The Family Emotional System

edited by

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The Instinctual Foundations of Infant Minds: How Primary Affects Guide the Construction of Their Higher Cognitive Proclivities and Abilities

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Human infants are born with affective minds that surely allow them to promptly experience themselves as coherent entities, as they receive diverse sensory inputs from their bodies and the world. These primal aspects of consciousness, with a variety of intrinsic emotional, homeostatic and sensory systems, coursing through their old mammalian (subcortical) brains, are essential for the growth of all the other mental abilities. Although we know little about their primal affective selves, which provide a center of coherence for all important future life activities, we can finally be confident that such powers of the mind emerge from subcortical brain regions

(Damasio, 2012; Denton, 2006; Merker, 2007; Panksepp, 1998a,b; Solms & Panksepp, 2012) There are good reasons to believe that both human and animal possess core-selves that are heavily intermeshed with the primal emotional, homeostatic and exteroceptive systems of their brains—which engender diverse affective powers of the mind that are finally beginning to be understood neuroscientifically. This kind of knowledge will eventually help clarify not only how the upper mind matures in healthy ways, but should also provide novel ideas for alleviating psychiatric problems that are so common in our species, perhaps others also. Here, I will reflect on these developmental issues as they may impact child development.

The cross-species analyses of fundamental mental processes (e.g., emotional and homeostatic feelings) are newcomers on the landscape of psychological science. The name of the most relevant bridge discipline is *affective neuroscience.* It offers empirical strategies to cross between animal emotional behaviors and their valenced (positive and negative) states of mind, as models for our own, based on demonstrable evolutionary homologies. Such foundations of mammalian minds are of foremost importance in understanding how we can promote better "family values" where children have social environments in which they can thrive. Admittedly, we are only at the beginning of a long journey to understand how affective feelings are constructed within mammalian brains. A critical aspect of this journey is that at the most fundamental psychological level (what I will call "primary-processes" here), all mammals share the same basic emotional tool-kits, among which the most important for mental health are *emotional* feelings. Of course, the influence of *homeostatic* feelings such as HUNGER and THIRST, and of course the many *sensory* feelings (e.g., pleasant and aversive tastes and smells) that can feel good or bad in various ways, surely impact the qualities of mental life. In general, the labeling convention for primary-processes (evolutionarily-ingrained tools for living) that I use is full capitalization—for instance, SEEKING, RAGE, FEAR, LUST, CARE, PANIC and PLAY for the primary-process emotional systems that control distinct affective (valenced feeling) forms of arousal.

The positive and negative feeling states are regulated by diverse neurochemistries, with specificity provided by various neuropeptides (brain opioids, oxytocin, orexin, choleocystokin, corticotropin realeasing factor, and so forth). The overall arousal dimension of experience, which may be shared by all affective and cognitive systems, are heavily dependent on more general purpose acetylcholine, norepinephrine and serotonin activities (Panksepp, 1986; Pfaff, 2006), but here I will only focus on the emotional feelings that are most important for understanding psychiatric disorders and the overall quality of existence.

One prominent investigator of fear-learning in rat brain, has recently claimed that "We will never know what an animal feels" (LeDoux, 2012, p. 666). This was a common view throughout the 20th century, even though since 1954 we have been able to empirically determine that the shifting arousals of certain brain systems (with directed electrical Deep Brain Stimulation (DBS) can be "rewarding" and/or "punishing" (see the seminal work Olds & Milner's and Delgado & Miller's group, both published in 1954). Since we humans have no "rewarding" nor "punishing" events in our lives without accompanying affective feelings, it is reasonable, as a working hypothesis, to argue that brain rewards and punishments are experienced by other animals when their emotional systems are stimulated, especially if that knowledge can illuminate and even predict affective state shifts that humans experience (Panksepp, 1982, 1985, 1998a, 2005). If the animal work predicts the efficacy of new psychiatric treatments in humans (e.g., Panksepp, et al., 2014; Panksepp & Yovell, 2014), we should have even more confidence that our science is on the right track.

Now the data for affective states in animal is abundant, and my cardinal thesis is that certain human feelings can finally be understood by studying the homologous processes in animal brains. Here I will summarize why such cross-species emotional-affective investigations are critically important for understanding our deeper (i.e., primary-process) affective nature, and why it may even illuminate issues that may guide understanding of the emotional values upon which affectively positive and negative family structures are built.

