

**LIVING WITHIN THE CELLULAR ENVELOPE: SUBJECTIVITY AND SELF  
FROM AN EVOLUTIONARY NEUROPSYCHOANALYTIC PERSPECTIVE**

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# **LIVING WITHIN THE CELLULAR ENVELOPE: SUBJECTIVITY AND SELF FROM AN EVOLUTIONARY NEUROPSYCHOANALYTIC PERSPECTIVE**

(KEY WORDS: neuro-psychoanalysis. neurobiology, neuro-philosophy, evolution, Darwin, self, subjectivity)

## **Abstract**

A growing literature has been exploring the implications of reconciling psychoanalytic understandings of human behavior with the research findings of neuroscience. This essay proposes a new linking perspective -- neurodarwinian psychoanalysis -- as a way to reconsider the predominantly disembodied nature of existing analytic theory by grounding it in the biological realities of human nature, development, and psychopathogenesis. Beginning with a focus on the evolutionary significance of the cellular envelope within which all living organisms exist, it provides theoretical and clinical examples of how evolved neural assemblies in the brain play a key role in the representational depictions of both typical and atypical human predicaments. Conventional psychoanalytic concepts of such theoretical entities as ‘the self’ and tripartite concretizations of intrapsychic tropes are reformulated in terms of naturally selected neural innervations modifiable by social interaction. Accordingly, dynamically unconscious functioning and psychoanalytically informed therapeutic process are considered as crucial adaptations that warrant natural selection.

### **Introduction: arguments for a Darwinian neuropsychanalysis**

“...for the psychical field, the biological field does in fact play the part of the underlying bedrock”  
Sigmund Freud, Analysis Terminable and Interminable. (1937) S.E.23, p.252.

As psychoanalysts and psychodynamic therapists, our investigational realm is human subjectivity. We explore the subjective worlds of our patients and ourselves in order to facilitate healing. Since perception is not a passive process, we require conceptual templates or models to understand those inner worlds, as well as normative development and behavior, psychopathogenesis, and therapeutic action. Many of our standard conceptual models, ranging from ego psychological, Kleinian, or Kohutian to more contemporary intersubjective and relational templates, appear to be challenged by an increasing number of reports and studies from a seemingly new perspective. These recent reports point to a growing convergence of neurobiology and psychoanalytic thought (see e.g. Clyman 1991, Fonagy 2001a, Kandel 1998, 1999, 2006, Migone & Liotti 1998, Pally and Olds 1998, Pally 2000, Reiser 1984, Schwartz 1987, Shevrin et al. 1996, Watt 2001).

I suggest that the prevailing conceptual templates in psychoanalysis are problematic because they are epiphenomenal and therefore disembodied. A result is the present-day cacophony of competing analytic theories and schools of thought. I do not propose that a neurodarwinian perspective should totally replace current models; direct translation from

psychological to cell-biology terminology may never be possible. Yet, I wish to demonstrate that a biologically based theory utilizing Darwinian perspectives can allow us to preserve the core explanatory principles of psychoanalysis while constructing more clinically useful and less debatable conceptual templates. Since most psychodynamic clinicians are unfamiliar with salient aspects of the evolutionary literature, some introductory material from those sources will be included in this essay. In addition, a review of some of the basic features of neural structure and dynamics will be included.

To usefully construct basic principles of a neuro-darwinian psychoanalysis one must venture beyond a sole reliance on the psychoanalytic literature and be open to the findings of neighboring behavioral disciplines (Holtzman and Aronson 1992). These fields of inquiry into the biological and ancestral roots of human behavior include evolutionary biology and psychology, ethology, animal behavior, behavioral genetics, philosophy of mind, and cultural and paleoanthropology as well as cognitive neuroscience. A Darwinian psychoanalytic perspective utilizes those neighboring disciplines as basic behavioral sciences for psychoanalysis by reflecting the irreducibly evolutionary determinants of behavior. There are many theoretical implications of such a perspective--for example, a reconsideration of classical instinct theory (Peskin 1977).

**Living within the cellular envelope as a contemporary version of Plato's Cave : a new representational template for psychoanalysis**

A prominent view among cognitive neuroscientists is that the brain is a *closed system* modulated by the senses, with an evolved capacity to emulate reality through internal

mapping processes (Llinas 1997, Llinas and Pare 1998, Merzenich and deCharms 1998). The formation of conceptual templates for making sense of events in the world, addressed in this study, can itself be seen as an aspect of neural representation. (In a way, this perspective updates Plato's allegory of life in the Cave in which reality is apprehended solely by the casting of shadows of a variety of objects on a wall.)

The expression "living within the envelope" reflects these findings. Our major survival organ, the brain and its associated neurohumeral systems, have evolved to filter all sensate data through innately imprinted assemblies of synaptically linked brain cells. Each cell has its own membranous envelope. As neuroscientists have discovered, cellular envelopes have gated entries that allow for voltage changes to admit specific ion substances, such as calcium and potassium into cell bodies, but this fact does not contradict the existence of cell membranes.

A major aspect of the data filtration process is the coordination of partial aspects of sensory input. An example is the assembling function of the optic system in various areas of the brain (Kandel et al 2000 pp. 496- 501). Retinal neurons "specialize" in aspects of visual input such as motion, form, edges and color. These partial image data are conveyed via synaptic connections to a region of the thalamus, and then to the primary visual cortex, which assembles these component data into an image that represents the purported reality of the external object being viewed. The "realness" of the external object is further modified by extensive input of other neural networks so that the individual's "take" on the object is ultimately idiosyncratic. That ultimate personal object

reflects more than the workings of the optic system alone. It is the resolution of stored memories of past experience and of motivational input, all imbued with affective toning. All of these additional inputs to a seemingly simple, seemingly camera-like capture of an object result from millions of years of Darwinian natural selection. These Darwinian processes further survival and reproductive success in those individuals whose random changes in genetic prescription have tended to assemble numerous component images that secure safety and effective living in a competitive and potentially dangerous external world. Can any psychoanalytic clinician who reads this paragraph not think of the evolutionary connections of this type of therapy? A clinical illustration was in the case of a married couple I was seeing in conjoint therapy.

*The wife, a highly sophisticated and clearly non-psychotic health professional herself, reported that, while waiting at the airport for her husband's return from an out-of-town business trip, she first saw her older brother come into the lounge among other arriving passengers, and immediately realized it was actually her husband. In her childhood, that older brother had taunted and physically tortured her. I had offered several interpretations in prior sessions that she was reacting to her husband's occasional angry outbursts as if she was re-living early experiences with that brother.*

### **Evolutionary value of time-saving neural connections**

Neuroscience empirically confirms that *we have no direct and unfiltered access to outer world phenomena.* As mentioned above, Darwinian natural selection has in effect favored representation over direct presentation of the environment for humans and

perhaps for other animals as well. An inescapable conclusion is that the raw data of our senses passes through the prisms of representational processes before they engender behavior. In addition, the seemingly perceived “here and now” aspect of experience is actually a phenomenon of the immediate past. Consider the fact that neural transmission from the periphery of the body to the emulation system of the 10 billion neurons of the brain requires a period of time – generally two to five milliseconds or more. Additional time is necessary for motor and neurohumeral connections, and more time yet for conscious processing. Innately encoded response patterns which can be brought on line most rapidly and efficiently would be understandably selected over broad reaches of evolutionary time. Also, the far from immediate neural transmission times argue for the selection of innate linkages that are anticipatory or predictive in nature. This will be further discussed.

