



## Psychiatry & Behavioral Science Section - 2015

### I10 The Acute Stress Response to Threats and Physical and/or Verbal Aggressions: The Influence of Epigenetics on Defensive Strategies of Human Behavior

Luca Massaro, MD\*, via degli Artigiani n° 4 ESTE (PD), Este (PD) 35042, ITALY; Patrizia Trapella, JD\*, via Cavour 24, Rovigo, ITALY; and Vincenzo Lusa, JD\*, Via Ferdinando, Palasciano #72, Rome 00151, ITALY

After attending this presentation, attendees will be informed about current perceptions of epigenetics on the issue of human capacity/ability to react to a threat.

This presentation will impact the forensic science community by reviewing the results of many important works concerning the acute stress response to threats in the hope that studies on the pairing of fear and epigenetics may shed more light on this subject.

It is a known fact that the behavioral responses — primordial and animal responses — to a dangerous stimulus are diversified among individuals as well as among subjects of varied age and gender.

In particular, the defensive (animal) forms of behavior are shown to be integrated within a complex and flexible mechanism which is distance-dependent (Eilam) — it is known that human behavior is organized in modules that are relatively independent from one another (Tooby and Cosmides).<sup>1,2</sup>

Over the years, Cannon's intuition (fight or flight) about the mechanism of human behavioral response to threat, Marks' behavioral sequence (flight, freeze, fight, and appeasement), Gray's sequence (freeze, flight, fight) as studied in animals and non-human primates, the theory of Gray and McNaughton (clear distinction between fear and anxiety), and the variant thereof put forward by Bracha (freeze, flight, fight, fright) have been reviewed and studied.

However, why does a subject take to flight in the face of an aggression while another individual will fight? Why is it that one woman runs away while another reacts by putting up a fight? Why does one child freeze when confronted with a dangerous situation while another flees? Why does a particular individual, when placed in front of the same threats, fight at one moment (or stage) of his life while at a different moment he escapes or, given the same scenario, he first escapes and then fights? The differences depend on a multiplicity of factors. (i.e., age, bio-social-genetic characteristics of the victims, etc.).

But how, for the sake of the survival strategy, does the environmental variability (Levins and theory of evolution in a fluctuating environment) interact with the genes?

The study of epigenetics may show how gene changes occur in accordance with the type of environment in which the individual finds himself interacting; for instance, "ill-treating environment" or "beneficial environment." A genetic variability is produced, one on which the evolutionary factors are capable of acting by molding the individuals' adaptation capacity; thereby, empowering the suited phenotypes to self-reproduce and be transmitted across generations. Simultaneously, the same mechanism prevents the unsuited phenotypes from gaining ascendancy, with a resultant decrease in the genotypes lying at the base. Notwithstanding that, studies carried out in the last decades have proven that the genomic variations are not merely "casual" but also "causal" (i.e., they are induced by the environmental impact, or better still, guided by whatever surrounds the organism (natural and social habitat)).

The suggested study hypothesis is as follows: in order to attain deep knowledge of all the aspects relating to acute response to a noxious (dangerous/lethal) stimulus as well as if and how such reaction is going to change in the future, one must be profoundly acquainted with the mechanism of fear, the way it is memorized, and the mechanism of decision making through epigenetics. Thus, one could understand the real assessment a human subject makes in response to external stimuli; value may be assigned to such a response with a view to exempting the subject from legal accountability in the event of a criminal trial against him/her.

#### References:

1. Eilam D. Die hard: a blend of freezing and fleeing as a dynamic defense – implications for the control of defensive behaviour. *Neuroscience and Biobehavioral Reviews* 2005;29(8):1181-1191.
2. Tooby J, Cosmides L. The psychological foundations of culture. In: Barkow JH, Cosmides L, Tooby J, editors. *The adapted mind: evolutionary psychology and the generation of culture*. New York Oxford University Press, 1992:19-136.

#### Epigenetics, Fear, Threats