



*The Abdus Salam*  
**International Centre for Theoretical Physics**



Minischool and Workshop on Multiple Time Scale in the  
Dynamics of the Nervous System  
16 to 29 June 2008, ICTP, Trieste, Italy

**NOTES FOR TALK ON**

**"FUNCTIONAL TRADEOFFS IN AXONAL SCALING:  
IMPLICATIONS FOR BRAIN DYNAMICS"**

**by Prof. Samuel WANG**

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**Scaling laws in the mammalian neocortex: does form provide clues to function?**

**Harrison KH, Hof PR, Wang SS.**

**1: J Neurocytol. 2002 Mar-Jun;31(3-5):289-98.**

Although descriptions of form have been a mainstay of comparative neuroanatomy, less well explored is the use of quantitative approaches, especially at the cellular level. In the neocortex, many gross and cellular anatomical measures show striking regularities over a wide range of brain sizes. Here we review our recent efforts to accurately characterize these scaling trends and explain them in functional terms. We focus on the expansion of white matter volume with increasing brain size and the formation of surface folds, in addition to principles of processing speed and energetics that may explain these phenomena. We also consider exceptional cases of neocortical morphology as a means of testing putative functional principles and developmental mechanisms. We illustrate this point by describing several morphological specializations at the cellular level that may constitute functional adaptations. Taken together, these approaches illustrate the benefits of a synthesis between comparative neuroanatomy and biophysics.