**Cell Size Regulation. November 9, 2016 Unsolved Problems**

***Please discuss & suggest possible causes for the following facts, & their relations to each other***.

I) Although it is lethal for mammals to be haploid, triploid, tetraploid, or pentaploid, individual cells survive (apparently normally) with abnormal numbers of chromosomes.

II) Frogs are not harmed by being haploid, triploid, tetraploid or pentaploid.

III) Some species of frogs are triploid or tetraploid versions of other species.

IV) For example, two species of Gray Tree Frogs live in the eastern United States, one of which is diploid and the other is tetraploid. They are almost indistinguishable, except that the cells of the tetraploid species have (exactly) twice the volume (per cell) as the cells of the diploid species.

V) Their songs are very different, and their ranges overlap only slightly.

VI) In all species of frogs, haploid individuals grow to the same size, but the volumes of the individual differentiated cells are half the volumes (per cell) as the volumes of diploid frogs of a given species.

VII) Tetraploid frogs have double-sized cells; and the component cells of individual pentaploid frogs have two and a half times the volume per cell of diploid cells of each differentiated cell type. The bodies of the frogs themselves do not vary with ploidy; i.e. haploid and tetraploid frogs are the same sizes as diploid frogs of any given species.

VIII) Haploid frogs therefore have twice as many cells per frog (and per organ!) as diploid frogs.

IX) Tetraploid have half as many (double-sized) cells per individual frog.

Please estimate the sizes of cells in pentaploid frogs, and the relative numbers of cells per frog.

X) The embryological mechanisms that control organ and body size must not work by counting cells.

X) Instead, these mechanisms must somehow measure or detect distances through tissues, or volumes of cytoplasm per organ. (Counter-arguments are welcome).

XI) In contrast, the mechanisms that control sizes of cells apparently detect ratios of amounts of DNA relative to volumes of cytoplasm.

XII) Many species of salamanders have much larger amounts of DNA than mammals, birds reptiles or fish. The extreme examples are members of the salamander genus *Amphiuma,* which live in rivers in North Carolina: they have about 25 times as much DNA per cell than humans, and their cells are 25 times bigger than mammal cells.