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DISQUALIFYING THE FLEA: GRAVITY CONSIDERED

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The oft-cited Herculean feats of the flea and of many other insects that have, thus far, put human beings and vertebrates in general to shame, must be taken with a grain of salt; for any argument in their favor would not hold water when properly conducted keeping in mind certain principles concerning the force of gravity and structural strength of materials. In this essay I will attempt to show that those cited physical feats are, in fact, nothing but illusions. Consequently, insects should immediately be disqualified with no possibility of appeal against such a verdict.

The Encyclopedia Britannica says of the flea: 'If man had equal ability, one leap would cover five city blocks! 'In response to such an irresponsible statement I could outright say: 'If the flea had man 's size, one such leap would be its last. ' Some cockroaches can run at an amazing speed of five km an hour. Applying the same faulty reasoning we should expect of man, who is about 70 x as long as a cockroach, to be able to clock 360 km an hour running on the ground to equal that feat. One good trick that could discredit the flea would be to imagine a million fleas jumping in a formation in the shape of a man. This hypothetical 'flea man ' would never be able to rise more than 50 cm off the ground in a high-jump competition, whereas an Olympic high-jumper would easily clear a 230 cm high bar. One can stretch his imagination further by considering the feat performed by each one of the hundred trillion cells in the body of the athlete: a 20-micron cell jumping 2300000 microns-high- 115000 times its length a super-Herculean feat indeed!

A more logical approach to the problem would be to consider the injuries sustained by mammals from falls. A 20 cm rat dropped from a height of 10 meters has about the same chance of dying as a 170 cm tall man falling from the same height, because the traumatic effects of the fall depend on the absolute rather than the relative height of the fall. Yet this height is 50x the rat 's length as compared to a mere six times the man 's height. Does that mean that the rat is about eight times less susceptible than man to injuries from falls? consider also the hypothetical fall of a 20-meter whale from a 10-meter height on the ground. Do you think it would have a better chance of survival from the fall just because it happens to be from a height half its length?

This dependence of injuries sustained in falls on the absolute rather than the relative height of falls leads me to speculate on the sizes of organisms permissible by evolution and natural selection on inhabited planets of various sizes and densities. It is rather obvious that the larger or denser the planet (and consequently its gravitational force), the more would natural selection favor the smaller organisms on it. Small organisms are much more likely to survive after falls from heights in the region of their lengths than are huge organisms. Therefore, the sizes of organisms on different planets must be inversely proportional to the force of gravity on their surfaces; Size = V times 1/g, where v represents all the other variables combined.

Of course, many other factors are involved in the final outcome of the size of organisms on a certain planet; the concentration of breathable gases, the availability of buoyancy (water), the availability of sufficient food, the lifespan of the organisms, structural limitations etc…. For example, the size of the whale, on earth, though little affected by gravity it being buoyed by water- may nevertheless be limited by the resistance of arteries to blood flow, necessitating enormous blood pressures unsustainable by biologic structures. As an organism grows larger, its nerve conduction velocity would become, relative to its size, slower making it more vulnerable to accidents. Finally, a fixed life span would cut short the growth to a potential size.

Having thus argued, I would marvel at the apparent ability of the huge dinosaurs of the past to run or even walk, and the pterosaurs to fly, in a gravitational field as strong as ours. Now that cloning fossils is becoming a feasible endeavor, I would be extremely curious to see a thirty meter 'resurrected 'dinosaur rise from the ground, let alone walk or run. If a modern dinosaur fails to do this, I would have no option left but to hypothesize that the earth must have had a much smaller density (and gravity) in the era of dinosaurs than it has now.

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The article discusses the credit erroneously given to insects for extraordinary athletic feats they perform as compared to human athletes, completely disregarding the effect of gravity in such comparisons. The discussion leads to a theoretical formula regarding the size of animals in the different gravitational fields of habitable planets.