Feet may be the key to hand evolution

January 20 2010, by Lin Edwards

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(PhysOrg.com) -- Scientists in Canada have used a mathematical model to simulate the evolution from an ape-like hand to the modern-day human hand, and discovered that changes in our fingers and hands developed in parallel changes in our toes and feet.

In research reported in the journal Evolution, a team of scientists, led by Campbell Rolian from the University of Calgary, took extensive measurements of the feet and hands of chimpanzees (genetically, our closest relatives) and humans to try to find out how the extremities of our chimp-like ancestors might have evolved.

They found there was a definite correlation between measurements of similar areas of the foot and hand, so for example if the big toe was long, the finger was also long. Dr Rolian speculated the correlation between toes and fingers may be because they share a similar genetic “blueprint”,

so minor changes to the blueprint would affect both hands and feet.

Once they had the anatomical measurements, the team used the data to create a mathematical simulation of the evolution of the hands and feet from those of our chimp-like ancestors to humans. The model simulated the evolutionary pressures and changed the shape of the feet or hands in small increments to see what effects the changes would have. They discovered that changes made to the feet also caused corresponding changes to the hands, particularly in the relative lengths of fingers and toes, and Dr Rolian said these changes may have allowed the hands of early hominins, including Neanderthals, the dexterity required to use stone tools.

The scientists say the capacity to walk upright on two feet is linked intrinsically to the emergence of the use of stone tools. Dr Rolian said the findings go "back to Darwin's The Descent of Man," since Darwin was one of the first scientists to consider there might be a link between walking upright and using stone tools. But Darwin's idea was that bipedalism evolved first, and this freed the hands, which could then be used for purposes other than locomotion, while Rolian's work suggests they evolved together.

Professor Robin Crompton at Liverpool University in the UK, said the feet and hands of chimpanzees may not necessarily be good models for those of human ancestors, and suggested the extremities of lowland gorillas may be more "interesting" in this respect. He also said the shape and biomechanics of hands and feet were more complex than simple anatomical measurements might suggest.

Professor Crompton is head of the university's Primate Evolution and Morphology Research Group. His research has found that orang-utans, which are tree dwellers, are more like modern humans in bipedal walking than the chimpanzees, and his work suggests bipedalism may

even have arisen as early as 24 million years ago.

More information: THE CO-EVOLUTION OF HUMAN HANDS AND FEET, *Evolution*, DOI:10.1111/j.1558-5646.2009.00944.x