

NATURE DISRUPTED: EVOLUTION, KINSHIP AND CHILD SEXUAL ABUSE

Mark Erickson

Summary

Much of modern illness is caused by novel pathogens. Examples include asthma caused by air pollution and cancer due to tobacco use. Incest and child sexual abuse may be analogous. They may be caused by evolutionarily novel *pathogens of kinship*. Several lines of evidence are supportive. We have learned that incest is rare in nature. Biological and anthropological studies now demonstrate that a Darwinian adaptation for *incest avoidance* exists in virtually every social species, including humans. In contrast, human clinical studies show that incest is alarmingly common. Moreover, the victims of most incest in our species are children. The equivalent behavior, sexual abuse of infants and juveniles by mature males, is virtually non-existent in other primates. The biology of familial bonds has rested, for several hundred million years, on developmental regularities including the early association of kin and hormonal changes associated with maternal and paternal care. There are now a multitude of evolutionarily novel pathogens that may disrupt this biology. Incest and the sexual abuse of children may be one manifestation.

Key words: Child Sexual Abuse – Child Maltreatment – Familial Bond – Incest – Incest Avoidance – Kin Selection – Kin recognition – Maternal Care – Paternal Care – Prolactin – Testosterone – Westermarck Effect

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Nature Disrupted: Evolution, Kinship, and Child Sexual Abuse

Much of modern illness is caused by novel pathogens. Examples abound. Asthma is caused by air pollution. Emphysema and lung cancer are the result of tobacco use. An epidemic of obesity and diabetes can be traced to our modern diet. I will argue that incest and child sexual abuse are analogous. To a substantial degree incest may be caused by exposure to *pathogens of kinship* not encountered in natural history. There are numerous possible pathogens including cultural practices that reduce early association between kin and substances that disrupt hormonal changes linked to parental care.

Epidemiological studies have shown that incest, and child sexual abuse, is far more common than was imagined. About 13.5% of women report a history of child sexual abuse. In over half of these cases the perpetrator was within the family (Molnar et al. 2001). Most appallingly, victims of incest are usually children (Phelan 1995, Faller 1987, Adler and Schultz 1995). Further, incest is a risk factor for severe psychopathology including depression, anxiety disorders, substance abuse, and post-traumatic stress disorder (Arnow 2004).

In contrast to clinical findings, biologists have

discovered that incest is *rare* in nature. An adaptation for *incest avoidance* evolved, presumably because of the maladaptive effects of close inbreeding (e.g., Bittles 1995). Of critical importance to psychiatry, anthropologists have shown that humans, too, possess this incest avoidance adaptation (e.g., Wolf 1995, 2004). When incest occurs in nature it is between mature animals. The equivalent of child sexual abuse, so common in our species, appears to be virtually non-existent in other primates (Personal communications: Anne E. Pusey, Michael T. McGuire, Toni Ziegler, Frans De Waal - see footnote at end of text).

A double irony has emerged. It was long believed that incest was common in nature and rare in our species. We now know incest is rare in nature and rather common among humans. Freud imagined human incest was rare *because of culture*. It is now more reasonable to argue that the reverse is true. Culture is not inhibiting incest – it is increasing its prevalence. The *mismatch* between the hunter-gather society, in which we evolved, and the cultural milieu in which most humans now live may be disrupting adaptations of kinship. Child sexual abuse, and its psychological sequelae, might be one manifestation.

There is an emerging biology of kinship which is not well known within psychiatry. I will review rel-

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evant studies with an emphasis on incest avoidance and the endocrinology of paternal care. These data are integrated into a general model of kinship called the familial bond hypothesis (Erickson 1989, 1993, 2000, 2004). This model predicts three areas of vulnerability where pathogens, not encountered in natural history, are most likely to disrupt adaptations of kinship. Potential pathogens are discussed and implications for prevention and treatment are considered. Although my focus is child sexual abuse, the hypothesis, that culture is disrupting the biology of kinship, may be equally relevant to understanding child neglect and child physical abuse.

I. Natural Selection and Incest Avoidance

For most of the twentieth century it was assumed that a *cultural* rule, an incest taboo, was necessary for inhibiting incest. Incest was believed to be natural. Freud (1913/1953) took this assumption to its logical conclusion when he argued that repression of incestuous impulses creates a universal human neurosis, the Oedipus complex.

Edward Westermarck (1891/1922), a contemporary of Freud, presented a remarkably different hypothesis – one we now realize was prescient. Westermarck proposed that an aversion of incest had evolved because of the maladaptive effects of close inbreeding. This aversion was *not* hardwired or present at birth. Rather, it depended on the close affiliation of kin in early life. In modern terms Westermarck asserted that a mutual bond forms between parent and child, during an early sensitive period. This bond is inherently, *biologically*, non-sexual. If sexuality intrudes into the bond it is experienced as aversive. As parents and children are in close early affiliation, in all traditional cultures, this hypothesis is plausible.

A. Incest avoidance in nature

Although no objective findings supported either hypothesis, Freud's model gained ascendancy. Decades passed until discriminative data emerged. In 1968, primatologist Donald Sade published a study showing incest was uncommon in rhesus monkeys. Sade (1968:19) wrote:

The rarity of mother son mating (in rhesus monkeys) is even more remarkable when the fact is considered that behavior such as grooming, body contact and mutual defense occur frequently between mother and some mature sons during mating seasons as well as non-mating seasons. One could expect that mating would occur most commonly between mother and son but, in fact, the reverse is true.

