

## Winning and Losing: An Evolutionary Approach to Mood Disorders and Their Therapy

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**Objective:** To advance a new evolutionary model that examines the effects of winning and losing on mood and physiological variables. Previous studies have focused on the involuntary defeat strategy in de-escalating conflict. Here, we propose that there also exists an involuntary winning strategy (IWS) that is triggered by success and characterized by euphoria and increased self-confidence. It motivates efforts to challenge, and promotes reconciliation.

**Method:** Previous studies are presented, including data on student athletes, demonstrating the impact of winning and losing on mood.

**Results:** Winning is consistently shown to be related to physiological changes such as increased testosterone and serotonin levels in primates. It reliably leads to mood changes that serve to motivate winners to continue their competitive efforts.

**Conclusion:** When the IWS functions optimally, success leads to success in an adaptive cycle. Over time, the initial differences between the winners and losers of agonistic encounters become magnified in a process known as difference amplification. As a result of assortative mating, the children of people who have entered into an adaptive cycle will inherit traits from both parents that will, in turn, give them an increased competitive advantage. In this manner, difference amplification could have accelerated human evolution by natural selection. Vignettes of clinical interventions are also used to illustrate therapeutic strategies designed to disrupt maladaptive cycles and promote adaptive behaviour.

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### Clinical Implications

- Previous evolutionary theories of mood have focused on negative outcomes, whereas the model put forward in our paper is chiefly concerned with the positive implications of winning. We advocate a stronger focus on optimal functioning and well-being in psychiatry.
- An understanding of the IWS model provides a rationale for stressing the importance of successful experiences for children and adults.
- The model can account for the rapidity of change as humans evolved from homo erectus to homo sapiens.

### Limitations

- Because the model has so many ramifications, one cannot adequately present the model in a single article.
- Because the model should be integrated with other models, it becomes very difficult to test the psychotherapeutic efficacy.

**Key Words:** *winning, losing, involuntary defeat strategy, involuntary winning strategy, depression, hypomania, psychotherapy*

When the home team scores in the final seconds of a crucial game the spectators burst into rapturous applause. When the visitors score, the suddenly silent stadium is witness to the feelings of gloom experienced by those who root for the losers. Though we take these reactions for granted, it would be revealing to consider why we are programmed to respond the way we do. We observe positive reactions to winning and negative reactions to losing in many cultures and in other primates and vertebrates. The pervasiveness of these reactions suggests they have survival value.

As far back as 1935, Schjelderup-Ebbe<sup>1</sup> introduced the term pecking order to describe the presence of this pattern in barnyard fowl. He found that if an alpha bird loses a fight and takes refuge in flight, its behaviour becomes entirely changed:

Deeply depressed in spirit, humble, with drooping wings and head in the dust, it is—in any rate on being vanquished—overcome with paralysis, even though one cannot detect any sign of physical injury.<sup>1, p 966</sup>

In 1967, Price<sup>2</sup> drew on observations of long-tailed macaques and noted the similarity between patients with depression and animals that lost in competitive encounters and were pressed into a subordinate social role. In our paper, we will explore the pattern of reactions to winning and losing, their evolutionary function, and relevance to psychotherapy.

## Methodology

We sought to integrate several areas of study to posit an evolved IWS. Therefore, the review of the literature is highly selective and the paper is more theory-driven than a typical review paper. The PsycINFO, MEDLINE, and Google Scholar databases were used to search for terms such as physiology and winning, hormones and competition, and neurochemical and competition. Only a small proportion of the studies that were found are discussed below.

## Mood Changes Associated With Winning and Losing in Sports

Sturman and Mongrain<sup>3</sup> found that, after losing, student athletes became significantly more dysphoric, hostile, and less anxious than before the match (Figure 1).

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### Abbreviations

5-HT	serotonin
AD	antidepressant
CNS	central nervous system
IDS	involuntary defeat strategy
IWS	involuntary winning strategy

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For our study, we reanalyzed the data to determine how reliable these mood changes are as a result of winning and losing. Within 1 hour of defeat, 91.5% of student athletes experienced an increase in dysphoria. Conversely, following victory, they became significantly less hostile and anxious, with 87.4% experiencing an increase in positive affect (Figure 2).

It is easy to take for granted that winning makes one happy and losing makes one sad, but by probing deeper into this question, by providing an evolutionary explanation, we are able to better understand the nature of mood and potential treatments for mood disorder.

