

**Emotional Operating Neuro Circuits***a brief introduction to Panksepp's model*

Please note: this is an updated version of what was previously B3 on this web-page; it now includes references to some of Panksepp's more recent work (e.g. Panksepp 2008; 2009; 2012). The new B3 Part I sets Panksepp's work in an historical and neuro-physiological context, and it may be helpful to look at Part I before embarking on this Part II.

<b>Contents</b>		<i>page</i>
Preamble		3
o Figure 1: The Seven basic Emotional Operating Neural Systems (EONS)		4
1. SEEKING / Desire System		4
1.1 Introduction:		4
o Figure 2: Basic neuro-physiological aspects of the SEEKING system		5
1.2 <i>SEEKING System, distressed states, and Well-Being</i>		5
1.3 <i>Phineas Gage and damage to the SEEKING System</i>		7
o Figure 3 Schematic illustration of the brain injury of Phineas Gage		7
1.4 <i>Do neo-cortical or sub-cortical systems motivate us – for example, for an Autogenic Training Session?</i>		7
2. FEAR / Anxiety System		8
2.1 Introduction:		8
o Figure 4: Basic neuro-physiological aspects of the FEAR system		8
2.2 <i>Memories and negative rumination can set in motion FEAR circuits</i>		8
2.3 <i>Learning, FEAR, and SEEKING</i>		9
o Figure 5: Negative feelings, fears, and cognitive performance		9
o Figure 6: Positive feelings and curiosity facilitate learning, understanding and self esteem		10
2.4 <i>Antidote Modulators of FEAR</i>		10
3. RAGE / Anger System		11
3.1 Introduction		11
3.2 <i>Are anger / aggressive feelings liked by mammals / human?</i>		11
3.3 <i>Modulators of RAGE circuits</i>		12
o Figure 5: Basic neuro-physiological aspects of the RAGE system		12
3.4 <i>Dysfunctional / inappropriate activation of RAGE circuits</i>		12
3.5 <i>Antidote Modulators of RAGE</i>		13
4. SEXUAL (LUST) circuits		13
4.1 Introduction		13
4.2 <i>Modulators of SEXUAL circuits:</i>		14
o Figure 6: Some basic neuro-physiological modulators of the SEXUAL system		14
4.3 <i>Intra-uterine brain chemistries of the sexes and their impact on Society</i>		14
4.4 <i>Trust, nurturing, long-standing intimate bonds and oxytocin</i>		15
4.5 <i>"Oxytocin and Peaceful Coexistence" – Panksepp 1998 p 257</i>		16
5. CARE / Nurturance circuits		16
5.1 Introduction		16
5.2 <i>Modulators of CARE circuits:</i>		17
o Figure 7: Modulators of CARE circuits		17
5.3 <i>Psycho-therapy and CARE circuits</i>		17
o Figure 8: Congruence and Incongruence in relation to Self Image and Ideal Self (Based on Saul McLeod 2007)		18
6. PANIC / DISTRESS / GRIEF System /		

<i>Contents continued</i>		<i>page</i>
6. PANIC / DISTRESS / GRIEF System – overlapping with Sadness		19
6.1 Preamble		19
6.2 <i>General Introduction to Separation Distress and DISTRESS Circuits</i>		19
6.3 <i>Modulators of Separation Distress and GRIEF/ PANIC Circuits</i>		20
o Figure 8: Modulators of Separation Distress and GRIEF / SADNESS / PANIC Circuits		21
6.4 <i>Antidotes to PANIC and Panic attacks</i>		21
6.5 <i>Loss and Separation Distress</i>		21
6.6 <i>Overlapping of CARE and PANIC circuits</i>		22
6.7 <i>Mind, Affect and Human Distress</i>		23
6.8 <i>Neuro-physiological reflections on the Intentional Off Loading Exercises and Grief</i>		23
6.9 <i>Therapeutic approaches to loss / human distress</i>		24
o Figure 9: Some suggested modalities involved in psycho-therapeutic healing		25
7. PLAY circuits		26
7.1 <i>General introduction</i>		26
7.2 <i>Modulators PLAY Circuits</i>		26
o Figure 8: Modulators of PLAY Circuits		26
7.3 <i>PLAY Circuits, the Autonomic Nervous System and Social Engagement</i>		27
8. Post Script		28
8.1 <i>Emotions as classified by Ekman</i>		28
o Figure 9: Emotions described by Ekman 1999		28
8.2 <i>Ekman, Darwin and primary process emotions</i>		28
9. Afterword I		29
<i>Some reflections on Pavlovian type fear conditioning and therapy</i>		29
o Figure 10: FEAR and RAGE circuits Deactivate Logic & Thinking of Neo Cortex		30
o Figure 11: Model for the modulating effect of Pre Frontal Cortex on Affect Regulation		31
10. Afterword II		32
o Figure 12: Emotional Operating Neuro Circuits in action (bronze by Meryl Evans)		32
Appendix I		33
<i>Emotional Operating Neural Circuits, the Triune Brain, and beyond</i>		33
Appendix II		
Background notes on Affective Neuroscience		34
<i>Where do primary emotions originate?</i>		34
<i>Some EONS produce distress, others a desire for more (of that EONS).</i>		34
References and sources		35
Linked themes in this Autogenic Dynamics section		38

## Preamble

Emotions and Feelings are central to the way we as human beings experience life and interact with each other. Emotions can be regarded as the underlying physiological response (such as the Flight / Fight Response) which is initially activated at an unconscious level as, for example, the RAGE or FEAR<sup>1</sup> neuro-circuits. “Feelings” in this paper will refer to the subjective experience of the emotion (after Damasio 1999).

Different authorities view emotions in different ways. For example, Paul Ekman has described six basic emotions that are not culture dependent and can be distinguished cross-culturally simply from the facial expression that manifests with that emotion<sup>2</sup> (Ekman 2007; 2008).

Panksepp takes a different perspective and looks at emotions in the context of the underlying neural circuits associated with what he has called primary process affects, whose neural circuits are found in deep midline structures of the ancient brain; his work is based on extensive research in animals and humans (Panksepp 1988, his opus magnum; and the even more readable Panksepp & Biven 2012; and please see B3 Part I). He describes seven basic Emotional Operating Neural Circuits or Systems (EONS in this paper). This does not imply that he discounts other emotions – such as jealousy or revenge. Rather, that if we want to understand the main drivers of the emotions in evolutionary terms, it is helpful to focus on these seven, which are: FEAR, RAGE, & SEEKING; and PANIC / GRIEF, LUST, PLAY, & CARE (see Figure 1). His notation is to use capitals – thus FEAR, when he is specifically referring to the FEAR Emotional Operating Neuro Circuit (System), as opposed to when using the term in a more conventional way.

It should be noted that these seven EONS are really shorthand for highly complex processes. So, for example, discussion regarding the PANIC / GRIEF circuits involves an understanding of our social human bonds and Separation Distress (Panksepp 1998); and thus, by extrapolation, attachment dynamics (Bowlby 1969; 1988; Schore 2003A; 2003 B; Schore 2003B). These Emotional Operating Neuro Circuits, which we share with primates and mammals, evolved within the ancient Reptilian and Old Mammalian brain circuits<sup>3</sup> (using MacLean’s model of the tri-une brain – MacLean 1949 / 1990; and see appendix / glossary). Cognitive processes developed much later with the development of the neo-cortex. These two systems (emotional and cognitive) are intimately interwoven. If our affect system (EONS) becomes dysfunctional, this will inevitably affect cognitive functions (Panksepp 2009). Such dysfunction will occur if the specific neuro chemistries / circuits of the specific EONS are compromised – in this sense we are dependent upon our neuro-chemistries for our well being.

Affect Regulation in infants and children is crucially dependent upon the physical nurturing-presence of the mother / caregiver. Where this is absent or inadequate, Affect Dysregulation will result (Schore 2003B & 2003C; Sunderland 2007); this may lead to problems later in life – especially in relationships.

The seven EONS are depicted in Figure 1. Notice that the inner four represent what Panksepp describes as the social emotions, the outer three the more basic emotional and motivational processes.

---

<sup>1</sup> Using Panksepp’s notation (Panksepp 1998) when referring to these Emotional Operating Neuro Circuits or Systems (EONS).

<sup>2</sup> The facial expressions described are: Happy; Angry; Surprised; Sad; Afraid; and Disgusted. Note that Panksepp does not regard disgust as a Primary Process Emotion (Panksepp 2008 p 48).

<sup>3</sup> i.e. EONS are not neo-cortical; electrical stimulation of the neo-cortex does not produce an emotional response anywhere; in specific sites deep within the brain (e.g. hypothalamus / amygdala) it does (Panksepp 2010; Panksepp & Biven 2012; see also B3 Part I)

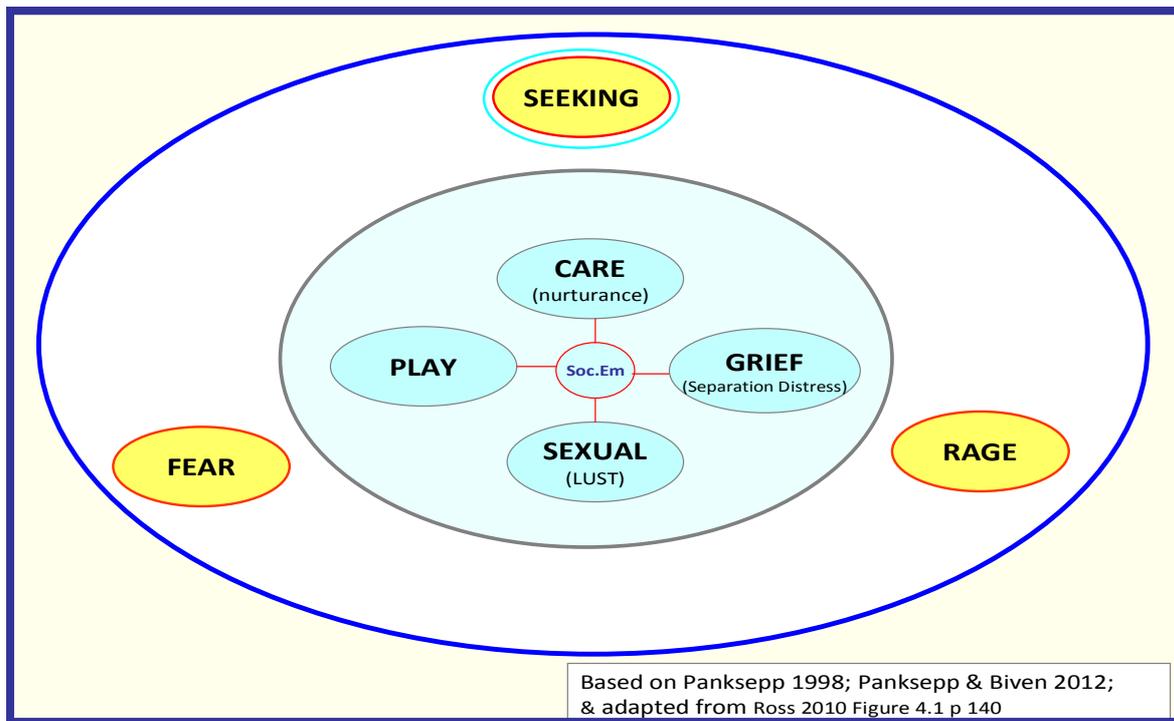


Figure 1

### The Seven basic Emotional Operating Neural Systems (EONS)

Based on Panksepp 1998; Panksepp & Biven 2012

#### Comments on Figure 1:

- Panksepp notates the sexual system as LUST; in the Figure above this has been changed to the SEXUAL EONS – see Section 4.
- Soc. Em: Social Emotions
- Separation Distress in younglings manifests itself in distress vocalisations and the activation of PANIC circuits; as adults (following loss) we will tend to experience this as GRIEF; hence Figure 1 has replaced PANIC with GRIEF, which is more understandable (Panksepp & Biven 2012 pp 314-315).

Research into these seven EONS suggests that, in general terms, only one will be active at any one time (Panksepp & Biven 2012 p xvi). This may be of social and clinical significance: for example, tenderness and CARE from a human being may overcome distress (e.g. FEAR) in another; oxytocin acts as an anti-dote to RAGE and FEAR circuits (discussed later in this paper).

We will now look at these systems in more detail, starting with the outer three, and then moving on to the central four Social Emotional Operating Neuro Circuits.

## 1. SEEKING / Desire System

### 1.1 Introduction:

In order to survive, animals and humans have a built in SEEKING system – to SEEK out, for example: water, food, and companions. So if this system is faulty, we will have difficulty in surviving. In humans, this system also embraces the SEEKING of *meaning*.

This harmoniously operating neuro-emotional system *drives* and *energizes* many mental complexities that humans experience as persistent feelings of interest, curiosity, sensation seeking, and, in the presence of a sufficiently complex cortex, the search for higher meaning. Although this brain state, like all other basic emotional states, is initially without cognitive content, it gradually helps cement the perception of causal connections in the world and thereby creates ideas. (As we will see), it appears to translate correlations in environmental events into perceptions of causality, and it may be a major source of ‘confirmation bias’, the tendency to selectively seek evidence for our own hypotheses.

Panksepp 1998 p 145

Figure 2 illustrates some of the basic aspects of the SEEKING systems in terms of neural networks / informational substances (e.g. neuro-transmitters)

### Neural Networks / Informational substances

- **Dopamine**

- “This is the mesolimbic dopamine system that arises from the ventral tegmental area (VTA) and projects through the lateral hypothalamus ..... (Panksepp 2009 p 9). This embraces what previously (and misleadingly) was called the “reward” or “pleasure” system (Panksepp 1998 p 147). It is better conceptualised as a “Well-Being” system (Panksepp 2009 p 10<sup>4</sup>; and see A3).
- Panksepp suggests that it overlaps with Spinoza’s concept of conatus (Panksepp 2009 p 9; Damasio 2003 – e.g. pp 36-37; and 170-175)

### Physiological states

- Thirst
- Hunger (for food)
- Hunger for physical contact<sup>5</sup>

### Music

Note that research suggests that dopamine is also released when listening to (pleasant) music, and is known to be associated with positive affect. It may also be that endorphins (endogenous opioids within the body) are released when we listen to certain forms of music. Consider this: naloxone (an opiate antagonist), when administered before listening, blocks the pleasant feelings that music usually brings about<sup>6</sup> (Menon & Levitin 2005).

Figure 2

Basic neuro-physiological aspects of the SEEKING system

## 1.2 SEEKING System, distressed states, and Well-Being

If the system becomes under-active, as can occur in the elderly, it can lead to depression. On the other hand, if it becomes over-active, it can lead to manic and associated behaviours (Panksepp 1998 p 53).

<sup>4</sup> Many researchers still use the term ‘reward system’, and this dates back at least to the work of Olds & Milner (1954), who showed that electrodes placed in specific deep structures of the rat brain (e.g. the septal area) gave a positive feeling – and would lead the rat to self stimulate this area (through a switch that activated the electrode in the brain). Electrodes at other sites caused distress of some sort (e.g. FEAR), and so in these areas the rats avoided self-stimulation. I think that Panksepp’s argument is partly that the term ‘reward system’ is better conceptualised – from the research evidence – as a subset of the SEEKING system.

<sup>5</sup> Appropriate physical contact is of course vital for our well being – for both children and adults (see, for example, Sunderland 2007). Thanks to Annie Sturgeon for suggesting that this hunger is included in the physiological states in Figure 2.

<sup>6</sup> i.e. Implying that opiate release while listening to appropriate music must at least be partially responsible for the pleasant feeling induced by the music.

- It may be that it is inappropriately overactive in modern society: craving embraces the same brain chemistries. In Buddhist psychology, three toxins are described: Craving (unwholesome desire); Hatred / Ill-will towards others; and Delusions<sup>7</sup> (Ekman 2005; Ross 2010 pp 158-159).

Meditative practice can act as an anti-dote to craving – and the whole Toxic Trio (Ekman et al 2005). Panksepp comments that it is a system that it is wise to embrace in all forms of psychotherapy:

The many interactions of the SEEKING system with higher brain regions highlight the degree to which basic emotive state-control systems can link up with cognitive systems that mediate secondary learning and tertiary thought processes, leading ultimately to awareness and thoughtful appraisals. It is best to recruit this system in every form of psychotherapy, for it is a generalised substrate for all the other emotional processes, from the establishment of libidinal social bonds to the seeking of safety in dangerous situations.

