



Vitor de Castro Gomes

TESE DE DOUTORADO

**Genetic selection of two new rat lines displaying
different levels of conditioned freezing behavior**

Thesis presented to the Departamento de Psicologia,
PUC-Rio as partial fulfillment of the requirements for
the degree of Doutor em Psicologia Clínica in the
Departamento de Psicologia do Centro de Teologia e
Ciências Humanas da PUC-Rio.

Advisor: Prof. Jesus Landeira Fernandez

Rio de Janeiro
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Abstract

Gomes, Vitor de Castro, Fernandez, Landeira-Fernandez, J. (Advisor). **Genetic selection of two new rat lines displaying different levels of conditioned freezing behavior.** Rio de Janeiro, 2012. 160p. PhD Thesis – Departamento de Psicologia, Pontifícia Universidade Católica do Rio de Janeiro.

Bidirectional selective breeding of a defensive response or any other phenotypic characteristic is a technique in which animals are bred to modify the frequency of the genes that underlie a particular phenotype. Mating animals within a population based on the opposite extremes of an observable characteristic will push, over many generations, this particular phenotype in opposite directions, leading to two separately bred lines. In the present work we employed the conditioned freezing in response to contextual cues previously associated with footshock as the phenotype criterion for developing two new rat lines. The basic protocol consisted of mating male and female albino Wistar rats with the highest and lowest conditioned freezing in response to the contextual cues of the experimental chamber where animals were exposed to three unsignaled electric footshocks on the previous day. Study 1 presents the initial results of fourteen generations of selective breeding. We found that after three generations, reliable differences between these two lines were already present, indicating a strong heritable component of this type of learning. The lines were named Carioca High conditioned Freezing (CHF) and Carioca Low conditioned Freezing (CLF). Also, we introduced a third group of randomly selected animals (RND) in our selective breeding program. In Study 2, we investigated the different patterns of fear extinction and reacquisition in these two new lines. Finally, in Study 3, results showed dissociation between contextual and phasic fear between CHF and CLF rats.

Keywords

Animal models of anxiety; Amygdala; Emotionality; Strains; Genetic selection.

Resumo

Gomes, Vitor de Castro, Fernandez, Landeira-Fernandez, J. (Advisor). **Seleção genética de duas novas linhagens de ratos selecionados com diferentes níveis de comportamento de congelamento condicionado.** Rio de Janeiro, 2012. 160p. Tese de Doutorado – Departamento de Psicologia, Pontifícia Universidade Católica do Rio de Janeiro.

Criação seletiva bidirecional de uma resposta defensiva ou qualquer outra característica fenotípica é uma técnica na qual animais são criados com o objetivo de modificar a frequência dos genes que estão subjacentes a um fenótipo em particular. O acasalamento de animais de uma determinada população com base nos extremos opostos de uma característica observável vai propagar, após diversas gerações, este fenótipo particular em direções opostas, levando-se à criação de duas linhagens contrastantes. No presente trabalho empregamos o congelamento condicionado em resposta a estímulos contextuais previamente associados com choques elétricos nas patas como critério de seleção para o desenvolvimento de duas novas linhagens de ratos. O protocolo básico consistiu de acasalamento entre machos e fêmeas Wistar com as maiores e as menores taxas de congelamento condicionado em resposta a sinais contextuais da câmara experimental onde os animais foram expostos a três choques elétricos não sinalizados no dia anterior. O Estudo 1 apresenta os resultados iniciais de quatorze gerações de criação seletiva. Os resultados mostraram que diferenças significativas entre estas duas linhagens foram encontradas após 3 gerações, indicando um forte componente hereditário deste tipo de aprendizagem. As linhagens foram denominadas Cariocas com Alto Congelamento Condicionado (CAC) e Cariocas com Baixo Congelamento condicionado (CBC). Além disso, nós introduzimos um terceiro grupo de animais aleatoriamente selecionados (CTRL) em nosso programa de criação seletiva. No Estudo 2 investigamos os diferentes padrões de extinção e da reaquisição do medo condicionado nestas duas novas linhagens. Por fim, no Estudo 3, nossos resultados sugeriram uma dissociação entre o medo contextual e o medo discreto entre animais CAC e CBC.

Palavras-chave

Modelos animais de ansiedade; Emocionalidade; Linhagens; Seleção genética

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“Spirit” comes from the Latin word “to breathe.” Despite usage to the contrary, there is no necessary implication in the word “spiritual” that we are talking of anything other than matter (including the matter of which the brain is made), or anything outside the realm of science. On occasion, I will feel free to use the word. Science is not only compatible with spirituality; it is profound source of spirituality. when we recognize our place in as immensity of light years and in the passage of ages, when we grasp the intricacy, beauty, and subtlety of life, then that soaring feeling, that sense of elation and humility combined, is surely spiritual. So are our emotions in the presence of great art or music or literature, or of acts of exemplary selfless courage. The notion that science and spirituality are somehow mutually exclusive does a disservice to both.”

(Carl Sagan, *The demon haunted world*)