Sade's comment is informative. He is surprised by his observations, giving witness to misconceptions about kinship that had persisted for decades. Not only was mating between mother-son pairs rare, even during mating seasons some mother and son pairs remained in close proximity. Their sexual "avoidance" was not

due to mutual disinterest. To the contrary, mother and son were central to the survival and social life of the other. There was frequent intimate contact through grooming. They maintained a stable attachment into adulthood, yet their bond was not sexual.

There is now an extensive literature on incest avoidance in nature. Animals as diverse as chimpanzees, pilot whales, gerbils, and the acorn woodpecker, rarely mate with immediate kin (Pusey 2004, Amos et al. 1993, Agren 1984, Koenig and Pitelka 1979). When incest is seen in nature it occurs between sexually mature kin. The equivalent of child sexual abuse appears to be virtually non-existent in non-human species (Personal communications: Anne E. Pusey, Michael T. McGuire, Toni Ziegler, Frans De Waal - see footnote at end of text).

Consistent with Westermarck's hypothesis, developmental studies have shown that incest avoidance, in non-human species, depends on close association during an early sensitive period. Prairie voles, for example, rarely mate incestuously if raised within their biological litter. However, if siblings are experimentally separated at birth, and placed in foster litters, they will later avoid mating with foster sibs but mate incestuously with unfamiliar sibs (Gavish et al. 1984). It is early association, not genetic relatedness per se, which canalizes incest avoidance. Evolution has used early association as a reliable correlate of kinship. In nature it is. This finding is of clinical importance. It suggests one of the ways in which familial bonds are vulnerable to disruption.

B. Incest avoidance in humans

The key obstacle to understanding the foundations of human incest avoidance is the incest taboo. All cultures share this ostensibly cultural rule which has made it difficult to isolate biological influences. To control for this problem anthropologists have sought circumstances of early association without a later taboo on sexuality. Two compelling test cases have been extensively studied: one on Israeli kibbutzim, the other in rural Taiwan.

1. Kibbutz peer exogamy

On communal farms in Israel, called kibbutzim, children of the same age were, until recent generations, raised together. They lived in a "children's house" from shortly after birth through high school graduation. Aside from evening visits with parents, children of the same peer group remained in close, ongoing association. As peers matured no cultural rule opposed their sexual affiliation. Because of their constant early association Westermarck's hypothesis predicts that peers should be sexually avoidant. In a large study this prediction was well supported. Sexual affiliation whether through dating or marriage (n=2,769) was rarely observed between co-socialized peers. Association throughout early childhood (about 0-3 years) most powerfully precluded later sexual affiliation (Shepher 1971).

Notably, kibbutz peers showed other familial behaviors. They formed stable attachment bonds from

infancy (e.g., Rabin 1965:23). Later in life peers maintained close and remarkably supportive bonds. Bettelheim (1969:86) writes, “[Peers] show some of the psychological features of twins, the deep dependence and reliance on each other.” The sexual avoidance of peers existed alongside a stable, mutually supportive, attachment. This pattern, contingent on early association, is similar to that seen in other species. The pattern suggests a more inclusive adaptation than anticipated by Westermarck. Incest avoidance may have co-evolved with other behavioral adaptations of kinship including attachment and care-giving (Erickson 1983, 1993, 1999; Wolf 1993, 1995).

2. Sexual avoidance in *simpua* marriage

The most comprehensive test of incest avoidance, in humans, is the ongoing study of Stanford anthropologist, Arthur Wolf (1966, 1971, 1995, 2004). In Taiwan Wolf has, for over 40 years, studied a formerly common kind of marriage here called *simpua* marriage. In *simpua* marriage the bride (the *simpua*) is usually betrothed in infancy and raised in the groom’s home. The couple is married in their mid-teens within a culture that unequivocally endorses their conjugal bond.

Because *simpua* couples are raised together from early life Westermarck’s hypothesis predicts they will experience sexual aversion. Wolf’s findings are supportive. The divorce rate of *simpua* couples is about 2&1/2 times greater than for other arranged marriages. Their fecundity rate, by government records, is about 38% lower than other couples provided the bride to be entered the groom’s family in early life (Wolf 1995:207). This figure is likely conservative. Extramarital affairs were particularly common among both husbands and wives in *simpua* marriage. Illegitimate children born of these affairs were registered in the family name.

As with the kibbutz data the sexual avoidance of *simpua* couples is most pronounced if they are brought together in early childhood (0-3 years). Wolf now has data on over 14,000 *simpua* couples. This exceptionally large data set has allowed Wolf to test alternative hypotheses. The only hypothesis to survive this scrutiny is Westermarck’s (Wolf 1995).

In sum, Westermarck’s hypothesis, which was largely ignored for decades, now has far more empirical support than any alternative model. Incest avoidance research provides a remarkably thorough test of this evolutionary hypothesis of a human social behavior (Wilson 1998). Clinicians are acutely aware, however, that early association alone is not sufficient to establish incest avoidance. To the contrary, most incest occurs despite early association. Are there definable influences that disrupt this natural adaptation for incest avoidance? If so, might knowledge of these influences help us prevent child sexual abuse?