My DBS evidence-based thesis is that animals feel their emotional system arousals intensely, and their brain-feelings (indeed key aspects of their "family values" emerging from the CARE system) have a strong evolutionary relationship to our own, with remarkable neuroanatomical, neurophysiological and neurochemical homologies. Can we be *certain*? Of course, we can't, because science never provides proofs, only the weight of evidence to differentiate views. At the same time, we have no comparable scientific evidence that animals think or experience cognitive ideas about their feelings and the environmental events that surround them in the deeply thinking-feeling ways that we do. The probability is high that they have diverse sensory experiences, surely those of touch, hearing and vision, which probably evolved in that order (e.g., that conclusion can based on the ventral to dorsal sensory layering within the superior colliculi—see Figure 16.1, p. 312, in *Affective Neuroscience* (Panksepp, et al., 1998a). They also surely smell and taste the world in both valenced (sensory-affective) as well as cognitive (exteroceptive) ways, and there is a distinct possibility that the evolution of affects was a critical evolutionary passage for many cognitive developments, especially programming of higher cortical functions. In any event, animals surely also have primal *homeostatic* affects (e.g., HUNGER and THIRST), whose satisfactions guide behavioral strategies--see Denton (2006) for a fine discussion of those “bodily” *homeostatic* feelings.

The evolutionary value of all such valenced states of mind is surely related to the predictive value of such feelings for survival. In complex organisms, behavior-only mechanisms may be less precise guides to where one stands in terms of the many survival-relevant states that are needed in order to sustain life. It is likely that the fluctuations of affective-states control learning process. This linkage is probable since the unconditional (primary-process) states of the nervous system cannot respond rapidly in optimal (behaviorally complex) ways to environmental changes. Only through learning and memory, based on past affective shifts that accompany behaviors, can adaptive survival-promoting behavior patterns be optimized.

Surprisingly, more concerted effort has been devoted to the study of learning and memory than the affects that accompany unconditional emotional and other affective response patterns. The fact that the study of affect, until quite recently in human psychology, has remained an unembraced orphan as a topic of research (see, Miskovic, et al., 2015), is partly because causal brain-research (not just correlative—i.e., EEG and brain imaging) is needed for in-depth understanding (and the discipline of psychology has never developed a solid foundation in neuroscience, especially subcortically-focussed animal neuroscience where the best causal work on emotions comes from). In any event, valenced experiences—the varieties of desirable (rewarding) and undesirable (punishing) affective consciousness—remain pervasive, life-supportive brain process that psychology and psychiatry ignore at their peril. Here I will focus on child development where abundant conceptual and empirical wisdom has already been shared by many others (e.g., See Narvaez, et al. 2012, 2014; Reddy, 2008; Trevarthen, 2009).

The Emotional Dimensions of Early Childhood Development

What are the implications of the affective neurosciences for understanding the minds of human infants, and the family dynamics that are needed to support healthy mental growth and happiness as opposed to decline and misery? Of course human babies can't talk any more than most other species. But based on animal research we can be *confident* that our babies, during their first years of life, have comparable feelings to most of the ones identified in animal models. The most important finding that allows this bold statement, is that animals can "tell" us they have feelings by the consistently rewarding and punishing properties of deep brain stimulations (DBS) that evoke coherent emotional responses, and corresponding affective experiences are consistently reported by humans receiving such brain stimulations (Panksepp, 1985). There are at least seven primal emotions: In animals we can evoke behavior patterns that reflect i) SEEKING/exploration-curiosity urges, ii) RAGE/anger, iii) FEAR/anxiety, iv) LUST/sexual eagerness, v) CARE/maternal-nurturance, vi) PANIC/separation-distress, and vii) PLAY/social-joy. None of these evoked states is affectively neutral!

Developmental Trajectories of Higher Mental Processes (Cognitions)

Although the above facts allow us to understand human affective sentience through the study of evolutionarily related brain mechanisms of animals, we have no comparably robust (*causal*) ways to study the experiential aspects of cognitive decision making, although great progress is being made in studying neural *correlates* (Rolls, 2014). While considering these primal-evolved subcortical affective functions of mammalian brains, it is important to recognize that the tops of our infants' brains, their neocortices (aka 'thinking caps'), although evolutionarily structured as predictably interconnected neural networks (almost like un-programmed RAM chips in one's newly-purchased computer), are basically cognitively empty at birth. There may be some very interesting cognitive capacities in the brains of our infants before birth, but we have no experimental way to determine whether they arise from their neocortices or from lower brain regions. This is a critical issue, for we do know that infants born without their 'thinking caps'—eventually programmed by experiences, from early family life to cultural expectations--are mentally alive and emotionally vibrant creatures (Merker, 2007; Solms & Panksepp, 2012).