## IDS and IWS

For hundreds of millions of years, certainly since the days of our common ancestry with reptiles, and probably for much longer, each generation of our forebears has faced situations in which they must either defeat or submit to another member of our species.

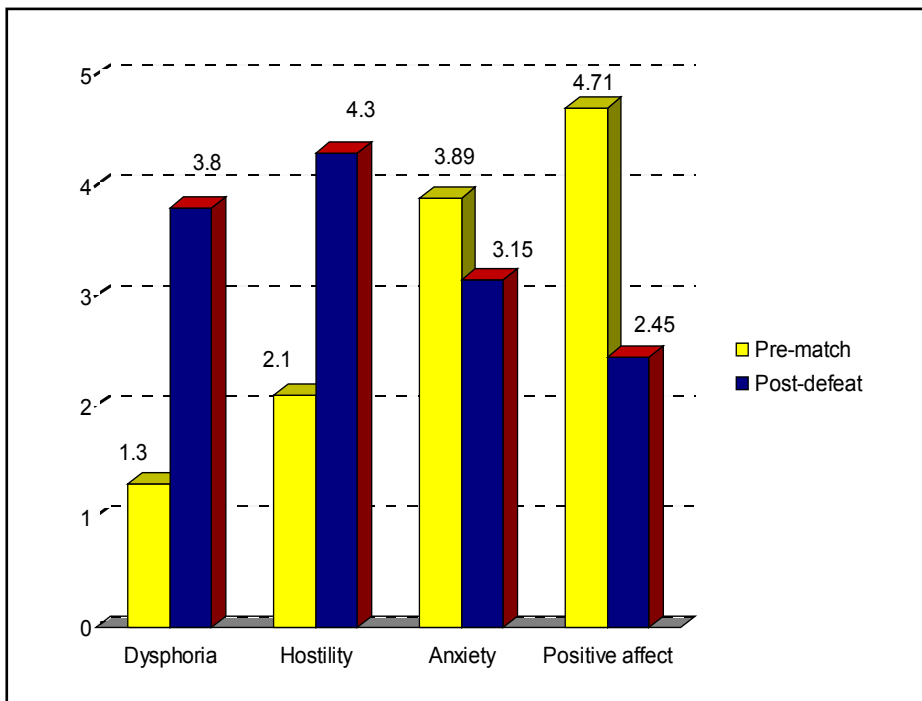
These situations have been ritualized so that normally no one gets seriously hurt, and the ritual takes the form of an encounter where each person has a choice of strategies: between escalation (fighting harder) and de-escalation (giving up). If they are evenly matched, they are both likely to adopt an escalation strategy and engage in fighting. To resolve the fight, 1 of the 2 rivals must switch to a de-escalation strategy and submit. This ends the fight, enabling the winner to enjoy the prize (whatever the fight was about), while the loser accepts the loss.

The psychobiological response patterns of escalation and de-escalation have been maintained in our reptilian forebrain, and they are of course now supplemented by more recently evolved competitive behaviours. They have survived the enormous changes in method of competition that have occurred during the transition from reptile to mammal to primate to human. In fact, they can still be discerned not only in people who are actually fighting but also those engaged in competition for prestige. Perhaps the clearest expression of the psychobiological response to winning and losing is seen in more conventionally ritualized sports, such as hockey, and even in spectators of sports.