Panksepp 2009 p 10

Loss and depression tend to be associated with loss of meaning; if we are unable to re-kindle a sense of meaning (underpinned by appropriate activation of the SEEKING System), our recovery will tend to flounder.

Emotional systems are not good or bad in themselves: that depends upon how they manifest themselves – and / or how we allow them to manifest themselves. In the context of psychotherapy, personal development, and Well-Being, it is suggested that the safest way to recruit these systems appropriately and ethically is through some form of Mental Training (such as Positive Mental Training, Meditation, Tai Chi (Siegel 2010 p 89; 92) and / or Autogenic Training). These all enhance the nine specific functions of the medial Pre Frontal Cortex (Siegel 2007) that facilitate personal and social harmony – in addition to Well-Being (A3).

Before moving on to the FEAR system, it may be instructive to quote Panksepp's preamble to his summary of the SEEKING system:

.....the SEEKING system (is) a most intriguing and highly generalised emotional system – one that all the other emotional systems may depend upon for their own appointed affairs. This system remains poorly recognised in most psychological theories, partly because it is involved in all motivational processes. It has been mislabelled as “the brain reward system” by behaviourists not interested in the nature of emotions. As we have repeatedly discussed, a brain reward system is a highly misleading concept (Ikemoto & Panksepp 1999). Yes, mild arousal of the SEEKING system feels good in a special way, but this good feeling is not at all like a consummatory reward. It is the epicentre of the excitement of living, much of which consists of the *pursuit* of rewards.

Panksepp 2009 p 9

I think that Panksepp is implying here that in life it is often the journey (i.e. the pursuit motivated by the SEEKING system) that is of significance, rather than the destination (the 'reward'). My brother Michael has conceptualised the SEEKING system by way of an analogy with climbing a mountain: the point of the day out, or the expedition, is not just the five or ten minutes that we are on the top (which could be seen as a

<sup>7</sup> In the sense that we have a deluded view of the nature of reality, rather than we are suffering from delusions in the psychotic sense.

'reward'); rather, it is the feeling and the motivation that allows the whole day to be – from awakening in the tent, the purring of the primus stove, the walk up through heather and trees, the gradual extending of horizons as we climb up, the clouds on the ridge, the swooping flight of a ptarmigan, the top, and the varied way down till we arrive back at the camp, and the gathering dusk, and the first stars appear. Alan Watts<sup>8</sup>, in one of his tapes, put it this way (paraphrasing): 'If we go to a concert, and hear a great classical symphony, we do not go to just hear the trumpet and the cymbals of the last thirty seconds. Imagine going to a concert and just hearing that last thirty seconds, and that was it! No, the point of the symphony is the whole composition and whole performance – through each of the various movements.'

It is in the absorption and being in the present moment (Being the SEEKING) that positive affect and meaning emerges.

### 1.3 Phineas Gage and damage to the SEEKING System

As implied in the introduction, healthy operation of the EONS depends upon very specific neuro-circuits and chemistries. If the dopamine pathways of the SEEKING systems are compromised, this will seriously interfere with our well being. This is movingly illustrated in the case of Leonard L, in *Awakenings* (Sacks 1973 – and quoted by Panksepp 1998 p 144). The SEEKING system of Phineas Gage's neuro-circuits was catastrophically damaged when a tamping rod passed through his head (Damasio 1994 pp 3-33; Ross 2010 pp 141-145). These catastrophic events are depicted schematically in Figure 3 below.

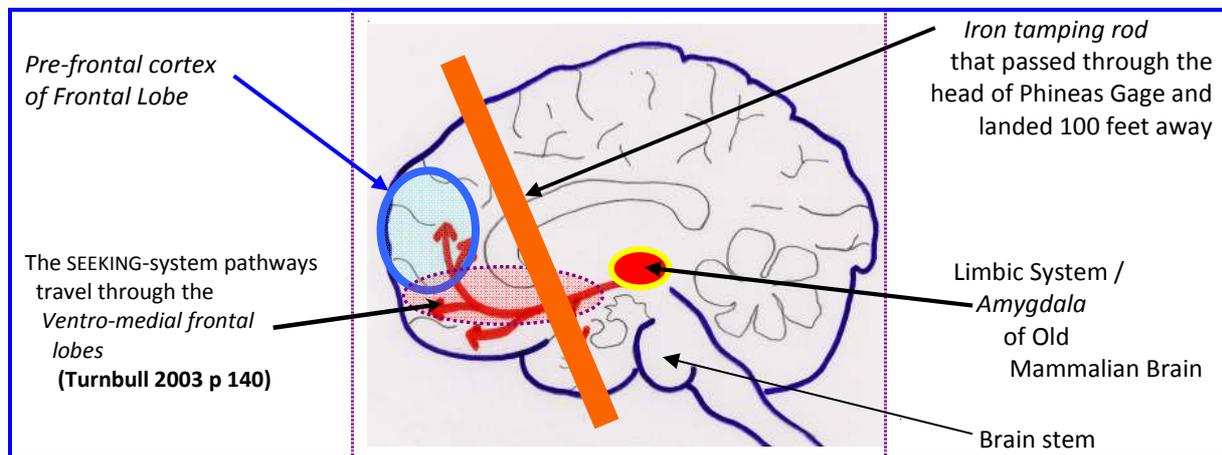


Figure 3

Schematic illustration of lesion caused by the iron rod that passed through the ventro-medial region of Gage's Frontal Lobes, thus damaging the SEEKING system pathways

This image appears as Figure 4.4 in Ross 2010 p 144, which itself has been redrawn and adapted from Turnbull 2003; p 142 – with thanks.

The implications of Phineas Gage's injuries, and subsequent research in neuro-physiology, is that our ability to be humane and caring beings is crucially dependent upon healthy EONS, and not simply on our logical / analytical cortex.

### 1.4 Do neo-cortical or sub-cortical systems motivate us – for example, for an Autogenic Training Session?

Previously, I had assumed, I think, that when we actually decide to practise an Autogenic sequence, that was a left brain neo-cortical decision – even though the actual mindful process of AT is lateralised to the right. This may not be exactly the case: the motivation may come from the sub-cortical SEEKING system – and this may be lateralised to the right brain. (Schore 2012 argues that basic emotions are lateralised to the right side.)

<sup>8</sup> Author of *Tao: The Watercourse Way*

## 2. FEAR / Anxiety System

### 2.1 Introduction:

FEAR circuits help to protect us from danger. A fear of heights may have a protective effect on a species, as may fear of a predator. FEAR circuits are linked to the flight / freeze part of the Fight and Flight response. In adult humans the FEAR circuits can be down-regulated by Meditative type practices, as a result of increased activity in our Pre-Frontal Cortex (PFC); babies and children do not have a developed PFC, and so rely on their parents' nurturing abilities to affect regulate FEAR (Sunderland 2007).

- It is also this FEAR system that is activated by Unconditional Stimuli (Primary Inducers) – e.g. a snake, resulting in the Unconditional fear Response – see B10.
- We can also elicit the FEAR system by recalling previous fearful memories (see B1 especially Figure 4 and 5).
- We can reduce such fears by activating positive memories (B1 Figure 6).

Figure 4 illustrates some of the basic aspects of the FEAR systems in terms of neural networks / informational substances (e.g. neuro-transmitters)

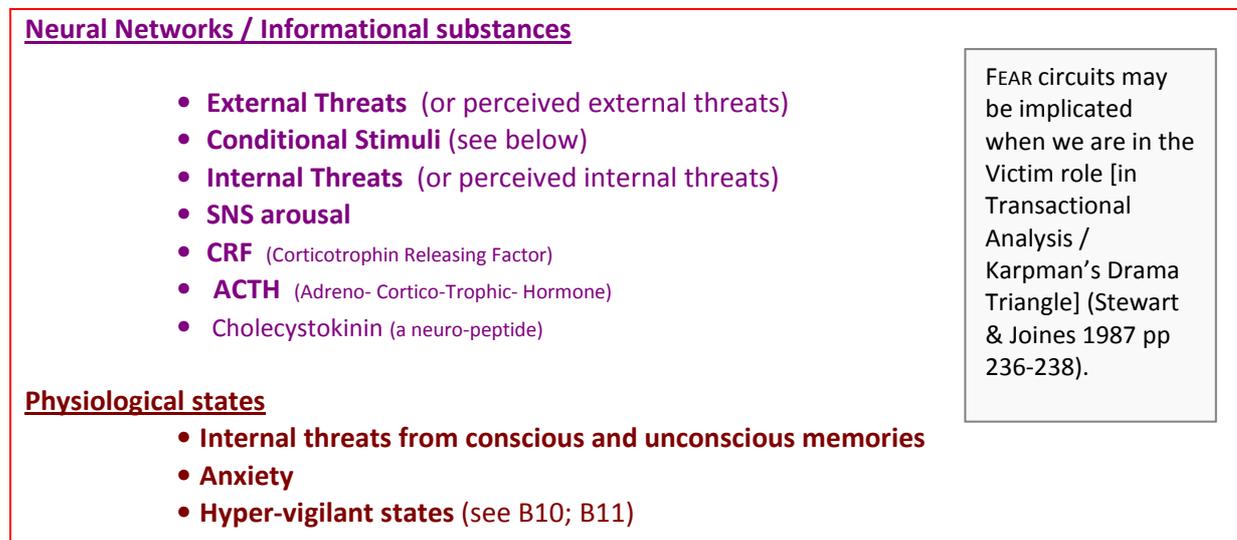


Figure 4

Basic neuro-physiological aspects of the FEAR system

### 2.2 Memories and negative rumination can set in motion FEAR circuits

If we experience a very traumatic event, the memory of this event may stay "locked" within the Amygdala / Limbic System, and thus not be processed in the normal way by the neo-cortex.

- Unconscious fear memories may be embedded in our neuro-circuits and be associated with Conditional Stimuli producing Conditional FEAR Responses. For example, tall men may make us afraid because in childhood a tall man repeatedly threatened us: we now feel threatened by all tall men as they have all become, unconsciously, Conditional Stimuli. (For a more accurate yet brief overview of this matter, see, for example, Ross 2010 p 275 under Extinctions: Example 2; and also see B10 on this website.)
- Note that when FEAR is activated, blood is preferentially directed towards our legs (Ekman & Dalai Lama - 2008 p 4).

The FEAR system is fundamentally implicated in:

- Generalised Anxiety Disorders
- "Neurotic Disorders"
- Specific Phobias
- Post Traumatic Stress Disorder

Panksepp 2009 p 11

### 2.3 Learning, FEAR, and SEEKING

When we are afraid, or anxious, clear thinking becomes difficult / impossible as some of our neo-cortical circuits are compromised (illustrated in Figure 10).

In the context of learning and education, this can be a serious problem. A child at school may feel that she /he is not very good at maths – and is asked a question. The question itself activates FEAR circuits and anxiety, as illustrated in Figure 5.

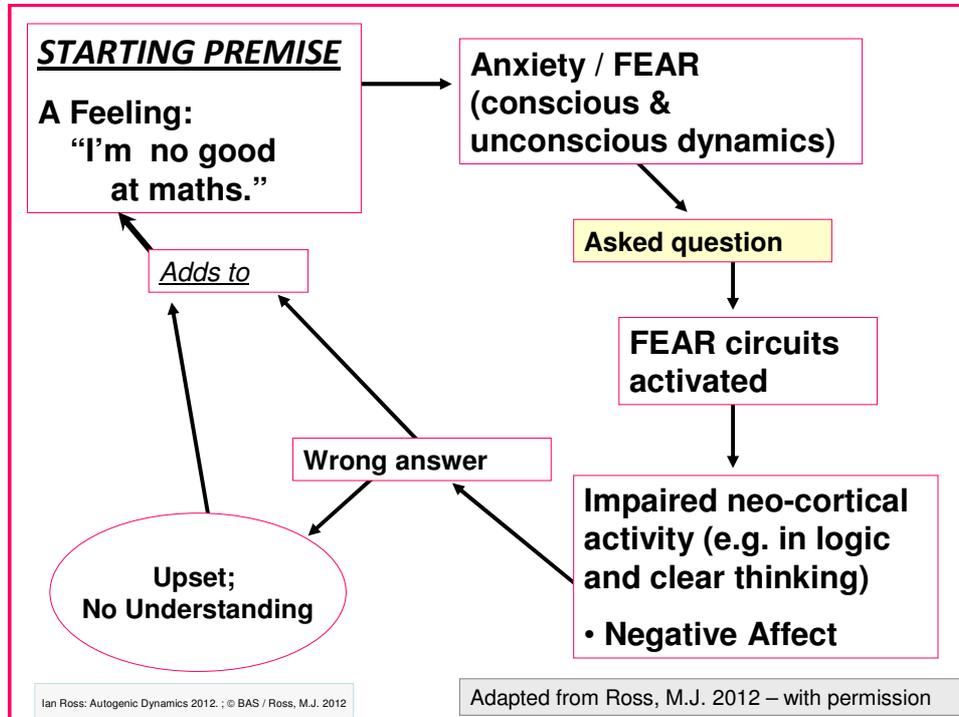


Figure 5

Negative feelings, fears, and cognitive performance  
(relating in this example to maths)

#### Comments on Figure 5

- Feeling negative / anxious / afraid reduces cognitive abilities.
- In this situation, we may be unable to answer a question or work out an answer that is actually within our potential.
- If we then give the wrong answer (with no discussion / explanation as to why it is wrong or what errors we made on the way to the wrong answer) this will add to our negative feelings and upset us more.
- Result: no learning and increased negative affect – leading to further feelings of inadequacy and perhaps worries about e.g. being ridiculed.
- This can all lead to a vicious downward spiral of self esteem and reduced learning.

Our fears of making a mistake, or being wrong, may be from maths to music – and will be greatly influenced by our own parenting – and in turn by our own confidence or otherwise when / if we are parents. This is well illustrated in 'Maths for Mum and Dads – *take the pain out of maths home work*' (Eastaway & Askew 2010).

On the other hand, if our parents and teachers approach learning and education from the perspective of facilitating understanding and curiosity – then there is no longer emphasis on whether we get a particular answer 'right' or 'wrong'. In this context our SEEKING system is uninhibited: if our answer is wrong (or right), we are curious as to why – we no longer see being 'wrong' as a failure.

In educational terms, the answer, whether it be right or wrong, is not the issue; the issue is: “Do we understand: do we understand why we get the wrong or the right answer?” In these terms, education and learning become intertwined with our innate curiosity – and thus with our SEEKING circuits. Figure 6 illustrates this.

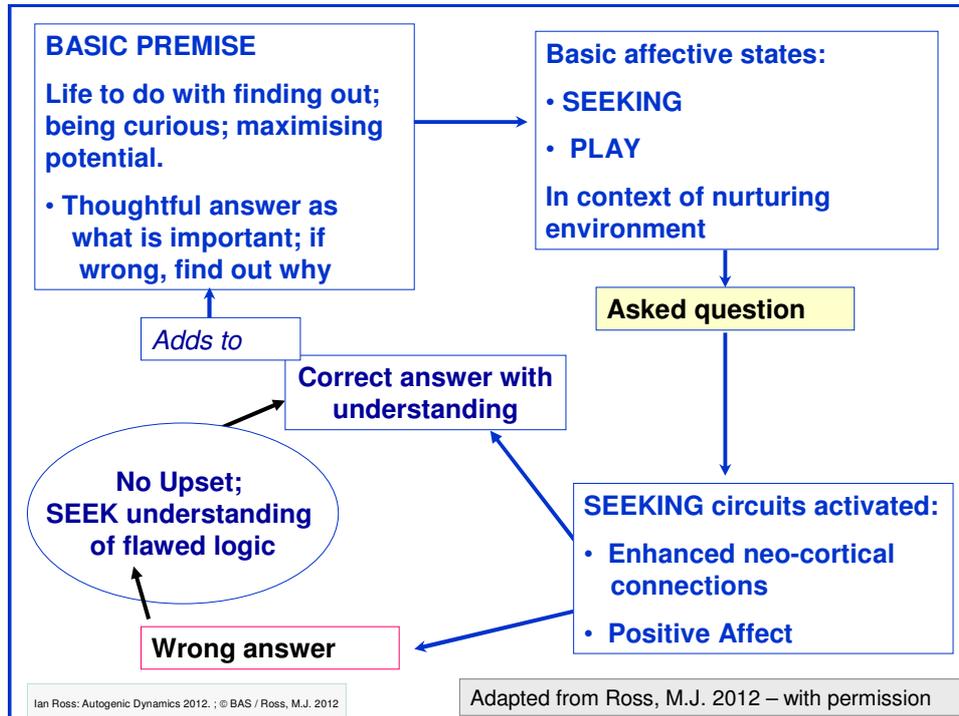


Figure 6

Positive feelings and curiosity facilitate learning, understanding and self esteem

Comments on Figure 6

- The essence of life and learning is interlinked with curiosity and SEEKING.
- Positive affect and understanding is the key.
- A ‘wrong’ answer becomes the road to greater understanding and self-awareness – and further SEEKING.