To the best of our knowledge, all neocortical functions emerge through the auspices of learning and memory, which are most robustly guided by affective shifts. This makes the social-affective qualities of early family life critical for optimal socio-cognitive-emotional development. Indeed, even though this is not the place to dwell on such details, modern epigenetic mechanisms have been revealed—namely changes in gene expression patterns without a change in nucleotide sequences of DNA (e.g., through gene methylation, histone modifications, etc), whereby life experiences can have life-long changes in gene expression patterns with massive implications for bodily and mental health (see Weaver, et al., 2004 and chapter in this book by Champagne). The science is not sufficient for mental health prescriptions, but some future possibilities will be along the lines we will discuss here—minimize negative affects, without eliminating them completely (having just enough for resilience), and maximize positive affects, which intrinsically maximize resilience and thereby minimize the development of life-long psychiatric problems that compromise the overall quality of life (for those interested in the abundant details, see the Fall issue of *Dialogues in Clinical Neuroscience* (Vol 16, No 3) for up to date information.)

Thus, while evolution provided the raw affective tools for mental life, whose neural circuits probably guide adaptive learning which, with the associated memory formation, enrich the neocortex with diverse cognitive capacities. Many of those cognitive superstructures, built on affective foundations, are acquired through the emotional qualities of interpersonal interaction. A wonderful clinically-oriented guidebook on how that can be achieved during early child development has been provided by Margot Sunderland (2006), (and for diverse psychological as well as diverse and important neuroscience perspectives, see Narvaez, et al., 2012). The qualities of family environments, with their interblending of affective realities and cognitive potentials, are decisive in the emerging qualities of children's personalities and intellectual potentials.

This conceptual issue bears repeating: With regard to the cognitive side of infant development, we need to recognize how fundamentally empty of cognitive riches the neocortex of infants is at birth. In a sense, philosophers such as John Locke (1632-1704) were partly correct in their vision of the newborn mind being a *tabula rasa*. Indeed, we are born with higher brain (neocortical) brains regions that are essentially empty of thoughts and memories. As far as cognitive/knowing skills are concerned, newborn cortices are more akin to a "blank-slates" rather than "beehives" of evolutionarily-specialized "modular" specializations. Once we realize this, the outstanding importance of high quality family emotional lives, full of enthusiasms and joys, along with well-attuned social sensitivities, can be seen as critical for the development of the higher mental apparatus, with its various cognitive strengths and weakness.

The Neuroscience of Cortical Development

Many evolutionary psychologists still believe our cognitive apparatus has been programmed by evolution. There is little to support that contention (Panksepp & Panksepp, 2000; Panksepp, 2007a). Life experiences modularize the tops of our brains. Even the capacity of the visual cortex to see the world is learned. The first definitive lines of evidence came with the

Nobel Prize winning work of Hubel and Wiesel (1962) on the visual systems of cats. It became clear that "normal" early experiences with vision were essential for normal visual abilities to develop in the cortex. For instance, if one eye of a newborn kitten was prevented from seeing, then the visual cortex for that eye was monopolized by the one intact eye, which prevented normal stereoscopic (depth) vision from developing. Eyes unused for a certain amount of time after birth (e.g., with one eye being covered) would forever remain visually deficient. The uncovered eye would take up too much of the territory in the visual cortex that would normally be programmed by the uncovered eye.

Across the years this developmental lesson has been solidified with additional remarkable findings: i) If we surgically excise (eliminate) the visual cortices in fetuses (of rodents that is), and ask if those animal, when mature, have major visual deficits, the surprising and resounding answer is "no they do not" (Sur & Rubinstein, 2006): Although the subcortical visual networks do have a neurochemical urge to innervate the cortex (normally the occipital lobe), if the closest tissue is removed, the neurons simply lay down roots in the closest remaining cortex, and program it to be visually skilled.

We will not dwell on other such remarkable facts, but simply reiterate: All the specializations of the neocortex that have been closely studied are developmentally rather than evolutionarily programmed. This contrasts with the abundant evidence that our subcortically-generated primary emotions and other primal affective capacities are more definitively evolutionarily programmed than our cognitive tendencies. After a brief synopsis of the substantive progress that has been achieved about mammalian emotional networks, we will move on to consider how such knowledge can help optimize family dynamics to help assure that children have excellent opportunities to grow into richly empathic, self-actualizing adults, who are optimally situated to construct positive social worlds down through the generations.