II. Juxtaposing Evolutionary and Clinical Research: A Step Toward Prevention

Studies of incest avoidance demonstrate the enormous influence of early association on later sexual af-

filiation. Animals rarely mate incestuously unless they are experimentally separated in early life. The kibbutz peer and *simpua* marriage findings show that early association largely precludes later sexual attraction. Findings from biology and anthropology when coupled with clinical studies point to distinguishing two kinds of incest: (1) incest following early separation and (2) incest occurring despite early association. The former is consistent with the evolutionary model, the latter demands explanation. Given early association, how is our adaptation for incest avoidance disrupted? Clinical research suggests an answer.

Incest following early separation

In his large study, Weinberg (1955) showed particular interest six pairs of incestuous siblings. In this group both brother and sister desired incest. There was no evidence of coercion on the part of the brother, as is typical in sibling incest. Although aware of the incest taboo both brothers and sisters were largely indifferent to it. They apparently lacked guilt. Relationships were often passionate. Three resulted in marriage. Notably, in *every* case siblings had been separated in infancy and only later reunited. Weinberg was not aware of Westermarck’s hypothesis. His data are, however, consistent with it. Early separation of kin should preclude incest avoidance.

Our best window into incest, following the early separation of kin, is through Britain’s Access to Birth Records Act, approved in 1975. This act allows adopted persons over the age of 18 years to use government records to trace kin. An unexpected complication of this legislation has been the sexual attraction, often intense, between reunited kin. Greenberg and Littlewood (1995) have estimated that over 50% of reunited kin experience significant sexual attraction. What is most striking is that sexual attraction is often *mutual* whether the reunited are siblings, a mother and son, or father and daughter. The following examples from their study are illustrative:

(A 22-year-old civil servant meets his mother) “We meet, smile, kiss...I notice her nose, brow, deep set eyes; I am constantly looking for similarities...She said ‘I’ve got to touch you’ and touched my face...It felt nice...I felt teased, and she admitted she was teasing me...We kissed tinkering on the edge.”

(A 35-year-old nurse meets her biological father) “It developed very quickly, we hugged and kissed that first weekend...I had a sexual dream about him, wanting it. I thought it was crazy but discovered he was open to it.”

Many similar anecdotal accounts exist. Allen and Patty Muth, brother and sister, had an incestuous bond that spanned several years. It resulted in the birth of four children. The couple moved frequently, staying ahead of the law, but were eventually arrested and convicted for the felony of incest in the State of Wisconsin. Mentioned, as an aside in the popular press, was that the couple had been separated in infancy and did not meet until Patty, the younger sibling, was eighteen years of age (Voll 1998).

Perhaps the most vivid account of father-daughter incest is found in the diaries of writer Anais Nin (Bair 1995). Although not completely separated from her father, concert pianist Joaquin Nin, contact was limited because Joaquin was frequently on tour. At home he usually withdrew from the family. When he noticed Anais at all he was often critical and dismissive, calling her "ugly little girl". When Anais was ten Joaquin abandoned the family altogether. Twenty years later they reunite. An attraction developed quickly. On their second meeting Joaquin states, "You are the synthesis of all women I have loved... *I don't feel towards you as if you were my daughter*", Anais replied, "*I don't feel as if you were my father*" (emphasis added). He responded, "I have finally met the woman of my life and it is my daughter... I am in love with my own daughter". Anais replies, "Everything you feel is reciprocal".

A recurrent story line in literature in which incest is a theme is one of early separation. Examples include *The Book Bag* by Somerset Maugham and *The Caryatids* by Isak Dinesen. The Myth of Oedipus is the best-known example. Oedipus is separated from his mother, Jocasta, in infancy. Much later they reunite, incestuously. Anthropological findings now illuminate this myth in a way not anticipated by Freud. Oedipus portrays the literal truth that early separation undermines a natural adaptation for incest avoidance.

Incest with Early Association

In striking contrast to incest following early separation, incest with early association is usually coercive and aversive. In father-daughter incest the experience of the daughter is typically one of fear, disgust and shame. Phelan (1995) found that none of the daughters in her study initiated incest or enjoyed what happened. Given early association it seems that incest is rarely emotionally tolerable to the daughter (e.g., Lukianowicz 1972). Mothers in father-daughter incest families are, consciously or unconsciously, often complicit. They may indirectly support or not interfere with their husband's incestuous abuse. Not surprisingly, victims of father-daughter incest typically have extremely negative views of their mother. In one study 39 of 40 women had a markedly negative maternal image, using adjectives such as cold, indifferent and un-giving to describe their mothers (Herman 1981). The only exception was a woman who had lost her mother in early childhood.

A similar pattern is seen in sibling incest. The personal relationship between an offending brother and his sister is typically non-existent aside from physical abuse and coercive sexual contact (Laviola 1992). With early affiliation sibling incest virtually never eventuates in an ongoing, mutually desired, sexual bond.

The most salient predictor of incest, given early association, may be the severely disrupted early attachment experience so frequently found in perpetrators, whether parents or older siblings. Incestuous fathers typically describe a childhood filled with rejection, neglect and physical and/or sexual abuse (Cavallin 1966, Parker and Parker 1986, Justice and Justice 1979, Kaufman et al. 1954, Lustig et al. 1966, Raphling et al. 1967, Mian et al. 1994). Mothers, in father-daughter incest families, generally have experienced a childhood

of emotional deprivation and, not infrequently, sexual abuse (Justice and Justice 1979, Mian et al 1994, Mrazek 1981).