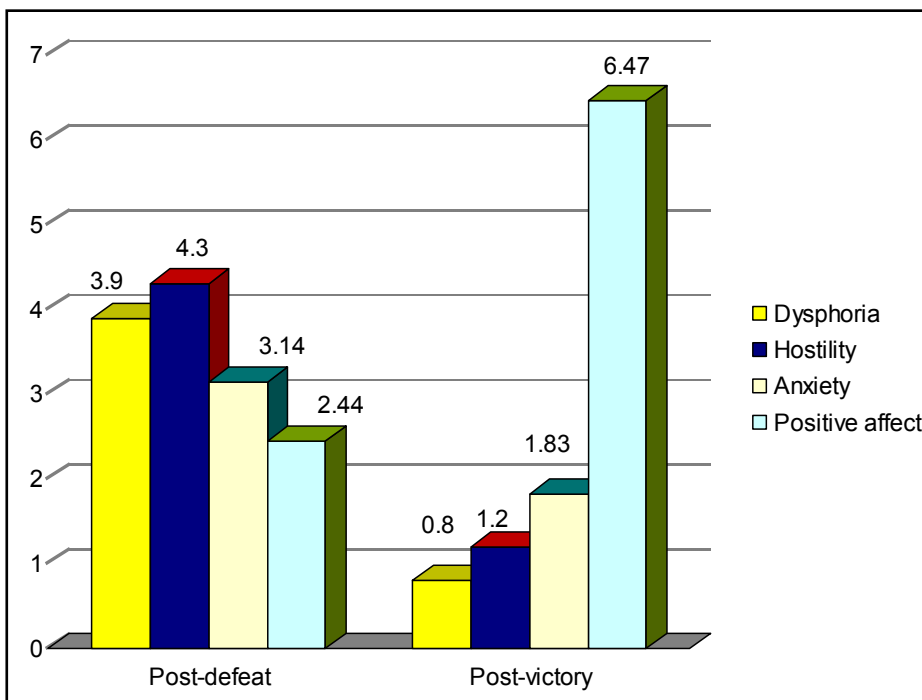
Many different labels have been used to describe the pattern first described by Price.<sup>2</sup> We choose to use the term IDS, which is not only triggered by agonistic defeat but also by failure in other arenas. It is involuntary because it is triggered automatically outside conscious awareness. It is a strategy because the psychological, physiological, and behavioural changes have a specific function.<sup>4</sup>

However, we believe that another, equally pervasive, pattern of response has also promoted species survival; we define this IWS as a reaction to winning characterized by euphoria, increased self-confidence, and a rise in social rank or hierarchy.

**Figure 1 Comparing athletic defeat and victory on mood, with mood measured by visual analogue scales after competitive matches**



**Figure 2 The effect of athletic defeat on mood, mood measured by visual analogue scales before and after competitive matches**



## Evolutionary Function of the IDS

Price's<sup>2</sup> conclusion, after observing the similarity between long-tailed macaques' reaction to hierarchical loss and human depression, was that "states of depression, anxiety and irritability are the emotional concomitants of behavior patterns that are necessary for the maintenance of dominance hierarchies in social groups"<sup>244</sup>

One observes that ideas of inferiority and unworthiness, withdrawal, loss of self-esteem, loss of libido, and other features of depression are exquisitely designed to discourage a person from continuing a competitive struggle, or attempting to regain their former status. The defeat pattern minimizes the chances of physical injury or death for both adversaries by triggering submission and thereby bringing the conflict to an end.

## Evolutionary Functions of the IWS

Nesse<sup>5</sup> says that feeling bad can push us into more productive activities that make us feel good. We have a broader view in that we argue that one may also try hard to avoid the negative affect associated with failure, and (or) to achieve the euphoria associated with success, regardless of whether we feel good or bad initially. Rayo and Becker<sup>6</sup> also view euphoria as an incentive. Therefore, both the IWS and the IDS can motivate us to try our best. Because of our wish to feel good and avoid feeling bad, our anticipation of success or failure helps us make a prudent choice in deciding whether to enter into a competitive encounter.

The euphoria associated with winning also promotes a shift from an adversarial mindset to feelings of benevolence, which promotes reconciliation with the loser. We can observe this in other primates. Goodall<sup>7</sup> observed, "although a male chimpanzee is quick to threaten or attack a subordinate, he is usually equally quick to calm his victim with a touch, a pat on the back, an embrace of reassurance."<sup>118</sup> Whereas the positive mood, low hostility, and low anxiety (IWS) associated with victory, promotes magnanimity and reconciliation, the dejection associated with loss (IDS) promotes submission. Therefore, the reactions to defeat and victory have complementary functions in terminating agonistic conflicts and promoting reconciliation.

Finally, the increased testosterone that follows a competitive victory has been hypothesized to energize an organism and prepare it for continued challenges, the so-called challenge hypothesis.<sup>8</sup> This hypothesis was supported by Oyegbile and Marler<sup>9</sup> who found that mice who had won in agonistic encounters experienced an increase in testosterone and were more likely to win future contests. McGuire et al<sup>10</sup> showed a correlation between high social status and peripheral and CNS 5-HT both in human and in nonhuman primate species.