The Instinctual Foundations of our Primal Affects: The Animalian Affective/Evolutionary Foundations of Human Minds

Here is a synopsis of basic emotion systems (archival-worthy details can be found in Panksepp, 1998a and Panksepp & Biven, 2012). The following 7 primary emotional networks have been delineated through animal brain research and they are abundantly corroborated by both human brain research and psychological experiences: We focus first on the 4 affectively positive primal emotions, and then the 3 negative ones:

Insert Figure 1 about here

1) Highly motivated SEEKING behaviors (mainly, exploration, foraging and inquisitiveness), along with positive feelings of enthusiasm and exhilaration, can be engendered by a massive neural system called the Medial Forebrain Bundle (see Fig 1) which has only recently been characterized in humans (Coenen, et al., 2012), and many are beginning to envision that stress (especially PANIC) induced depletion of this system can promote depression (Panksepp, et al., 2014) and suicide (Panksepp & Yovell, 2014). This complex system is the bedrock for three more specific enthusiasms—LUST, CARE and PLAY. It motivates us to pursue all things needed for survival, and it can promote all kinds of addictions from drugs to all the other excessive appetites. Thus, an early parental focus to channel this psychic energy (of enthusiasm and curiosity) toward an engagement with the better values of the world is an essential nurturant responsibility.

2) LUST, which comes in male and female varieties, and takes advantage of regions of the SEEKING System that are especially enriched in gonadal hormone receptors (especially testosterone in males and estrogen and progesterone in females); this focuses the SEEKING system toward passionate feelings of sexual desire, that get dramatically magnified by puberty. Wise parental guidance through such development passages is possible, especially if it recognized that transsexual brain and body organizations have always been with us, where feminized brains can developmentally emerge in male-typical bodies, and masculinized brains in female ones. The acceptance of such natural variations should be part of the learned wisdom of parenthood. Other key aspects are part of our inherited adult wisdom.

3) A natural consequence of reproduction is the sensitization of the SEEKING System toward maternal CARE. This kind of sensitization occurs especially in MFB regions that have abundant prolactin and oxytocin receptors, which are commonly more enriched in female than male brains. The CARE system is also surely an important contributor to empathic tendencies. There are gender differences in this system, but not, as far as we know, in early childhood. Female brains generally come to be more adept at CAREing, but the potential is there in males, and can be cultivated by reinforcing so many opportunities that are available, especially with pets. Boys that want to play with dolls should not be discouraged, for fear of influencing their gender identities. There is no evidence that can occur, although when it has occurred biologically, wise parents should recognize and cherish the differences.

4) Finally, young animals, whether human or other mammals, have robust (indeed 'rough-and-tumble') PLAY urges, characterized by delightful physical engagements full of running, chasing, wrestling and laughter (indeed, we discovered a simple way to study this in rats by tickling them). The underlying brain circuits for the last three variants of SEEKING are probably

the fundamental source of “social joys”, with many brain benefits (Burgdorf, et al., 2011; Moskal, et al., 2011), especially against depression (Panksepp, et al., 2014; Panksepp & Yovell, 2014). Children that do not get adequate social play may gradually become impulsive and thereby be diagnosed with Attention Deficit Hyperactivity Disorders (ADHD). Most medicines given to ADHD-type children tend to reduce playfulness. The first line of defense against ADHD should be abundant daily play. In single child families, making this a daily routine, twice a day (especially by fathers), can benefit children in many ways (Panksepp & Scott, 2013).

5) Among the three negative systems, the aversive feeling of FEAR was first the first to be studied. This system coaxes animals to recoil from potential harm, and is probably one the major sources of the feeling that accompany anxiety disorders. A child that has too many such feelings may not be able to take full advantage of its many manifestations of SEEKING urges. Excessive sensitivity of the FEAR system surely participates in the genesis of anxiety disorders, partly because the system can become sensitized—namely, more susceptible to being aroused (Adamec & Young, 2000).

6) The intense feeling of RAGE is quite a different negative feeling, commonly called anger, which emerges when ones desires are thwarted. Thus psychological frustrations and bodily irritations lead one to reach out and strike someone. This system can surely be *sensitized*, so that the more a child has experienced anger, the more likely this system will become excessively responsive, just like the FEAR system.

