

# Can PLAY Diminish ADHD and Facilitate the Construction of the Social Brain?

Jaak Panksepp PhD<sup>1</sup>

## Abstract

The diagnosis of attention deficit hyperactivity disorders (ADHD) has been increasing at an alarming rate, paralleled by the prescription of highly effective psychostimulants whose developmental effects on growing brains remain inadequately characterized. One reason for the increasing incidence of ADHD may be the diminishing availability of opportunities for pre-school children to engage in natural self-generated social play. Pre-clinical work indicates that play can facilitate behavioral inhibition in growing animals, while psychostimulants reduce playfulness. The idea that intensive social play interventions, throughout early childhood, may alleviate ADHD symptoms remains to be evaluated. As an alternative to the use of play-reducing psychostimulants, society could establish play "sanctuaries" for at-risk children in order to facilitate frontal lobe maturation and the healthy development of pro-social minds.

**Key words:** ADHD, play, social brain, growth factors, frontal lobes

## Résumé

**Introduction:** Le trouble du déficit d'attention avec hyperactivité est de plus en plus souvent diagnostiqué, et ce, à un rythme alarmant. De même, des psychostimulants extrêmement efficaces, dont on ne connaît pas encore clairement les effets sur les cerveaux en formation, sont de plus en plus prescrits. Il se peut que l'augmentation du nombre de cas de TDAH s'explique surtout par l'impossibilité, pour ces enfants, d'interagir avec d'autres enfants par le jeu. **Méthodologie:** Des travaux pré-cliniques indiquent que le jeu aide les animaux en pleine croissance à surmonter leur inhibition, mais que les psychostimulants diminuent leur envie de jouer. **Résultats:** Il convient d'approfondir l'idée selon laquelle les interventions sous forme de jeu intensif avec d'autres enfants peuvent alléger les symptômes du TDAH. **Conclusion:** La société doit remplacer les médicaments par des « centres de jeu » destinés aux enfants à risque, afin de favoriser la maturation du lobe frontal de leur cerveau et de développer la socialisation.

**Mots clés:** TDAH, jeu; socialisation; facteurs de croissance; lobe frontal;

The human genome project revealed that humans have ~22,000 genes rather than ~100,000 as previous thought. But even that larger number would have fallen short of containing enough information to organize a fully-developed social mind. While our chromosomes contain enough information to construct the sophisticated brains babies possess at birth, our hereditary stores do not code for a full set of socialization skills. What genes contribute to development of social brains are the raw "primary-process" emotional and cognitive *tools* whereby family and societal influences can readily build socially functional minds. To exploit these genetic gifts to their fullest, we must create social environments for children that not only allow, but encourage them to satisfy their natural and joyful PLAY<sup>1</sup> urges (Panksepp, 1998a, 2001). Human socialization occurs when children's brain are allowed to learn and develop in culturally rich, mind-supporting environments, including those that support a variety of self-generated social activities encompassed by the concept of "natural play." Consider this vignette shared by German psychiatrist Elisabeth Troje:

"Our big house in the Black Forest is surrounded by meadows and trees. In

vacation time the family meets there. In my apartment are two grandchildren, who live in Antigua, West Indies and speak only English, Jasper, 10, and Imogen, 5 years old. There arrive two boys, grandchildren of my sister, 8 and 6 years, who live near London, speaking English and German. The four children stare at each other without a word. Then Jasper and Imogen begin to tease each other, using their feet, to knock each other, it looks dangerous, they hit

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## Footnote

<sup>1</sup>Much empirical evidence supports the existence of at least seven prototype emotional systems in all mammalian brains: SEEKING, RAGE, FEAR, LUST, CARE, PANIC and PLAY (Panksepp, 1998a). Please note that capitalizations are used for primary-process emotional systems to i) avoid part-whole confusions, ii) to alert readers to the claim that these may be *necessary* brain systems for those types of emotional behaviors and feelings although by no means *sufficient* for all the emotional manifestations that may arise from those systems in real world activities, and iii) to highlight that *specific psychobehavioral brain systems* are the referents of these labels).