The psychological variables, such as increased mood and confidence, that are associated with winning have a reciprocal relation with increases in testosterone in

motivating us to meet new challenges. This cyclical pattern over time contributes to individual maturation and individuation (Figure 3).

Rather than thinking of the adaptive and maladaptive cycles as independent processes, they appear to be on the same continuum.<sup>11</sup> For example, the adaptive cycle is associated with rising self-esteem and an increasingly positive mood and the maladaptive cycle is associated with falling self-esteem and increasingly negative mood.

## Maladaptive Cycles

Generally, we are able to accept defeat and submit before depression has become too entrenched. This terminates the IDS and allows one to move on to new challenges for which one is better equipped. For example, if a person walks to the dressing room with their opponent after losing a match, their bad feelings may have worn off by the time they arrive at their destination. In contrast, clinical depression is characterized by a more long-lasting and powerful IDS whereby persistent failure continues to trigger the IDS, while generating mounting frustration and increasing anger. Whereas the anger motivates a person to continue the confrontation, the belief that they are losing continues to trigger the IDS. This process can escalate with an increasingly powerful IDS leading to clinical depression as shown in Figure 3.

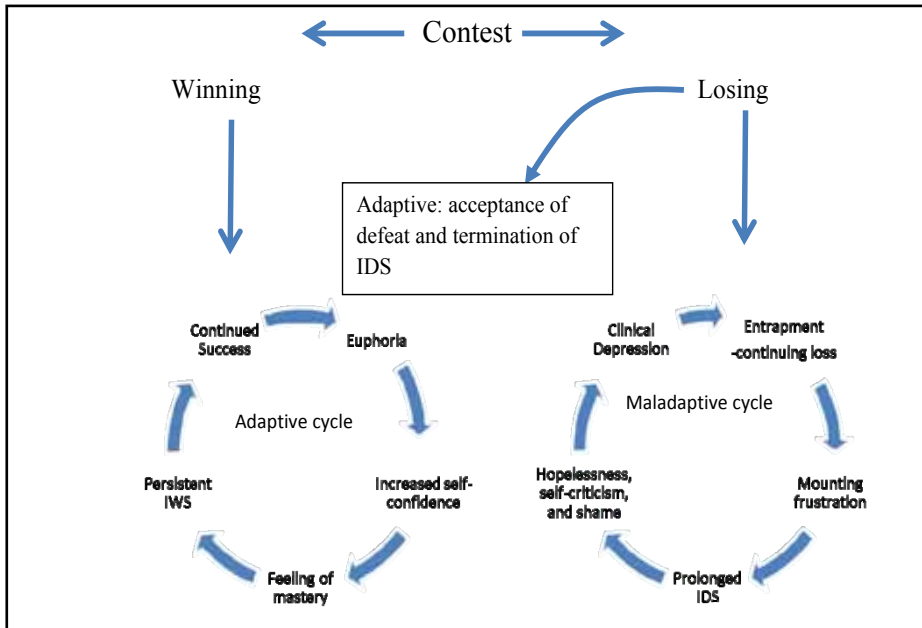
We have shown how the IDS can become maladaptive, but the IWS can also become maladaptive as shown in hypomania. Hypomania has been attributed to failure to terminate the dominance mechanism.<sup>12</sup> Whereas failure to accept defeat may lead to persistent triggering of the IDS, in the case of the winner, failure to accept that the agonistic encounter has terminated, may lead to a persistent triggering of the IWS. The euphoria, which has no objective basis, manifests as hypomania or mania.

The extravagant spending of the hypomanic person may be related to the perception that, because they feel dominant they deserve to be rewarded, which leads them to buy things they do not need.