7) Finally, there is a PANIC system that engenders a distinct negative type of feelings that arise from the severance of social bonds—basically the negative feelings of grief and loneliness that arise from the deprivation of social support. Thus, this system also figures prominently in the quality of social bonds. Brain opioids, which are normally activated by social contacts (Keverne

et al., 1989; Panksepp & Bishop, 1981) powerfully soothe this type of psychological pain, providing one reason that people, especially those who are lonely and in psychological pain, get attracted to opioid drugs. Depression and even suicidal tendencies induced by excessive PANIC can be effectively reversed with safe opioids that have long been known to reduce feelings of PANIC(separation-distress)—(for a synopsis of those clinical findings, see Panksepp & Yovell, 2014).

The "Laws of Affect" that Guide Learning and Memory

Enormous advances have been made in the last few decades in understanding how primal emotions are organized in the brain, and how *primary-process* emotions control *secondary-process* learning and memory, which provide the essential ingredients for *tertiary-process* higher-order mental activities (Panksepp & Biven, 2012). This hierarchical organization of the BrainMind in terms of nested-hierarchies, allows us to better conceptualize the bottom-up development of human mind. In sum, mammalian brains contain a fundamental emotional substrate for positive and negative feelings and behaviors that accompany the energetic, positively motivated life activities that subserve all our emotional and bodily needs.

This knowledge is helping us re-conceptualize the scientific foundations of psychiatry and psychotherapy, which may eventually lead to major advances in the treatment of emotional disturbances that control the development and expression of mental illnesses. The affective neuroscience approach allows us to focus more directly and effectively on the emotional problems of people (hence we developed the Affective Neuroscience Personality Scales (ANPS)—see Davis & Panksepp, 2011 for most recent version), and it provides new insights on how to re-establish positive affective balance, using the natural plasticity of the human MindBrain. The importance of focusing on the neural dynamics of SEEKING, PANIC and PLAY systems in emotional homeostasis and development of new anti-depressant treatments has been recently extensively discussed (Watt & Panksepp, 2009; Panksepp, et al., 2014).

At the same time a focus on how our neuroscientific understanding of the various primary-process positive emotions, especially PLAY and social solidarity, can strengthen positive attitudes has received considerable attention (Burgdorf, et al., 2011; Gruber, et al., 2014; Sheldon, et al., 2011) Also, the Affective Neuroscience Personality Scales (ANPS) will be introduced as a tool to provide better objective measure of clients' specific primary-process emotional strengths and weaknesses. Some recent applications of ANPS (Farinelli, et al. 2013, 2015) in stroke patients put in evidence the impact of specific brain lesions on basic emotion (SEEKING in particular) and depression. Observed abnormalities concerning mainly basic emotions also indicate that the effect of brain lesions may enhance the interrelation between basic emotions and attachment. Main findings of the mentioned studies shed light on the possible relationships between emotions and attachment that are subserved by distinct and segregated underlying neural systems .

Basic emotions are associated with different neural systems in subcortical networks, while social attachment (based on learning) is assumed to be related to neural activity in more cortical regions such as some regions of the cortical midline structure and, in particular, the medial orbital prefrontal cortex or the ventromedial prefrontal cortex. ANPS could be a useful instrument in the follow-up of patients during the different phases of the reorganization of the self, following brain lesions and to choose specific rehabilitative and psychotherapeutic techniques .

Implications for Family Dynamics and Child Development and Related Psychiatric Problems

Although infants of no species are born with cognitively rich lives—minds full of perceptually-based knowledge, ideas and intuitions—they have basic learning and memory mechanisms to acquire those capacities, but those require various affects, attention and lots of neocortex. Thus basic emotions are substantial part of the neuro-mental engines that motivate children to learn and remember. In short, a child's instinctual emotional life is a critical foundation upon which their memories and cognitive styles are formed. Thereby the affective qualities of early development, and the resulting memories, have a lasting influence on the cognitive channels that control how one thinks about the world and their role in the greater social order (or disorder!): Surely the family dynamics can cast both sunny light and abysmal darkness on these processes. By fusing the realities of the past with the possibilities of the future, one's character is formed. So let us briefly consider some very general advice one might offer from this perspective, especially for the first years of life, as one considers a select group of emotional primes.