Similarly, in families in which there is sibling incest both mothers and fathers are often neglectful and emotionally absent. Physical abuse is extremely common. Adler and Schultz (1995) found that over 90% of boys, who perpetrated incest, had been physically abused by one or both parents. Finally, mothers who perpetrate incest typically describe unremittingly bleak childhoods using terms such as "rough" and "horrible" to describe their experience. Physical and/or sexual abuse is very common in the childhood of incestuous mothers (McCarty 1986).

Perhaps the most disturbing clinical finding has been that incest is frequently initiated early in a victim's life. Father-daughter incest often begins when the daughter is six years of age or younger. It has been estimated that the average age of onset is about eight to nine years (Kaufman et al. 1954, Phelan 1995, Sariola and Uutela, Wyatt 1985, Lukianowicz 1972, Herman 1981). In sibling incest the brother is usually an adolescent when incest starts. The mean age of his sister is about seven years (Adler and Schultz 1995). In maternal incest the mean age of victims at assessment is about 6 years of age (Faller 1987). The early onset of much of human incest does not appear to derive from fixed pedophilia. Perpetrators of incest rarely limit their sexual attention to children (Frenzel and Lang 1989).

From a biological perspective, incest inflicted on children is particularly bizarre. It has no reproductive function. It is often psychologically devastating. It exposes offspring to sexually transmitted diseases and other medical problems. It is difficult to see child sexual abuse as anything but maladaptive. As noted, the largest prevalence study we have finds that 13.5% of women report a history of child sexual abuse (Molnar et al. 2001). Moreover, the equivalent of child sexual abuse is virtually never observed in other primate species (Personal communications: Anne E. Pusey, Michael T. McGuire, Toni Ziegler, Frans De Waal – see footnote at end of paper).

We share what is almost certainly a homologous adaptation, for incest avoidance, with other primates. Why then is child sexual abuse so common in our species? In my view, the most plausible explanation is that it is being caused by the disruption of the evolved biology of human by relatively novel pathogens. What these pathogens might be is discussed shortly.

To summarize, incest following early separation is fundamentally distinct from incest occurring despite early association. The only circumstance where incest is mutually desired, and may eventuate in a stable sexual bond, is when kin are separated throughout early childhood and are only later reunited. In contrast, incest occurring despite early association is typically experienced as aversive and virtually never results in a mutually desired sexual bond. Those who perpetrate incest, despite early association, were usually abused and/or neglected in childhood. The apparent link between childhood abuse and the later disruption of the incest avoidance adaptation is not predicted by Westermarck's hypothesis. Explaining this variance is critical if the biological studies of incest avoidance are to inform our clinical understanding of incest.

III. The Familial Bond Hypothesis: An Integrated Model of Kinship

Freud's model of kinship was comprehensive in that it included both evolutionary and developmental hypotheses. His Oedipal model was, however, based on assumptions we now know to be incorrect. In contrast, Westermarck's model, although limited in scope, rested on assumptions that were correct. Might Westermarck's hypothesis provide the cornerstone for a revised and comprehensive model of kinship?

Until the 1960's, even among biologists, there was considerable confusion about evolution and familial behavior. Then, evolutionary biologist, W.D. Hamilton (1964) presented what he called *kin-selection theory*. Kin-selection theory has since revolutionized the study of social behavior. It is nothing short of a paradigm shift. Many now regard Hamilton's contribution as the most significant amendment to evolutionary biology since Darwin.

A useful, although oversimplified, summary of Hamilton's central argument can be stated as follows: Natural selection maximizes the ability of individual organisms, *not* species, to gain *genetic representation* in future generations (Williams and Nesse 1991). What is critical, for psychiatry, is the general prediction that organisms will behave in ways that increase their own genetic representation. Kin are, genetically, relatively similar. Preferential treatment of kin should, therefore, result in greater future genetic representation. Hamilton's model thus predicts that kinship should be a nexus in the evolution of social behavior.

The most obvious prediction of kin-selection theory is that *altruistic* behaviors (e.g., parental care, defense against predators) will not be random, but preferentially bestowed on kin. In showing such a preference an organism will more effectively increase its future genetic representation. When biologists controlled for kinship this prediction was supported. Altruistic behaviors are, in nature, overwhelmingly kin-directed (e.g., Axelrod and Hamilton 1981).

A second prediction is that the attachment bonds of young will be kin-directed. This is because kin are more likely to respond to the needs of their own offspring. Indeed, attachment bonds are not random – their object is virtually always immediate kin (Bowlby 1969).

A third prediction is that severe aggression will be modulated by kinship. To seriously injure or kill kin would usually reduce the aggressor's future genetic representation. Research carried out in the 1970's by Harvard primatologist Sarah Hrdy (1979) supported this prediction. Severe violence, to the point of death, has since been observed within many species. This violence is, however, directed away from kin.

At the beginning of the 1960's there was little consensus about the role of kinship on social behavior. Hamilton (1964) provided an evolutionary hypothesis, kin-selection theory, which made discriminating predictions. By the late 1970's research had accumulated which provided broad support for kin selection theory. Hamilton's model had successfully predicted that kinship is associated with altruistic behavior, attachment and the modulation of aggression. Other research demonstrated that incest avoidance was yet another kind of

kin-directed adaptation. Four classes of kin-directed behaviors had been described - attachment, altruism, incest avoidance and modulated aggression.