My brother Michael, on proof reading this paper, comments:

What I have read recently gives a parallel perspective on this.

- If young children are told they are *good boys/ girls* when they get something right, they automatically assume they are *bad boys/ girls* when they get something wrong! This is instilling a fixed mindset. Equally if someone older is told - *You have real talent, you are bright, you are more able and talented, you are a genius....* all this inhibits them from taking on challenges in case they are no longer seen as talented and bright.
- On the other hand, if the feedback is on the lines of effort and strategies, this instils a growth mindset which relishes a challenge. Some teachers now actively try to instil the growth mindset by describing how famous people did not easily get to the top but struggled and made huge efforts to achieve success. (For example David Beckham, Andre Agassi.)

This all relates to Attribution Theory and Locus of Control. If learners believe that intelligence / ability is *fixed* and *external*, that mindset will be self-confirming and they will not make progress. If, on the other hand, we can get learners to take responsibility rather than blaming others/ luck/ bad teachers etc., they are far more likely to develop a growth mindset in which they see intelligence / ability as fluid (i.e. not fixed) and *internal*, and personal effort is effective and *internal* – and will lead to greater understanding and growth.

Michael J. Ross in email 20.X.2012; slightly adapted and layout slightly altered  
Also see: Dweck 2000; Kamis & Dweck 1999

## 2.4 Antidote Modulators of FEAR

Some informational substances and some forms of mental training may reduce fears and FEAR-circuits, for example:

- Oxytocin
- Opiates on mu sites (Panksepp 1998 p 218)
- Beta-blockers – e.g. propranolol
- Meditation.

Meditation has specific effects on pre-frontal cortex circuits – which connect with the amygdala in such a way as to down-regulate the fear response<sup>9</sup> (Siegel 2007 pp 337- 345; Herwig et al 2010; Austin 2012; see also Figure 3 of B9).

## 3. RAGE / Anger System

### 3.1 Introduction:

In evolutionary terms, the RAGE system is linked to fighting (and the Fight part of the Fight and Flight response); in a confrontation between animals of different species, winning such a fight may provide the source of food for the next meal. As humans, if we allow our RAGE system to be activated, we may be setting in motion neural circuits that end up killing another person.

All of us alive today probably only exist because our ancestors had well functioning RAGE circuits that allowed them to defend themselves against external aggression.

- i. In modern day society, these neuro-circuits are often dysfunctional – that is, their activation will not resolve the types of problems we face (see iii. below).
- ii. Whatever the reason for the activation of RAGE circuits, this is associated with blood being preferentially directed to our hands (Ekman & Dalai Lama – 2008 p 41); this can potentially have disastrous consequences.
- iii. Severe Dysregulation of the RAGE circuits can occur as a result of childhood traumas (see e.g. Schore 2003C; Sunderland 2007). This means that these ancient neuro-circuits can become inappropriately “wired” and so result in severe emotion dysfunction. Panksepp comments:

“Aggressive irritability is also highly dys-regulated in trauma, both in terms of inappropriate aggression towards others as well as directed internally toward the self. For instance, when children are demeaned, ignored, sexually abused, or beaten, such domestic atrocities generate intense anger and irritability, often toward caretakers, but often also toward themselves.”

Panksepp 2009 p 11

Such feelings of intense anger and irritability will often be mediated by Conditional Stimuli that set in motion the RAGE (and FEAR) circuits. It is suggested that appropriate therapy for such traumas later in life has to involve a change in the underlying “whole-body-physiological-state” (see Dobbin 2011; and B10 & B11 in this series). Such therapies include PMT, Meditative Practices, and Autogenic Training.

### 3.2 Are anger / aggressive feelings liked by mammals / humans?

This may sound like an outlandish question; yet it is important.

#### Research Findings

Some of Panksepp’s research has used electrodes deep in the brain (e.g. in the hypothalamus in the case of anger / aggression responses) to elicit the seven EONS. The animal can then be taught to switch the

<sup>9</sup> This implies that regular practice of Mental Training – such as Meditation / Autogenic Training can reduce our fears and anxieties by reducing these amygdala neural activities.

electrode on – which the animal will tend to do only if the emotion in question is positive / liked. However, some emotions such as Aggression / Anger / RAGE can have different manifestations, for example:

- Anger / irritation (Hess type): every animal provoked “into that emotional display would voluntarily turn off the electricity if given the choice”.
- Predatory Aggression: “Whenever we applied that stimulation, the animal was willing to turn it on. We had animals that were not predatory, but they went and turned on the brain stimulation, and they attacked – in a predatory, quiet biting attack, stalking way – a prey species.<sup>10</sup>”

Quotes from Panksepp 2010 p 9

The implication is that deep within the brain in mammals and humans there are some rage / aggression circuits associated with catching / killing prey for food, and that these give the organism a positive feeling. In the human context, this may take on a particular significance in pursuits such as foxhunting, and in those being trained to fight / go to war (cf. Stevens 1989). Such predatory aggression may be epigenetically induced by developmental stressors / social breakdown. (See Schore 2012 pp 241-258 for the catastrophic effects of environmental degradation on elephants’ social groupings and behaviour.)

### 3.3 Modulators of RAGE circuits

Figure 5 illustrates some of the basic aspects of the RAGE systems in terms of neural networks / informational substances (e.g. neuro-transmitters)

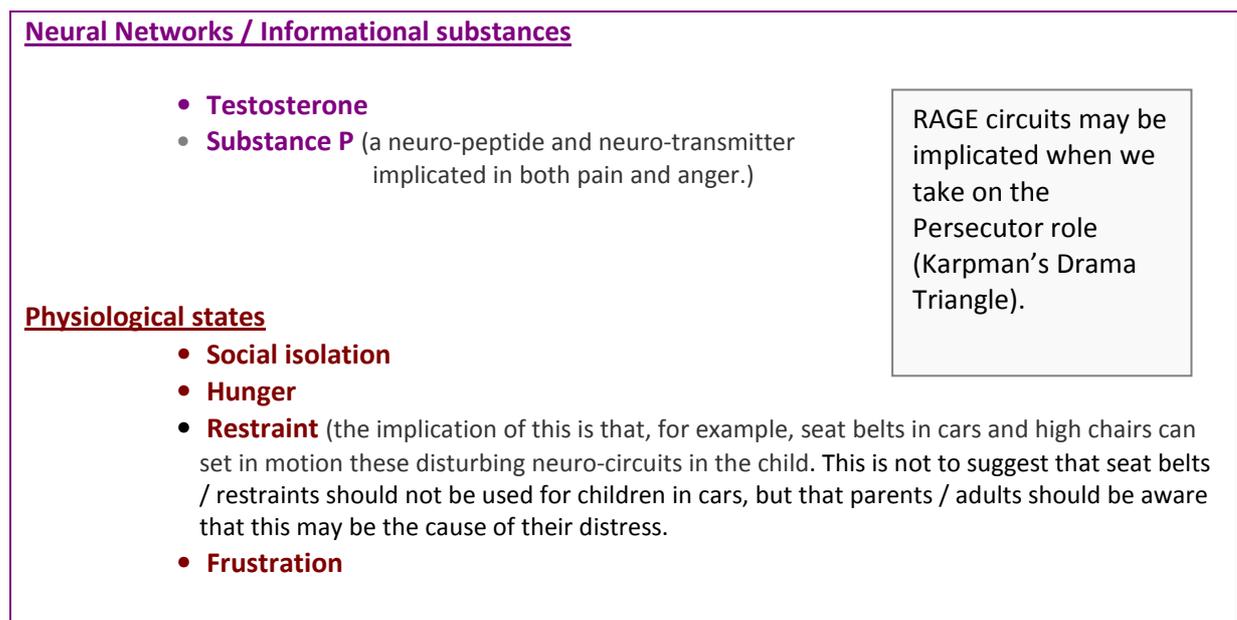


Figure 7

Basic neuro-physiological aspects of the RAGE system

### 3.4 Dysfunctional / inappropriate activation of RAGE circuits

As discussed above, the modern paradigm is that RAGE (and FEAR) circuits evolved to protect us – and hence facilitate the survival of our species. These same RAGE circuits can be activated inappropriately. The other evening after a long day, I was looking forward to going to bed; I was just getting into bed when I noticed that Chlöe (one of our cats) had been sick on the duvet cover as a result of a large fur-ball: momentarily, some irritation arose – and then the feeling of “This too will pass”, and I smiled and sorted the matter out.

<sup>10</sup> i.e. if specific areas of the brain were activated in non-preying species, the result was that they behaved / acted and had affect as if they were a prey species.

Activation of RAGE circuits in such situations as a cat being sick is dysfunctional; it has nothing to do with ensuring survival per se. Rather, if we allow our RAGE and FEAR circuits to be activated inappropriately, this will be associated with the release of mal-molecules (Ross 2010); and mal-molecules flowing through our being will distress ourselves, others, and may hasten death. Hence the importance of developing our skills in affect regulation<sup>11</sup>.

### 3.5 Antidote Modulators of RAGE

Certain informational substances and social factors act as anti-dotes to RAGE-circuits; these include:

- Oxytocin (related to CARE circuits)
- Progesterone
- Oestrogen
- Endorphins (endogenous opiates)
- Touch.

A disturbed and angry small child will be unable to regulate his or her rages and angers because their pre-frontal cortex is not yet sufficiently mature – and has not yet been exposed to sufficient experiential leaning through a nurturing and loving parent. The good-enough parent (Winnicott 1965; Bettelheim, 1987) will pick up and cuddle their distressed child: the settled neuro-circuits of the parent will then be transmitted through touch to the child: this over time will allow the child's own frontal lobes to mature appropriately – with the result that as the child grows and becomes an adult she / he will develop internalised and appropriate affect regulating circuits within the frontal lobes (Sunderland 2007; Liedloff 1975).

The CARE-circuits will also act as anti-dotes to RAGE (partially mediated through oxytocin). CARE-circuits are reinforced with appropriate Mental Training / Meditative approaches.

Note that the female response to threat can be one of "Tend and Befriend": the normal flight response is often maladaptive for women with children (Sapolsky 2007 p 608; Taylor et al 2000; see also Ross 2010 p 56 and webpage A1).

Primates, and humans in particular, have developed over aeons very sophisticated frontal lobes. "Higher cortical processes, especially in the frontal lobes" (Panksepp 2009 p 11) can inhibit the RAGE circuits. In particular, the activation of the medial Pre Frontal Cortex can reduce the activation of the RAGE circuits in the amygdala (Siegel 2007; also see B5), and thus reduce "internalised irritability, hatreds and resentments" (Panksepp 2009 p 11).

## 4. SEXUAL (LUST) circuits

### Preamble

Panksepp (Panksepp 1998) designates the Sexual EONS as LUST as a sort of shorthand: the actual chapter (12) is called: "The Varieties of Love and Lust: neural control of sexuality"<sup>12</sup>. In some ways I think SEXUAL is a better word for it, as lust is somewhat misleading when we are discussing this complex, potentially dangerous, but also potentially beautiful EON system. SEXUAL and SEEKING circuits are closely linked (Panksepp 2009 p 12; Panksepp & Biven 2012).

### 4.1 Introduction:

All higher animals have been dependent for their existence on the coming together sexually of their parents; and this coming together is linked in with what Panksepp describes as the LUST circuits, as mentioned above. These are highly complex neuro-circuits, and involve many neuro-chemicals – yet these circuits overlap to a remarkable extent in females and males (Panksepp & Biven 2012 p 258). What follows is highly simplified.

<sup>11</sup> (Pentlands Hill Walk 22.V.2012)

<sup>12</sup> In his 2009 overview, Panksepp designates this as the LUST / Sexual Systems (Panksepp 2009 p 12).

Love and Lust can be confused. The SEXUAL system embraces both. However, as we know, there can be lust without: love<sup>13</sup>, tenderness and understanding.

- In males, aggression and lust can overlap, and both are modulated by AVP (Arginine Vasopressin) and Testosterone (Panksepp 1998 pp 240-242). When sexual lust and love do not go together, great hurt and upset may of course result: and ultimately may lead to rape.
- In enduring relationships lust and love can coexist in harmony – leading to a fulfilling and wholesome relationship.

The SEXUAL system thus involves far more than lust. Long lasting sexual relationships embrace both sexuality and loving tenderness, and this is underpinned during sexual intercourse and orgasm by various hormones which are released – including oxytocin (in both women and men). Oxytocin is linked with nurturance and CARE circuits.

#### 4.2 Modulators of SEXUAL circuits:

Various informational substances and physiological states can modulate the sexual circuits, and these are summarised in Figure 6.

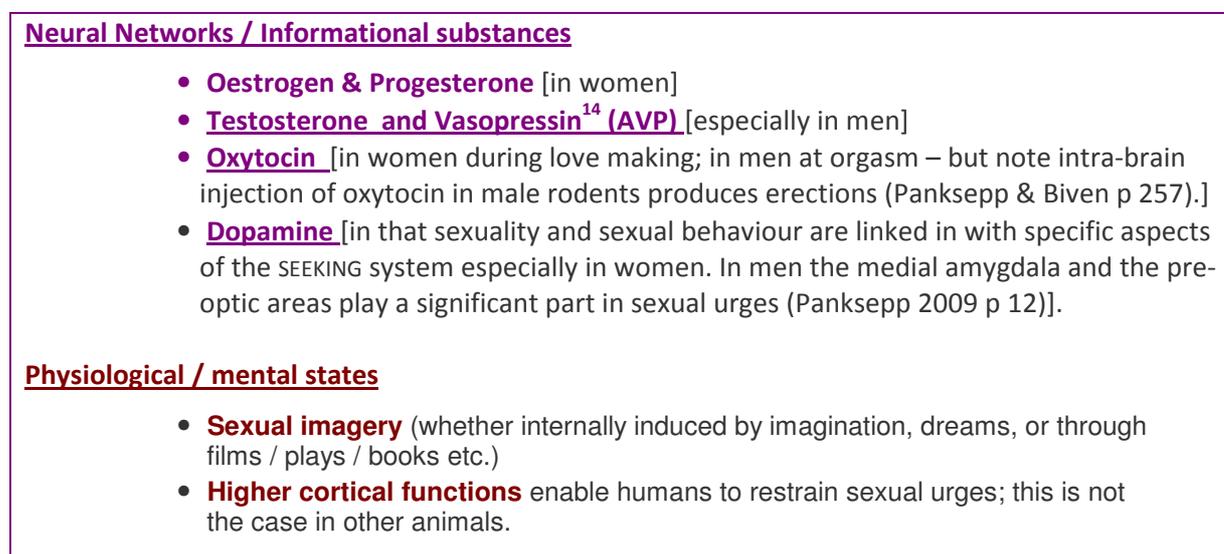


Figure 6

Some basic neuro-physiological modulators of the SEXUAL system

#### 4.3 Intra-uterine brain chemistries of the sexes and their impact on society

Brain development is highly dependent on the chemistries that exist in our brains before birth. It so happens that the default position, as it were, of human brains is the female brain. (Some call this the “no-fault” position – Panksepp 1998 p 225.) This feminine-type brain is associated with increased connections between the two hemispheres. This implies that the holistic integration of the two hemispheres may be more easily achieved in women than in men<sup>15</sup>.

The male-type brain develops in-utero under the influence of informational substances such as testosterone. This has many effects, including a reduction in the Corpus Callosum connections between the two hemispheres: thus, in later life, hemispheric integration (C6 and C7 on website) may be more difficult for men than women. The history of the (male dominated) western world in recent centuries suggests that this integration has not occurred, and thus our society has increasingly reflected the “rational, logical,

<sup>13</sup> Love here in terms of CARE-circuits: nurturing, cherishing, and understanding.

<sup>14</sup> AVP, or Arginine-Vasopressin to give it its full name.

<sup>15</sup> Note also that due to the complexity of the control factors modulating brain development before we are born, “it is quite possible for a male-type body to contain a female-type brain, and for a female-type body to contain a male-type brain.” (Panksepp 1998 p 225).

mathematical and thinking” domains of the Left Hemisphere. This may be one of the reasons that mankind is facing multiple problems including an inability to address the issue of climate change. For a sane society, we crucially need both left and right hemisphere functions to be balanced (see McGilchrist 2009; and C7 page 5).