SEEKING: This system is the foundation for enthusiasm, curiosity and ultimately creativity, and under the worst conditions, diverse addictions. Parents are well advised to provide environments where a variety of opportunities are provided for engaging this system in ways that can broaden children's interest both in social and non-social domains. Obviously, this will require remaining attuned to the activities that engage a child, while at the same time providing opportunities for broadening interests, especially in activities that have strong social components, that require shared attention. Obviously, the computer revolution has provided many creative options, but also activities that promote autistic aloneness. In this, we should remember that when a human engages youngsters in the learning of new languages, the most progress is made with real CAREing human beings. Infants looking at a video rendition of the same person, obtain few benefits (Kuhl, 2009); infants are designed for social engagements (Reddy, 2010; Trevarthen, 2009) and everything that maximizes those opportunities are bound to yield more lasting life benefits than those that are pursued in “autistic” aloneness.

LUST: Infantile sexuality has been a contentious topic in psychoanalysis, and there is insufficient space here to weave through that contentious topic. What affective neuroscience can add is clarity about the simple fact that bodily gender and brain gender are controlled by different developmental programs. Thus, wise parents should recognize that a male brain organization in a male-typical body is the norm, as is a female brain organization in a female-typical body. However, as many cultures have recognized, without much worry, is that cross body-brain variations are normal as far as our neuroscientific understanding of sexual variation is concerned. The hormonal patterns that lead to the masculinization and feminization of brain organization—most of which is expressed at the subcortical primary-process emotional levels (admittedly, in the minority of children)—should be deemed normal variants of human developmental trajectories. Children’s gender-identity and resulting developmental trajectories, whatever they are, should be allowed to be manifested with consistent parental support and care, channeled as much as possible toward consistent pro-social values.

CARE: Obviously the care-giving urges, typically stronger in mothers than fathers (indeed, more in girls than boys), need to be a blessing for each child’s life. There should be a consistent sense of security that is affirmed in the earliest interactions. Perhaps the most compelling short image we have is of a mother holding her baby, with caresses and hugs, accompanied by the whispering or singing of ‘sweet somethings’ in the baby’s ears. These affirm the solidity of parent-infant bonds, which provide ideal affective jumping-off points for the essential playful interactions that enrich a child's life from the very beginning, promoting the likelihood of become caring adults. Both affective qualities allow children to grow up into warm and engaging people who have a seemingly natural capacities to make others feel good and welcome.

PLAY: The whole social-developmental trajectory is guided by the qualities of social PLAY--one of the greatest pro-social forces of the brain, much underutilized, even misunderstood and marginalized in modern life, perhaps contributing to the current epidemic of childhood psychiatric disorder. All children should be allowed to freely engage with each other in joyous games of their own making, allowing them to grow up to be superb parents. The finest parental indicator that one is on the right path with young children is the abundance of the laughter, and desire to engage in physical tickle games with parents, that evolve into a diversity of fun social activities. We were shocked to discover a primal form of laughter in laboratory rats twenty years ago, but that is another story, starting with Panksepp & Burgdorf, 1999, 2000; Panksepp, et al., 2001), and now progressing well for a long time without much funding or scientific interest, but remarkable enthusiasm from animal lovers (for summaries, see (Burgdorf & Panksepp, 2006; Panksepp, 2007b),

Obviously most early play should be among children, but in a one-child family, the father is well advised to take up the slack, for a play-starved child is liable to act out in troublesome ways, that may be seen by professionals (especially those untutored in ludic behaviors) as an Attention Deficit Hyperactivity Disorder (ADHD). One of the shocking affective neuroscience facts found first through animal research is that the medications that are commonly given to ADHD children are agents that consistently reduce playfulness in animals. There are good reasons to believe that abundant childhood play can provide prophylaxis for the development of such disorders (Panksepp, 2008; Panksepp & Scott, 2013).

PANIC: Although all of the above systems have a role in social-bonding, there are reasons to believe that feelings of separation-distress, and especially their alleviation, are key factors in early social attachment bonds (Panksepp, Herman, et al., 1980: Panksepp, Siviy & Normansell, 1985 and many other reviews). Children without secure attachments are likely to have emotional problems throughout life. This has been obvious ever since the work of John Bowlby (1980). However modest doses of separation-distress can surely be used by parents effectively as a way of instructing children in the value of basic human relations. There are many safe situations where secure children may challenge the need of parents to shift priorities from, let's say, outdoor play at a playground where there are no other children to other activities/responsibilities. And if their child gets grumpy and doesn't cooperate, a willingness to walk away, perhaps around a corner, and wait for the child to get a bit distressed, followed promptly by a comforting reunion, may be a useful lesson that can facilitate future cooperation and development of pro-social values.

