1077-92-1494 **Bernard Sapoval*** (bernard.sapoval@polytechnique.edu), Route de Saclay, 91128 Palaiseau, France. *Magic fractal distribution trees in living systems: 1-Implication for evolution theory 2-Role of randomness.* Preliminary report.

Arborescent structures are common in living systems and their structure can be described by fractal geometry. In particular, the upper structure of the respiratory system of mammalians, or bronchial tree, is a fluid transportation system made of approximately 15 generations of bifurcations leading to the order of 215= 30.000 bronchioles. We discuss the optimal properties of such structures, energy efficiency, rapidity, and space filling. The ideal system is found to be multi-optimal. This multi-optimality suggests that, in the course of evolution, an organ selected against one criterion could have been later used later for a totally different property.

Real physiological trees are close to this ideal tree but different. For example the human bronchial bifurcations present a systematic branching asymmetry. This could lead to a multifractal distribution of the fluids and create a strongly uneven repartition of fluids with obvious dangerous consequences for life. We discuss how nature has lifted this contradiction in a different manner for airways and arteries. (Received September 20, 2011)