### **Kandel’s interest in psychoanalysis as natural science**

Eric Kandel (1998, 1999) has proposed “a new intellectual framework for psychiatry” in two of the most significant recent papers linking psychoanalysis and neurobiology. Kandel claims that while neurobiology needs psychoanalytic perspectives, psychoanalysis itself will not survive unless it in turn is reconciled with the biology of the brain. He has found it productive to study human behavior through the radical reductionism of tracing neural activity to basic molecular processes. Kandel helps lay the groundwork for supplementing psychodynamic perspectives by incorporating classical and operant conditioning and the neurobiology of learning and memory. His Nobel award was for his study of these processes in the sea snail, *Aplysia*, and his

pioneering work has engendered further research (E.g. Martin et al 2001, Barad 2002). In a recent autobiographical volume, Kandel (2006) elaborates on his professional odyssey from psychoanalytically intrigued psychiatric resident to renowned molecular biologist intent on establishing the scientific grounds for re-conceiving psychoanalysis as a biological field of inquiry.

### **On expanding psychodynamic focus by ‘thinking Darwinian’**

Evolution is at the growing heart of all biological phenomena; and therefore the persistence of certain categories of human behavior over many millennia necessarily reflect imprints of evolutionary processes upon the cell assemblies of the brain. More specifically, I suggest that psychodynamic understanding can be broadened to encompass behavioral inclinations that are the contemporary products of thousands of generations of Darwinian natural selection. Rather than attempting to directly translate the familiar terminology of psychoanalysis into a new biological lexicon, I propose enriching current theoretical models by grounding them in the identifiable neurobehavioral patterns evolved across many thousands of ancestral human and pre-human generations. The term “innate imprint” refers to the natural selection of *innervative preferences* within brain neural circuits that lead to certain evolved patterns of behavior. ‘Thinking Darwinian’ also allows us to utilize new neurobiological perspectives on subjectivity, intersubjectivity, and analytic theories of development, pathology, and cure.

### **An abbreviated review of evolutionary perspectives on behavior**

First, a necessary epistemological note. Many of the truth claims of evolutionary



psychology rest largely on speculation and inference, although many investigators in that field cite hard archeological evidence for their studies. An example is the evolutionary psychologist Andrew Whiten's paper on hunting-related ancestral behaviors (1999, p173). Of course, speculation and inference need hardly perturb us as psychoanalytic clinicians who, according to Grunbaum (1994), base much of our own theorizing on speculation and inference. For example, what is the empirical evidence for such analytically reified phenomena as ego and super-ego, inner objects and part-objects, unconscious fantasy, or, for that matter, a definitive self? In our efforts to understand the psychological phenomena that confront us clinically, we imaginatively employ, following Freud, a variety of conceptual metaphors about conflicting intrapsychic entities. With regard to new neuro-darwinian perspectives, the evolutionary psychiatrists Stevens and Price (2000) have nevertheless indicated, citing William Blake, that what is now proved was once imagined.

### **Freud's Darwinian inclinations**

Sigmund Freud, "biologist of the mind" according to Sulloway (1992), reflected a strong Darwinian orientation. He regarded constitutional and instinctual psychic forces as innately imprinted. Freud was influenced by Darwin's ideas (Darwin 1858, 1871, 1872) from the inception of his education. According to Ritvo (1990), his development of instinct theory and recognition of the pervasive nature of inner conflict can be traced in large measure to his receptivity to Darwin's thinking. Over a century has passed since he wrote the "Project for a Scientific Psychology" (1895), his attempt to construct a neurobiological theory of psychoanalysis that would have carried forward his Darwinian

inclinations.

Ever the scientist, Freud was disappointed with the clinically unsustainable localizationist hypotheses ( phrenology) held by neurologists of his day – for example, brain centers for causality, benevolence, hope, and destructiveness (Kandel et al. 2000 p.7). We now can realize that his frustration was due to the lack in his era of modern experimental research techniques such as behavioral studies utilizing laboratory animals, to say nothing of electronic imaging of brain tumors and injuries and studies of the impact on animal behavior of gene modification. Because of his disappointment, Freud reluctantly chose to develop his theory as a pure psychology (see Solms and Saling 1986). Yet, as recently as 1937, he referred to an ultimate biological bedrock of psychoanalysis (SE 23 p.252). The pervasiveness of conflict in human life which has been a pillar of Freud’s theories has been illustrated in contemporary Darwinian writings (Jones and Fabian 2006). Freud’s Darwinian persuasions were limited by his mistaken Lamarckian belief in the inheritance of acquired characteristics. This limitation is understandable in view of the fact that the ‘Modern Synthesis’ of evolution and genetics was not developed until after his death.

The Modern Synthesis identifies random gene mutations as the pivotal target of natural selection. The Oxford zoologist Richard Dawkins (1989) embodies this principle in his notion of the “selfish gene” as the ultimate entity in the individual organism impacted by natural selection. The ‘selfish gene’ concept highlights the ruthlessly competitive struggle for gene survival (Badcock 2000) presumably at the core of all life forms. It is important to add that the concept of innate imprint applies not to the inheritance of learned

behaviors, but rather to the reproductive success of individuals in whom random genetic differences from an earlier generation have produced certain new behavioral propensities (phenotypes) which happen to favor survival.

To some extent, many commonly held standards and behaviors have also survived over generations because of similar group selective processes (Wilson and Sober 1994). Although cultural impact on behavior is of importance, I emphasize individual selection theory as described by Darwin and Dawkins because it appears most directly applicable to the individual behaviors that are of psychodynamic concern. In the history of Western thought, the modern synthesis amounted to a radical and enduring corrective to the then-prevailing Enlightenment views of human infancy as a “blank slate”. According to that empiricist perspective, all behavioral tendencies are inscribed within the infant and child by the social environment alone – referred to in the social science literature as the ‘Standard Social Science Model’ (Tooby & Cosmides 1992). Arguably -- and regrettably – this empiricist model remains as a conceptual guide for much of present-day psychoanalytic theorizing. Tooby and Cosmides, both evolutionary social scientists, also tend to strongly favor individual selection theory over group selection emphases.