- Adult male brains have higher levels of arginine-vasopressin (AVP) circuits.
- Adult female brains have more extensive oxytocin circuits.

Panksepp 1998; p 226

It can happen that intra-uterine brain sexual chemistries are altered through, for example, maternal stress, which can “hinder the normal process of masculinisation by desynchronising the underlying physiological processes” (Panksepp 1998 p 225). Similar disturbances in-utero can affect the feminisation of female foetuses. As a result, it is quite possible for a “male-type body to contain a female-type brain, and for a female-type body to contain a male-type brain” (Op cit p 225). Our subsequent sexual orientation may depend crucially upon the history of our intra-uterine brain chemistries. Whoever we are, our sexual feelings and orientations are fundamentally the result of brain neuro-chemistries. This means that there is no right or wrong, good or bad, concerning sexual orientation; our loves and sexual desires are not the result of any innate quality of ourselves, but rather we ride on the wave of our brain neuro-chemistries. In this light, sexual orientation discrimination results from brain neuro-chemistry illiteracy. Let us therefore feel blessed whatever our orientation, and honour it in love, nurturing, and understanding with whomever our beloved may be – and at the same time honour the relationships of those with different orientations.

#### 4.4 Trust, nurturing, long-standing intimate bonds and oxytocin

Normally, sexual intimacy only occurs when the couple feel safe – in other words, when there are no, or no perceived, external or internal threats. In this situation, the Para-Sympathetic Nervous System (PSNS) becomes active, while the SNS is depressed. This increased PSNS activity, in this context, is associated with two crucial aspects:

- It facilitates our Social Engagement system, that involves facial expression, eye contact, and tone of voice (Porges 2011 e.g. pp 14-17; see also A7 in this series)
- It results in increased sexual feelings and arousal.

The orgasmic phase is associated with SNS activity – see for example Sapolsky 1998 p 21.

Female sexuality is modulated from early on in foreplay by oxytocin – while in the male – oxytocin is associated with orgasm. Oxytocin facilitates care and nurturing – see CARE and nurturing circuits below.

There is some evidence that some aspects of our sexual behaviours may be learned (in a Pavlovian sense) – related to the release of vasopressin and oxytocin (Porges 2011 pp 176-177; 184). Brief sexual encounters – especially where the couple do not spend the night together – to some extent dilute the significance of the release of oxytocin during orgasm in the man (Porges 2011 p 184). If the couple subsequently separate quickly, then the nurturing bond that tends to develop under the influence of oxytocin is not there<sup>16</sup>. This means that there will be less chance of a neuro-physiological love-bond developing. Porges puts it this way: “.....promiscuous sexual activity need not lead to enduring bonds, if the sexual activity were physically active and both sexual partners limited periods of immobilisation<sup>17</sup>” (op cit p 184).

<sup>16</sup> See CARE and Nurturing circuits below.

<sup>17</sup> Extended periods of being still (“immobilisation”) during love making facilitates the “monogamy switch” and the development of conditioned love – again in the Pavlovian sense (Porges 2011 pp 183-184). On the other hand, many individuals may focus on the seduction side of sexual encounters, “and opt for relationships that are not monogamous” (op cit. p 183). Such encounters will tend to be brief with few or no periods of prolonged stillness.

On the other hand, if the couple stay intimate and close for some time (e.g. overnight) then the nurturing and caring circuits released by oxytocin increases the bonding at a neuro-physiological and psychological level<sup>18</sup>.

Research suggests that men and women in hetero-sexual relationships differ somewhat in what distresses them most in terms of infidelity. Women are most distressed by their partner's emotional infidelity; men, on the other hand, are most distressed by their partner's sexual infidelity<sup>19</sup> (Porges 2011 p 185, quoting the work of Buss et al 1992).

All of the above suggests that our sexual mores and sexual "ethics" may in some senses be determined by our sexual behaviours – which then neuro-physiologically reinforce the decisions and activities (and ethics) we have taken. This is a sort of warning to us that our ethics can be neuro-physiologically determined. On the other hand, can we envisage a Mindful Ethic in these matters? The answer is, I think yes – but then our emerging ethic will at least in part be oxytocin and nurturing circuits dependent. Plato's concept of forms suggests a pre-human consciousness aesthetic. The present neuro-physiologically informed idea would be that ethics and neuro-physiology are intimately related.

#### 4.5 Oxytocin and Peaceful Coexistence (sub-heading – Panksepp 1998 p 257)

Human relationships – including sexual dynamics – are complex and diverse. Parental CARE circuits, love, nurturing physical touch, and tenderness can facilitate the development of appropriate Affect Regulation in the growing child. Lack of such nurturing can lead to Affect Dysregulation in the child and teenager (Sunderland 2008).

Panksepp comments:

The chemistries that promote pleasure and family values are also able to dramatically reduce irritability and aggressiveness. It has long been known that human societies that encourage physical closeness, touching, and the free flow of intimacy tend to be the least aggressive in the world. For instance, it has been documented that societies that exhibit high levels of physical affection toward infants and children and permit premarital sex are generally low in adult physical violence, while those that are low in physical affection and punish premarital sex tend to be more violent (Prescott 1971).

Panksepp 1998 p 257

Whether this perspective / research is compatible with the matters discussed in section 4.4 above is perhaps a relevant subject for further research.

## 5. CARE / Nurturance circuits (based on Panksepp 1998 / 2009)

### 5.1 Introduction:

Nurturance and care of offspring is essential for many animal species, especially mammals and humans. The CARE circuits are linked in with our Social Engagement circuits (Porges 2011 e.g. pp 14-15 – and see A8 in this web series).

The touch of a baby on her / his mother's skin releases oxytocin from the mother's brain, and this oxytocin facilitates nurturing behaviour by the mother, and is crucial to the CARE circuits. These circuits are

<sup>18</sup> Lovemaking normally occurs with some immobilisation – especially in the woman – and this is "immobilisation without fear" (see A7 page 10 Figure 3 part 5). The love bond develops through trust, feeling safe and the secretion of oxytocin; if the trust is lost, then especially for the woman "immobilisation without fear" becomes impossible – and actually becomes "immobilisation with fear", or *mobilisation* of the FEAR or RAGE systems (Porges 2011 p 183).

<sup>19</sup> At the extreme end of this spectrum, research from animal studies suggests that pathological jealousy in men may be neuro-chemically determined in the form of vasopressin being released during sexual activity (Panksepp 1998 p 242).

particularly activated in breast-feeding; and also in gentle love-making (Panksepp 1998; Uvnäs-Moberg 1998; 2004; Ross 2010 p 141 including Figure 4.2A: “Binti the gorilla” from Panksepp 1998 Figure 13.3).

Note that some aspects of play in childhood are mediated by these same CARE circuits – which are foundationed on oxytocin. For example, a young girl tenderly playing with her doll and toy pram (see also Sunderland 2007).

CARE circuits are of central importance in many domains of life including:

- The development of a healthy mother-infant relationship
- In family life in general
- Between couples / partners
- For social cohesion and well being
- Sympathetic Joy [mudita: rejoicing in another’s happiness / good fortune] (Salzberg 1995 Ch 8)
- In counselling / psychotherapy (Blatt et al 1996; Rogers 1961)
- For wider issues such as care and concern for the environment and our planet.

### 5.2 Modulators of CARE circuits:

There are various modulators and enhancers of CARE circuits, as outlined in Figure 7.

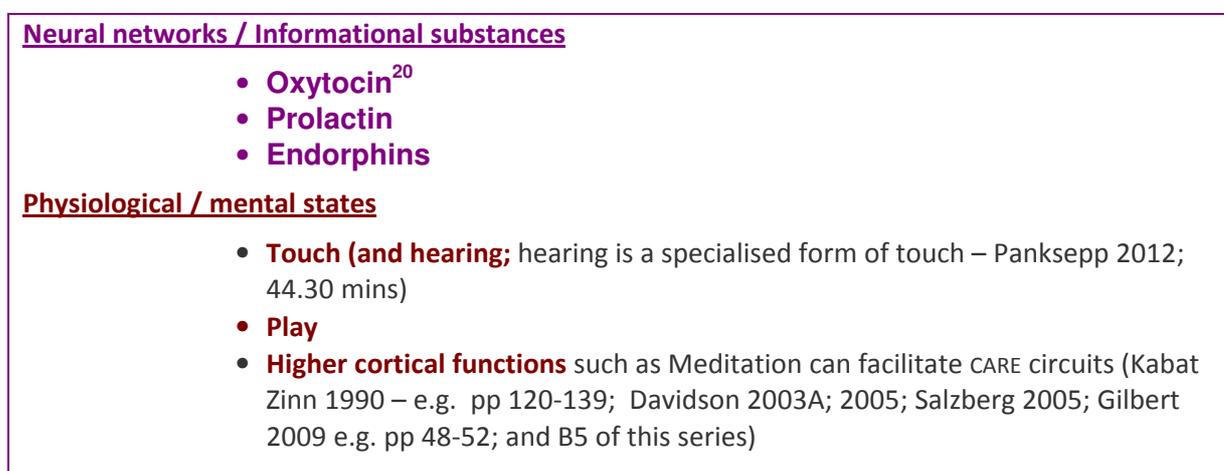


Figure 7  
Modulators of CARE circuits

Research over the last couple of decades has shown that our brains are far more “plastic” than previously envisaged – not just in infants but also in adults<sup>21</sup>. This means that the actual development of our EONS from childhood onwards is crucially dependent upon our internal and external environment. This aspect is particularly important in the CARE circuits of parents in the context of the effect this will be having on the developing brains (and thus the developing EONS) of their off-spring in psychological, neuro-physiological, sociological, and epigenetic terms (see for example Sunderland 2009; Knox 2011 e.g. pp 1-18; Panksepp & Panksepp 2000). Panksepp is concerned that some Evolutionary Psychologists overlook these neuro-physiological and epigenetic dynamics (op cit). For the infant and child, the greatest positive modulator of their developing CARE and other EONS will be the psycho-biologically attuned parent (Schore 2003B & C).

### 5.3 Psycho-therapy and CARE circuits

In the context of counselling and psychotherapy, a positive therapeutic relationship (as perceived by the client / patient) can have an important role in a positive outcome. Research by Blatt et al (Blatt 1996)

<sup>20</sup> Note that oxytocin is also a positive modulator of the LUST / SEX circuits; Panksepp suggests that the CARE system grew out of the sexual circuits – thus sexual pleasure was co-opted for the CARE and nurturance and maternal feelings (Panksepp 2011 32.00 minutes: “The evolutionary understanding of the brain is that the maternal CARE system grew out of the LUST system”; they share certain neuro-chemistries).

<sup>21</sup> For example, see Lüscher et al 2000; and Ross 2010 pp 115 – 123, which is based on the work of Rossi 2002; 2004.

showed that in depression, where the client has *moderate* levels of perfectionism (rather than very high or very low levels), the quality of the relationship as perceived by the client / patient has a significant effect in reducing depression. This was measured using the Barrett-Lennard Relationship Inventory (BRLI), which has been well validated and is based on Carl Rogers' (e.g. Rogers 1959; cited by Blatt 1996; and Rogers 1980 e.g. pp115-117) key concepts of the therapist's:

- Empathic understanding;
- (Positive) Level of Regard;
- Unconditionality of Regard;
- Congruence (see below).

Congruence here is the extent to which our Self-Image overlaps with our Ideal-Self. If we have a poor Self-Image, which is nowhere near our Ideal-Self, this is regarded as incongruent. If, on the other hand, our Self-Image significantly overlaps with our Ideal-Self, this reflects internal congruence (McLeod 2007), and will mean that it is easier for us to "Self Actualise" (Maslow 1954<sup>G-M</sup>) – see Figure 8.

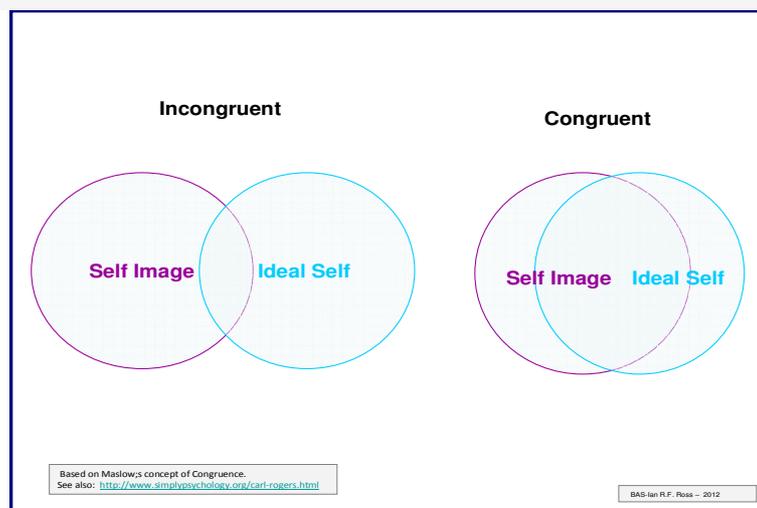


Figure 8  
(Based on Saul McLeod 2007)

Congruence and Incongruence in relation to Self Image and Ideal Self

Comment on Figure 8

If our Self Image and Ideal Self overlap very little, then Personal Development (in a spiritual sense) and Self Actualisation will be difficult.

As the Self Image and the Ideal Self increasingly overlap, Self Actualisation becomes more and more possible: the SEEKING system has found a Way.

Note that Maslow's concept of Self Actualisation overlaps to some extent with the concept of our "Authentic Self", in which there will be an increasing overlap between our Self-Image and our Ideal Self. It is suggested that Mental Training such as Meditation and Autogenic Training (AT) will facilitate the process of increasing internal congruence. A poor Self-Image may reflect a hyper-vigilant state of our body – and AT will tend to settle such states (see B11 in this series – especially Figures 3 and 4). With increased congruence, we will be more able to nurture and care for ourselves and others.

The positive outcome (in the Blatt study) was independent of whether the client was receiving CBT (Cognitive Behaviour Therapy) or Interpersonal Therapy (IPT). Carl Rogers' key concepts cannot be realised without our CARE circuits. It is likely that the outcome in Autogenic Training will also be significantly

<sup>G-M</sup> My understanding had been that Maslow coined the term Self-Actualise / Self-Actualisation. However, Rogers (1951 p 489) cites Goldstein as originating the term (Goldstein 1940).

influenced by the quality of the therapist – client relationship (as perceived by the client; see also Rodin 2005).

Feeling safe and secure will facilitate activation of our CARE circuits – and this overlaps with the Soothing and Contentment system highlighted by Gilbert (Gilbert 2009 – p 24; and B16). In these situations, there will be increased activity of the myelinated ventral vagal Para-Sympathetic Nervous System (PSNS) in terms of Porges' Polyvagal Theory (see Porges 2001; 2009; 2011; Schore 2009). This myelinated part of the PSNS is closely linked in with our Social Engagement system which facilitates eye contact, facial expression, and tone of voice (Porges 2011 e.g. pp 14-19; A7 and A8 in this series).

Meditative type disciplines activate the Left Frontal Lobes on EEG, and this is associated with increased positive emotions – such as these CARE circuits (see also B5). At the same time, the increase in Left Frontal Lobe activity inhibits negative and destructive emotional circuits – by down regulating, for example, fear dynamics in the amygdala (Davidson 2003A; 2003B<sup>(p 337)</sup>; 2005; and Goleman 2003).

## 6. PANIC / DISTRESS / GRIEF System – overlapping with Sadness (based on Panksepp 1998 / 2009<sup>22</sup>)

### 6.1 Preamble

In his chapter on “Brain Emotional Systems and Qualities of Mental Life” Jaak Panksepp (Panksepp 2009) makes it more explicit (than in Panksepp 1998) that the PANIC system could also be called the GRIEF / DISTRESS system; all are related to Separation Distress states originating in childhood<sup>23</sup>.

Mental distress is a common feature in those coming for counselling / psychotherapy / AT; and forms of treatment for such distress often embrace other EONS such as CARE and PLAY. For this reason, this section is the longest in this review of Panksepp's work.

### 6.2 General Introduction to Separation Distress and GRIEF / DISTRESS / PANIC Circuits

Panksepp links PANIC circuits to Separation Anxiety that we will all have experienced in early childhood; these circuits are distinct from FEAR circuits. Separation Anxiety may, of course, be precipitated by either physical separation or psychological estrangement (where the mother may be present physically) – or both.