In the early 1980's, I was a graduate student in biological psychology at the University of California at Berkeley. Within the psychology department developmental ethologist, Mary Main, was studying infant attachment. Paul Sherman (now at Cornell) had recently published pioneering work on the link between kinship and altruistic behavior. Berkeley anthropologist, Phyllis Dohlinow was embroiled in a debate with Sarah Hrdy, then at Harvard, that informed our understanding of kinship and modulated intra-familial aggression (Hrdy won this debate). At nearby Stanford University anthropologist Arthur Wolf was studying human incest avoidance.

A question which intrigued me was this: Are these four classes of kinship behaviors interrelated? Did they co-evolve? On purely theoretical grounds one could hypothesize they have. Incest avoidance, attachment, altruistic behavior and modulated aggression may be biologically integrated because their object, throughout evolutionary history, has been the same, close kin (Erickson 1983, 1989). If familial adaptations co-evolved, Westermarck's hypothesis describes one part of a larger adaptation. This notion provides the foundation for what I have called the familial bond hypothesis, a general model of kinship (Erickson 1989, 1993, 2004). The model can be summarized as follows.

Familial Bond Hypothesis: Levels of Analysis

1. **Evolutionary:** *Behavioral adaptations of kinship co-evolved.* At the evolutionary level the familial bond model asserts that four classes of kin-directed behavior - attachment, incest avoidance, altruism (e.g., parental care), and modulated aggression - co-evolved and are behavioral manifestations of a functionally integrated familial system. The central prediction at this level is that there should be evidence at proximate levels, e.g., ethological, developmental, hormonal, that these classes of behavior are biologically integrated.
2. **Ethological:** *The quantity of close association, during an early sensitive phase, is crucial for establishing the direction of a familial bond – in both parents and offspring.* The key prediction at an ethological level is that adequate early association canalizes, i.e., establishes the direction of, all behavioral manifestations of kinship. Available evidence is supportive. Attachment of infants to parents is obviously dependent on early association (e.g., Bowlby 1969). Studies show that early close association is essential to establish incest avoidance in humans (e.g., Shepherd 1971, Wolf 1995) and non-human species (e.g., Gavish et al. 1984, Penn and Potts 1998). Various studies show that early affiliation also promotes altruism or parental nurturance in both animals and humans (e.g., Poindron 1993, Maestripieri 2001, O'Connor 1977, Fuchs 1987). Finally, although data is limited, what exists suggests that early affiliation is essential for modulated intra-familial aggression (e.g., Strushaker and Leland 1987, Wilson and Daly 1988).

3. **Developmental:** The *quality* of close association, during an early sensitive phase, is critical for the development of the capacity for adaptive familial behavior in offspring. Two factors, (1) early association and (2) nurturance, have been the most dependable markers of kinship throughout natural history. While the quantity of early association establishes the *direction* of a familial bond, the *quality* of early association, i.e., nurturance, establishes the *capacity* for familial behavior in offspring. Nurturance can be defined as responsive (altruistic), non-sexualized (incest avoidance) and non-violent care (modulated aggression). The key prediction at this level is that adequate nurturance facilitates the *development* of behaviors of kinship - initially attachment and later, kin-directed altruism, incest avoidance and modulated intra-familial aggression. Extant data is supportive. Attachment research has shown that parental responsiveness (nurturance) predicts secure attachment in offspring and their later capacity to nurture their own progeny (e.g., Steele, Steele and Fonagy 1996, van Ijzendoorn 1995). No studies have directly examined a link between early nurturance and a later capacity for incest avoidance and modulated intra-familial aggression. The clinical data which does exist is supportive. For example, as earlier noted, the childhood experience of parents of incest families is marked by a lack of nurturance.
4. **Psychopathological:** Adaptive familial bonding is inherently intergenerational. The *quantity* of early association establishes the direction of familial bonds. Usually between parent and child. The *quality* of nurturance from parents to offspring promotes the capacity for familial behaviors in offspring. This approach points to *three* general classes of pathogens: (1) pathogens which disrupt the quantity of early association, (2) pathogens which disrupt the quality of early association, i.e., parental nurturance, and (3) pathogenic attachment (often called disorganized attachment). Although inter-related, this distinction is important. A clinically useful model must explain two phenomena: (1) how adaptive familial bonds are disrupted in the first place and (2) once disrupted, why abuse frequently persists inter-generationally. Addressing pathogens of parental nurturance and the quantity of early association is largely an issue of prevention. Addressing pathological attachment, and generational patterns of abuse, is a clinical treatment problem.

IV. Pathogens of Kinship and Child Sexual Abuse

This paper began with the hypothesis that most incest and virtually all child sexual abuse may be caused by novel pathogens. Incest was likened to other disorders caused by novel pathogens such as asthma due to air pollution or cancer due to tobacco use. This hypothesis is supported when evidence that the equivalent of

child sexual abuse is virtually non-existent in other species is juxtaposed with human research showing the prevalence of child sexual abuse to be alarmingly high.

The familial bond hypothesis is the first to explicitly propose that the development of incest avoidance depends on a positively reinforcing stimulus - adequate parental nurturance. Previous models had argued that aversive conditioning, e.g., castration fears, established incest avoidance (see Erickson 1989 for review). This is also the first model of kinship to argue that incest avoidance co-evolved, and is functionally integrated with, attachment, kin-directed altruism and modulated intra-familial aggression. The familial bond model thus predicts that disruption of the biology of nurturance will have a pervasive effect on familial behavior in general (Erickson 1983, 1993, 2004).