### **The pioneering evolutionary psychoanalytic work of John Bowlby**

Following in the adaptationist wake of Hartmann (1958) and Erickson (1964), the English psychoanalyst John Bowlby (1969) ventured outside of conventional psychoanalytic scholarship by studying ethological and paleoanthropological accounts of the social behaviors of prehistoric humans. He referred to the period of several hundreds

of thousands of years in the Pleistocene era as the EEA—the “environment of evolutionary adaptedness”. During this period, our human ancestors’ personal and reproductive survival depended on the natural selection of propensities to compete, cooperate, deceive, detect deception, and otherwise negotiate survival in the relational surround of small bands of hunter-gatherers in the African forests and savannas. According to Bowlby and to most contemporary anthropologists, major evolution of modern humans occurred during the era of the EEA.

Natural selection has operated over a vast time scale, often producing dysfunctional changes. It prevails in the absence of any intrinsic teleology, such as perfection of a species. Darwin’s writings (1858, 1971) included an additional dimension of innate imprint: sexual selection (see Miller 2000). He was also a keen observer of emotional display in terms of facial and bodily expression (Darwin 1872). The existence of “face neurons” in primate brains has been extensively investigated (DeSouza et al. 2005). The contemporary clinical psychologist Paul Ekman (1997) has recently reconfirmed this foundational investigation in his studies of human facial expressions.

It is essential to note once again that naturally selected phenotype, characteristic of all living organisms, is reflected in patterns of behavior as well as in morphology. These innate imprints can be understood as neurobiological substrates of both normative and pathological behaviors. Sociocultural input, notably relational input often reflecting group selection processes, plays a significant role, through gene activation and suppression, in constraining, enhancing, or otherwise modifying innately imprinted

behaviors. Evolved neural circuitry is implicated as well in the actual mechanisms of environmental input that involve processes of learning, including extinction of learning, and of memory (Kandel 1998, 1999, 2006; Barad 2002). I suggest that the growing neurobiological canon of learning and memory will be increasingly applicable to psychoanalytic theories of development, psychopathogenesis, and cure.

### **Some evolved characteristics of brain neurons**

Millions of years of natural selection have conserved within neural circuits of the brain certain connective propensities that produce baseline innate behaviors when triggered by specific environmental factors. These innate processes illustrate the principle that naturally selected imprinted behaviors are a product of gene-environment interaction, and do not reflect genes alone. Innately encoded neural circuits have been conserved to the extent that they possess the following connective properties:

- 1. The tendency of neurons which fire together to form lasting connections, first reported by Hebb (1949).*
- 2. A general bias toward neural innervations that are anticipatory, or predictive, in nature. Such innervations, in promoting individual survival, are understandably conserved by natural selection.*
- 3. A bias toward conservation of neural and synaptic transmission times, however miniscule (Libet et al.1979, Kinsbourne 1998 p.112), This parsimonious principle favors innate behaviors that are optimally responsive to environmental challenges with an absence or minimum of time-consuming conscious processing, as Dennett & Kinsbourne ( 1992) have argued.*

4. *A capacity for innately encoded neuronal connections to be variably modified by the organism's experiences in the environment (synaptic plasticity). This capacity allows for behavioral changes resulting from learning, including extinction of learned behaviors, as exemplified in psychotherapeutic interaction.*
5. *The development of internal emulations or representations of the outer world often referred to as brain mapping, which entail anticipatory innervation. Somewhat counter-intuitively, this reflects the closed-system nature of the brain mentioned above. No sentient organism is privileged to experience its physical and social environments in an immediate and unprocessed way. Organisms must 'make sense' of their surroundings in order to survive physically, relationally, and genetically. Data conveyed from the 'outer world' impact our membranous envelopes and are then processed and represented by neural assemblies. The clinically useful psychoanalytic concept of mental representation can be understood as a complex aspect of such evolved neural emulation processes.*
6. *Innervations have evolved to favor a tendency for individuals to relate themselves with others of the same species in horizontal (affiliative/avoidant) and vertical (hierarchical) patterns. Innately encoded horizontal social patterns are exemplified by mating, attachment, and combative behaviors, and vertical configurations are seen in status hierarchies and ranking behaviors, such as dominance and submission in dyads and groups. These pre-configured behavioral propensities have been referred to as "mental organs" by Wright (1994) and as "evolved psychological architecture" by Tooby and Cosmides (1992; see also Slavin and Kriegman 1992). Innately encoded patterns are readily observable in*

*a wide variety of contemporary behaviors if clinicians are open to seeing them in their patients and themselves. Basic evolved behaviors are considered pathological when they are maladaptive and ultimately self-defeating. This is exemplified in neurotic behaviors and in personality disorders.*

*7. Within social patterning propensities, certain more complex social behavior tendencies have been neurally encoded. Examples are kin altruism, deception and self-deception (Hamilton 1964, Trivers 1971), presumably conserved during the Pleistocene era – the EEA -- when human ancestors needed to negotiate the challenges and opportunities of competing for resources while living in small hunter-gatherer bands. Again, these foundational behaviors are observable in contemporary life. For example, much of the ego defense mechanisms, the dynamic unconscious and symptomatology of clinical concern draw upon ancestrally evolved capacities for self-deception, often leading to deception of others. Those psychoanalysts who are guided by standard ego metapsychology interpret these deceptive behaviors in terms of denial, isolation, projection, and projective identification.*

### **The adaptational significance of predictability and neurobehavioral disposition**

Anticipation and predictability appear to be the guiding principles of mental activity, which is largely unconscious because greater efficiency is gained when time is saved by avoiding unnecessary conscious processing. Neural transmission time is conserved when mentation is unconscious, and consciousness is called up for duty when there are

significant lacks of correspondence between what is predicted –what neural networks are prepared for—and what is actually occurring.

The 10 billion neurons and 10 trillion synapses that constitute the closed-system human brain are capable of a great variety of patterned linkages, many of which are more or less modifiable through learning and memory. The changeability, or plasticity, of neural connections is governed by the basic principle of adaptive suitability. The adaptive advantage of predictability allows the mind/brain to promptly (and non-consciously) assess the immediate surround for adaptive advantage. Depending on environmental challenges, neural connections are altered, and articulated closely with innate bioregulatory linkages. Such connections are established by means of alterations in gene expression at the cellular level. As mentioned earlier, Kandel (1998 p.461) indicates that gene alteration and the resulting changes in protein manufacture are the biological mechanisms that mediate environmental impact on innate innervations. In addition, Kandel views habituation as occurring by means of regression and pruning of synaptic connections (1998 p.465).

Physical survival depends upon neurally represented predictions of discomfort and danger. Contending with human and other aspects of the environment often activates innately pre-programmed, genetically driven emotional states and mostly reflex behaviors that, as mentioned above, have been conserved across millions of years of early hominid history. A widespread example in contemporary life would be a driver's automatic swerving when a large converging object unexpectedly enters the lateral visual field.



Some milliseconds after the vehicle or large boulder impinging from the side has been successfully avoided, conscious awareness of the incident develops along with feelings of anxiety, followed by relief. From a neurodarwinian point of view, the precedence of action over awareness and fright in such a case is an example of evolved physical survival strategies that do not require consciousness to be effective. Renik's paper on the analyst's subjectivity (1993) highlights the precedence of enactment over interpretation in the analyst's interventions.