When young children get lost, they are thrown into a PANIC because they possess separation-distress circuitry, a major source of psychic *pain*. They cry out for care, and their feelings of sudden aloneness and distress reflect the ancestral neural codes of the separation-distress system from which adult sadness and grief are constructed.

Panksepp 2009 p 13

So separation distress is associated with sadness, and can at times lead to, or verge on, PANIC and panic attacks (Panksepp 1998 p 261; Panksepp 2008 pp 54-56).

Mammals (and humans) have evolved with these Separation Distress circuits, which alert the mother to her offspring's physical or psychic separation, and activate her (the mother's) CARE circuits. The

<sup>22</sup> Panksepp 1998 describes this as the PANIC system; Panksepp 2009 extends this to embrace PANIC or GRIEF / DISTRESS (Panksepp 2009 pp 13-16).

<sup>23</sup> In his most recent publication, Panksepp, referring to the use of the term 'PANIC circuits', states: “.....many readers found the label confusing, probably because when older people are deprived of companionship, they tend to feel lonely and sad rather than panicky like little children.” (Panksepp & Biven 2012 p 315).

child's distress is normally settled once she / he is back in the arms of her / his mother. Primate parents keep in close physical contact with their younglings – including at night, when they sleep together (Sunderland 2007 p 70). This is the default EONS position.

All primates except humans co-sleep with their young as a matter of course..... Leaving a baby sleeping on its own (solitary sleeping) is only a very recent shift for human kind. For most of their two million years of evolution, humans have co-slept with their babies.

Sunderland 2007 p 70

Sunderland goes on to say:

Studies have shown that the majority of babies in South East Asian families sleep with their parents at night. Some researchers believe that this factor may be linked to the low incidence of SIDS (Sudden Infant Death Syndrome) in South East Asian populations. In China, where co-sleeping is taken for granted, SIDS is so rare it doesn't have a name.

Sunderland 2007 p 74

This implies that the western practice of having our younglings sleep in a cot in another room is inappropriate. In recent decades, western cultural norms seem to have trumped two million years of wise evolutionary practice. The idea that a distressed child in a cot can be left, as it will eventually fall asleep, is based on a gross misunderstanding of what is going on neuro-physiologically. Prolonged crying is alerting us to the child's distress, which can only be relieved by physical contact and checking for obvious upsets (such as a nappy needing changing). A crying child left alone will fall asleep – as a result of the feeling of abandonment eventually leading to exhaustion (Sunderland 2007 p 38): which may be partially mediated by activation of the un-myelinated vagal PSNS activated in the Freeze Response that is associated with "behavioural shutdown" (Porges 2009 pp 44-45 and A8). Each time this happens it reinforces the Separation Anxiety / PANIC / DISTRESS circuits, and over time this may pre-dispose the child, years later, to depression and prolonged grief reactions.

In certain 'primitive'<sup>24</sup> societies, such as the Yequana of South America, babies / small children are kept constantly in their mother's arms (or carried in a sling next to her body). This predisposes the child to on-going affect regulation and may help to reduce behavioural and emotional problems later in life (Liedloff 1975 / 1985).

Panksepp (2009 p 14-15) considers that the PANIC / DISTRESS system is active in many forms of depression; and of course, loss and grief can precipitate depression. As implied above, if we have suffered from recurrent Separation Anxiety in childhood, this may predispose us to depression – and prolonged grief reactions following the death or protracted illness of a spouse / partner.

### 6.3 Modulators of Separation Distress and GRIEF/PANIC Circuits

There are various modulators of PANIC / Separation Distress circuits and these are summarised in Figure 8 on the next page.

<sup>24</sup> Here used in the context of admiration for such aboriginal societies; there are some very primitive (in a negative sense) features in modern western society.

### Neural Networks / Informational substances (i.e. inducers of distress etc)

- Corticotrophin Releasing Factor (CRF) &
- Cortisol
- Withdrawal of Endorphins
- ? glutamate

### Physiological / mental states

- Separation from parent
- Stressors
- Loss and Bereavement

### Inhibitors of Separation distress / loss

- Oxytocin
- Prolactin
- Beta-endorphin
- Caring Support
- CARE and concern for another human being

Figure 8

Modulators of Separation Distress and GRIEF / SADNESS / PANIC Circuits

#### 6.4 Antidotes to PANIC and Panic attacks

As indicated in Figure 8, certain informational substances and social factors act as antidotes to Separation Distress / PANIC-DISTRESS circuits; these include:

- Touch and Nurturing (touch releases brain endorphins, oxytocin, and probably prolactin (Panksepp & Biven 2012 p 318).
- Comforting sound / Voice / Music
- Beta-endorphin – an endogenous opiate (on mu receptors)
- Oxytocin
- Prolactin
- Imipramine (an older type anti-depressant)

#### 6.5 Loss and Separation Distress

Bereavement / Loss of a loved one can reactivate these Separation Distress circuits, and is associated with feelings of profound sadness – which have been shown to be associated with opiate (endorphin) withdrawal states (Panksepp 2008 p 55; Zubieta et al 2003). Knowledge of the stages of bereavement is no antidote to loss. Close relationships are linked to the release of oxytocin, prolactin, and endorphins – so the death or severe illness (e.g. catastrophic stroke [CVA], advanced Alzheimer's disease) of a loved one can lead to a fundamental change in our neuro-chemistries.

The subtle feeling of social presence is almost undetectable, until it is gone. We simply feel normal and comfortable when we are in the midst of friendly company, and that same feeling becomes warmer when we are among those we love deeply..... We often take these feelings, like air itself, for granted. But we should not, for when this feeling of normalcy is suddenly disrupted by the undesired loss of a lover or the unexpected death of a loved one, we find ourselves plunged into one of the deepest and most troubling emotional pains of which we, as social creatures, are capable. In everyday language, this feeling is called sorrow or grief, and it can verge on panic. At a less acute but more persistent level, the same essential feeling is called loneliness or sadness. This psychic pain informs us of the importance of those we have lost.

Panksepp, 1998, p 261,  
at the start of Chapter 14 on:  
Loneliness and the Social Bond: *The Brain Sources of Sorrow and Grief*.

Separation Distress neuro-circuits in various different mammals are more or less identical, and these same areas light up in PET (Positron Emission Tomography) during human sadness (Panksepp 2008 p 55; Damasio et al 2000). (Areas involved are from the Anterior Cingulate to Peri Aqueduct Gray – PAG). Thus our mental distress in loss is precipitated by changes in our neuro-chemistries. This is not to say or imply that our feelings are purely determined by our neuro-chemistries, or that our feelings are nothing but the conscious manifestation of neuro-chemistries. Rather, the two are co-dependent; thus the model of cause (neuro-chemistry) producing the effect (feeling) is inadequate. Our feelings also cause and change our neuro-chemistries. Eastern philosophies have been aware of this inter-dependence of all things for millennia: it is sometimes called Dependent Origination (Dalai Lama pp 35-49) or Inter-dependent Co-Arising (Hanh 1998 pp 221-249).

Separation Distress / sadness will tend to impair our Social Engagement System. Our myelinated vagal PSNS system is intimately linked with positive Social Engagement, which will tend to be de-activated in times of loss and distress (Porges 2009 pp 44-45; Porges 2012 – e.g. pp 11-51; and A8 of this series). In addition, such loss, over time, may lead to an increased activation of the un-myelinated vagal PSNS with resultant feelings of despondency and giving up (Porges op cit; Frankl 1946; and A8). In any event, the stressors that occur with loss will tend to activate Corticotrophin Releasing Factor (CRF) from the hypothalamus, which increases Separation Distress (Panksepp 2008 p 55).

On the other hand, oxytocin and prolactin have a calming effect, and are released in situations of Social Engagement and with close physical touch and CARE. Some of these positive effects may be partially mediated by endogenous opiates – endorphins (Panksepp 2008 pp 54-56). The loss of a close partner can thus have multiple effects; for example, not only can it be very stressful per se, but in addition, the close physical relationship that may have sustained the partners through the ups and downs of life over decades – with not infrequent releases of oxytocin – is no longer. This can result in a grave loss in Social Engagement.

#### 6.6. Overlapping of CARE and PANIC circuits

CARE and PANIC circuits are interlinked. That is, when a psycho-biologically attuned mother (Schoore 2003C p 19) hears the distress calls of her child, this will activate her own CARE circuits (Panksepp 2009; Ross 2010 pp 173-193 – ‘Affect Regulation, the Infant-Mother Dyad, and Autogenic Therapy’). As indicated above, cultural norms can derail these CARE circuits; when in doubt, a mother needs to listen to her heart, not the cultural conventional wisdom (e.g. Liedloff 1975 / 1985).

When we are, from time to time in our lives, in need of nurturing / psychotherapy, there will often be some sense of loss or grief and / or feeling abandoned: in other words, just the states that set in motion Separation Anxiety. Panksepp comments on the role of therapists:

If therapists cannot assume the interpersonal stance in which they resonate with the psychic pain of the client, there can never be that sense of trust that is critically important for the healing touch.....

.....The attitude of CARE – nurturant verbal guidance through the affective possibilities of life – is essential for the empathic stance that is essential for therapy.

Panksepp 2009 p 14

CARE circuits are interlinked with Resonance Circuits (Siegel 2007; 2010; and see C3); and with Rogers’ key concepts of psychotherapy – including congruence (see section 5.3 above; and Rogers 1959).

### 6.7. Mind, Affect and Human Distress

Cognitive and drug approaches have tended to dominate psychiatry and psychology in recent decades. Recent research in neuro-science indicates that a cognitive approach alone is inadequate in treating human distress.

The prevailing cognitive view of mind remains starkly incomplete without the affects. A common belief among cognitively oriented scholars, albeit not therapists who deal with troubled human lives, is that being scared (derived from the basic feelings of fear) is caused largely by the way people think. That is the more obvious part of cognitive-affective dynamics. The alternative they rarely consider, which every physician must face, is that FEAR-ful, RAGE-ful and PANIC-y feelings have a mind of their own, a raw affective consciousness, that interacts with, and can run roughshod over, cognitive awareness.

Panksepp 2009 p 18

As mentioned in the Preamble to this paper, and discussed more fully in B3 Part I, FEAR, RAGE, and DISTRESS circuits (and all EONS) are primary process systems that originated, in evolutionary terms, aeons before the neo-cortex developed. Hence, as Panksepp emphasises, they can have a mind of their own. Such “raw affective consciousness” is often the backdrop of those suffering from Medically Unexplained Symptoms (see Dobbin & S. Ross 2012; B10 & B11). Loss and psychic pain should, properly speaking, be considered as whole-body-mind-physiological states. Acceptance is of course a key factor in coming to terms with grief – yet acceptance on its own may not dissolve the whole-body-mind-physiological distress. An aspect of the acceptance is that the loss is loss.

In order to restore a wholesome mind-body-physiological state, it is suggested – based on underlying physiological principles – that social engagement activities, CARE, and PLAY are considered for on-going healing and restoration (see for example Porges 2009; and A7 of this web series). This theme is developed further in section 6.9 below.

### 6.8. Neuro-physiological reflections on the Intentional Off Loading Exercises and Grief

Many students / practitioners of Autogenic Training have benefited from the Intentional Crying Exercise. In my AT groups I previously, but now feel erroneously, also called this the Intentional Off Loading of Grief exercise. It is erroneous because I do not feel that it is in essence to do with Off Loading Grief; however, it is to do with off loading Crying Need Symptoms (Luthe 1982) – which may of course be related to unresolved grief.

Jane Bird, an Autogenic Therapist, introduces this exercise by reading out the list of Luthe’s Crying Need Symptoms, and then asking for a show of hands in the group as to how many have experienced one or more of these symptoms. Usually most in the group have (personal communication 2012).

From some perspectives, the Intentional Crying Exercise can be seen as the archetypal Off Loading Exercise – as it simulates the emotional catharsis that experience shows can greatly relieve pent up feelings and distress.

On the other hand, from an evolutionary and Separation Anxiety perspective (and thus in the context of explicit grief / bereavement), it has limitations. The purpose of Separation Distress (i.e. its vocal and behavioural manifestations) is for the infant / child to be re-united with her / his mother (or carer); it is this in-arms physical reunion that brings about the required affect regulation of the distressed child<sup>25</sup> as a result of the physiologically attuned mother passing her calmness on to her child through physical contact (Sunderland 2007). As adults, we too may require similar physical and “in arms” support. See also Susan Hill

<sup>25</sup> and not, of course, the crying per se.

and her insightful and beautiful book: “In the Springtime of the year” – e.g. p 135. The extent to which “closure” is an appropriate concept with regard to the loss / death of those very close to us is problematic – see for example Melnick & Roos 2007. So rather than closure, a more helpful idea / approach may be to be compassionate and CARING with ourselves when we are bereaved and lost (see also A8 page 7 in this series).

### 6.9. Therapeutic approaches to loss/human distress

- Nurturing psycho-therapies can all be considered in terms of “Affective Balance Therapies” (ABT – Panksepp 2009), and these have the potential to activate healing neuro-circuits. Client centred therapies such as those developed by Carl Rogers have as their essence a nurturing and CARE approach. It may well be this that resulted in the findings of Blatt et al (cited above, Blatt et al 1996) – i.e. that for specific groups suffering from depression the most important indicator of a good outcome was the quality of the relationship as perceived by the client – rather than the specific form of psychotherapy (CBT or Interpersonal Therapy – IPT).
- Rodin has emphasised the importance of the therapeutic relationship between those being taught AT and the Autogenic Therapist (Rodin 2005).
- Regular meditative-type practices can help dissipate some of the precipitators of separation anxiety and PANIC – and thus can be considered as a form of ABT. Each time we do an Autogenic Standard Exercise sequence, or a brief exercise such as a Partial Exercise, we are helping to create in our being cascades of eu-molecules (Ross 2010 e.g. p 275) that can act as anti-dotes to DISTRESS and grief.
- In effect, these practices are activating our own internal Soothing and Contentment System (Gilbert 2009 – e.g. pp 23-30; Gilbert 2010); with the potential release of oxytocin and other mediators of the CARE circuits. See also A8 pp 11-13 and B16 of this series.
- Integration of our feelings and emotions is seen as crucial to our Well-Being (Siegel 2009; 2010)

Figure 9 summarises some of these dynamics.

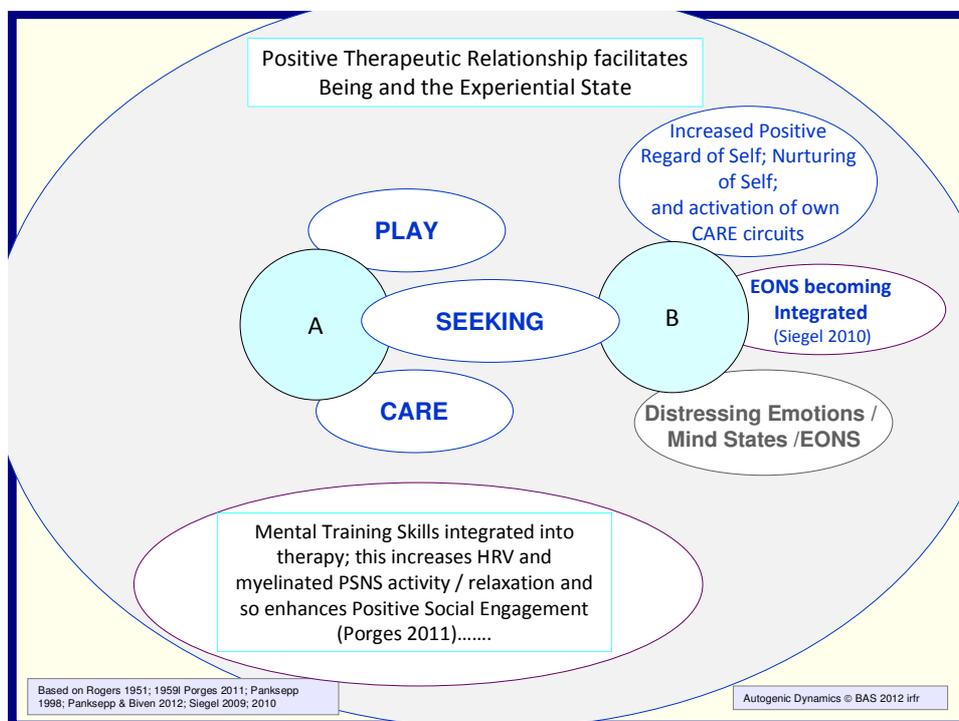


Figure 9

Some suggested modalities involved in psycho-therapeutic healing

Some comment on Figure 9

- i. A represents the psychotherapist, B the client / person seeking help.
- ii. B is seeking help ...
- iii. .... and A is seeking to help Affect Balance in B.
- iv. These dynamics will be foundationed on SEEKING, CARE, and PLAY circuits – the latter two initially coming mainly from A.
- v. This implies that aspects of the relationship may be re-creating aspects of the early parent-child dyad (consciously or unconsciously; these may have positive and / or negative resonances requiring further exploration / investigation).
- vi. The outer blue line representing the therapeutic relationship extends out of the frame of the Figure, indicating re-integration with the outside world during therapy.
- vii. Mental Training as an integral part of the psychotherapy can help facilitate the development of B's Soothing and Contentment System mentioned above (Gilbert 2009), which in turn acts upon B's own CARE circuits. This in turn will facilitate positive Social Engagement – which is often lacking when we are distressed.
- viii. Integration of our (negative and positive) feelings and emotions is seen as crucial to healing and our Well-Being (Siegel 2009; 2010), and this is facilitated by a healthy therapeutic relationship and by regular Mental Training.