Nurturance is the *sine qua non* of kinship. It is arguably the most complex of social adaptations. Complex adaptations often require a specific environmental stimulus, during a sensitive period, for normal development. Vision, is one example. The developing visual system depends, literally, on exposure to light during an early sensitive period for normal maturation (e.g., Wiesel and Hubel 1963; Campos 1995). Another example is the auditory system. Exposure to sound, during an early sensitive period, is critical for the development of auditory brain and the capacity to hear (Kral et al. 2001). Similarly, nurturance may be a critical environmental stimulus for the development of the capacity for familial behavior. The effect of light on the developing visual system may be biologically analogous to that of nurturance on the developing familial system.

Pathogens of paternal nurturance

The biology of nurturance is evolutionarily ancient. Consider paternal nurturance. Care-giving by fathers has existed for over 400 million years. In fish, there are thousands of species in which fathers guard eggs, fan eggs (to oxygenate) and then protect newborn fry. In birds, in over 90% of species, fathers actively contribute to nurturance of the young. Paternal care is less common in mammals but nevertheless found in many species. In marmosets and tamarins, two primate species, fathers actively engage in the care of infants.

The hormone prolactin may be critical for initiating paternal nurturance. In fish, fathers have higher prolactin levels than non-fathers. Similarly, elevations of prolactin are seen in fathers in both birds and mammals (see Ziegler 2000 or Schradin and Anzenberger 1999 for reviews). Several studies now link prolactin to paternal care in non-human primates including marmosets and tamarins (e.g., Dixon and George 1982, Roberts et al. 2001, Ziegler and Snowdon 1997, Ziegler et al. 2004, Schradin and Anzenberger 2004). Two studies suggest that prolactin may be associated with paternal nurturance in humans (Fleming et al. 2002, Storey et al. 2000).

Dopamine inhibits prolactin. Bromocriptine, a dopamine agonist, reduces prolactin levels and has been shown to disrupt parental nurturance (maternal and paternal) in most (Bridges and Ronsheim 1990, Kindler

et al. 1991, Roberts et al. 2001) but not all animal studies (Brooks et al. 2005). Many substances of abuse, directly or indirectly, are dopamine agonists. Cocaine, a dopamine agonist, has been shown to acutely lower prolactin levels in men (Mendelson et al. 2003). The link between prolactin and nurturance is undoubtedly biologically complex (e.g., Bridges et al 1985). Nevertheless, a further link between dopamine agonists like cocaine, their acute effects on prolactin, and child neglect and abuse is conceivable.

Testosterone may have a reciprocal relationship with prolactin (Ziegler 2000). Testosterone levels tend to be elevated in males when they are seeking a mate and then decline as they become fathers. Experimentally increasing testosterone in animals can profoundly disrupt paternal care. In birds, experimentally increased testosterone is associated with the neglect and abandonment of offspring (Hegner and Wingfield 1987, Oring et al. 1989, Van Roo 2004). Although alcohol has complex effects on testosterone a recent study showed that central nervous system (CNS) testosterone levels increased acutely, by 300-400%, in Wistar rats, within minutes of alcohol consumption (Alomary et al. 2003). Might alcohol inhibit human paternal care by increasing testosterone, as is seen in other species?

Early separation as a pathogen of kinship

If hormones influence paternal nurturance, as animal data suggests, a critical follow-up question is what initiates the hormonal changes of paternity? How does a male *know* (conscious awareness is not implied) he is about to become a father? Females have an endogenous signal of pending maternity – they are pregnant. There is remarkably little known on how hormonal changes of paternity are initiated (see Ziegler et al. 2004). They may depend on a signal or signals from the mother, pre-partum, and both mother and infant in the post-partum. If so, separation from the mother and infant may disrupt neuroendocrine changes that underlie paternal nurturance.

In many species adult males can be extremely aggressive toward, and may kill, offspring of other males. The same males virtually never harm their own offspring. How is paternal aggression modulated? The only occasions I know of, in which a monkey father was thought to have killed his offspring, occurred when fathers were separated from the mother pre-birth and the mother and infant in the early post-partum period (Strushaker and Leland 1987). Separation may disrupt hormonal changes related to paternal behavior and recognition of offspring. Consistent with this, step-fathers, who are generally not in early association with step-children, are far more likely to severely harm or kill offspring than biological fathers (Wilson and Daly 1988). Similarly, diminished involvement in caring for offspring is a risk factor for sexual abuse by fathers and step-fathers (Williams and Finkelhor 1995, Parker and Parker 1986).

Given the importance of early association, studies of maternal-infant separation are noteworthy. In some species, e.g., goats or sheep, separation of mother and infant for as little as a few hours, immediately post-partum, often results in the complete maternal rejection

of the infant (Poindron et al. 1993). The effect of separation is not as dramatic in non-human primates. Nevertheless, post-partum separation is associated with maternal neglect (Maestripieri 2001). In humans, O'Connor et al. (1977) showed that "at risk" mothers who simply roomed in with their infant, for the first two days post-partum, were significantly less likely to later abuse or neglect this infant than mothers who received care as usual. (At the time of this study care as usual consisted of rooming infants in a nursery with periodic visits to mother.) Similarly, *la Maternite*, a charity hospital in Paris during the 1800's, reduced infant placement in orphanages when administrators had mothers remain in the hospital for several days post-partum to nurse their newborn (Fuchs 1987). The importance of early post-partum association for promoting maternal nurturance may be linked to specific hormonal changes (e.g., Nissen et al. 1995).