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<sup>1</sup>Department of VCAPP, College of Veterinary Medicine, Washington State University, USA

Corresponding email: [jpanksepp@vetmed.wsu.edu](mailto:jpanksepp@vetmed.wsu.edu)

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the other's stomach and genital regions, but they do it softly, perhaps practised in Karate-like sports. They begin to laugh at each other without taking notice of their cousins, who stare at them, begin to move, to jump on the spot, begin to laugh, too. As soon as they move all in the same rhythm, Jasper turns to the door, running downstairs, behind him Imogen, behind them the two cousins follow immediately, they are running outside, and they disappear in the meadows and between the trees, playing for hours."

Laughter is the clearest signal that natural play urges are being engaged (Panksepp, 2007). Many years ago, Plato extolled the benefits of free play — "those natural modes of amusement which children find out for themselves when they meet"; continuing in *The Republic* [section IV] he insisted that "our children from their earliest years must take part in all the more lawful forms of play, for if they are not surrounded by such an atmosphere they can never grow up to be well conducted and virtuous citizens." To reduce the rising incidence of ADHD, perhaps we should follow Plato's advice and encourage more free play. More natural play may facilitate the growth of pro-social brains and minds and keep the incidence of ADHD to a minimum (Panksepp, 1998b, 2001).

### **Play and Brain-Mind Maturation**

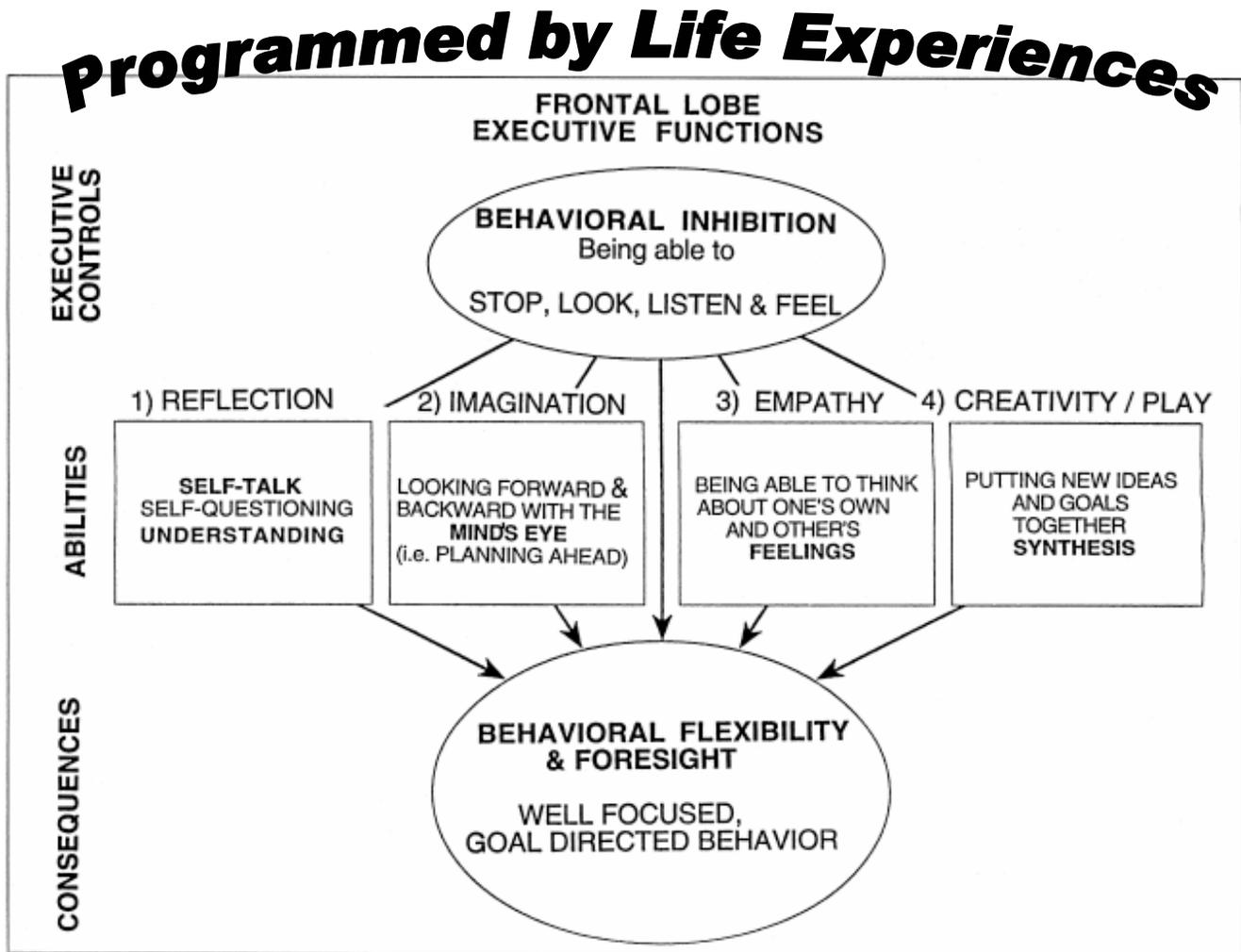
If animal data is a valid guide (Panksepp, et al., 2003), abundant play will facilitate maturation of the frontal lobe inhibitory skills that gradually come to regulate children's impulsive primary-process emotional urges. Here I develop the idea that the more children indulge in pro-social play, the sooner and more completely will they develop frontal lobe regulatory functions (Figure 1) that allow children, indeed all of us, to inhibit impulsive urges—allowing us to "stop, look, listen & feel." Such frontal lobe regulatory skills promote enhanced capacities for "self-reflection, imagination, empathy and creative/play": These executive abilities promote the kind of "behavioral flexibility and foresight" that constitute "well-focused, goal-directed behaviors" that may last a lifetime.