In any event, separation-distress needs to be seen as a useful index of the prosocial qualities of a child. There is considerable evidence that autistic children may have a deficit in social bonding by their failure to show any distress upon separation, perhaps in some caused by elevated brain opioid activity which can markedly dampen activity in separation distress systems. We have often seen such children to exhibit more pro-social behaviors after their levels of endogenous opioid activity have been reduced with very modest does of the opiate-receptor anatagonist naltrexone (for overview, see Panksepp & Sahley, 1987, with our best double-blind study being Bouvard, et al., 1995).

It would be interesting to study with tools like the ANPS, basic emotional profiles and attachment styles of parents of children suffering from ADHD and other behavioral, mental and psychosomatic disorders aimed at characterizing the developmental context and the benefits of interventions and therapies. Furthermore, the emotional and attachment-style assessment of parents would contribute to focus psychological interventions not only on symptoms shown by children but on the structure and functioning of the whole family. Psychotherapeutic practice shows that family members very often need to be actively involved during the psychotherapeutic process to make possible lasting changes at very basic levels. Family members along with various psychological and and psychopharmacological treatments can positively contribute to improved child mental health. Variants of the ANPS (e.g., comparable *state* measures) could also be used to monitor changez in family dynamics during complex psychotherapeutic processes to help assure that children are exhibiting positive affective rebalancing of family relational system.

These are just modest examples of the types of thinking that affective neuroscience perspectives suggest in terms of child development issues. Clearly, a book could be written about child development issues based on an understanding of the fundamental emotional systems of mammalian brains. Indeed, a superlative one has been written (Sunderland, 2006). And this chapter is just a brief sampler of the brain-mind issues that taking primal emotional systems seriously suggest in their roles as major barometers and guides of our lives.

Denoument

In sum, we are finally able to weave a coherent web of evidence concerning the affective foundations of the human mind, shared with many other mammals because the underlying ancestral solutions to living are the shared genetic birthrights of all mammals, as Darwin surmised in his last two books—the *Descent of Man* (1871) and *Expression of Emotions in Man and Animals* (1872). Of course, our capacity to understand, or even accept the evidence for the existence of the internal feelings of other animals, has long been denied by prominent scientists (see Panksepp, 1998, 1999), even to this day (e.g. LeDoux, 2012 ; Rolls, 2014) . We scientists share three fundamental values: Beside our primal values of i) skepticism and ii) the fact that scientific conclusions always need to be based on the weight-of-evidence, not "proof" (which does not exist in deep science) we also recognize (if adequately philosophically trained) that iii) there is no absolutely perfect scientific understanding, namely "proof", in our fragile (always open to modification) attempts to understand nature.

For the past half century, abundant lines of evidence have supported the conclusion that other animals do feel their emotions (for overviews see Panksepp, 1981, 1982, 1998a; Panksepp & Biven, 2012), and because of the remarkable anatomical and neurochemical homologies that exist among the most ancient (subcortical) brain area, we can provisionally conclude, based on the weight-of-evidence, that all mammals have a diversity of evolutionarily/genetically-endowed brain emotional systems that are rewarding or punishing, and hence they also have homologous (evolutionarily-*related*, albeit surely not *identical*) affective experiences. We are almost at the point where we can reach the same conclusions with respect to homeostatic affects like HUNGER, THIRST and DISGUST (Denton, 2006).

In short, the neuroscientific study of all mammals (at least those that share evolutionarily related brain sensory, homeostatic and emotional affective-systems) can provide important evidence concerning our own affective lives. That such evolved survival indicators help jump start and consolidate the acquisition of new knowledge, based on brains' intrinsic capacities for learning and memory, allows us to entertain new "Laws of Affect" (Panksepp, 2012) as opposed to the behavioristic "Law of Effect" that still encourages some to talk about "negative reinforcement" processes (i.e., that translates to "elimination of punishments") as opposed to affectively meaningful psychological concepts such as "relief". If anyone still has trouble believing animals have feelings akin to "relief" when given "safety signals" indicating that shock will be withheld for a while (during commonly used classical fear-conditioning paradigms), they need to explain why their animals so consistently exhibit "double-respirations" (also known as "sighing") when safety signals periodically come on relieve their emotional agony **(**Soltysik & Jelen, 2005)**.** Conversely, from a feeling perspective, if we tickle rats, as we have now been doing for a quarter century as a measure of positive social affect, we were recently pleased by the work of Polish colleagues that such animals become "optimistic" based on solid behavioral observations (Rygula, et al., 2012).