To my knowledge there are no studies, similar to those of O'Connor (1977) or Fuchs (1987), on paternal behavior. Might fathers who remain in close association with infant and mother in the post-partum period (perhaps because of generous family leave policies) experience more pronounced hormonal changes, and show greater paternal nurturance, than fathers who return immediately to work? Is the biology and behavior of paternal nurturance altered in fathers who are abroad, perhaps in the military, during their wives pregnancy and into the post-partum?

Surrogate parents

It is crucial to consider is how little is known about *how much* early association is needed for normal familial bonding. Consider incest avoidance. At one extreme the continuous early association of non-kin, such as kibbutz peers, establishes misdirected incest avoidance. At the other, early separation of kin completely precludes the development of this adaptation. Presumably there exists a range of diminished early association where a familial-sexual ambivalence may emerge. The study of surrogate parenting, e.g., use of nannies, may be informative.

Surrogate parenting (non-kin taking a major role in raising offspring) is new to our species. It is virtually non-existent in nature. Sigmund Freud had a surrogate parent, a nanny, Monica Zajic. The intimate bond Freud felt for his nanny is revealed in letters sent to friend and colleague Wilhelm Fliess in 1897. Freud, then in the midst of his self-analysis, recalls his nanny who he had not seen for nearly 40 years. He describes her as his "prime originator" and as the woman "who instilled in me a high opinion of my own capacities" (Freud 1985:268). Freud does not make comments of similar emotional immediacy about his mother in these letters. His affiliation with his nanny reduced the amount of early association with his mother that is presumably typical for our species. Is it possible that being raised, in part, by a nanny provided Freud with an anomalous perception of familial relationships? Might this, in turn, have influenced his meta-psychology of kinship?

Breast feeding in our species

Mammalian breast-feeding has a 65 million year evolutionary history. Beyond its nutritional function breast feeding likely affects emotional development and attachment. Cross-species comparisons suggest that human infants evolved to nurse a minimum of 2&1/2 years to an upper limit of seven years (Dettwyler 1994). Modern breast feeding practices reduce the quantity of physical intimacy and, perhaps, the quality of nurturance between mother and child relative to the norm for our species.

In Western industrialized society infant crying tends to be prolonged. Crying bouts tend to be shorter in cultures such as the Kung San of Botswana where an infant is carried virtually continuously in a sling. Kung San mothers have been rated, by experimental measures, as more responsive than Western mothers. Infants are nursed on demand rather than on schedule. This form of care-giving, by Kung San mothers, may be typical of our species. Repeated many times each day this indulgent form of maternal nurturance may engender secure attachment (Barr 1999).

Familial sleeping arrangements

In virtually all social species infants sleep in immediate proximity to their parents. This practice is obviously adaptive. Sleeping in immediate proximity to parents provided critical protection to infants in traditional societies. Such sleeping arrangements may also promote normal physiological development (McKenna et al. 1999). In the vast majority of non-Western cultures various forms of parent-child co-sleeping are the norm during the first few years of life. Infants sleeping alone is an evolutionarily anomalous practice of Western industrialized nations. It reduces close early association of parent and child and could have an effect on nurturance and attachment. Consistent with this notion is the finding that children who co-slept with parents were less likely to have been treated in a mental health clinic for emotional and behavioral problems (Forbes and Weiss 1992).

Summary

My key point is that our modern world presents a plethora of evolutionarily novel phenomena that may disrupt the biology of parental nurturance and the quantity of early association. In so doing, the quality of a child's attachment to its parents may be eroded. This disrupts the child's later capacity to bestow altruism, incest avoidance and modulated aggression to its offspring. Generational patterns of diminished nurturance, merging into abuse and neglect, may manifest. Anomalous practices, e.g., limited or no breast-feeding, by themselves probably have little, if any, harmful influence. However, when enough disruptive factors intrude on the biology of kinship, pathologies are to be expected. Familial bonding, like the cardiovascular system, the pulmonary system, or any other biological adaptation should eventually succumb to novel insults

with pathological manifestations. Child sexual abuse may be a pathology of this type.

Many clinicians believe we are in the midst of an epidemic of child abuse. This assertion is difficult to prove through epidemiology. All prevalence studies have been published within the last 25 years and therefore provide limited historical measure. Another way to examine this question is to ask whether the evolved biology of kinship is increasingly disrupted by a growing number of novel pathogens in the modern world. This is a testable question.

Pathological Attachment

Novel pathogens may erode the biology of nurturance. Once this has happened, however, severely disrupted attachment, in and of itself, can perpetuate inter-generational pathology. As noted earlier, the most salient aspect of parents of incest families may be that they, too, were abused and neglected in childhood.