Although relevant prospective research

remains scarce, kids who had little opportunity for play are more likely to become anti-social, criminally prone adults. As Stuart Brown (1998) noted, "play deficient creatures suffer from 'value laden adaptive map deficiency.' As each brain map yields new functions, new kinds of memory, and a series of new inner value laden scenes, the player may begin (depending on its evolutionarily derived cartography capabilities) to develop a rudimentary sense of *self-other*". Thus, children must be "taught the requirements of intimacy and playfulness on an individual basis". . . for "game deprived child may well become the socially dysfunctional adult who cannot handle the complexities inherent in the adult world." It is known that animals that had little play when young are deficient in regulating their aggressive urges when adults (Potegal & Einon, 1989). Play has many benefits in developing animals (van den Berg, et al. 1999). Overall, the dynamic brain changes promoted by play probably facilitate brain growth and maturation, perhaps sensitizing pro-social circuits of the brain.

Since the urge to play is a neurological drive — an insistent emotional motivation — ludic tendencies become excessive in play-starved animals and children (Panksepp, et al., 1984), especially in classrooms and other social settings where other kids are readily available but rough-and-tumble activities are not acceptable. Might such play-deprived children be commonly diagnosed with Attention Deficit Hyperactivity Disorders (ADHD), and psychostimulants prescribed, which quell natural playfulness, a well documented effect in animal models? Some may consider it presumptuous to suggest animal data have important implications for human clinical practice. Still, the ability of abundant early social play to reduce ADHD needs to be formally evaluated in human children.

What is not controversial is that children are spending less of their early years learning socialization skills in the school-room of natural play. Because of this, increasing numbers of children may be getting attention-promoting psychostimulants to help their restless minds "sit still" during often boring academic lessons. In animals, all such medicines reduce playfulness at incredibly low doses (Beatty, et al., 1982, 1984). Although psychostimulants promote



**Figure 1. A synoptic overview of frontal lobe functions that may be slow to mature in children diagnosed with attention deficit hyperactivity disorders (adapted from Barkley, 1997, and Panksepp, 2001).**

outward attentiveness, such mind “medicines” rarely facilitate long-term learning and retention.