7. PLAY circuits /



PLAY is linked in closely with SEEKING circuits, and in an evolutionary context, “it takes the form of a predatory practice (such as when a kitten toys with a ball of yarn” (Panksepp & Biven 2012 p 354).

### 7.3 PLAY Circuits, the Autonomic Nervous System and Social Engagement

In PLAY, there is a bio-dance between the Myelinated Vagus and the SNS (Porges 2009; and A7 page 10 Figure 3). We play when we are feeling safe: “If young animals are healthy and feeling good, they almost invariably play together when given the chance” (Panksepp & Biven 2012 p 355). This all implies that there is a close relationship between PLAY, Social Engagement, Positive Affect (Burgdorf & Panksepp 2006), the Myelinated Vagal system and the SNS – i.e. combining Panksepp’s research and insights with those of Porges’ Polyvagal Theory (Porges 2009 pp 50-54).

When we play a game such a badminton, there is an on-going modulation between physical activity (e.g. making a forceful shot with our racket) which is underpinned by SNS activity (Porges 2009 p 50), and staying relaxed and cheerful between shots (modulated by the myelinated vagal system and its associated Social Engagement System – Porges 2009; 2011; and A7 & A8 of this series); this myelinated vagal system is closely linked in to non-verbal communication such as our facial expressions (Porges 2009).

In play there is thus a reciprocal relationship between SNS activity (associated with increased heart rate), intermittently putting a brake on the heart rate via the PSNS myelinated vagal system (the vagal brake), and the closely interlinked modulation of non verbal communication through, for example, eye contact, head movements, and our facial expressions (Porges 2009 pp 50-54; and A7 in this series).

This means that, in play, facial expressions that convey fun and good-will are reciprocally communicated between the players – such that both SNS activity and PSNS myelinated vagal activity are kept in a dynamic balance (see A7 Figure 2) in all the players – or at least that is the ideal we are aiming for – if play is to remain within the domain of PLAY, and not tip over into frustration, irritation, FEAR or RAGE. As implied above, Porges, in his Polyvagal theory, states that the myelinated vagal system is closely inter-related with our Social Engagement System, which embraces the modulation of our facial expression, eye movement / contact, head movements, and the intonation and rhythm of speech (Porges 2009; 2011 e.g. p 15; A7 ). In so far as Positive Social Engagement is a fundamental aspect of PLAY, and oxytocin facilitates such social engagement (Porges 2012 e.g. p 292), we can add oxytocin to the informational subjects that facilitate PLAY.

---

## 8. Post Script

### 8.1 Emotions as described by Ekman /

## 8. Post Script

### 8.1 Emotions as described by Ekman

This review of the specific Emotional Operating Neuro Circuits described by Panksepp has included some of the underlying processes that allow Mental Training – such as Meditation and Autogenic Training – to be effective.

Now of course Panksepp's classification leaves out a whole range of emotions that we are familiar with. Not all cultures have words for less common emotions: if there is not a word in our particular culture for a particular emotion, we may be at a loss to explain how we feel to ourselves and others. Ekman, having studied *those emotions that can be recognised by facial expression cross culturally*, (see page 1), went on to describe a total of seventeen<sup>28</sup>, which are:

<b>Happiness</b>	<b>Anger</b>	<b>Surprise</b>	<b>Sadness</b>	<b>Fear</b>	<b>Disgust</b>
<b>Amusement</b>	<b>Contempt</b>	<b>Contentment</b>	<b>Embarrassment</b>	<b>Excitement</b>	<b>Guilt</b>
<b>Pride</b> (in achievement)	<b>Relief</b>	<b>Satisfaction</b>	<b>Sensory pleasure</b>	<b>Shame</b>	

Figure 9  
Emotions described by Ekman 1999  
(and elsewhere)

### 8.2 Ekman, Darwin and primary process emotions

Ekman's work consolidates and reframes Darwin's insights into emotions (e.g. Ekman 2006). Darwin's observations led him to the idea that humans share many of our basic emotions with animals, and so also very much overlap with the work of Panksepp.

As discussed in B3 Part I, Affective Neuroscience is to do with primary-process affective systems (deep seated in old midline structures of the brain) and their seven basic EONS described by Panksepp (Panksepp 1998). Panksepp is well aware of the secondary and tertiary process levels (B3 Part I pp 5-6), and in this connection has commented:

The further one goes up BrainMind<sup>29</sup> complexity – from primary to tertiary levels – the more variable and complex the overall equation becomes. Multiple emotional streams may cross in the thinking mind, creating an enormous variety of higher emotions that are often the focus of psychologists – pride, shame, confidence, guilt, jealousy, trust, disgust, dominance, and so forth with hundreds of possible variants. However, without a clear vision of the primary processes the important work of higher processes remains profoundly incomplete. We cannot have a credible theory of mind without a credible understanding of the basic emotional feelings we inherit as evolutionary tools for living.

Panksepp & Biven 2012; pp xi-xii

It is probable that each emotion is associated with a unique combination of neuro-circuits and informational substances. Meditative type practices have a particular effect on the underlying neuro-circuits described by Panksepp; and these practices seem to be associated with specific and wholesome pre-

<sup>28</sup> Note that in Buddhist literature there are a total of 51 "mental faculties" (Goleman 2003 pp 110-111) which include what in the west we call emotions. There is no specific Buddhist word for our word "emotion" (Goleman 2003 p 75).

<sup>29</sup> Panksepp's new notation for brain / mind matters is: BrainMind, to emphasise their inseparability (Panksepp & Biven 2012).

frontal cortex (PFC) functions such as empathy, insight, and attuned communication (Siegel 2007 including Appendix III pp 337 – 362; and C2). These (neo-cortical) PFC circuits will facilitate mindfulness and new insights into tertiary level emotions such as pride, shame, guilt, jealousy and trust – and to a greater appreciation of inter-relatedness and inter-being (D4).

## 9. Afterword I:

### Some reflections on Pavlovian type fear conditioning and therapy

It is very easy for us to imagine that our fears and angers are the result of our thinking – that is, that they originate in the neo-cortex. Actually, as implied in this paper, FEAR and RAGE are deeply embedded in our Reptilian and Old Mammalian parts of our brains, and thus predate, in evolutionary terms, cognition and our cognitive thoughts about them. In addition, fear and anger can, in childhood, become paired with ‘innocent’ objects / people through Pavlovian type conditioning (B10 & B11). This is at an unconscious level and so cannot be treated by direct cognitive / conscious approaches.

This all means that it is inappropriate to imagine we can overcome such fears and angers by purely cognitive (thinking) approaches. In considering appropriate approaches, the following may be helpful:

1. Meditative type practices such as Positive Mental Training, Meditation, and Autogenic Training have been shown to reduce negative and destructive emotions (e.g. fear / rage) and facilitate positive emotions and CARE circuits (see B5). This is partly because such Mental Training activates the middle and pre-frontal cortex, which then in turn reduces amygdala activity – one of the centres of FEAR and RAGE circuits.
2. Affect Labelling. That is, mentally labelling the disturbing affect as we experience it. For example: “Anger”; “Anger is arising within me”; “Fear”; “Fear is arising”. Note that this is different from saying “I am angry” or “I am afraid” – as in these formulations we are identifying with the anger / fear. For further details, see B12. In addition, the process of Affect Labelling can enable us to distance ourselves from the raw and distressing emotion (C4).
3. The judicious use of the *intentional* Off Loading Exercises. Note that in the fear, anger, and loss / grief exercise it is important that we actually verbalise out loud the distressed feeling in words (e.g. “Anger”; “Anger is here”; “Fear is here”). It is suggested that for any particular emotional issue, such Off Loading exercises can be carried out for a few weeks or so; but not on a long term basis. This is because the whole aim of such exercises is to Off Load them; not to activate the ANGER / RAGE / FEAR circuits per se.

Regular and ongoing Mental Training (e.g. Meditation / Autogenic Training) can greatly facilitate the above. Such mental training mobilises:

- our reframing / reappraisal circuits, which can play a crucial role in our ability to affect regulate (see B2 in this web series).
- our CARE, PLAY, SEEKING and LUST-for-life emotional operating neuro circuits. (Anxiety, on the other hand, tends to dampen down all of these four crucial circuits – Panksepp 2009 p 18.)

Note that dance is a form of PLAY. Panksepp suggests that activation of PLAY circuits during counselling / psychotherapy can be of particular value (e.g. Panksepp 2009 pp 21-22).

Figures 10 and 11 summarise some of the above dynamics.

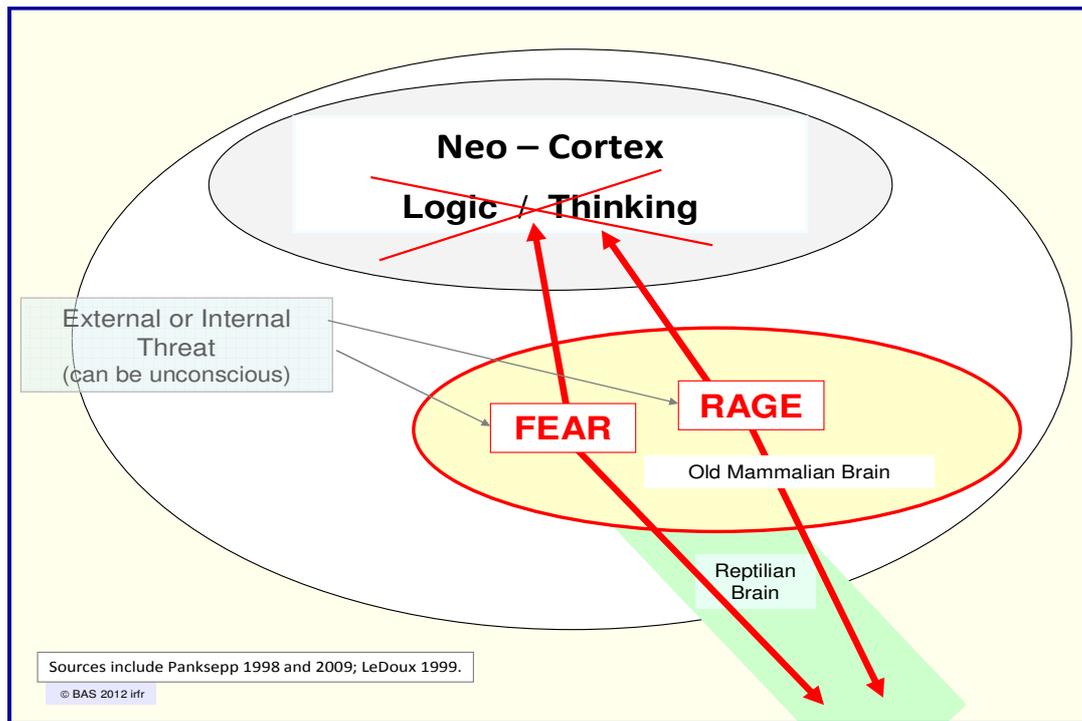


Figure 10  
**FEAR and RAGE circuits**  
**Deactivate Logic & Thinking of Neo Cortex**

Comment on Figure 10

- The Old Mammalian Brain includes the Limbic System and the Amygdala.
- Activated FEAR and RAGE circuits mobilise the body (flight and fight response) via the Reptilian Brain.
- Activated FEAR and RAGE circuits also have an inhibiting effect on logic and thinking of the neo-cortex.
- When we are being chased by a tiger, thought becomes of secondary importance!

While Figure 10 highlights some of the problems / dynamics of fears and anger, particularly in regard to such neo-cortical functions as logic and thinking, Figure 11 suggests some of the important dynamics involved in modulating such negative affects in an appropriate way<sup>30</sup>.

<sup>30</sup> If we are significantly disturbed, the dynamics of Figure 11 may only be realised if initially we receive care and nurturing from another human being: the CARE circuits of the other person can then activate our own CARE and soothing circuits – and enable us to have the psychic strength for Meditation / Mental Training.

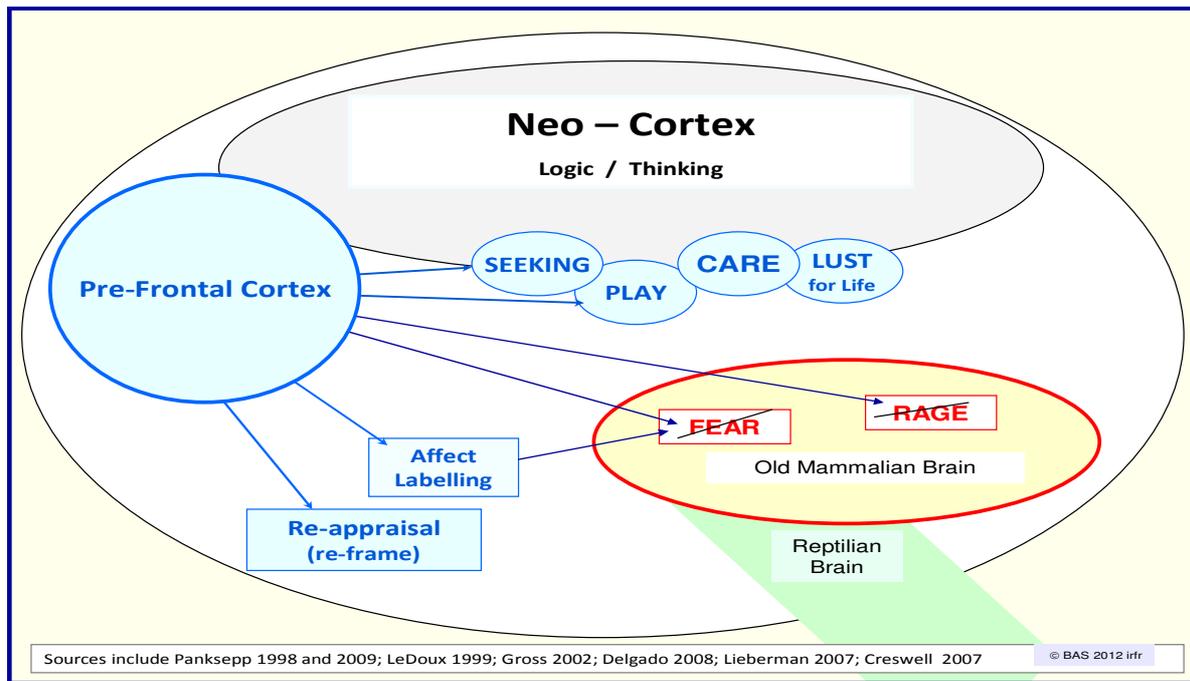


Figure 11 (Highly Schematic)

**Model for the modulating effect of Pre Frontal Cortex on Affect Regulation**

Sources include Panksepp 1998 and 2009; LeDoux 1999; Gross 2002; Delgado 2008; Lieberman 2007; Creswell 2007; Cahn & Polich 2006; and Davidson 2003A