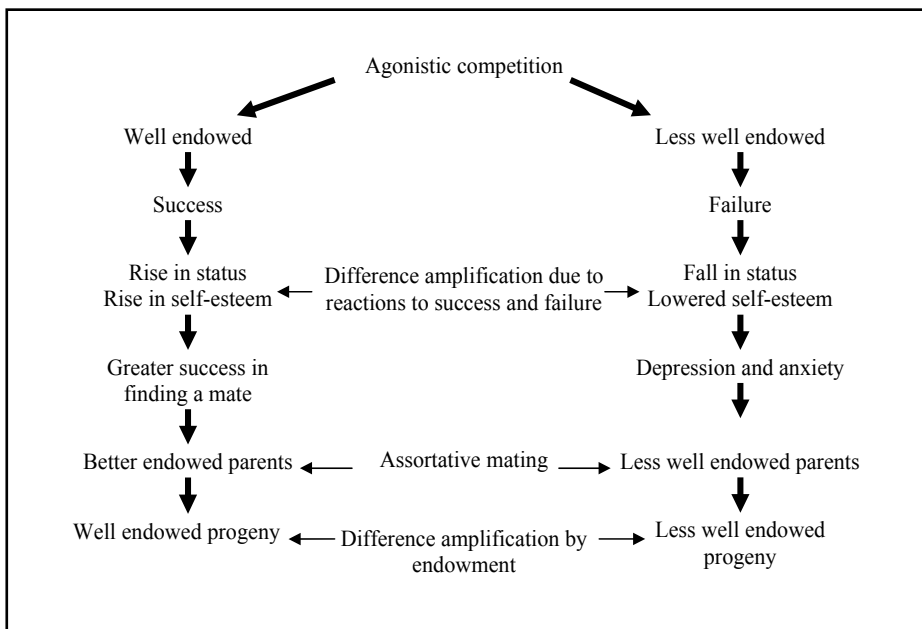
## Adaptive Cycles

The triggering of the IWS, within the framework of the challenge hypothesis, is associated with psychological and biological changes, which promote further success through a cycle of adaptation. Success may be measured by objective and subjective criteria. For example, in tennis, one might feel fine about losing to a more skilful opponent, if a person has played really well and done better than expected, or the person who wins may feel badly, because he or she feels undeserving of the win. Having a competitive advantage promotes success while success increases self-confidence and enthusiasm, which leads to further success, an example of success leading to success.

**Figure 3 The cycle of adaptation associated with success and the maladaptive cycle associated with repeated failure**



**Figure 4 Difference amplification between winners and losers and the endowment of progeny**



Mazur<sup>13</sup> has suggested that surges in testosterone, following a victory, may serve to reinforce winning-related behaviours. Testosterone was thought to be crucial in attaining and maintaining status. The adaptive cycle was described from a physiological perspective by Mazur as follows:

Each triumph elevates testosterone, enhancing both the formidable demeanor of the victor and the probability of further triumphs; each defeat depresses testosterone, reinforcing both the stooped posture of the vanquished and the likelihood of subsequent defeats. Thus individuals at the bottom of the status hierarchy are ill-equipped to challenge those above, while those who have attained high status have the hormone-reinforced motivation and posture to maintain their positions.<sup>13, p 383</sup>

Success depends on the efficient functioning of psychophysiological mechanisms and also serves to promote the continued efficient operation of these mechanisms, and the IWS plays a pivotal role in promoting the cycle of adaptation. Reeve et al<sup>14</sup> showed that winning facilitated both competitive performance and intrinsic motivation relative to losing, and Steptoe et al<sup>15</sup> showed that positive well-being is directly related to health.

### Implications for Pharmacotherapy

Subordinate male vervet monkeys illustrate how neurochemical changes associated with success and winning contribute to continued success. For instance, monkeys that received tryptophan and fluoxetine, which enhance 5-HT activity, won most of the contests against other males and achieved dominance, while subordinate males that received fenfluramine and cyproheptadine, which interfered with 5-HT activity, remained subordinate.<sup>16</sup> However, the dominant monkeys did not achieve their status through increased aggression or hostility. Indeed, monkeys that received ADs showed significantly less aggression and more approach and affiliative behaviours. The increase in winning was largely due to making allies of the females in the group, who supported them in their contests. This change in personality toward social affiliation and lowered hostility has also been found in humans given ADs.<sup>17,18</sup> Therefore, one of the positive effects from ADs in humans may be due to increased social affiliation, which in turn, promotes success in various endeavours.

McGuire et al<sup>10</sup> reported a high positive correlation between peripheral 5-HT levels, CNS 5-HT responsivity, and social status. High status or dominant male vervets have peripheral 5-HT levels between 1.5 and 2 times the levels of low status or subordinate males and when the presiding dominant male was removed from a social group, the male that replaced him as the dominant monkey showed an increase of about 60% in blood 5-HT levels.<sup>19</sup> Dominant males had proportionally greater responses to substances such as tryptophan or fluoxetine that influence CNS 5-HT

concentrations and function. McGuire et al<sup>10</sup> conclude that adult male vervets compete for high social status not only because it gives priority access to females, food, and more, but also because of the physiological and psychological effects associated with an elevated CNS 5-HT responsivity. We call this the equivalent of the IWS in monkeys. McGuire et al<sup>10</sup> acknowledge that the 5-HT system is more complex than their discussion suggests.