It is important to note that the swerving behavior itself, a product neither of conditioned learning nor of memory, is not the entity conserved by Darwinian selection. What is conserved is the innate inclination, or propensity, to take immediate, unpremeditated, avoidant action in predicaments that are neurally and non-consciously processed as threats to physical survival. Of course, the capacity to drive a car is itself a product of learning and procedural memory, but in such crises, the innately imprinted propensity to avoid or flee (in this example, unconsciously perceived) threat takes behavioral priority. Counter-intuitively, consciousness is often retrospective even in situations that do not threaten physical survival (Dennett and Kinsbourne 1992, Wegner 2002). This principle of reflexive and unpremeditated behavior is also applicable to many transference/countertransference behaviors, where perceptions, ideation, feelings, and actions are not responsive to the salient realities of a current interaction.

### **The Darwinian neurodynamics of subjectivity**

From a neurodarwinian perspective, subjectivity can be conceptualized as the full spectrum of mental states and processes, chiefly non-conscious (Kinsbourne 1998), that has evolved to represent and evaluate survivability issues to the organism. These processes usually involve unconscious rule-based ‘if/then’ algorithms readily inferable in the analysis of transference (and of countertransference). A clinical example from my practice that emerged in the transference was ‘if an older man, then a danger of unwanted sexual attentions’, in the case of a female patient molested in her childhood by an uncle. In a supervised case, a female analytic candidate confronted by her male patient’s sibling-rivalry upset over meeting another male patient in her waiting room, the algorithm was ‘if a competing peer, then a danger of abandonment by a maternal figure’. Unconscious algorithms of this kind underlie many or most of the behaviors of clinical psychoanalytic and psychodynamic interest. With the brain comprising billions of neurons and trillions of synapses, it is arguable that naturally selected unconscious algorithms influence behaviors of every kind.

### **Innately imprinted behavior systems as foundations for subjectivity**

Subjective processing is a prime feedback system conveying significant information about the organism’s successes and failures in negotiating the rocks, shoals, and clear channels of life in a complex world of attachment opportunity, competitive challenge, and possibilities for compromise. Let us examine the innately imprinted, evolutionarily conserved armamentarium of neural pre-programming that each newborn possesses, variably subject to triggering and modification by the relational environment. In order to focus on two behavior systems especially relevant to psychoanalysis, I shall omit

discussion of the innate propensities characteristic of autonomic functions, of social signaling and other properties of social ranking, and of sexual selection.

Relational survivability in human surrounds appears to be built upon evolved interactional dispositions that have been encoded in the genome from early in our mammalian prehistory starting at least 20 million years ago. Examples are the socio-emotional systems described by Panksepp (1998), largely encoded in the more ancient limbic areas of the brain such as the sentinel-like amygdala, with its evolved capacity to engender fear responses. Panksepp has denoted such “emotional command” systems as Seeking, Fear, Panic, Rage, Play and Self, and has empirically identified their neurobiological correlates. He maintains that “the behavioral systems are evolutionary tools to promote psychobehavioral coherence” (1998 p.55).

The neuro-philosopher Patricia Churchland (2003 p.31) views neural representation as having arisen “as evolution found network solutions for coordinating and regulating inner-body signals, thereby improving behavioral strategies”. I suggest that evolved network solutions have produced the innately established baseline behavioral systems common not only to humans but to other animals as well.

### Temperament

During historical times, a common classification of human temperament was as follows: a) choleric, b) melancholic, c) phlegmatic, and d) sanguine. Currently, Pinker (2002) prefers the following dichotomies: a) open to experience vs. incurious, b) conscientious

vs. undirected, c) agreeable vs. antagonistic, d) extraverted vs. introverted, and e) neurotic vs. stable. Analytic clinicians, so often guided by the Standard Social Science Model, should stay aware of innate temperamental factors in their patients and in themselves (see Cloninger 1994). The clinical use of this perspective may assist in understanding many a therapeutic impasse. A clinical example is the frequent observation that with some patients much therapeutic progress may seemingly be made with no substantial lessening of their neuroticism. The analytic duo may have come up against the immovable wall of temperament in many of these cases. Innately imprinted temperamental factors also present extensive implications for child-rearing. Neubauer and Neubauer (1996) maintain that insensitive child rearing often results from parental attempts to change temperament in their children. Fonagy (2001 a) has made a similar point in his discussion of data from behavioral genetics, which emphasize the persistent impact of inborn temperament on behavior. Currently, there is considerable interest in the findings of behavioral geneticists on the influence on migratory behavior and novelty seeking of a long form (allele) of the dopamine receptor gene DRD4 (Noble et al.1998). Many adventurous and risk-taking people can be unknowingly responding to the behavioral effects of this long allele, and need not necessarily be reflexly pathologized as sociopathic or borderline.

#### The attachment behavioral system

A growing body of reports in the psychoanalytic literature has highlighted the pivotal role of attachment experience in mother-infant interaction (Beebe et al. 1997), child development (Siegel 1999, Stern 1985), and in psychoanalytic clinical interaction

(Holmes 2001, Fonagy et al. 2002). It increasingly appears that John Bowlby's (1969) efforts to align psychoanalytic thought with ethological and anthropological data, roundly condemned by most of his colleagues during his lifetime, are finally coming into fruition. Attachment is a prominent instance of the horizontal basic innate behavior systems. The core concept of attachment theory is that the infant actively seeks close emotional connection with its caregivers. The varying success or failure of these innately imprinted efforts is reflected in later behavior. In the case of mother-infant interaction, clinicians often find a tendency to re-play pathological attachment scenarios across subsequent generations of infant upbringing (Main 1993, 2000). The impact of attachment experience on the individual's subjectivity is observable in subsequent relationships, including clinical interactions.

In one of my recent analytic cases, for example, my patient transferentially reflected his early dismissive attachment experiences with his mother in at least two ways. First, he raged at me frequently when my attempts to communicate my understandings of him fell short of the mark. He would then accuse me of ignoring and dismissing him. Second, via projective identification, even when he was not rageful, he often induced in me the empty feeling of not being acknowledged or valued --- a major aspect of his own early experiences as a child.

### Mentalization

Almost in lockstep with attachment reports, studies on another key aspect of innate imprint -- mentalization, or theory of mind -- have recently begun to appear in the

psychoanalytic literature. By contrast, the evolutionary biology and anthropology literatures have been replete with theory of mind articles for some years (e.g.. Baron-Cohen 1995, Whiten 1991). Fonagy and his co-investigators (2002) have posited that insecure attachment experience can lead to theory of mind deficiencies, especially in borderline patients.

In fact, Fonagy and his collaborators view psychotherapy itself, in all of its incarnations, as the rekindling of mentalization. Here we witness a prominent contemporary analytic author defining the essence of psychotherapy as enhancing an evolutionary function. This emphasis seems to imply that corrective emotional experience (Alexander and French 1946) and attention to the patient's impressions of the therapist's thoughts and feelings (Hoffman 1983) can ameliorate mentalization difficulties, thereby facilitating good psychotherapeutic outcomes. Reasonably inferring the intentions of others is of distinct survival value in humans and other primates whose eventual reproductive possibilities hinge on effective relationships.