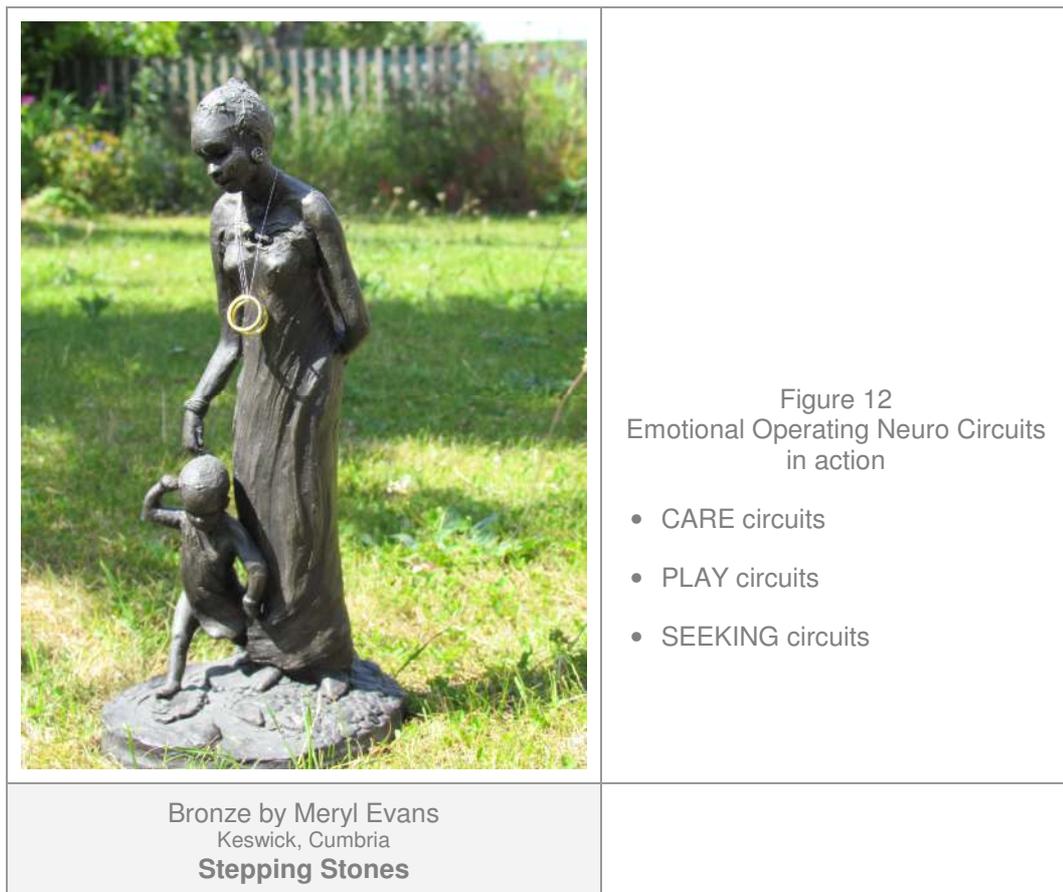
Comments on Figure 11

1. The Old Mammalian Brain includes the Limbic System and the Amygdala.
2. Activation of the Pre Frontal Cortex (PFC) [specifically the Lateral PFC and the Ventro-Medial PFC] down regulates the FEAR and RAGE circuits in the amygdala, part of the Old Mammalian Brain – (Gross 2002; Delgado et al 2008; Ross 2010 p 210-211).
3. Meditative / Mental Training type states activate the PFC [specifically the Lateral PFC which connects to the Ventro-Medial PFC], and this in turn is associated with re-appraisal / reframing (Cahn & Polich 2006; Davidson 2003A; and B2 in this web series) – which is a crucial element in facilitating positive mental change.
4. Activation of the PFC (the right ventro-lateral Pre-Frontal Cortex) is associated with Affect Labelling which in turn reduces amygdala activity – and thus FEAR and RAGE. In Figure 11 this is represented just for FEAR for the sake of clarity (Lieberman 2007; and see B12 figure 6 in this web series).
5. Meditative approaches have been shown to increase activity in the Left Frontal Cortex – and this is associated with positive emotions such as CARE circuits (B5). It is suggested that, in general terms, such meditative practices will also facilitate the activation of SEEKING, PLAY, and CARE circuits (extrapolating from Panksepp 2009).
6. In restoring mental harmony, SEEKING meaning is crucial for our Well Being (A3).
7. Note that these aspects of Well Being can be realised without explicit cognitive / thinking.
8. Note also that the decision to do an Autogenic Sequence does have a cognitive aspect!

In conclusion, it is suggested that meditation practices, including Autogenic Training, can have a positive effect on EONS and thus on our well-being and attunement to others.

### Afterword II:

The psycho-biologically attuned mother (Schore 2003C pp 5 - 35) will enable the Emotional Operating Neuro Circuits of her child to develop appropriately – both in terms of appropriate affect regulation of FEAR and RAGE circuits, and in terms of developing CARE, PLAY, and SEEKING circuits. The latter three are well illustrated in Figure 12.



Meryl Evans, in her maternal wisdom, was in touch with African wisdom, and the essence of Liedloff's (1975 / 1986) perspective. The figure of the mother depicts her gently facilitating particularly the PLAY and SEEKING circuits of her young child; what is less apparent is that her left hand is supporting her other infant nestling in a support on her back – and thus demonstrating her own CARE circuits in action.

## Appendix I

### Emotional Operating Neural Circuits, the Triune Brain, and beyond

The concept of the Triune Brain goes back to MacLean's work, and a summary of the concept is given below:

<p><b>Triune Brain</b> Tri = three; + unus = one; i.e. the three in one brain</p> <p>E4</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Extracted from the Glossary of Ross 2010</p> </div>	<p>A concept developed by Paul MacLean (MacLean 1949; 1952; 1990) in an attempt to understand various aspects of the brain in animals – including especially mammals and primates. From an evolutionary perspective, we can see the brain as having three parts:</p> <ol style="list-style-type: none"> <li>i. <b>The Reptilian Brain:</b> this is the 'deepest' and most ancient part of the brain and includes the basal ganglia (the extra-pyramidal motor system). This processes basic motor (movement) behaviour – including behavioural responses related to fear, anger and sexuality.</li> <li>ii. <b>The Limbic System (<i>Old Mammalian Brain</i>):</b> includes newer circuits and 'programs' related to various social emotions (e.g. maternal acceptance; care and nurturing; social bonding; separation distress; and rough and tumble play).</li> <li>iii. <b>Neo- mammalian Brain (the <i>Neo-Cortex</i>):</b> The most recent part of the brain to develop in evolutionary terms. The Neo-cortex is influenced by the <a href="#">Emotional-Operating-Neural circuits</a> of i. and ii above, and can influence them to some extent (by various appraisal processes). The Neo-cortex does not itself generate emotions – which can only arise through the sub-cortical structure (i.e. i. and ii.). The feelings that we have that arise from the emotional-operating-circuits are mainly dependent upon the neo-cortex, and especially the Frontal and Pre-frontal Lobes. [As does consciousness itself; but consciousness is also dependent upon the more ancient sub-cortical structures.] The <a href="#">Frontal Lobes</a> of the neo-cortex (especially the <a href="#">Pre-Frontal Cortex</a>) – with their many connections to various parts of the brain including the Cingulate Cortex and the <a href="#">Amygdala</a> – have many crucial functions, including modulating social interactions, meaning and ethical considerations.</li> </ol> <p><u>Sources:</u></p> <ul style="list-style-type: none"> <li>• Panksepp 1998; MacLean 1990; Gross 2002; Damasio 2003; Goleman 2003. MacLean's concept was an elaboration of that of Papez 1937 (ref. Panksepp 1998 p 351.)</li> </ul>
---	--

Although the amygdala is often talked about as though it is the centre of emotions; this is an oversimplification; certainly it has a very important role in the case of FEAR and Pavlovian type conditioning (Panksepp 1998 p 34; Panksepp 2008 p 53).

As previously indicated, the Emotional Operating Neuro Circuits / Systems are common to all mammals and primates. Panksepp has this to say about the matter:

It is a scientific fact, *and not just conjecture*, that a series of cross-mammalian emotional systems has been revealed through animal brain research. These emotional systems, concentrated heavily in the medial structures of the brain – from the midbrain periaqueduct gray, through the medial regions of the diencephalon (both hypothalamus and thalamus) to basal forebrain nuclei, ranging from the bed-nucleus of the stria terminalis, preoptic area, septum and basal ganglia (e.g., the nucleus accumbens), up toward the amygdala, insula, and various medial frontal lobe structures (including the anterior cingulate cortex, orbitofrontal cortex, and medial prefrontal cortex) – all figure heavily in the genesis of various emotional and clinical disorders (Panksepp 2004b, 2006). The amygdala is *not* the centre of our emotionality. All of the above structures are especially important for our diverse emotional-affective arousals.

Panksepp 2009 p 7

In so far as it is the Pre-Frontal Cortex (PFC) that plays a crucial role in modulating emotions in adults, it can be argued that we should regard this as a fourth development of the brain – thus making it a four-in-one brain. This is implicit in Figure 11 above.

## Appendix II

### Background notes on Affective Neuroscience

Jaak Panksepp has been one of the main pioneers in the development and research of Affective Neuroscience. He grew up in the era of the behaviourist psychologists such as B.F. Skinner; at that time emotions were regarded as merely subjective experiences and not worthy of scientific study. Panksepp disagreed fundamentally with this behaviourist perspective.

Subsequently attention shifted towards Cognitive science and the later development of Cognitive Behaviour Therapy (CBT); this accepted that emotions and feelings were of importance, yet assumed that emotions were unique to humans and were a purely neo-cortical phenomena.

#### Where do primary emotions originate?

Several decades ago, electrodes were placed in the brains (cortex) of various mammals. It was found that by stimulating the motor cortex, movement could be elicited in the animal – e.g. the movement of a leg. In humans, if the sensory cortex was stimulated, then that could give a sensation of say the left little toe being touched.

Research over the years failed to show any evidence of emotional systems within the cortex – i.e. there was nowhere in the cortex where an electrode was found to stimulate an emotion. Panksepp, however, found that deep down in the brain specific emotions could be elicited by such electrical stimulation. This implies that there are within mammals discrete Emotional Operating Neuro Circuits / Systems (EONS) that can be activated by energising (with the electrode) specific brain areas – for example, in the amygdala, hypothalamus and peri aqueduct grey. Panksepp discovered seven discrete systems: RAGE, FEAR, SEEKING (e.g. seeking food, water, shelter, companionship) & LUST / SEX, CARE, Separation Anxiety manifesting as PANIC, and PLAY.

#### Some EONS produce distress, others a desire for more (of that EONS)

Some of these EONS were found to cause distress in the animal, whereas others were positive in that the animal wanted more of it – demonstrated by the animal switching on the electrode that had been placed in the brain (referred to as self-stimulation). Some were ambiguous. For example, FEAR was not liked; however, RAGE that was to do with being attached was not appreciated, whereas RAGE related to chasing a prey was found to lead to increased self-stimulation (Panksepp 2010 p 9).

The SEEKING system is closely linked with various other EONS such as PLAY, LUST / SEX, and CARE, in addition to, in humans, being a fundamental neuro circuit involved when we seek meaning.

B3 Part I on this website discusses the above background to Affective Neuroscience in greater detail.

---

Sources and References /

## Sources and References

<b>Austin, James H. 2012. Meditating selflessly at the dawn of a new millennium. Contemporary Buddhism – an interdisciplinary journal</b> pp 61-81. Routledge / Taylor & Francis; ISSN 1463-9947.
<b>Bettleheim, Bruno. 1987. A Good enough parent.</b> ISBN 0-500-01413-2
<b>Blatt, Sidney J., Zuroff, David C, Quinlan, Donald M., &amp; Pilkonis, Paul A. 1996. Interpersonal Factors in Brief Treatment of Depression: Further Analyses of the National Institute of Mental Health of Depression Collaborative Research Programme.</b> Journal of Consulting and Clinical Psychology, 1996, Vol 64; No 1, 162-171)
<b>Blatt, Sidney J.; Zuroff, David C; Quinlan, Donald M.; &amp; Pilkonis, Paul A. 1996. Interpersonal Factors in Brief Treatment of Depression: Further Analyses of the National Institute of Mental Health of Depression Collaborative Research Programme.</b> Journal of Consulting and Clinical Psychology, 1996, Vol 64; No 1, 162-171)
<b>Bird, Jane; and Pinch, Christine. 2002. Autogenic Therapy: self help for mind and body.</b> (pp 92-100 ISBN 0 7171 3422 9
<b>Bowlby, John: 1969. Attachment and Loss: Volume 1: Attachment.</b> Pelican. ISBN 0-14-022606-0
<b>Burfdorf, J.; &amp; Panksepp, J. 2006. The neurobiology of positive emotions.</b> Neuroscience and Bio-behavioural Reviews, 30, 173-187
<b>Buss, D.M.; Larsen, R.J.; Westen, D.; &amp; Semmelroth, J. 1992. Sex differences in jealousy: Evolution, physiology, and psychology.</b> Psychological Science, 3, 251-255).
<b>Damasio, Antonio R. 1999. The Feeling of What Happens. Body and Emotion in the Making of Consciousness.</b> ISBN 0-15-100369-6
<b>Damasio, A.R.; Grabowski, T.J.; Bechara, A.; Damasio, H.; Ponto, L.L.B.; Parvizi, J. et al. 2000. Subcortical and cortical brain activity during the feeling of self generated emotions.</b> Nature Neuroscience, 3, 1049-1056.
<b>Dalai Lama 1999. Ancient Wisdom, Modern World – ethics for a new millennium.</b> ISBN 0-316-91428-2
<b>Davidson; Richard J. et al; 2003A Alterations in Brain and Immune function Produced by Mindfulness Meditation.</b> Psychosomatic Medicine (2003); 65: 564 - 570 (From the Laboratory for Affective Neuroscience, Dept. of Psychology, University of Wisconsin, Madison, Wisconsin: Stress Reduction Clinic.)
<b>Davidson, Richard 2003B; e.g. pp 179-234. 336-341. IN: Destructive Emotions: a dialogue with The Dalai Lama</b> narrated by Daniel Goleman ISBN 0-7475-6182-6
<b>Davidson; Richard J. 2005. Emotion Regulation, Happiness, and the Neuroplasticity of the Brain.</b> Advances in Mind-Body Medicine; 21; 3/4; pp 25 - 28
<b>Dobbin, Alastair D and Ross<sup>31</sup>, Sheila. 2012. Resilience and Recovery – Dumping Dualism</b> Contemporary Hypnosis and Integrative Therapy pp 136-155
<b>Delgado, Mauricio R.; Nearing, Katherine I.; LeDoux, Joseph E; and Phelps, Elizabeth. 2008. Neural Circuitry Underlying the Regulation of Conditioned Fear and its Relation to Extinction.</b> Neuron 59, 829-838 (11.09.2008)
<b>Dweck, Carol. 2000 Self-theories: their role in motivation, personality, and development Psychology Press ISBN 978-1-84169-024-7</b>
<b>Cahn, B. Rael; Polich, John. 2006 Meditation States and Traits: EEG, ERP, and Neuroimaging Studies.</b> Psychological Bulletin. Vol 132(2), Mar 2006, 180-211.
<b>Creswell, J. David; Way, Baldwin M.; Eisenberger, Naomi I.; Lierberman, Matthew D. 2007</b> Neural Correlates of Dispositional Mindfulness During Affect Labelling Psychosomatic Medicine 69:560–565
<b>Eastaway, Rob; &amp; Askew, Mike 2010. Maths for Mums and Dads – take the pain out of maths home work.</b> ISBN 978-0-224-08635-6
<b>Ekman, Paul. 1999. Basic Emotions.</b> Chapter 3 IN: Handbook of Cognition and Emotion; edited by T. Dalgleish and M. Power;. Sussex, U.K.: John; Wiley & Sons, Ltd... Also available on line: <a href="http://e-edu.nbu.bg/pluginfile.php/345890/mod_resource/content/3/29.04.2011_Paul-Ekman_-_Basic_Emotions_chapter_of_a_Handbook_1999_.pdf">http://e-edu.nbu.bg/pluginfile.php/345890/mod_resource/content/3/29.04.2011_Paul-Ekman_-_Basic_Emotions_chapter_of_a_Handbook_1999_.pdf</a>
<b>Ekman, Paul; Davidson, Richard J.; Ricard, Matthieu; and Wallace, B.Alan: 2005. Buddhist and Psychological Perspectives on Emotions and Well-Being.</b> April 2005; Current Directions in Psychological Science: Vol. 14; 2; page 59 – 63
<b>Ekman, Paul; 2003. IN: Destructive Emotions: a dialogue with The Dalai Lama – narrated by Daniel Goleman.</b> ISBN 0-7475-6182-6
<b>Ekman, Paul: 2006. Darwin and Facial Expression</b> ISBN 1-883536-88-X
<b>Ekman, Paul: 2007 (second edition; first edition 2003). Emotions Revealed.</b> ISBN 13-13-978-0-8050-8339-2
<b>Ekman, Paul, (Ed) and Dalai Lama: 2008. Emotional Awareness: overcoming the obstacles to psychological balance and compassion.</b> ISBN 13: 978-0-8050-8712-3
<b>Frankl, Viktor E.: Man's Search for Meaning; 1946; 1984.</b> Pocket Books; Simon & Schuster. ISBN 0-671-02337-3
<b>Gilbert, Paul. 2009. The Compassionate Mind. How to use compassion to develop happiness, self-acceptance and well-being.</b> ISBN 978-1-84901-098-6
<b>Gilbert, Paul. 2010. Compassion Focused Therapy</b> ISBN 978-0-415-44807-9
<b>Goleman, Daniel: 2003; Destructive Emotions: a dialogue with The Dalai Lama narrated by Daniel Goleman;</b> ISBN 0-7475-6182-6
<b>Goldstein, Kurt. 1940. Human Nature in the Light of Psychotherapy.</b> Cambridge: Harvard University Press (cited by Rogers)
<b>Gross, J.J. 2002. Emotion regulation: Affect, cognitive, and social consequences.</b> Psychophysiology, 39: 281-291
<b>Hanh, Thich Nhat: 1998. The Heart of the Buddha's teaching; transforming suffering into peace, joy and liberation.</b> ISBN 0-7126-7003-3
<b>Herwig, Uwe; Kaffenberger, Tina; Jäncke, Lutz; and Brühl, Annette B. 2010. Self-related awareness and emotion regulation.</b> NeuroImage 50 (2010) 734–741
<b>Hill, Susan. 1974; 1989 In the Springtime of the Year</b> ISBN 0-14-004110-9
<b>Ikemoto /</b>

