak would use as a tool throughout his professional career, provided a compelling demonstration of the evolved instinctual emotional roots embedded in the subcortical brain. Specifically, by introducing a crude electrical stimulation to particular subcortical brain regions, such as the hypothalamus, one could elicit coherent complex emotional behavioral displays from the animal.

After a brief interlude studying energy balance and hunger, which he would later distinguish as a homeostatic rather than emotional affect, Jaak accepted a position in a burgeoning physiological psychology program at Bowling Green State University (BGSU). There he began pursuing his "opioid hypothesis," which closely followed the discovery of opioid receptors as well as endogenous opioids in the brain. Jaak capitalized on Scott's (Elliot & Scott, 1961;



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Davis, Gurski, & Scott, 1977) ongoing work in social attachment and separation distress at BGSU, and he guided many students within a cross-species research program that delineated the anatomical and pharmacological dynamics of the separation distress experience. This research included an early demonstration of separation distress alleviation using low-dose morphine in canine puppies (Panksepp, Herman, Conner, Bishop, & Scott, 1978)—one of many publications in this area, which fit in with his youthful goal of understanding emotions as the route to understanding psychopathology. Jaak's work with opioids eventually led to his contributions to the treatment of autistic children with naltrexone (an opioid blocker; e.g., see Sahley & Panksepp, 1987).

Later, Jaak became known as the "rat tickler". For Jaak, this meant the prototypical "rough-and-tumble" mammalian PLAY system. Among his many contributions in this area was the demonstration that neonatal decortication did not diminish play in juvenile rats (Panksepp, Normansell, Cox, & Siviy, 1994). Indeed, he provided evidence that play in these neonatally decorticated rats could not be reliably distinguished from sham-operated control rats. Moreover, Jaak discovered "rat laughter" underlining his efforts to dedicate his late research life to understand the molecular underpinnings of joy as a route to find new targets to treat psychiatric disorders (e.g., Panksepp & Burgdorf, 2003). Jaak also switched to exclusively study the science of joy and positive affect, because he was convinced that animals feel raw affects in many of the same ways as humans, with neural circuitries underlying these emotions being highly conserved evolutionarily across mammals (see also his interesting works on consciousness of animals and his interest in studying the human soul: Panksepp, 1998, 2005a, 2007; Alcaro, Carta, & Panksepp, 2017).

Jaak carved "Mother Nature at her joints" and delineated seven primary emotions deeply rooted in subcortical areas of the human brain. Always written in capital letters to designate their specific scientific meaning, he labeled them SEEKING, LUST, CARE, PLAY (positive emotions) and RAGE, FEAR, SADNESS (negative emotions), which also have been described in detail in his classic textbook "Affective Neuroscience" originally published in 1998. Of note, Jaak, in 2012, published an update of this influential book called "The Archaeology of Mind" together with Lucy Biven (Panksepp & Biven, 2012). His last book called "The Emotional Foundations of Personality" will be posthumously published in 2018 (Davis & Panksepp, 2018).

Jaak strongly believed that the neocortex was a "tabula rasa" brain region. While many subcortical brain regions were genetically programmed, the neocortex had to be programmed by experience. Further, as demonstrated in the decorticated rat pups, the neocortex was not necessary for the expression of primary emotions. Merker (2007) had shown that anencephalic human children likewise displayed a full complement of primary emotions. Jaak also frequently cited Mriganka Sur's work showing that auditory cortex could process visual stimuli when thalamic inputs were neonatally rerouted (e.g., Sur, Garraghty, & Roe, 1988; Sharma, Angelucci, & Sur, 2000). Jaak felt that Hubel and Wiesel's (1959) work with feline vision was strong evidence that sensory processing had to be "programmed" into the cortex confirming that cortical processes were not genetically determined. A capstone on this debate was the Florio et al. (2015) *Science* paper reporting on the evolutionary expansion of the human neocortex by a single gene (shared by Neanderthals and Denisovans but not by other primates) that greatly expanded the human neocortex through increased basal progenitor proliferation. Altogether, Jaak was deeply skeptical about finding innate neural modules with distinct evolved functions in the recently expanded human neocortex with cortical plasticity being the norm and the spectacular representational and re-representational capacities of the human neocortex being acquired through experience likely guided by subcortical processes.

Since moving to Washington State University in 2006, Jaak seemed to be devoting more effort toward fulfilling his original dream of utilizing knowledge about mammalian emotions to develop psychiatric treatments. In this realm he invested much energy into the International Neuropsychoanalysis Society. In conjunction with the Falk Institute, he focused on gene expression in playing rats, which eventually resulted in *GLYX-13*, a rapidly acting safe antidepressant that is currently in phase III trials at the Food and Drug Administration (see also Moskal, Burgdorf, Kroes, Brudzynski, & Panksepp, 2011). He also helped coordinate work on deep brain stimulation to the medial forebrain bundle of

**Figure 1.** Jaak Panksepp dedicated his professional career to the study of mammalian emotions (picture taken by Henry Moore Jr., CVM/BCU, Washington State University).