### **On the neurodynamics of therapeutic interventions**

The formation of new and altered neural circuitry in the course of conditioning and extinction of behaviors has been documented by cognitive neuroscience (Shevrin et al.1996). Damasio (1994) states "in some systems more than in others, synaptic strengths can change throughout the life span, to reflect different organism experiences, and as a result, the design of brain circuits continues to change" (p.112). The essentially contingent flexibility of neural circuits allows for "... a balance between circuits whose firing allegiances may change like quicksilver, and circuits that are resistant though not

necessarily impervious to change” (p.113). The enduring changes resulting from analytic and psychotherapeutic interaction can be expected to reflect synaptic alterations of this kind (Kandel 1999, Brickman 2000, Gabbard and Westen 2003). These findings argue for the desirability of a common ground to be shared by psychoanalytic and cognitive-behavioral approaches. If employed synergistically, combined approaches reflecting these seemingly disparate perspectives might enhance therapeutic effectiveness.

### **Re-thinking the mind and self as encoded modular neural patterns**

The evolutionary perspective regards the mind as emergent brain processing, primarily evolved and subsequently modified during the individual’s life span through gene-environment interaction. The earliest experiences with the parental surround are encoded exclusively in implicit, or procedural, memory, processed by the amygdala (LeDoux 1996), encoded in the orbitofrontal cortex, and not subject to memory recall. This finding is the current neurobiological understanding of Freud’s references to infantile amnesia (1899). With the development of certain subcortical structures after age four or five, experiences are encoded as explicit or episodic memory in the hippocampus and medial temporal lobe. These experiences are subject to recall (Squire 1986, Clyman 1991).

In their essay on neural networks and neurohumeral processes involved in pathogenesis, Migoni and Liotti (1998) have incorporated the work of Edelman (1992) and Control Mastery Theory as devised by Weiss and Sampson (1986) in a persuasive attempt to integrate psychoanalytic and cognitive neuroscientific thinking. With increasing understanding of the role in pathogenesis of memory and/or neurohumeral and hormonal

influences--e.g. peptides, glucocorticoids and catecholamines—comes a recognition that behaviors based on pathogenic beliefs are context-specific. The clinician can regard such behaviors, reflecting modular patterns of neural connection, as attempted adaptive strategies. Freud's (1923) concept of the repetition compulsion, shorn of its controversial references to a death instinct, would be consistent with the biological concept of modular neurobehavioral patterning. This would also apply to transference/countertransference behaviors.

In order to conceptualize the modular relational algorithmic templates that are characteristic of acquired innervations, investigators have developed a variety of terms. Examples are: Bowlby's "Internal Working Models" (1969,1988), Stern's "Representations of Interactions Generalized" (1985) Luborsky's "Core Conflictual Relationship Theme" (1984), Horowitz's "Role Relationship Models" (1991), Brickman's Contingent Affective Relational Dispositions, or CARDs (1999) and, more recently, Gabbard and Westen's "associational networks" (2003 p.828). These neural network patterns comprise sensorimotor components, anticipatory innervations, and relationally derived implicit and explicit memory. Baseline neural activities of the corticolimbic and midbrain systems are also involved, as well as the hypothalamically influenced neurohumeral and hormonal systems.

Affect plays a key role in these patterned neuro-behavioral modular dispositions as well. For example, Ciompi (1991) has identified the significant role of affect in the learning processes leading to memory storage. These dispositions are modular in nature to the



extent that they are deployed under characteristic relational circumstances. Those circumstances resonate with earlier experiences largely encoded in procedural memory. Connections to the motor cortex indicate that motor neuron innervation is an integral feature of intentionality, whether or not eventuated in bodily action (Libet et al. 1983). It is important to note the absence in all of these reports of any reference to a central commanding or coordinating homuncular neural entity,

### **On the selection of neural network solutions**

The neurobiologically demonstrated failure to identify a “pontifical” command station in the brain was anticipated years ago by the Nobel physicist Erwin Schrodinger (1944). Instead, modular dispositional networks (Edelman 1992) compete for neuronal group selection by means of trial innervations in the context of a particular environmental challenge. An obvious psychoanalytic instance of these processes would be in transference behaviors. It would follow from Edelman’s theory of neuronal group selection that the competing potentially crystallizable relational disposition that would prevail in life situations such as a transference arena would be unconsciously chosen as the one most adaptively suited to enhance ultimate survivability.

### **Questioning the unitary self from a neurodarwinian perspective**

“Normally, there is nothing of which we are more certain than the feeling of our self, of our own ego. This ego appears to us as something autonomous and unitary, marked off distinctly from everything else.”  
[Freud 1930, pp.65-66]

“Selves do not exist in the world”. [Metzinger, contemporary neuro-philosopher, 2003]

Psychoanalytic clinicians regard the self as a psychic structure endowed with such properties as ego strength and self-esteem, or suffering from fragmentation or self-loathing (Jacobson 1964). While a majority would probably hold that the self is interactively or relationally influenced—even Freud’s original concept of the superego reflects internalization of relationally-acquired perspectives—it is unclear how many would agree that the self in fact arises from contact with others. Yet, the neurobiological perspective suggests such a view of the supposedly unitary self. The most parsimonious view of the self would be referential: the unvarying point at the center of all experience. The sense of self-as-agency tends to convey an impression that all behavior is initiated by the conscious will of the organism itself. A contrary conclusion, namely that conscious will is an illusion, is reported by Wegner (2002). Damasio’s recent work (2003) is compatible with Wegner’s, and this will be further discussed.

There is a hint of a “deus ex machina” or of a homuncular cerebral entity in many psychoanalytic writings on the self. Kohut built a relatively new psychoanalytic paradigm on the concept of the self as a psychic entity, despite never having defined it. Meissner defines the self as “a supraordinate theoretical construct synonymous with the human person” [1999 p. 155]. Schore [1994] entitled his volume “Affect Regulation and the Origin of the Self”, and appears to regard the self in terms of an identifiable structure with a core (p.33). He portrays the self as “an active cognitive-affective structure or motivating system that records and organizes the memory of biologically activated bodily zones and the modes of relationships with others”. If Wegner and others (Damasio2003,

Kinsbourne and Dennett 1992) are correct in postulating the antecedence of behavior before conscious will, the notion of an agentic self becomes questionable.

Resonating with Harry Stack Sullivan (1950), Siegel (1999 p.229), referring to studies in child development, declares that “the idea of a unitary, continuous self is actually an illusion our minds attempt to create”. Siegel goes on to observe (p.229) that, in cognitive science, the mind is considered to have many distinct “parts” responsible for a wide variety of activities, “from feeding and reproducing to affiliation and reading other people’s minds” He also contends that dividing the information-processing modules is adaptively necessary to carry out efficient interactions with others in the world.