Social rank has also been associated with dopaminergic functioning in macaque monkeys and rats, with evidence of heightened synaptic dopamine apparent in subordinate animals.<sup>20-22</sup> This is relevant because both dopamine and 5-HT receptors can play a role in mood regulation.

### Primordial Agonistic Patterns in Modern Man

In early man, agonistic success promoted survival by providing more ready access to food, territory, and desirable mates. In modern society, agonistic encounters take many forms, but success may yield similar benefits. Every field of endeavour, from football to opera singing, has its own hierarchy. Success enables one to move up in the hierarchy. But the gains made from upward movement in modern hierarchies can be surprisingly archaic. The fact that extreme success on the sports field can enable a man to become a cultural icon with increased attractiveness to women illustrates the evolutionary link between agonistic success and reproduction.

### Difference Amplification

The triggering of the IWS by agonistic victory in early man led to the cycle of adaptation in the winner and a possible maladaptive cycle in the loser. A slight edge over the other would be affected by their respective adaptive and maladaptive cycles, which increased the initial advantage that the winner enjoyed. This sometimes emerged a diverging social status (Figure 4).

As a result of assortative mating, those who rose in the hierarchy, by virtue of their agonistic successes, would choose mates who were genetically well endowed.<sup>23</sup> These mates have a higher inclusive fitness as their genes are more likely to survive over generations. As a result of assortative mating, the progeny of the winner enjoy a greater superiority in endowment over the progeny of the loser (difference amplification in endowment), and we can expect to see traits that led to winning become increasingly prevalent in the species in subsequent generations.

A skilled ballet dancer illustrates the attractiveness of good poise and carriage. Mood and gait pattern are also linked.<sup>23,24</sup> The way one feels can be reflected in the way one moves, which, in turn, plays a role in a person's attractiveness. Mood and gait both play a role in assortative mating whether it be positive, or negative.<sup>25</sup>

## Psychotherapeutic Implications of Social Rank Model

The social rank model examines the roles of the IDS and the IWS. When treating a patient with mild depression, the psychotherapist aims to terminate the IDS and trigger the IWS. It may be helpful to explain to the patient that their depressive symptoms arose from the triggering of a biological mechanism one can label the defeat reaction, that originally had the adaptive function of ending conflict, and problems arose because it was not terminated. It is encouraging for the patient to learn that their feelings of inadequacy could help them avoid attacking someone they do not want to hurt.

Swallow<sup>26</sup> described how the social rank (IDS) model of depression interfaces with the cognitive therapy model and showed how cognitive factors play a crucial role in mediating the genetically programmed responses that contribute to the IDS. In behaviour therapy, the effective use of positive reinforcement enables subjects to feel successful, which terminates the IDS and triggers the IWS.

### Clinical Vignettes

These clinical vignettes will illustrate how understanding these mechanisms can help the therapist formulate interventions.

*Betty, a 40-year-old woman, contacted a therapist, requesting immediate psychiatric hospitalization. She had been director of public relations for a very large educational system when a new management team decided to let her go. She vowed to fight her hardest to keep her job. However, she acknowledged that her chances of succeeding were slim. Her therapist advised her to accept the job loss and fight for a better severance package. Within a few days, her mental state was much improved. By advising her to give up and aim instead for something with a high chance of success the IWS replaced the IDS.*

*Margaret, a 36-year-old woman, was feeling too depressed to go to work on a regular basis. When she did go, she was hassled by her supervisor for her poor attendance, which further discouraged her. The therapist framed the situation as a battle between herself and her supervisor. She was told that the way for her to win the battle was to go to work on a regular basis. By going to work, she could deprive the supervisor of the ammunition that was being used against her, thus "winning" the battle. The therapist gave Margaret a card to read several times a day. It read: "I am going to win this battle. I will show my strength by going to work and when I get to work she won't be able to touch me." By turning her attendance*

*into an agonistic success, the therapist triggered Margaret's IWS and as Margaret experienced the IWS more frequently in the context of the battle with her supervisor, her IDS was inhibited, thereby alleviating her depression.*

