Is the fifth toe vestigial?

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Orthodox Darwinism postulates modern humans evolved from an apelike common ancestor. Consequently, theories of human foot evolution are based on comparisons of hypothetical pre-human feet to modern chimp feet.[1] One alleged vestigial organ occasionally discussed by evolutionists is the 5th toe, also called the little or small toe.[2]

One prediction of Darwinists is that the 5th toe not only has shrunk since we supposedly evolved from our common ancestor, but will continue to shrink in the future. In 1933, from an analysis of human foot mechanics, Shapiro predicted the eventual complete loss of the 5th toe in humans.[3] His theory postulated that in the "course of primate evolution the line of leverage shifted to a position midway between the big and the second toes as a result of adaptation" to the evolution of bipedal locomotion. In other words, Shapiro hypothesized that the line of weight-bearing load in humans has moved toward the big toe as we have evolved from the chimp foot design in which the four parallel digits are all close to equal length and the 'thumb' digit is shaped very much like a human thumb.[4] As a result, evolutionists postulate the big toe has evolved to become the largest toe, accompanied by a progressive decrease in both the size and function of the smallest toe.

Kadakia has noted modern primates use their feet to grab, to claw, and to climb trees, but humans "don't need that function anymore … we're not jumping up and down trees and using our feet to grab. We have toes … because we descended from apes, but we don't need them as people."[5] Therefore, for these reasons

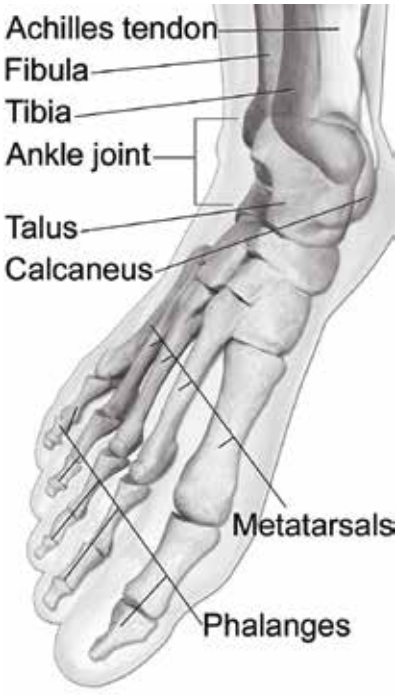
presumably the 5th toe will eventually disappear in humans.

Another argument used to support the gradual loss of the little toe is the fact that in some people it has degenerated to a tiny digit, sometimes without a nail, or only its vestige.[2] Shapiro predicted that in the future the little toe will continue to become smaller and perhaps will exist simply as a remnant of the digit in most humans. Shapiro added this suggests its total disappearance could occur in the future. Toe loss "is a phenomenon well-known in the evolution of a number of common mammals, such as the horse, cow, camel, pig, etc."[6]

Shapiro gave as a parallel example the condition of male type baldness, which is much more frequent among what Shapiro calls the "highly civilized races of mankind than among primitive people", as illustrated by the paucity of bald-headed Indians, Polynesians, and Melanesians. Assuming we evolved from an ape, he predicted that virtually all of the remaining body hair will also eventually be lost from all humans. These two examples, loss of the 5th toe and body hair, are claimed to be both the results of the disappearance of traits caused by evolution.

The design of the 5th toe

The bone at the tip of the 5th toe is the phalanx distalis (distal phalanx) which is connected to the phalanx medialis (medial or middle phalanx), in turn connected to the phalanx proximalis (proximal phalanx), connected to the os metatarsale, or metatarsal bone.This set is a very important unit that helps with balance and walking. The 5th toe is controlled by the abductor digiti minimi muscle, which serves for flexion and abduction of the 5th toe. As a result of its important role in posture and during physical activity, the abductor digiti minimi is often the target of injury. The most common of this type of injury



Lower Leg and Foot

occurs in women, possibly due to the bone's smaller size in females.

When its loss is predicted, it is not clear if it's suggested only the visible part will be lost or if the entire set of bones connected to the 5th toe noted above will disappear. If the entire set were lost, a major redesign of the foot would be required. The muscle system, and the bony structures of the 5th toe are key components in balance. The foot is a complex structure of 26 bones, 33 joints, layered with an intertwining web of more than 120 muscles, ligaments, and nerves that function as a unit. A loss of any one part affects the function of the entire system.