In sum, the increasing diagnosis of ADHD may reflect, in part, a cultural illness rather than any biological disorder (Panksepp, 1998b). This concept may help us understand why more than 10 million American children are presently being chronically medicated with psychostimulants, at the highest rate of any country in the world. The long-term biological and psychological effects of these drugs remain inadequately clarified in animal models, not to mention young humans. The trickle of evidence from animal models should alert us to possible dangers, including the potential for such maneuvers to increase depressive disorders.

Our work suggests we are not recruiting the social PLAY urges – genetically provided brain-tools that prompt positive social engagements and learning – to enhance healthy pro-social brain maturation. To evaluate this hypothesis, we must create joyful learning environments for pre-school children where natural playful activities have an optimal chance to do their appointed mind-creating work.

#### **Emotional Substrates of Pro-Social Tendencies**

All humans inherit at least three genetically-provided, social-emotional, brain-mind tools, shared by all young mammals, that help promote construction of fully-social minds: Our

childhood urge to PLAY should be integrated with our capacity to CARE for others, and to feel PANIC (separation-distress) when social bonds are severed (Panksepp, 1998a, 2005). These, and other, inherited emotional action systems allow young children to become fully social—they facilitate social bonding, social understanding and ultimately empathy and concern for others. Collectively, in the context of PLAY, they could be better used for joyful, positive enculturation. PLAY may help build and strengthen the reflective, inhibitory resources that enable empathetic-thinking brains (Figure 1). At present, such inherited emotional resources are being used haphazardly. If we learn to use them well, we may have less need for addiction-promoting, personality-changing psychostimulants that temporarily enable neocortical functions that have not adequately matured under the guidance of brain PLAY systems.

I am not questioning the genetically-based temperamental variability that contributes to the diagnosis of ADHD, and the high efficacy of psychostimulants in reducing impulsive behavior (Faraone, et al., 2006). These are well-established facts. I simply assert that we have, at our fingertips, better social-emotional, maturation-promoting tools to address such problems than are currently widely used to promote childhood development at home or within school systems. At a societal level, we have yet to institutionalize the power of PLAY to promote desirable mind maturation.

We have spent three decades studying the behavioral and neural nature of two of the most important social tools that our mammalian genetic heritage provides for children to become productive members of society. They are the ancient subcortical PANIC and PLAY emotional systems (Panksepp, 1998a, 2001, Panksepp, et al. 1980, 1984). Among the emotionally most painful genetically provided “tools for living” are the circuits that mediate separation distress (PANIC states), facilitating crying, sadness and social bonding. Such pro-social feelings ensure that young children value the company of others, especially those willing to invest in their welfare. Without adequate social attachments, no child can utilize the opportunities that healthy educational environments provide. The most wonderful evolutionary tool

to achieve full socialization of the brain is the rough-and-tumble PLAY system of the mammalian brain. Social PLAY allows youngsters to learn about social dynamics in affectively positive ways, leading them to CARE about others while they SEEK to understand the world. An enormous number of behavioral and mental functions may be refined during youthful play. Such neurobiological urges percolate persistently in every normal child, each and every day. If unfulfilled, there will be consequences, and one of them, may be an increasing incidence of ADHD (Panksepp, 1998a,b).

Our current “no child left behind” educational policy, focusing on reading, writing and arithmetic, at the expense of physical education and the arts, continues to steal *natural* PLAY functions away from our children, to be replaced, all too often, with regimented activities and sometimes psychostimulant medications that reduce play urges. Pre-clinical evidence (Panksepp, et al., 2003) suggests that if we learn to restore the power of PLAY into our pre-schoolers’ educational diet in new and creative ways, we may promote frontal lobe executive functions (Barkley, 1997; Panksepp, et al., 2003) and thereby reverse the rate at which ADHD is proliferating. Real play opens up the possibility of using all of our natural emotional tools for the epigenetic construction of social brains (Panksepp, 2001). A fine practical guide for such neuroscientifically based child-rearing is Margot Sunderland’s (2006) *The Science of Parenting*.