Siegel’s concept of multiple selves which are needed to carry out the many and diverse activities of our relational lives is consonant with the neurobiological findings I have been citing, and therefore with Darwinian imperatives as well. Major exceptions to the notion of a unitary self can also be found in the works of interpersonal and relational analysts such as Mitchell (1993) and Bromberg (1996) who have argued for a psychoanalytic concept of multiple selves. Daniel Stern’s position (2002) is that “multiple-self theorists focus primarily on *the experience of self* as it is shaped by particular relational contexts” (my italics). Rather than fixed magisterial psychic entities, selves as contemplated by Stern are products of varying intersubjective experience. One may add, in view of the work on antecedent action cited above, that ‘selves’ are reflective rather than originary in nature. Renik’s (1993) paper on the analyst’s spontaneous comments preceding conscious processing is also pertinent here.

A broader, more neurodarwinian, definition of ‘agency’ appears necessary. A *sense of self* may derive, in part, from neuronal linkages to associative cortical areas in the left hemisphere that have been empirically shown to encode consistency of subjective experience across time and circumstance. In any event, a sense of self appears to function as an orienting recursive signal while self-deceptively signaling central origination of behavior.

In the absence of a unitary authorial self, it would seem that the only consistent aspect of self-experience—or ‘selfing’ function---across contexts is *perspectival* self-function (Brickman 1999) referring to the subjective experience of being at the geographic center of one’s personal world. The consistent sense of self-function could be modulated by means of large functional clusters of neuronal groups which assemble themselves flexibly and adaptively to form mutually interactive “dynamic cores” of high complexity (Tononi and Edelman 1998). Complexity, or chaos, theory (Palombo 1999) appears applicable to the study of these dynamic cores, which can produce a consistent sense of central sentience. But, as the authors I have cited argue, central sentience is not central authorship in the sense of consciously willing one’s behavior. The innately imprinted systems reflect all of the naturally conserved social behavior propensities that tend to modify extreme self-interest in the interest of relational competence. These patterns include kin altruism, reciprocal altruism, and the virtuous social acts of companionship, cooperation, and reciprocity. Social behaviors chiefly based on deception and self-deception often lead to exploitation, seduction and repulsion, combative sexual rivalry,

and—most often in groups—tribalism and territoriality. Our hunter-gatherer ancestors needed to live cooperative social lives in order to assure personal and reproductive survival, according to paleoanthropological scholars such as Whiten (1991). As major groups of *homo sapiens sapiens* migrated out of Africa and began to develop croplands in Asia Minor at the inception of the Holocene era ten or fifteen thousand years ago, cooperative behavior was naturally selected along with the prevailing aggressive and competitive behaviors depicted by Tennyson in 1849 as “Nature red in tooth and claw”.

A quest for consensuality is embedded in much of contemporary human discourse. We often seek authentication of our view of reality, giving rise to such inchoate questions as, “Do you have the same or similar impressions/experiences as my own? Do I ‘read’ your feelings accurately? Do you read mine? Do we agree on matters of weather/politics/ the state of civil life/ the appearance and behavior of others?—of each other?” I suggest that this wish for consensuality reflecting an inherent fear of disconnected, solipsistic existence in an ultimately unknowable world may be a behavioral effect of the closed-system nature of the brain. We emerge from the envelope of the womb seeking relationships which hopefully will protect us against the dread of existence in a vacuum.

The neurally encoded ‘selfing’ nature of subjectivity impels the individual to make sense adaptively of subjective experience—including one’s own fantasies, thoughts, and bodily sensations—in the course of encounters with others. Such neural encodings also establish and maintain the psychoanalytically addressed dynamic unconscious, a realm of mentation that arguably has been naturally selected. The dynamic unconscious can be

seen as an adaptive self-healing process re-working implicit memories of traumatic experiences in early life by generating fantasies, inchoate thoughts, dreams, and often neurotic behaviors. Self-healing aspects of the dynamic unconscious are frequently the source of creativity as well.

### **Adaptive implications of intersubjectivity and the dynamic unconscious**

Freud's (1912) vision of the analyst's receptive tuning of his own dynamic unconscious to the transmitting of the analysand's unconscious was the first reference to clinical intersubjectivity in the analytic literature. In recent years, notably emphasized by developments in self psychology ( e.g. Stolorow et al. 1994), a two-person image of the therapeutic process has received increasing acknowledgement. While this orientation has received much favor, there has been an accompanying tendency in these writings to de-emphasize or even to omit any references to the dynamic unconscious. This may be a result of "throwing out the baby with the bathwater" in an effort to deny the clinical utility of classical ego psychological views of the dynamic unconscious as a realm of insufficiently integrated primitive sexual and aggressive impulses seeking gratification..

It appears difficult to conceive of a psychoanalysis that takes no account of unconscious psychodynamics. To eliminate the unconscious would be to reduce psychodynamic therapy to a kind of clinical social psychology in which conscious-level cognition is the subject matter. It would also amount to a failure to recognize the lasting effects of storage of early childhood traumatic experience in procedural memory and consequent non-conscious attempts at self-healing and survival through dreaming, creativity, fantasy, and

even an extensive variety of eventually maladaptive behaviors. A neurodarwinian perspective, therefore, suggests the evolutionary survivability of a dynamic unconscious as a modular adaptive tool, an immune system for the psyche. Dreams, fantasies, unthought ideas are among the self-healing activities of that conflict-laden domain of unconscious mentation. Borrowing from naval parlance, the self-healing aims of such an adaptive tool suggests the 'sick bay' function of a ship at sea, where medical personnel promote the goals of the voyage by attending to the injuries of officers and crew so they may remain on partial or full duty until fully healed. A limping, bandaged or depressed member of the ship's company remaining in the healing care of sick bay personnel is not a critical deterrent to the vessel's continued voyage. Further research is clearly necessary to establish the evolutionary rationale for this prime domain of psychoanalytic interest.

### **Summary**

In this essay, I have presented arguments for adopting and integrating neurodarwinian conceptual templates for psychoanalytic understandings of behavior as a promising link in the growing convergence of psychoanalysis and neurobiology. Biology entails the natural selection of neural configurations, or network solutions, ultimately favoring reproductive success. As aggregations of cells whose membranous borders require time for neural processing of sensate data, organisms have responded to selective pressures that have favored the development of cellular networks that map external reality by internally anticipating, representing, and interpreting outer-world experience in timely 'good enough' ways. Natural selection has also favored neural networks that provide the organism with an innately imprinted array of instinctive basic behavioral algorithms and

propensities that form the underpinnings of everyday relational interaction, normative and pathological.

In recent years, two evolutionarily significant basic behavioral functions, attachment and theory of mind, have been featured in psychoanalytic thinking. It has been argued in this paper that subjectivity and self are better comprehended with the help of such evolutionary understandings. A neurodarwinian view of the dynamic unconscious applying the analogies of a 'psychic immune system' or of a ship's 'sick bay' is also proposed.