The blphalangeal (having two phalanges) abnormality of the big toe is significantly related to pathology.[7] These variations lend further support to the importance of the 5th toe in locomotion, further refuting the argument that it is a 'vestigial organ'.

The lack of significant selection pressures to drive any reduction in the size or function of the 5th toe is another concern. Perhaps social pressures ('neo-Lamarkian') may play a part if some isolated society ethos decided that this appendage was no longer fashionable. In view of the fact that our world is increasingly connected electronically and by airplane, this possibility is very unlikely.

The case for the 5th toe's importance

While our toes do not help us to grab trees, or anything else, they are critical in helping us to stand, walk, run, and play many sporting and dancing activities (e.g. ballet or football). Especially important are the set of bones connecting our toes to our ankle, namely the 26 bones that make up the hindfoot, midfoot, and forefoot (the toes being contained in the latter structure). The big toe consists of two large bones, while each of the rest of our toes consists of only three very small bones that function as a set. Loss of any one of these bones adversely impacts the effectiveness of the total system.[8]

Though all the bones in the foot are assembled as a functional unit forming the foot structure, the main bones responsible for our balance are the metatarsals. As explained by Wenjay Sung, walking and standing are supported by a tripod, consisting of the big toe, the 5th toe and the heel, and "If you remove one part of that tripod, you lose balance."[4] Thus, the 5th toe is part of the tripod, and its loss will force significant compensation in balance and walking, often by the 4th toe taking up the slack. Functionally, the two most important toes are the big toe and the 5th toe, as they function somewhat independently in contrast to the middle three toes. This is especially true in running. In Heinrich's words, "in order to achieve top speed, we literally run on our toes".[9]

Designed for running

University of Calgary evolutionist Campbell Rolian concluded that our short, stubby toes are custom-designed for running, noting:

> "Biomechanical analysis shows that long toes require more energy and generate more shock than short toes … . Longer toes require muscles to do more work, and exert stronger forces to maintain stability, compared to shorter toes … as we were engaged in substantial amounts of running, natural selection would favor individuals with shorter toes."[10]

Most mammals that can run efficiently, such as cats, dogs, and horses, have very short toes and often paws composed almost entirely of palms. Most primates—including our alleged closest relative, the chimpanzee—have proportionately much longer toes than do humans. Human toes are comparatively small, capable only of minor extending and flexing. Specifically, the human foot consists of only 9% of the total adult leg mass, compared to about 14% in adult chimpanzees.[11]

Research led by Rolian examined the theory that our foot's physiological design can be explained by our exceptional running skill. They found no significant increase in digital flexor energy output associated with longer toes in walking. Conversely, multiple regression analyses, based on their sample, found, when running, "increasing average relative toe length by as little as 20% doubles peak digital flexor impulses and mechanical work, probably also increasing the metabolic cost of generating these forces. The increased mechanical cost associated with long toes in running suggests that modern human forefoot proportions" confer a clear advantage in endurance running for humans.[12]

Few animals are capable of long-distance running, and fewer can do so in the blazing sun. To prevent overheating, many animals, such as wolves and hyenas, which have no sweat glands to cool their bodies, require cold weather or nightfall for long-distance hunting. This is why many large cats hunt at night. The endurance running achieved by humans sets us apart from all mammals. The best example is the human 42.2 km (26.2 miles) marathon, which very few mammals can achieve except horses, some artiodactyls, and perhaps the African wild dog (*Lycaon pictus*) under ideal circumstances.[13] One major reason is that the design of the human toes, including the 5th toe, is critical in achieving this running feat.[14]

Studies on the effect of amputation are also a source of information about the function of the 5th toe, due to the high frequence of issues reported as a result of its loss.

A very common issue, especially in women, is hammer toe involving the 5th toe, in which it overlaps the 4th toe. This is often caused by high-heeled shoes or shoes that force the feet into unnatural shapes, such as pointed-toe shoes or poorly fitting shoes. This condition causes significant problems in walking, which indicates the importance of the 5th toe.[15] Hammer toe can also be caused by lack of exercise, such as from lying down for long periods of time, diabetes, and diseases that affect the nerves and muscles.

Conclusion

This evidence supports the conclusion that the small toe is not vestigial, but serves an important role in not only balance and walking normally, but also in the exceptional human skill of endurance running and other activities, such as certain dances. The human foot is designed so that all parts function as a system, and the loss of the 5th toe results in significant loss of foot function and adaptation level. This skill (running, dancing, etc.) helps to explain the fact that a major contrast exists between the design of the human foot and that of all other primates.

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