Still the evidence-based conclusion that animals do experience diverse affects (Panksepp, 1998, 2005, 2011a,b) does *not* permit us to jump to the conclusion that there is sufficient evidence to conclude that animals "think" about their dilemmas in ways that resemble our *ideas.* We cannot go there with any scientific confidence, albeit there are impressive lines of evidence that they also may experience complex emotions, even some as subtle as "regret" (Steiner & Redish, 2014). The fact that animals experience survival values affectively, does not yet allow us to conclude that they think about their place in the world in any way that resembles the cognitive activities that our massive neocortical regions permit.

The implications of our growing understanding of the neuroscience of cross-mammalian affective processes, has profound implications for understanding the maturing minds of our babies, and the importance of family dynamics in providing a secure base for healthy

psychological growth. We have only touched upon a few simple implications of this knowledge: Perhaps the most important being that sufficiently rich storehouses of positive affective memories allow growing children to become adults who naturally promote positive human relationships and values that nourish healthy societies. The simple fact that diverse positive and negative affects emerge neurodynamically in humans at subcortical primary-process levels, where all mammals share brain emotional and homeostatic mechanisms that affectively encode for survival trajectories, provides for a psychologically satisfying understanding of the kinds of creatures we are, and how we can become better in the midst of supportive families and cultural dynamics.
In sum, affects are the neuropsychological representatives of survival values—all good/desirable feelings statistically predict survival trajectories; all bad/undesirable feelings indicate animals need to take certain actions to maximize survival. Because of a shared ancestral past, we share basic affective feelings with all the other mammals, as well as diverse other organisms. To our astonishment, even crayfish return to places where they received drugs that are highly addictive in humans—amphetamine, cocaine and morphine—presumably because they engender desirable feelings (Huber, et al., 2011), but of a kind that is hard for us to understand with any precision. But the lack of precision at the psychological level does not preclude confidence in the conclusion that they also experience the world in ways indicative of survival & thriving vs likelihood of destruction. Family dynamics that favor the former are to be cherished and culturally promoted. Those that favor the latter are not worthy of our admiration.

An understanding of the neurobiology of human affective sentience, so important for understanding ourselves and helping people in psychiatric distress, has long been delayed by too many prominent scientists claiming we cannot know anything about the emotional feelings of other animals. We can. And that is a solid pathway to understanding our own primal emotional feelings scientifically.

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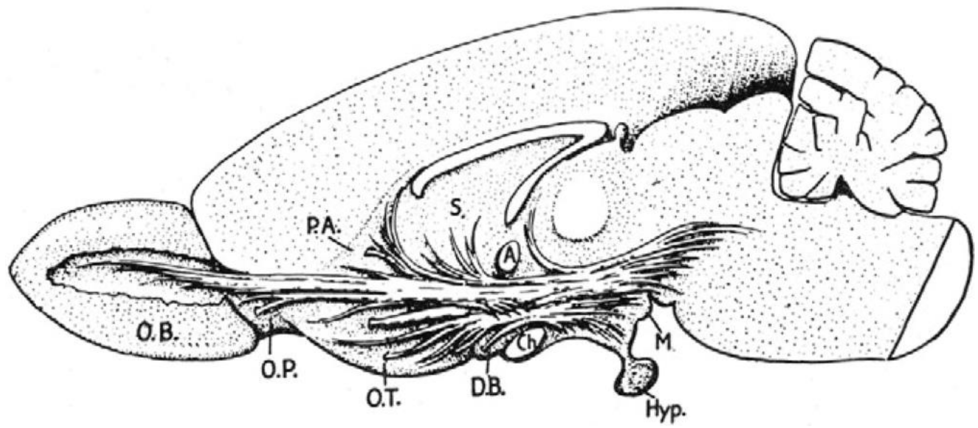

Figure 1. A drawing of the Medial Forebrain Bundle (MFB), which illustrates the main trajectory of the SEEKING system (classically referred to as "the brain reward system"). It runs up from the midbrain, through the lateral hypothalamus (LH), into more rostral neural regions, with abundant descending connections as well as local control (such as specific hormonal fields (e.g., sex and stress steroids), as well as neuropeptides such as those that control male and female LUST (vasopressin & oxytocin respectively) and CARE (especially oxytocin and prolactin). Other neural regions pictured: optic chiasm (Ch), olfactory bulbs (O.B.), olfactory peduncle (O.P.), paraolfactory area (P.A.), olfactory tract (O.T.), diagonal band of Broca (D.B.), anterior commissure (A), pituitary gland/the hypophysis (Hyp.), septum (S.), and mammillary bodies (M). (Figure from Le Gros Clark, 1938.)