In this regard, a particularly informative study is that of Sroufe and Ward (1980). In their research, 194 mother-toddler dyads were videotaped during a play episode. Importantly, mothers were aware they were videotaped. Nonetheless, investigators found that about 10% of mothers interacted with offspring in a sexualized or seductive manner – *even while being videotaped*. A mother, for example, might have asked her child for a kiss and if refused physically force a “passionate” kiss on the child's lips. Seductive mothers were also more likely to strike their child and were less attuned to their child's signals. When interviewed seductive mothers were more likely to have a developmental history indicative of early abuse. These data suggest parental boundary violations may be remarkably unconscious. The propensity for these violations may be traceable to severely disrupted childhood attachment. These data also suggest early abuse has a global effect on later familial behavior. Not only were sexual boundaries violated (incest avoidance) but also maternal responsivity was diminished (kin-directed altruism) and maternal aggression was increased (modulated aggression). Haynes-Seman and Krugman (1989) have made similar observations. Parents who reported a childhood history of neglect or abuse were more likely to exhibit sexualized interactions with their infants even while aware the session was being videotaped (see also Madonna et al. 1991).

V. Rethinking Kinship: A Path to Preventing Child Abuse?

Just over forty years ago there was little consensus of how evolution had shaped human kinship. Since then a confluence of findings have emerged which demonstrate that the behaviors which support familial bonds are ancient and observed across species. These data clearly suggest that the underlying biology of kinship has been conserved.

It has been hypothesized that child sexual abuse may be caused by the disruption of the biology of kinship by novel pathogens. The foundation of this hypothesis rests on an evolutionary model of kinship, the

familial bond model, which asserts that all classes of kin-directed behavior - attachment, incest avoidance, altruism and the modulation of aggression - have co-evolved. Nurturance, in this model, is the critical environmental stimulus for the development of the capacity for familial bonding. Nurturance is thought to be analogous to the effect of light on the developing of the visual system.

The most important clinical prediction of the familial bond model is that a sufficient disruption of nurturance will have a global, pathological, effect on the development of adaptive familial behavior. Sufficiently disrupted nurturance may effect, in offspring, impaired attachment (disorganized) and later, a propensity for diminished altruism (parental neglect), sexual boundary confusion (child sexual abuse) and a disruption of modulated intra-familial aggression (child physical abuse). The biology of nurturance has an evolved dependence on environmental regularities. We live in a world in which these regularities are, almost certainly, more vulnerable than ever before.

Freud developed the first comprehensive model of kinship. His assertion that familial bonds develop unconsciously, through early association, is now well supported. Other key assumptions have proven to be in error. Freud wrongly imagined that humans were fundamentally asocial. His notion that both incest and murderous intra-familial aggression were common in our pre-cultural ancestors was incorrect.

Object relations theorists recognized the importance of relationships. Yet, there is nothing inherent in object relational theory that can explain why object relations exist and why objects refer, invariably, to immediate kin.

The familial bond model integrates kin selection theory with research on incest avoidance. It provides a model of kinship that comprehends previous limitations. "Objects" exist and virtually always refer to kin because kin are the only reliably proximate and nurturing others in the natural world. Recognizing kin is critical for survival. Inherent within the model is an explanation of why severe aggression and sexuality are rare within the family, whether the species is non-human or human.

Beyond the capacity for adaptive familial behavior, familial bonds are crucial for allowing human and non-human species to segregate, unconsciously, familial and sexual forms of affiliation. Animals rarely confuse familial and sexual bonds. This is, perhaps, not surprising as the adaptive function of each type of bond is quite distinct. Examined in this perspective the psychological virulence of child sexual abuse can be better understood. The intrusion of sexuality into a familial bond disrupts the development of social life at its most fundamental level. Boundary confusion emerges. Secure and intimate relationships, whether with kin, or a sexual mate, are extraordinarily difficult to achieve. It is not surprising that severe psychopathology is often associated.

Although my focus has been on child sexual abuse non-human primate research hints that much, but not all, of child physical abuse and neglect might be other manifestations of novel pathogens of kinship (e.g., Maestriperi and Carroll 1998). Discussing this issue is beyond the scope of this paper.

The general model outlined herein argues that prevention of child sexual abuse will depend on interventions which effectively support adaptations of kinship. Such interventions may, in principle, be rather simple. For example, if separation of fathers from the mother and offspring, in the pre and post partum period, disrupts hormonal changes of paternity, and paternal care, then biologically informed paternal leave policies should be pursued. Other interventions may be more complex. At present, despite very impressive progress, our knowledge of the biology of kinship is limited relative to our clinical needs. Basic science has repeatedly provided foundations for improved treatment. Treatment of pathologies of kinship should be no exception.

Footnote: To the best of my knowledge there is no published or non-published data documenting the equivalent of child sexual abuse in non-human species. More specifically, there appear to be no observations of mature males engaging sexually with infant or juvenile females in other species. I have discussed this issue either directly or via email with Anne E. Pusey, Ph.D., and McKnight Professor, Department of Ecology, Evolution and Behavior, the University of Minnesota (conversation of 2/25/00); Frans De Waal, Ph.D., and C. H. Candler Professor of Primate Behavior at Emory University (email of 4/18/02); Michael T. McGuire, M.D., co-editor of this issue and Professor of Psychiatry and member of the Brain Research Institute of the University of California, Los Angeles (conversation of 5/21/2002) and Toni Ziegler, Ph.D., and Senior Research Scientist at the University of Wisconsin and the Wisconsin Regional Primate Center (email of 11/12/02). Drs. Pusey, De Waal and Ziegler are primatologists. Dr. McGuire is a psychiatrist whose research has involved extensive observation of primates, both human and non-human. None of these investigators knew of data, published or not, which documented the equivalent of child sexual abuse in non-human primates.

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