### **The Neural Nature of ADHD and Brain Effects of Psychostimulants**

Despite years of psychiatric research, *most* of what gets diagnosed as ADHD may be little more than natural variability of brain maturation that results partly from genetic factors and partly from the social environments we have created. At the neuroscience level, we know that ADHD children are a bit “short” (~5%) in their frontal lobe executive functions (Castellanos & Tannock, 2002) with many other brain regions of interest (Krain & Castellanos, 2006), especially brain dopamine dynamics (Staller & Faraone, 2007). It is debatable whether this is a clinically relevant brain *disorder*, at least until kids enter school, where they are commonly not as cooperative as children

who have better brain-mind regulatory functions. Such social-compliance problems may arise from the fact that their urges to play have been thwarted. Might play interventions earlier in development facilitate frontal lobe inhibitory functions and promote pro-social brain development? Might such cultural maneuvers forestall the need to prescribe attention-promoting, behavior-improving medications whose long-term biological cost-benefit functions remain inadequately characterized? Wisdom dictates that all natural interventions should be given a proper chance before resorting to powerful psychostimulants that have long-term effects on brain plasticity.

Although psychostimulants can increase attention in *everyone*, there is *no evidence* they promote the construction of pro-social brains during early development. Although there are many secondary benefits from not being ostracized by teachers and peers, a critical question is whether such drugs modify socially desirable brain plasticity? Animals treated chronically with such potential drugs of abuse exhibit various long-term, potentially undesirable, developmental effects (Moll, et al., 2001; Robinson & Kolb, 2004). The supposition that such brain changes may be “therapeutic” and desirable is currently without basis. And there are a variety of other long-term problems to consider.

### **ADHD, Psychostimulants and Drug Abuse**

Psychostimulants used to treat ADHD have neurochemical effects comparable to cocaine. Whereas cocaine smacks the brain fast and hard, psychostimulants like methylphenidate enter and exit the brain more slowly (especially with new slow-release preparations), yielding more desirable “therapeutic” profiles. This does not diminish the fact that all these drugs are highly addictive if access is unregulated.

Children with ADHD have traditionally exhibited higher than normal risk for developing substance abuse disorders later in life (Biederman, et al., 1998; Wilkens, 2004). Forced administration of psychostimulants promotes addictive tendencies in animal models (Robinson & Berridge, 1993). However, recent work claims that psychostimulant treatments promote no drug abuse in ADHD-type adolescents (Mannuzza, et al., 2003; Willens & Biederman, 2006), but such studies routinely fail to include

quantities of psychostimulants prescribed by physicians in overall drug intake statistics. In scientific fairness, we should compute the amounts of psychostimulants being medically administered in overall drug consumption, even if that does not meet criteria for our formal *conceptualization* of Substance Use Disorder. We must question psychostimulant-induced prophylaxis for drug abuse in ADHD kids until the underlying motivational and emotional changes that may result from these drugs are empirically addressed.

Also, in early studies (Biederman et al., 1999) ADHD children placed on methylphenidate initially had substantially lower drug abuse tendencies than unmedicated, controls (0% and 38% respectively at outset, and about 27% and 77% at four year follow-up). Interpretation of intake patterns when baseline differences in drug consumption exist, are problematic. Future studies corrected such flaws (Wilken & Biederman, 2006), but it is an open question whether psychostimulants are sometimes protective because of “therapeutic” effects as opposed to desirable feelings of getting “high” from prescribed drugs. Also, since kids getting medications often receive more social supervision, changes in drug intake patterns may be secondary to better psychosocial treatment of medicated children.