## **References**

- AINSWORTH, M.D.S., BLEHAR, M.C., WATERS, E., & WALL, S. [1978] *Patterns of attachment: A psychological study of the Strange Situation*. Hillsdale, NJ: Erlbaum
- ALEXANDER, F., & FRENCH, T.M., [1946] *Psychoanalytic Therapy*. NY: Ronald Press
- ARON, L. [1991] The patient's experience of the analyst's subjectivity. *Psychoanalytic Dialogues* 1:29-51
- BADCOCK, C. R. [2000] *Evolutionary Psychology: A Critical Introduction*. Malden, MA: Blackwell Publishers, Inc
- BARAD, M. [2002] A biological analysis of transference. *Paper presented at the Los Angeles Psychoanalytic Society and Institute, Jan.12, 2002*
- BEEBE, B ., LACHMANN, F. & JAFFE, J. [1997] Mother-infant interaction structures and presymbolic self- and object-representations. *Psychoanalytic Dialogues*. 7, 113-182



- BOWLBY, J. [1969] *Attachment*. New York : Basic Books
- BRICKMAN, H. R. [1999] Rethinking psychoanalysis neurobiologically: the Darwinian connection as missing mind-brain link. *Invited paper presented MAY 14, 1999 at Austen Riggs Center, Stockbridge, MA*
- \_\_\_\_\_[2000] Revisiting Freud's bedrock: Evolution and the neurobiological turn in psychoanalysis. *Pre-circulated paper presented at the Winter Meeting of the American Psychoanalytic Assn. Meeting, New York City, December 15, 2000*
- CHURCHLAND, P. S. (1998) *Toward a Neurobiology of the Mind*. In Llinas, R. and Churchland, P.S. Eds. *The Mind-Brain Continuum*. Cambridge, MA: The MIT Press
- \_\_\_\_\_. (2003) Self-representation in nervous systems. *Ann NY Acad Sci.1001:31-38*
- CIOMPI, L. [1991] Affects as central organizing and integrating factors: a new psychosocial/biological model of the psyche. *Brit. J. Psychiatry* 159: 97-105
- CLONINGER, C.R. [1994] Temperament and personality *Current Opinion in Neurobiology* 4:256-273 .
- CLYMAN, R. [1991] The procedural organization of emotions: a contribution from cognitive science to the psychoanalytic theory of therapeutic action. *J. Am. Psychoanal. Assn.* 39 suppl.: 349-382
- DAMASIO, A. (2003) *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain*. Orlando: Harcourt, Inc.
- DARWIN, C [1858] *The Origin of Species*. London: Murray
- \_\_\_\_\_[1871] *On the descent of man and selection in relation to sex* (2 vols.) London: John Murray ( Reprinted in 1981 by Princeton University Press)

----- [1872] *The Expression of the Emotions in Man and Animals*. Chicago: Univ. of Chicago Press [1965]

DAWKINS, P. [1989] *The Selfish Gene*. Oxford: Oxford Univ. Press

\_\_\_\_\_ [1994] Burying the vehicle: commentary. *Behav. & Brain Sci* 17:4 616-617

DENNETT, D.C. & KINSBOURNE, M. [1992] Time and the observer: the where and when of consciousness in the brain. *Behav. & Brain Sci.* 15 (2) 183-247

DE SOUZA, W. C., EIFUKU, S., TAMURA, R., NISHIJO, H., AND ONO, T. (2005) Differential Characteristics of Face Neuron Responses Within the Anterior Superior Temporal Sulcus of Macaques. *J Neurophysiol* 94(2): 1252 - 1266

EDELMAN, G. M. [1992] *Bright Air, Brilliant Fire: on the matter of the mind*. New York: Basic Books

EKMAN, P & ROSENBERG, E.L. [1997] *What the face reveals*. New York: Oxford Univ. Press

ERIKSON, E. H. [1964] *Insight and Responsibility* New York: W.W. Norton

FONAGY, P. & TARGET, M.[1996] Playing with reality: I. Theory of mind and the normal development of psychic reality. *Int. J. Psycho-Anal.* 77 Part 2 pp.217-233

FONAGY, P [2000] Attachment and borderline personality disorder. *J. Am. Psychoan. Assn.* 48/4 pp. 1129-1146

\_\_\_\_\_ [2001a] The future of psychoanalysis and the psychoanalysis of the future. *Franz Alexander Memorial Lecture, Cedars-Sinai Medical Center and Southern California Psychoanalytic Institute, March 26, 2001*

\_\_\_\_\_ [2001 b] *Attachment Theory and Psychoanalysis* .New York: Other Press

- , Gergely, Jurist, E.L., & Target, M. [2002] *Affect Regulation, Mentalization, and the Development of the Self*. New York: Other Press
- FREUD, S. [1895] *The Project for a Scientific Psychology* S. E. 1: 283-359
- \_\_\_\_\_[1912] *Recommendations to physicians practicing psychoanalysis* S.E. 12: 111-120
- \_\_\_\_\_[1920] *Beyond the pleasure principle* S.E. 18: 7-64
- \_\_\_\_\_[1930] *Civilization and its discontents*. S.E. 21: 57-145
- \_\_\_\_\_[1937] *Analysis terminable and interminable*. S.E.23::216-253
- GERGELY, G. [2000] *Reapproaching Mahler: New perspectives on normal autism, splitting an libidinal object constancy from cognitive developmental theory*. J. Am. Psychoan. Assn. 48/4 pp. 1197-128
- HAMILTON, W.D. [1964] *The genetical evolution of social behaviour [I&II]* J. Theoretical Biology 7, 1-16, 17-52
- HARTMANN, H. [1958] *Ego Psychology and the Problem of Adaptation*. New York: International Universities Press
- HOFFMAN, I.Z. [1983] *The patient as interpreter of the analyst's experience*. *Contemp. Psychoan.* 19:3 pp. 389-422
- HOLMES, J. [2001] *The Search for the Secure Base* Hove: Brunner-Routledge
- HOLTZMAN, P. & ARONSON, G. (1992) *Psychoanalysis and its Neighboring Sciences: Paradigms and Opportunities*. *J. Amer. Psychoanal. Assn.*, 40:63-88
- JACOBSON, E. [1964] *The Self and the Object World*. New York. Internat. Univ. Press
- JONES, M. & FABIAN, A.C., Eds. [2006] *Conflict; Darwin College Lectures*. Cambridge: Cambridge Univ. Press

KANDEL, E. R. [1998] A new intellectual framework for psychiatry *Am. J. Psychiatry* 155:4 April 1998 pp.457-469

\_\_\_\_\_. [1999] Biology and the future of psychoanalysis: A new intellectual framework for psychiatry revisited. *Am. J. Psychiatry* 156: 505-524

\_\_\_\_\_, SCHWARTZ, J.H., & JESSELL, T.M. [2000] *Principles of Neural Science, International Ed.* New York: McGraw Hill

LIBET, B., WRIGHT, E.W., FEINSTEIN, B. JR., & PEARL, [1979] Subjective referral of the timing for a conscious sensory experience: a functional role for the somatosensory specific projection system in man. *Brain*, 102: 193-224