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treatment-resistant depression patients (Panksepp, Wright, Döbrössy, Schlaepfer, & Coenen, 2014). Jaak's efforts with Yovell et al. (2016) demonstrated the successful treatment of suicidal ideation with low-dose buprenorphine, a "safe" opioid agonist–antagonist with a "ceiling effect" for respiratory depression.

Since 2003 until early 2017, Jaak invested substantial time to bring his affective neuroscience theory (ANT) to other research areas including (neuroscientific-oriented) personality psychology (Davis & Panksepp, 2011; Davis, Panksepp, & Normansell, 2003; Montag & Panksepp, 2017a, b). In particular, the construction of the *Affective Neuroscience Personality Scales* (ANPS; Davis & Panksepp, 2011; Davis, Panksepp, & Normansell, 2003) together with Ken Davis made it possible to apply Jaak's theory to many areas of psychology—this scale is available in many languages including English (Davis, Panksepp, & Normansell, 2003), German (Reuter, Panksepp, Davis, & Montag, 2017), Italian (Pascazio et al., 2015), French (Pahlavan, Mouchiroud, Zenasni, & Panksepp, 2008), Spanish (Abella, Panksepp, Manga, Bárcena, & Iglesias, 2011), Turkish (Özkarar-Gradwohl et al., 2014), Chinese (Sindermann et al., 2018), and a Japanese version from Keichi Narita's group that will be published soon.

Why is Panksepp's theory of tremendous importance to study personality? As pointed out in earlier works (e.g., Davis, Panksepp, & Normansell, 2003; Montag & Panksepp, 2017) individual differences in primary emotional systems could represent the phylogenetically oldest part of human personality. This idea has not only been derived by stable associations across cultures (see references above) between individual differences in primary emotional systems as assessed with the ANPS and the Big Five personality model (e.g., as assessed with the NEO-Five Factor Inventory), but also from the fact that primary emotions are seated in ancient subcortical brain regions driving our behavior in a bottom-up fashion. In particular, for neuroscientific-oriented personality psychologists, Panksepp's ANT provides researchers with abundant biological candidates to be tested for linkages to human personality. Thus, Panksepp's ANT is a roadmap to study the neuroscientific basis of personality. To give an example: Montag and Panksepp (2017) demonstrated that PLAY might be the emotional foundation of extraversion. As Panksepp, Jalowiec, DeEskinazi, and Bishop (1985) provided evidence that PLAY behavior in rats is influenced by opioids, individual differences in opioid levels or genetic variations of opioid-related genes might be interesting candidates to understand individual differences in extraversion. An overview on candidates to be tested both on neurotransmitter/neuropeptide but also brain anatomical level in the context of personality neuroscience can be found in Montag and Panksepp (2017b) and in Montag and Davis (2018).

Jaak put tremendous efforts into building bridges with other emotion theories such as Ekman's facial theory of emotion (Montag & Panksepp, 2016). In the light of the late criticism by constructivists in emotion research he pointed out that "A primary-process/basic emotion view may prevail in many subcortical regions, and constructivist/dimensional approaches may effectively parse higher emotional concepts as processed by the neocortex … In other words, such debates may simply reflect investigators working at different levels of control" (Panksepp, 2010, p. 536). See also his last efforts to find consensus between more affective and cognitive driven neuroscientists (Panksepp et al., 2017).

As fate would have it, the young student who dreamed about understanding psychopathology by first understanding emotions was himself to experience an intense bout with strong negative emotion. Namely, in what he would describe as "the most painful time of my life" (Panksepp, 1998, cited from the preface), his 16-year-old daughter, along with three friends, was killed by a drunk driver, which precipitated an acute depressive episode in his life that significantly stalled the writing of his "Affective Neuroscience" (Panksepp, 1998). As Jaak described it, after two and one-half demoralized years, "Through the magic of friends and modern psychiatric drugs, my spirits were partially restored" (again cited from the preface; Panksepp, 1998), and he was able to restart and eventually complete his massive writing project.

On a more joyful note, Jaak was able to watch his younger son, Jules, complete a PhD in neuroscience at BGSU and continue on to gain his own independent research footing. Jules is currently in the Oregon Health and Science University Department of Behavioral Neuroscience, and in addition to his personal work, he and Jaak have published several joint articles, the most recent being a chapter on empathy in the APA Handbook of Comparative Psychology (Panksepp & Panksepp, 2017)

Jaak was a wonderful and warm-hearted colleague whose interest in the study of the human mind never ceased. Until his last days he was an enormously productive scientist fostering research across disciplines. He is deeply missed. If he had one last message to leave us, it would likely be to continue to focus on expanding the knowledge of primary-process mammalian emotions as understanding our subcortical brain may prove to be the limiting factor as we attempt to comprehend our human mind.

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