Only well-controlled animal studies can provide evidence for unconditional pharmacologically induced prophylaxis. At present, the jury remains out whether juvenile animals exhibit stronger or weaker addiction liability after being exposed to psychostimulants. There is evidence both pro and con (e.g., Andersen, et al., 2002; Brandon, et al., 2001). A critical unanswered question is whether humans chronically treated with such medications develop stronger drug cravings, as repeatedly shown in well-controlled animal studies? Might the brains of psychostimulant-treated children exhibit differential craving of such drugs later in life when most have outgrown ADHD symptoms? No study has yet attempted to evaluate changes in *desire* for drugs in adults medicated as children.

### **Neural Changes Resulting from Psychostimulants**

Changes in drug craving have never been

monitored in psychostimulant-treated ADHD children as they have in other animals. Animals routinely become *sensitized* to periodic administration of all psychostimulants. Their nervous systems become chronically hyper-responsive to various drugs of abuse, and this increased sensitivity is reflected in increased drug desire (Berridge & Robinson, 1998). This reflects a motivational shift from normal desires, “I want” so to speak, to “I WANT IT, and I WANT IT NOW.” Psychostimulant sensitization makes animals more urgently “materialistic” — more eager for all kinds of hedonic rewards (Nocjar & Panksepp, 2002). It is long past time to evaluate whether psychostimulant-induced “sensitization” has transpired in kids medicated for ADHD. This could be done by contrasting the acute physiological effects and psychological changes produced by psychostimulants in control children about to be medicated for the first time as compared to those that have been chronically medicated in the past.

The only solace we have is that very young animals do not sensitize as readily as older ones (Solanto, 2000), although they certainly sensitize to some extent (Laviola, et al., 1999; Panksepp, et al., 2002). As noted, psychostimulant exposure also leads to various other long-lasting neurochemical and neuroanatomical changes in the brain (Moll, et al., 2001; Robinson & Kolb, 2004). So far there is no evidence that such brain changes are desirable or beneficial. Chronic exposure to psychostimulants also promotes depressive affect when drugs are withdrawn (Carlezon, et al., 2003; Mague, et al., 2005). Regardless of how the above issues are resolved by future research, one social fact is clear: Psychostimulants used to treat ADHD are among the most powerful play-reducing drugs ever discovered through the use of animal models (Beatty, et al., 1982, 1984). This effect needs to be formally evaluated in ADHD children.

### **Play and Psychostimulants in ADHD Children**

It is a common claim, scientifically undocumented, that following onset of psychostimulant medications, ADHD children become less playful, more adult-like. Such changes are reasonable since psychostimulants promote neocortical arousal, and the neocortex inhibits all primary-process emotional urges (Liotti &

Panksepp, 2004). Primal playful urges are a subcortical birthright of animals (Panksepp, et al., 1994).

Are ADHD kids generally more playful than typical? So far it has been noted that preschooler with ADHD, during free play periods, engage in less play activity than controls and that ADHD children engage in less social, more solitary play than typical children (Hubbard & Newcomb, 1991). Such findings are not consistent with the idea that untreated ADHD kids have elevated play urges. However, since social-learning occurs rapidly in play, these results may indicate that the social-overtures of ADHD type children have been too rough or primitive – too “rude” - leading normal kids to avoid play with ADHD-type children.

Have ADHD children received less social play in childhood? This has never been documented. But what if it turned out that a substantial percentage of ADHD kids currently receiving psychostimulants are simply normal kids who have excessive, unsatisfied desires to play, and ADHD symptoms would diminish with play supplementation? In our informal efforts to evaluate this, we (at the Memorial Foundation for Lost Children in Bowling Green, Ohio) routinely counseled fathers in families with young ADHD children to expend special effort to have daily periods of happy rough-and-tumble play with their children. Their feedback was consistently that such daily activities were beneficial.

Might it be that many children given psychostimulants seem better largely because the drugs reduce disorderly behaviors that arise from poorly regulated play urges? Clearly, we need more work on how both social play and chronic exposure to psychostimulants influence long-term brain-mind organization. It is also time to ask whether a consistent diet of natural social play throughout early development may facilitate the construction of better pro-social brains and diminish the need for medications whose long-term consequences remain unknown. Until such questions are answered, we may be playing neurochemical dice with too many normal children.