LLINAS, R. AND CHURCHLAND, P.S. Eds.[1998] *The Mind-Brain Continuum.* Cambridge, MA The MIT Press

LLINAS, R., & PARE, D. 1998 The Brain as a Closed System Modulated by the Senses. In Llinas, R. & Churchland, P.S., *The mind-Brain Continuum.* Cambridge, MA : MIT Press

MAIN, M. [ 1993] Discourse, prediction, and recent studies in attachment: implications for psychoanalysis. *J. Am. Psychoan. Assn.* 41, 209-244

\_\_\_\_\_ [2000] The organized categories of infant, child, and adult attachment: flexible vs. inflexible attention under attachment-related stress. *J.Am.Psychoan.Assn.* 48:4, 1055-1127

MARTIN, K. C. , CASANDRO, A. , ZHU H, ROSE J C, CHEN M, BAILEY C H, & MERZENICH, M.M., & de CHARMES, R. C., Neural Representations. Experience, and Change, in LINAS, R., & CHURCLAND, P. S. (1998) *The Mind-Brain Continuum.* Cambridge, MA: MIT Press

- KANDEL, E. R. [1997] Synapse-specific, long term facilitation of Aplysia sensory to motor synapses: a function for local protein synthesis in memory storage. *Cell* 91: 923-938
- \_\_\_\_\_ [1998] A new intellectual framework for psychiatry. *Am. J. Psych.* 155:4 457-469
- \_\_\_\_\_ [1999] Biology and the future of psychoanalysis: a new intellectual framework psychiatry revisited. *Am. J. Psych.* 156:4 505-524
- \_\_\_\_\_ [2006] *In search of memory*. New York: W.W.Norton & Co.
- MEISSNER, W.W. [1999] The self-as-subject in psychoanalysis: I. The nature of subjectivity. *Psychoanal. Contemp. Thought.* 22,1: 155-201
- MIGONE, P. AND LIOTTI, G. [1988] Psychoanalysis and cognitive-evolutionary psychology: an attempt at integration. *Int. J. Psycho-anal.* 79: 1071-1095
- MILLER, G.F. (2000) *The Mating Mind*. New York: Doubleday
- NEUBAUER, P.B. & NEUBAUER, A. [1996] *Nature's Thumbprint: The new genetics of personality*. New York: Columbia Univ. Press
- NOBLE, E. P., OSKARAGOZ, T. Z., RITCHIE, T. L., ZHANG, X., BELIN, T. R., & SPARKES, H. S. [1998] *D2 and D4 dopamine receptor polymorphisms*. *Am. J. Med. Genetics* 81: 257-267
- PALLY, and Olds, D [1998] *Consciousness: a neuroscience perspective*. *Int. J. Psycho-Anal.* 79: 971-989
- \_\_\_\_\_. [2000] *The Mind-Brain Relationship*. New York and London: Karnac Books
- PESKIN, M. [1977] Drive theory revisited. *Psychoanal. Q.* 66: 377-402
- PINKER, S. (2002) *The Blank Slate: The Modern Denial of Human Nature*. New York:

Viking

RENIK, O. (1993) Analytic Interaction: Conceptualizing Technique in Light of the Analyst's Irreducible Subjectivity. *Psychoanal. Q.*, 62: 553-571

REISER, M.F. [1984] *Mind, Brain, Body: Toward a Convergence of Psychoanalysis and Neurobiology*. New York: Basic Books

SCHORE, A.N. [1994] *Affect Regulation and the Origin of the Self*. Hillside, NJ: Lawrence Erlbaum Associates

SCHWARTZ, A. [1987] Drives, affects, behavior-and learning: Approaches to a psychobiology of emotion and to an integration of psychoanalytic and neurobiological thought. *J. Am. Psychoanal. Assn.* 35 #2: 467-506

SHEVRIN, H., BOND, J., BRAKEL, L.A.W., HERTEL, R.K., & WILLIAMS, W.J.,[1996] *Conscious and Unconscious Processes: Psychodynamic, Cognitive, and Neurophysiological Convergences*. New York: Guilford Press

SIEGEL, D. J. (1999) *The Developing Mind*. New York: Guilford Press

SLAVIN, M.O. AND KRIEGMAN, D. [1992] *The Adaptive Design of the Human Psyche*. New York: Guilford Press

SOLMS, M. AND SALING, M. [1986] On psychoanalysis and neural science: Freud's attitude to the localizationist tradition. *Int. J. Psycho-Anal.* 67: 397-428

STERN, D. et al.(2001) The Process of Change Study Group:[1998] Non-interpretive mechanisms in psychoanalytic therapy: the 'something more' than interpretation. *Internat. J. Psycho-Anal.* 79: 903-921

STERN, D.L. (1985) *The Interpersonal World of the Infant* New York: Basic Books

STEVENS, A. & PRICE, J. [2000] *Evolutionary Psychiatry : A new beginning*. 2<sup>nd</sup> Ed.

London: Routledge

STOLOROW, R.D., ATWOOD, G.E., & BRANDCHAFT, B., [1987] *The intersubjective perspective*. Northvale, N.J.: Jason Aronson

SULLOWAY, F.J. [1992] *Freud, Biologist of the Mind: Beyond the Psychoanalytic Legend*. Cambridge, MA: Harvard Univ. Press

\_\_\_\_\_ [1996] *Born to Rebel: Birth Order, Family Dynamics, and Creative Lives*  
New York: Pantheon Books

TOOBY, J. & COSMIDES, L.(1992) The psychological foundations of culture, In Barkow, J.H., Cosmides, L., & Tooby, *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*. Oxford: Oxford Univ. Press

TRIVERS, R.L. [1971] The evolution of reciprocal altruism. *Quart. Rev. Biology* 46:35-37

WATT, D. [2001] The dialogue between psychoanalysis and neuroscience: alienation and reparation. *Neuroscience*: 2:2

WEGNER, D.M. [2002] *The Illusion of Conscious Will*. Cambridge, MA: The MIT Press

WEISS, J , SAMPSON, H.. and the Mount Zion Psychotherapy Research Group [1986]: *The Psychoanalytic Process; Theory, Clinical Observation, and Empirical Research*. New York: Guilford Press

WHITEN, A. [1991] Ed., *Natural Theories of Mind* . Oxford: Basil Blackwell

\_\_\_\_\_ [1999] *The evolution of deep social mind in humans*. In: *The Descent of Man*. M. Corballis & S. Lea (Eds.) pp. 155-175 Oxford: Oxford Univ. Press

WILLIAMS, G.C. [1966] *Adaptation and Natural Selection*. Princeton: Princeton Univ. Press

WILSON, D.S. & SOBER, E. [1994] *Re-introducing group selection to the human behavioral sciences*. Behav. & Brain Sci. 17(4): 585-654

WRIGHT, R. [1994] *TheMoral Animal*. New York: Vintage Books

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