Charge Transport of Cancer-Related Genes

Chi-Tin Shih[1], Yun-Yin Cheng[1], Stephen A. Wells[2], Rudolf A. Römer[2], Stephan Roche[3], Ching-Ling Hsu[4]

[1] Department of Physics, Tunghai University, 40704 Taichung, Taiwan and The National Center for Theoretical Sciences, 30013 Hsinchu, Taiwan
[2] Department of Physics and Centre for Scientific Computing, University of Warwick, Gibbet Hill Road, Coventry, CV4 7AL, UK
[3] CEA/DSM/DRFMC/SPSMS, 17 avenue des Martyrs, 38054 Grenoble, France
[4] Department of Physics, Chung-Yuan Christian University, Chung-Li, Taiwan

We report on theoretical studies [1] of point mutations effects on charge transfer properties in various DNA sequences related to genes from cancer databases, in particular the tumour-suppressor gene p53. On the basis of effective single-strand or double strand tight-binding models which simulate hole propagation along the DNA, we perform statistical analysis of charge transmission modulations associated with all possible point mutations. We find that in contrast to non-cancerous mutations, mutation hotspots tend to result in significantly weaker changes of transmission properties. This suggests that charge transport could play a significant role for DNA-repairing deficiency yielding carcinogenesis. The data for p53 is corroborated by another 34 cancer-related genes, including 20 of the most important tumour suppressors, with known genotype and phenotype analyzed. There are strikingly many properties of charge transport for these cancer-related genes which behave similar to the p53 gene. These new results strongly suggest that the aforementioned scenario of early pathogenesis related to charge transport can be applied to a wide range of disease-related genes.

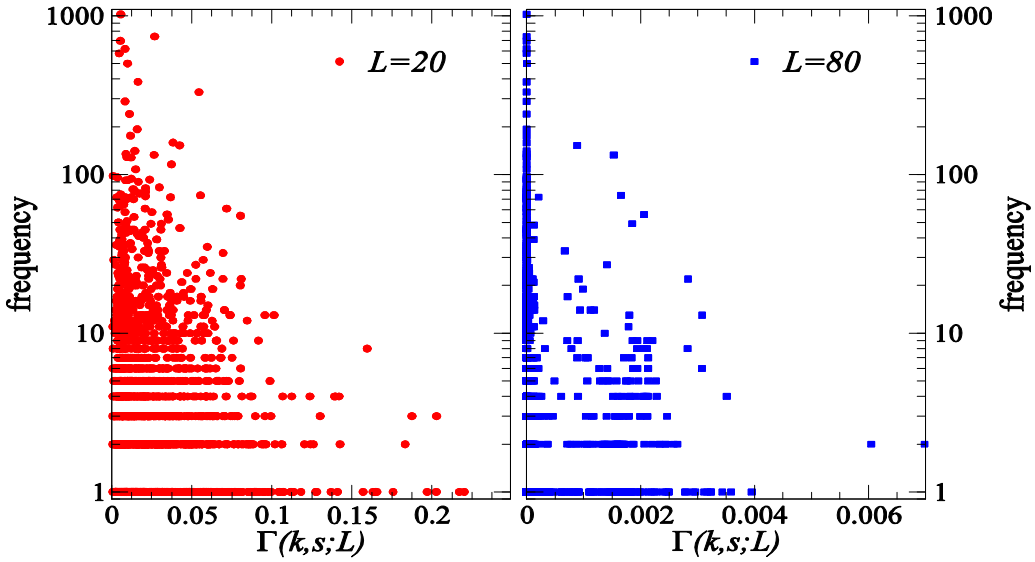

Figure 1 Scatter plots of the frequency of mutation versus the mean charge transport change for the p53 gene.

[1] **"Point Mutations Effects on Charge Transport Properties of the Tumor-Suppressor Gene p53"**, C.-T. Shih, S. Roche, R. A. Römer, Phys. Rev. Lett. 100, 018105-4 (2008)