### **ADHD and the Pro-social Effects of PLAY**

Although studies of brain and behavioral benefits of social play remain in their infancy, implications for ADHD have been evaluated in

one animal model. Play-therapy in ADHD-type rats effectively reduced some impulse control problems later in life (Panksepp, et al., 2003). When taken in the context of the finding that psychostimulants can chronically reduce social play in juvenile rats and *sensitize* the brain substrates for desire (i.e., “I WANT”, as monitored by elevations in appetitive ultrasonic vocalizations), we have cause for concern (Panksepp, et al., 2002).

Are the neuropsychological benefits of childhood play diminished in children whose social play-urges are chronically diminished with psychostimulants? We don't know, but relevant genetic work in animal models has been initiated. Social play in rats can activate growth factors such as BDNF in the brain (Gordon, et al., 2003). Our recent broad-scale brain gene expression analysis has indicated that activity of about of a third of the 1,200 brain genes we evaluated in frontal and posterior cortical regions are significantly modified by play within an hour of a 30 min play session (Kroes, Burgdorf Panksepp and Moskal, 2006, Unpublished observations from Falk Center for Molecular Therapeutics, Northwestern University). If such dynamic brain changes evoked by play facilitate brain growth and maturation, perhaps solidifying pro-social circuits of the brain, we must worry about anything that diminishes the progression of such developmental processes. It seems inconceivable that psychostimulants could simulate such dynamic gene expression patterns, but relevant work is nonexistent. In the absence of such evidence, we should assume that very different genetic “tunes” are “strummed” in higher brain regions by natural play and drugs used to treat ADHD, even if the medications help reverse brain conditions such as hypo-perfusion of frontal lobes (Akaya, et al., 2006).

At present, reasonable predictions are that: (1) psychostimulants will reduce the natural play urges of human children (perhaps best evaluated by psychoanalytically oriented play therapists); (2) a regular diet of physical play, each and every day during childhood, should alleviate ADHD-type symptoms in many children and diminish numbers of kids on the “clinical” track; (3) play will have long-term pro-social benefits for children's brains and minds that are not obtained with psycho-stimulants; (4)

psycho-stimulants may sensitize young brains and intensify internally experienced materialistic and drug desires that may be manifested, *if socio-environmental opportunities are available*, as elevated drug use (perhaps only in adulthood when parental-constraints loosen); (5) if relevant genetic studies can ever be conducted in human children, we anticipate that the profiles of gene-activation resulting from abundant play and chronic psychostimulants will be vastly different within the brain. If so, we may have sufficient cause to worry and to develop social policies that encourage abundant early physical play to promote pro-social brain/mind development.

### Play and Early Learning Social Policies

Have we compromised the playful birthrights of our children? Can a fully social brain emerge without play or will it remain socially stunted for life? In addition to the opening quote, in *The Laws* [VII, 794] Plato encouraged free play in children, asserting that “At the stage reached by the age of three, and after ages of four, five, six, play will be necessary. These are games which nature herself suggests at that age; children readily invent these for themselves when left in one another's company. All children of the specified ages, that of three to six, should first be collected at the local *sanctuary*—all the children of each village being thus assembled at the same place. Further, the *nurses* are to have an eye to the decorum or indecorum of their behavior” (my italics). Although Plato advocated more social engineering than might be wise in a free society, his basic message was that without supervised *natural* play our children cannot become fully human. Preliminary results already indicate that access to play improves classroom behavior and academic performance (Pellegrini & Smith, 1998).