*Nora was a schoolteacher who had 2 sons, aged 9 years and 11 years. The older son, James, who had high-functioning autism spectrum disorder, was hard to manage because of his noncompliance and verbal abuse. Because James had previously lodged a complaint with a child protection agency, Nora was afraid to be firm with him. Whenever James refused to listen to her, Nora immediately turned to her husband, Steve, to intervene. He would say that she should handle the situation and an argument would arise between them. This led to an escalating conflict with Nora emphasizing the severity of James' problems and Steve responding by ostensibly trying to reassure her by minimizing James' problems. Her failure to successfully handle either James or Steve made Nora feel inadequate, helpless, and hopeless.*

*At a therapy session that included Nora, Steve, and James, the therapist explained to Nora that Steve's refusal to assist her made her feel defeated, which triggered her defeat reaction (IDS). Because her defeat reaction made her feel helpless, hopeless, and incompetent, she became less able to handle James' noncompliance. The therapist set out to help Nora experience success, allowing her to avoid triggering the defeat reaction. He did this through being supportive and making her more aware of her own competence by noting that she was a successful teacher who knew how to handle children. He noted that Nora knew how to handle James but had been rendered powerless by her defeat reaction. The therapist acknowledged that James's autism spectrum disorder made handling him more difficult. After this intervention, Nora brightened up and reached out to touch Steve in an affectionate way. When Nora effectively handled James later on in the session, the therapist used this to illustrate her competence and strengthen her IWS.*

This final vignette illustrates a therapeutic intervention designed to assist a client avoid the triggering of her IDS and promote the triggering of her IWS. Drawing attention to James' special difficulties helped Nora appreciate that her difficulty in handling him was not owing to her own incompetence.

### Conclusions

We have shown how the current features of the IDS and the IWS are linked to their functions in the distant past and have thrown light on the nature of mood disorders and

how they arise within the context of social rank theory. There is a close interrelation between attachment theory, which is concerned with degrees of closeness, and social rank theory, which deals with hierarchy.<sup>27</sup> Both theories bridge the dichotomy that has traditionally existed between biological and psychotherapeutic approaches in psychiatry, breaking down the dichotomy between mind and body. The IDS and IWS are genetically based and a genetic variance in these patterns would contribute to genetic vulnerability to depression. This model provides a broader understanding of how we react to stress<sup>28</sup> and how to intervene therapeutically. Psychiatrists generally think in terms of proximal causality when treating their patients. We propose that a distal (evolutionary) approach adds a new dimension, which can be helpful in devising therapeutic interventions.

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## **Résumé : Gagner et perdre : une approche évolutionnaire des troubles de l'humeur et de leur thérapie**

**Objectif:** Mettre de l'avant un nouveau modèle évolutionnaire qui examine les effets de gagner et de perdre sur les variables physiologiques et de l'humeur. Les études précédentes ont mis l'accent sur la stratégie de défaite involontaire afin de se sortir de l'escalade du conflit. Ici, nous proposons qu'il existe également une stratégie de réussite involontaire (SRI) qui est déclenchée par le succès, caractérisée par l'euphorie, et accrue par la confiance en soi. Elle motive les efforts pour relever les défis, et favorise la réconciliation.

**Méthode:** Des études précédentes, notamment les données sur les athlètes étudiants, sont présentées démontrant l'effet de gagner et de perdre sur l'humeur.

**Résultats:** Il est régulièrement démontré que la réussite est liée aux changements physiologiques comme les taux accrus de testostérone et de sérotonine chez les primates, ce qui mène invariablement à des changements de l'humeur qui servent à motiver les gagnants à continuer leurs efforts compétitifs.

**Conclusion:** Lorsque la SRI fonctionne de façon optimale, le succès mène au succès dans un cycle adaptatif. Avec le temps, les différences initiales entre gagnants et perdants de rencontres agonistiques se magnifient par un processus nommé amplification des différences. Par suite de l'homogamie, les enfants de personnes qui sont entrées dans un cycle adaptatif hériteront des traits de leurs deux parents qui, à leur tour, leur donnent un avantage compétitif accru. Ainsi, l'amplification des différences pourrait avoir accéléré l'évolution humaine par sélection naturelle. Des vignettes d'interventions cliniques sont aussi utilisées pour illustrer les stratégies thérapeutiques destinées à entraver les cycles mésadaptés et à promouvoir le comportement adaptatif.