<sup>31</sup> No relation to Ian Ross

Sources and References *continued*

<b>Ikemoto, S., &amp; Panksepp, J.: 1999. The role of nucleus accumbens dopamine in motivated behaviour: a unifying interpretation with special reference to reward-seeking.</b> Brain Research Reviews, 31, 6-41.
<b>Kabat-Zinn, Jon 1990 (2006). Full Catastrophe Living: How to cope with stress, pain and illness using mindfulness meditation</b> ISBN 0-7499-1585-4
<b>Kamis, Milissa; &amp; Dweck, Carol. 1999. Person Versus Process Praise and Criticism: Implications for Contingent Self Worth and Coping. Developmental Psychology; 1999; Vol 35: 3, 833-847</b>
<b>Knox, Jean. 2011. Self-Agency in Psychotherapy – attachment, autonomy, and intimacy.</b> ISBN 978-0-393-70559-1
<b>LeDoux, Joseph. 1999. The Emotional Brain.</b> ISBN 798-0-7538-0670-8
<b>Lieberman, Matthew D.; Eisenberger, Naomi I.; Crockett, Molly J.; Tom, Sabrina M.; Pfeifer, Jennifer H.; and Way, Baldwin M. 2007. Putting Feelings into Words – Affect Labelling Disrupts Amygdala Activity in Response to Affective Stimuli.</b> Psychological Science: 2007; Volume 18; Number 5: 421 – 428)
<b>Liedloff, Jean. 1975 /1986. The Continuum Concept.</b> ISBN 0-14-019245-X
<b>Lüscher, C.; Nicoll, R.; Malenka, C.; and Muller, D.; 2000. Synaptic plasticity and dynamic modulation of the post-synaptic membrane. Nature Neuroscience, 3, 545-567)</b>
<b>Luthe, Wolfgang; 1982 Workshop notes for Autogenic Training Therapist course.</b>
<b>MacLean, Paul D. 1949; Psychosomatic Disease and the “visceral brain”: Recent developments bearing on the Papez theory of emotion.</b> Psychosomatic Medicine: 11: 338-353.
<b>MacLean, Paul D. 1952. Some Psychiatric implications of physiological studies on frontotemporal portion of limbic system (visceral brain).</b> Electroenceph. Clin. Neuro-physiology. 4: 407-418
<b>MacLean, Paul D. 1990. The Triune Brain in Evolution: role of Paleocerebral Functions.</b> New York; Plenum Publishing Corporation
<b>Maslow, Abraham H.; 1954 [Third Edition 1970] Motivation and Personality;</b> Harper & Row; ISBN 0-06-041987-3
Melnick, Joseph, and Roos, Susan. 2007. The Myth of Closure Gestalt Review, 11(2):90-107.
McLeod, Saul. A. 2007. Simply Psychology; Carl Rogers. <a href="http://www.simplypsychology.org/carl-rogers.html">http://www.simplypsychology.org/carl-rogers.html</a>
<b>McGilchrist, Iain. 2009. The Master and his Emissary: The divided brain and the making of the Western World.</b> ISBN 978-0-300-1-4878-7
<b>Menon, V.; Levitin, D.J. 2005. The Reward of music listening: Response and physiological connectivity of the mesolimbic system.</b> NeuroImage 28 (2005) pp 174 - 175
Olds, J., & Milner, P. (1954). Positive reinforcement produced by electrical stimulation of the septal area and other regions of rat brain. Journal of Comparative and Physiological Psychology, 47, 419–427.
<b>Panksepp, Jaak: 1998. Affective Neuroscience: The Foundation of Human and Animal Emotions;</b> Oxford University Press; ISBN 0-19-509673-8
<b>Panksepp, J.: 2004b. Affective Consciousness: Core emotional feelings in animals and humans.</b> Journal of Consciousness Studies, 12, 161-187.
<b>Panksepp, J.: 2006. Emotional endophenotypes in evolutionary psychiatry.</b> Progress in Neuro-Psychopharmacology and Biological Psychiatry, 30, 774-784.
<b>Panksepp, Jaak; 2008 Third Edition. The Affective Brain and Core Consciousness – How Does Neural Activity Generate Emotional Feelings?</b> IN: Handbook of Emotions; ed. Michael Lewis, Jeanette M. Haviland-Jones, & Lisa Feldman Barrett. ISBN 978-1-60918-044-7
<b>Panksepp, Jaak: 2009. Brain Emotional Systems and Qualities of Mental Life.</b> (pp 1-26) IN: The Healing Power of Emotion – Eds: Diana Fosha, Daniel J. Siegel, & Marion Solomon. ISBN 978-0-393-70548-5
<b>Panksepp, Jaak: 2010. Interview with Ginger Campbell; Brain Science Podcast Episode #65; text available on line:</b> <a href="http://www.brainsciencepodcast.com/bsp/2010/1/13/affective-neuroscience-with-jaak-panksepp-bsp-65.html">http://www.brainsciencepodcast.com/bsp/2010/1/13/affective-neuroscience-with-jaak-panksepp-bsp-65.html</a>
<b>Panksepp, Jaak. 2011: in an interview by Arvid Leyh in the "Languages of Emotion Cluster of Excellence" of Freie Universität Berlin in June 2011. Available on U Tube: <a href="http://www.youtube.com/watch?v=u4ICY6-7hJo">http://www.youtube.com/watch?v=u4ICY6-7hJo</a></b>
<b>Panksepp, Jaak; &amp; Biven, Lucy. 2012. The Archaeology of Mind: Neuroevolutionary Origins of Human Emotions.</b> ISBN 13-978-0-393-70531-7
<b>Panksepp, Jaak, &amp; Panksepp, Jules B. 2000. The Seven Sins of Evolutionary Psychology.</b> Evolution and Cognition, 2000, Vol 6, No 2 pp 108-131
<b>Panksepp, J; Burgdorf J; Turner C, Gordon, N 2003. Modelling ADHD-type arousal with unilateral frontal cortex damage in rats and beneficial effects of play therapy.</b> Brain Cogn. 2003 Jun; 52(1):97-105.
<b>Pert, Candace B.: 1997; Molecules of Emotion;</b> Pocket Books; ISBN 0-671-03397-2
<b>Porges, Stephen W. 2001. The polyvagal theory: phylogenetic substrates of a social nervous system.</b> International Journal of Psychophysiology 42 (2001) 123 – 146)
<b>Porges, Stephen W. 2009 Reciprocal Influences Between Body and Brain in the Perception and Expression of Affect.</b> IN: The Healing Power of Emotion – Eds: Diana Fosha, Daniel J. Siegel, & Marion Solomon pp 27 - 54 ISBN 978-0-393-70548-5
<b>Porges, Stephen W. 2011. The Polyvagal Theory – Neuro-physiological foundations of Emotions, Attachment, Communication, Self-Regulation.</b> ISBN 978-0-393-70700-7
Prescott, J.W. /

Sources and References *continued*

<b>Prescott, J.W. 1971 Early somatosensory deprivation as an ontogenic process in abnormal development and behaviour.</b> IN: Proceedings of the Second Conference on Experimental Medicine and Surgery in Primates. Ed. E.I. Goldsmith & J. Mody-Janokowski; pp 356-375; Basel: Karger.
<b>Rodin, Samuel K. 2005. The Dialogical Context of Autogenic Therapy.</b> (Paper submitted to British Autogenic Society for Level I diploma course.)
<b>Rogers, Carl. 1951. Client-centered Therapy: Its Current Practice, Implications and Theory.</b> ISBN 1-84119-840-4
<b>Rogers, Carl. 1959. A theory of therapy, personality, and interpersonal relationships as developed in the client-centered framework in psychology: A study of science.</b> IN: S Koch (Ed): Formulation of the person and the social context (pp 184-256). New York: McGraw-Hill.
<b>Rogers, Carl R. 1961. On Becoming a Person – a therapist's vies of psychotherapy</b> ISBN 1-84529-057-7
<b>Rogers, Carl R. 1980. A Way of Being</b> ISBN 978-0-395-75530-3
<b>Ross, Ian R.F. 2010. Autogenic Dynamics – Stress, Affect Regulation and Autogenic Therapy.</b> ISBN 978-0-9563993-0-4
<b>Rossi, Ernest L.; 2002; The Psychobiology of Gene Expression.</b> W.W. Norton; ISBN 0-393-70343-6
<b>Rossi, Ernest L.; 2004; A Discourse with our Genes.</b> ISBN 1-932462-35-X
<b>Sacks, Oliver. 1973. Awakenings.</b>
<b>Salzberg, Sharon. 2005. The Force of Kindness – change your life with love and compassion.</b> ISBN 1-59179-355-6
<b>Sapolsky, Robert M. 1994 / 1998. Why Zebras don't get ulcers.</b> W.H. Freeman and Co. ISBN 0-7167-3210-6.
<b>Sapolsky, Robert M. 2007. Stress, Stress-Related Disease, and Emotional Regulation.</b> IN: Handbook of Emotion Regulation. Ed. James J. Gross. pp 606 – 615. ISBN 13 978-1-59385-148-4
<b>Schore; Allan N. 2003A: The Seventh Annual John Bowlby Memorial Lecture: Minds in the making: attachment, the self-organising brain, and developmentally-orientated psychoanalytical psychotherapy.</b> IN: Revolutionary Connections: psychotherapy and neuroscience; Ed. Jenny Corrigan and Heward Wilkinson; Karnac; ISBN 1-85575-941-1
<b>Schore; Allan N. 2003B: Affect Regulation and the Repair of the Self.</b> ISBN 0-393-70406-8
<b>Schore; Allan N. 2003C: Affect Dysregulation and Disorders of the Self.</b> ISBN 0-393-70407-6
<b>Schore, Alan N. 2009. Right-Brain Affect Regulation – An Essential Mechanism for Development, Trauma, Dissociation and Psychotherapy.</b> IN: D. Fosha, M. Solomon, & D. Siegel (Eds.), The healing power of emotion: Integrating relationships, body and mind. A dialogue among scientists and clinicians (pp. 112-144). New York: WW Norton Chapter 5 ISBN 978-0-393-70548-5
<b>Schore, Alan N. 2012. The Science of the Art of Psychotherapy. [Chapter 7: How elephants are opening doors: developmental neuroethology, attachment, and social context]</b> ISBN 10: 0-393-70664-8
<b>Siegel, Daniel J. 2007. The Mindful Brain. Reflections on Attunement in the Cultivation of Well-Being</b> ISBN 10: 0-393-70470-X
<b>Siegel, Daniel. 2009. Emotion as Integration – A possible answer to the Question, What is Emotion? Chapter 6</b> IN: D. Fosha, M. Solomon, & D. Siegel (Eds.), The healing power of emotion: Integrating relationships, body and mind. A dialogue among scientists and clinicians (pp. 112-144). New York: WW Norton Chapter 6 ISBN 978-0-393-70548-5
<b>Siegel, Daniel. 2010. Mindsight - transform your brain with the new science of Kindness</b> ISBN 978-1-85168-761-9
<b>Stevens, Anthony: 1989. The Roots of War – A Jungian Perspective</b> ISBN 1-55778-24-5
<b>Stewart, Ian; Joines, Vann; TA Today: A New Introduction to Transactional Analysis;</b> Lifespace Publishing; 1987; (especially Chapter 2 and3; and pp 236 - 240.) ISBN 1-870244-00-1
<b>Sunderland, Margot. 2006 / 2007 What every parent needs to know</b> ISBN 978-1-4053-2036-8
<b>Taylor, Shelley; Klein, Lura; Lewis, B; Gruenewald, T; Gurung, R; and Updegraff, J. 2000. Bio-behavioural responses to stress in females: Tend-and-befriend, not flight-or-flight.</b> Psychological Review, 107, 411-429
<b>Torgersen, S: (1986); Childhood and family characteristics in panic and generalised anxiety disorders;</b> Am. J. Psychiat. 143: 630 - 632.
<b>Turnbull, Oliver: 2003. Emotion, False Beliefs, and the neurobiology of intuition.</b> IN <i>Revolutionary Connections: Psychotherapy and neuroscience</i> ; Ed. Jenny Corrigan and Heward Wilkinson; Karnac 2003; ISBN: 1-85575-941-1
<b>Uhde, T.W.; &amp; Tancer, M.: (1988); Chemical models of panic: A review and critique.</b> In <i>Psychopharmacology of anxiety</i> (P. Tyrer ed.); pp 119 - 131; New York: Oxford University Press
<b>Uvnäs-Moberg, Kerstin: 1997; Oxytocin linked anti-stress effects – the relaxation and growth response.</b> Acta Physiologica Scandinavica, Supplement, 640, 32-42.
<b>Watts, Alan. 1975. Tao: The Watercourse Way.</b> ISBN 0-14-022154-9
<b>Winnicott D.W. 1965. The maturational process and the facilitating environment.</b> New York: International Universities Press, 1965; and Karnac books ISBN 0 946 439 84 2
<b>Zubieta, J.K.; Ketter, T.A.; Bueller, J.A.; Xu, Y.; Kilbourn, M.R.; Young, E.A. et al; 2003. Regulation of human affective responses by anterior cingulate and limbic mu-opioid neurotransmitters.</b> Archives of General Psychiatry, 60, 1145-1153.

[Linked themes in this Autogenic Dynamics section /](#)

Linked themes in this Autogenic Dynamics section

A1	The Stress Response, the Relaxation Response, and the Tend and Befriend Response.
A7	Porges and the Polyvagal Theory – <i>reflections on clinical and therapeutic significance</i>
A8	The Polyvagal Theory <i>and a more sympathetic awareness of the ANS</i>
A3	Towards a concept of happiness and well-being
C2	Mindsight – our seventh sense – <i>and associated middle pre-frontal cortex functions</i>
C4	The Hub of the Matter
C7	Being in touch with our feelings – <i>Hemispheric Integration</i>
B1	Bears, Imagination, and Well Being
B2	Reframing, Reappraisal, and Well Being
B3	Part I: The Origins of Affect and Affective Neuroscience – <i>and the misplacing of Affect in the Neo-cortex</i>
B5	Emotions, Frontal Lobe Dynamics, and Meditation
B6	Perceptions, Flowers, and Reality
B9	Mental Training, the Pre-frontal Cortex, Resilience, and Equanimity
B10	Snakes, Conditional Stimuli, and Equanimity – <i>Approaches to treating mind-body disturbances</i>
B11	Transforming Distressing Mind-Body-States – <i>from Negative Ruminations towards Well-Being</i>
B12	Affect Labelling, Autogenic Training, and reducing Emotional Distress
B16	<i>Antidotes to Threats our Minds Create – the Soothing and Contentment System</i>
C3	Resonance Circuits, Mirror Neurones, and Mindfulness
C6	Integration and Well-Being
D1	Reflections on foundations for Mindful Living
D4	Duhkha, Impermanence, and Inter-relatedness

Thanks to Annie Sturgeon and Michael Ross for their helpful suggestions and proof reading.