One of the dilemmas in promoting socialization through abundant natural play is that physical play takes children to the edges of their emotional knowledge, where there will be inevitable social conflicts that must be promptly resolved with the help of caring social-educational assistants — Plato's *nurses* — hanging around the edges of play *sanctuaries*. Naughty things happen often during free play, and without supervision and social-guidance,

may lead to chronic bullying. However, under sympathetic watchful eyes, every one of those moments is a wonderful opportunity for positive social learning — the gentle sharing of our adult social expectations. Pursuant to the first well-controlled ethological analysis of human social play (Scott & Panksepp, 2002), we implemented this pro-social educational strategy within half-hour play sessions in pre-kindergarten classes of our public-school system. When pro-social expectations were gently but firmly conveyed and the reward was immediate continuation of play, young children understood well. They seemed to rapidly internalize the universal social rule “Do unto others”. . . in order to continue having fun (Scott, 2001). Obviously, care will need to be taken that such environments are designed so that children with ADHD tendencies will not experience excessive failures and rejections by their peers.

Although highly effective psychostimulants can keep kids on task in classroom situations, we must openly evaluate their overall costs and benefits. We still do not know, but there may only be a single indirect benefit: Highly impulsive children are less likely to get marginalized, thereby avoiding potential life-long negative consequences. As emphasized here, the costs may be many. The choice we now have is whether to give play and other psychosocial interventions (e.g., Chronis, et al., 2006) some priority in the sequence of developmentally attempted interventions.

### **Conclusion: Play Sanctuaries**

And where are Plato’s play *sanctuaries* for our times? Nature has been removed from the lives of too many of our children (Louv, 2006). Most young children have few rough-and-tumble play opportunities. Their surrogates - organized sports and “play dates”— are commonly pale imitations of real PLAY. Most parents, and educational systems, don’t even recognize the profound value of natural play – the “games which nature herself suggests at that age”. Many envision such activities as an incipient form of aggression. It is very different. Even though dominance seems to be a natural aspect of physical play (Panksepp, et al., 1984), with skill, this urge could be used to promote social sensitivity. Many parents and school systems neglect play needs (Sunderland, 2006), assum-

ing that treating children like little adults facilitates the construction of well-conducted citizens. But there is no evidence that young minds can mature optimally without daily PLAY satisfactions – a primary tool for social nurture that Mother Nature provided.

Perhaps, as Plato emphasized, pro-social brain maturation can be facilitated through abundant *natural* play throughout early childhood. Rough-and-tumble PLAY may also be an important prelude for more elaborate associative play that involve pretend play and the imaginative dramatizations of older children. If families can no longer provide adequate opportunities, perhaps society should consider investing in “play sanctuaries”— places where we meld joyful play and emotionally-fulfilling education, especially since lack of play may have dire psychological consequences other than ADHD (Brown, 1998). Thus, the consistent finding that all psychostimulants reduce playfulness in young animals is profoundly troubling. By blending the power of each child’s PLAY and SEEKING urges, more children may have optimal opportunities to internalize joyful living and learning as life-long habits.

PLAY circuitry is perhaps the major tool, provided by the genes, to allow fully social-brains to flower, nourished by the powerful daily sunshine of fun. Ultimately childhood laughter and shrieking are indicators of the quality of natural play, an emotional process evident in humans (Scott & Panksepp, 2001) and certain other animals (Panksepp, 2007; Panksepp & Burgdorf, 2003). Sustained satisfaction of the primal PLAY urge may reduce the incidence of impulse control disorders by promoting pro-social regulatory functions of the frontal lobes (Figure 1). There may be other benefits: Half-hour physical play-sessions half an hour or so before bedtime may help reduce all too common going-to-sleep problems in youngsters. Another “side effect” of early joyful living might be reduced incidence of childhood and adult depression. Childhood depression is devastating for playfulness (Mol Lous, et al., 2002), and as noted, withdrawal from psychostimulants can promote depression.

In our increasingly dangerous postmodern societies, it may be a wise cultural investment to build supervised, education-promoting play-*sanctuaries* for our ever increasingly play-

starved pre-schoolers. There, we might allow children to partake in the power of natural early socialization, with social sensitivity being a critical ingredient of all activities. These venues may also help us identifying youngsters that may need special attention long before serious psychological troubles have crystallized. . . and long before anyone, who has thought through the issues, would consider medicating them with powerful drugs whose long-term consequences remain inadequately documented.

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