

**EFFECTS OF PRENATAL STRESS ON THE RAT  
OFFSPRING'S HIPPOCAMPAL CA3 NEURONS AND  
THE INFLUENCE OF PYRAMID ENVIRONMENT:  
A MORPHOLOGICAL AND BIOCHEMICAL STUDY**



**MITCHEL CONSTANCE GEORGE**

**UMS**  
UNIVERSITI MALAYSIA SABAH

**SCHOOL OF MEDICINE  
UNIVERSITI MALAYSIA SABAH  
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ENVIRONMENT: A MORPHOLOGICAL AND  
BIOCHEMICAL STUDY**



**MITCHEL CONSTANCE GEORGE**



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UNIVERSITI MALAYSIA SABAH  
2012**

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Mitchel Constance George  
PU20098041



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## CERTIFICATION

NAME : MITCHEL CONSTANCE GEORGE  
MATRIC NO. : PU20098041  
TITLE : EFFECTS OF PRENATAL STRESS ON THE RAT  
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## DECLARED BY

### 1. SUPERVISOR

Prof. Dr. Krishna Dilip Murthy

Signature



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## ABSTRACT

### **EFFECTS OF PRENATAL STRESS ON THE RAT OFFSPRING'S HIPPOCAMPAL CA3 NEURONS AND THE INFLUENCE OF PYRAMID ENVIRONMENT: A MORPHOLOGICAL AND BIOCHEMICAL STUDY**

Stress is necessary and inevitable, but in excess is deleterious to the physical and mental well-being of any animal species. Stressful experiences during pregnancy lead to development of impairments that become evident in prepubertal as well as adult stages. Pyramid models constructed with the same base to height ratio as the Great Pyramid of Giza, when aligned on a true north-south axis, is believed to generate, transform and transmit energy which has beneficial effects. The present study was carried out to assess the effects of housing pregnant Sprague Dawley rats subjected to restraint-stress outside (RC) and under the pyramid (RP) as compared to unstressed normal controls (NC) and its effects on the offspring morphometric and physical development, plasma corticosterone levels and hippocampal Cornu Ammonis (CA3) pyramidal neuron arborisation. The results showed a delay of one day in the fur appearance, pinna detachment, ear and eye opening in RC which was significant when compared to NC, while there was no such delay in the RP offspring. Significant decrease in head, body and tail length along with decrease in body and brain weight in RC group was also seen when compared to NC, but not in the RP offspring. Significant hypertrophy of adrenal gland and increase in plasma corticosterone was seen in the stressed mothers. The results were similar to those we found in our earlier work on adult rats and mice. Similar hypertrophy of adrenal glands and increase in plasma corticosterone was also seen at Postnatal Day (PND) 10, 21, 40 and 60 of the offspring's born to the stressed mothers, indicating presence of stress induced in the Hypothalamo-Pituitary-Adrenal (HPA) axis of the foetus. RC group showed significant decrease at PND 10, 21, 40 and 60 in both the apical and basal dendritic arborisation when compared to NC and RP offspring. The effects were more significant at PND 10 and 21 which is just before weaning, and the effect became lesser after they were being weaned from the mothers and until adulthood. Thus, the geometric shape of the pyramid and the energy generated within helps reduce the effects of stress probably by suppressing the HPA axis. This study suggests the therapeutic potential of the geometric shape of buildings that could be used to reduce stress and stress related mental diseases. This study prompts us to explore the rehabilitation effects of previously stressed animals under the pyramid in the future.

## ABSTRAK

*Tekanan adalah keperluan dan tidak dapat dielakkan, jika berlebihan ia boleh mendatangkan kesan yang memudaratkan kepada fizikal dan mental mana-mana spesies haiwan. Tekanan semasa mengandung boleh melambatkan pertumbuhan yang kelihatan nyata selepas kelahiran dan juga pada peringkat dewasa. Model piramid yang dibina dengan nisbah tapak asas and ketinggian yang sama seperti Piramid Agung di Giza, apabila diarahkan menghadap Utara-Selatan, dipercayai boleh menjana, mengubah dan menghantar tenaga yang boleh memberi kesan yang baik. Kajian yang dibuat adalah untuk mengenalpasti kesan dengan memberi tekanan kepada tikus Sprague Dawley yang bunting (RC) dan diletakkan dibawah piramid (RP) lalu dibandingkan dengan tikus kawalan (NC) keatas perkembangan fizikal, aras kortikosteron dan morfologi neuron piramidal CA3 hipokampus keatas anak yang dilahirkan. Keputusan kajian menunjukkan signifikasi kelewatan sehari kepada kemunculan bulu, peleraian telinga, pembukaan lubang telinga dan mata di kalangan tikus RC berbanding kumpulan NC, sementara tiada kelewatan yang sama kelihatan pada kumpulan RP. Penyusutan yang signifikan juga kelihatan kepada pembesaran/pemanjangan kepala, badan dan ekor tikus RC berbanding kumpulan NC, tetapi tidak pada anak RP. Signifikan kepada hipertrofi kelenjar adrenal dan peningkatan pada plasma kortikosteron kelihatan pada induk yang diberi tekanan. Keputusan serupa juga perolehi dalam kajian terdahulu yang menggunakan tikus dewasa dan tikus mencit. Kesan yang sama juga kelihatan pada anak PND 10, 21, 40 and 60, menunjukkan kehadiran tekanan yang dicetus dalam sistem HPA semasa peringkat fetus lagi. Kumpulan RC menunjukkan pengurangan signifikan pada arborisasi dendrit kedua-dua apical dan basal neuron terhadap anak PND 10, 21, 40 dan 60 berbanding NC dan RP. Kesan yang lebih ketara kelihatan pada anak PND 10 dan 21 iaitu selepas tikus bercerai susu manakala kesan semakin berkurangan selepas anak tikus diasingkan daripada induk sehingga meningkat dewasa. Oleh yang demikian, bentuk geometri piramid dan tenaga yang dijana didalam boleh mengurangkan kesan tekanan dengan menyekat sistem HPA. Kajian menunjukkan potensi terapeutik daripada bentuk geometri bangunan boleh digunakan untuk mengurangkan tekanan dan penyakit mental yang berkaitan. Kajian ini mendorong kita untuk meneroka kesan pemulihan menggunakan piramid terhadap haiwan yang sudah diberi tekanan pada masa hadapan.*



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