

# Hereditary Gigantism – the biblical giant Goliath and his brothers

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## ABSTRACT:

The biblical giant Goliath has an identifiable family tree suggestive of autosomal dominant inheritance. We suggest that he had a hereditary pituitary disorder possibly due to the AIP gene, causing early onset and familial acromegaly or gigantism. We comment on the evidence within the scriptures for his other relatives including a relative with six digits and speculate on possible causes of the six digits. Recognition of a hereditary pituitary disorder in the biblical Goliath and his family sheds additional information on his and other family members' battles with David and his relatives.

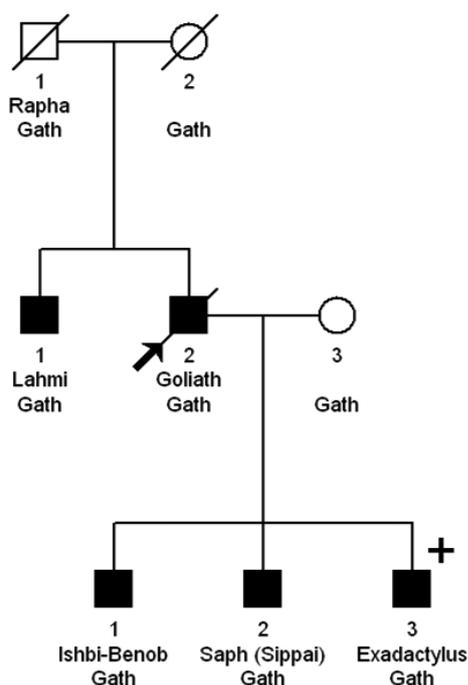


Fig 1. Goliath's Pedigree. Affected members are shaded in black. + symbol indicates exadactlyly.

## INTRODUCTION

Giants have been around since time began; they are first described in the Bible in the book of Genesis (6:1-4)<sup>1</sup>. Originally, giants appear to have been regarded positively, often considered as heroes, particularly by the non-Hebrew population. After the great Flood, giants remained present

in the scriptural texts, but their good reputation had waned in the eyes of the Hebrews, and they often tended to be seen as the enemy, often fighting in armies. Giants lived together as a number of separate races, before and after the Flood. The exact relations between different families of giants are a little unclear. For example, the Nephilim (Numbers 13:32-33), appear to be present before and after the flood. The Emites, the Ammonites (or Anakites) and the Rephaim (Deuteronomy 2:10-11), existed after the Flood and appear to be separate entities although the chronicler often uses the phrase 'like' suggesting they had a similar phenotype. The Anakim seem to be derived from the Nephilim. The Rephaim although similar to the Nephilim, appear to be distinct from them with respect to family lineage. Deuteronomy 2.21 states the Rephaim were largely subdued by the Ammonites which 'dwelt in their stead' One of the most prominent Rephaim was Og, King of Bashan, who slept in 'a bedstead of iron; nine cubits was the length, and four cubits the breadth of it' (Deuteronomy 3:11). A cubit was the distance from the elbow to the fingertips. He appears to be one of the last survivors of the Rephaim. A race of giants implies a hereditary element and the origins of some names may indicate the genetic pathway involved. The Hebrew word *anaq* may mean necklace (Proverbs 1:9), or possibly goitre. This could suggest hyperthyroidism, possibly due to underlying pituitary gland, or other endocrine, dysfunction.

## A FAMILIAL ASPECT TO GOLIATH'S GIGANTISM.

Goliath, the Gittite, is the most well known giant in the Bible. He is described as 'a champion out of the camp of the Philistines, whose height was six cubits and a span' (Samuel 17:4). From Samuel and Chronicles (table 1), we have drawn Goliath's pedigree (figure 1). A literal interpretation of the verses suggests that his brother and three sons were also of giant stature. The name of Goliath's third son does not appear in the Bible, so we have named him Exadactylus as it was said that 'he had on every hand six fingers, and on every foot six toes' (Samuel 21:20-21). Goliath's family tree is suggestive

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of a hereditary autosomal dominant pituitary gene, such as AIP<sup>2</sup>.

Goliath was killed by David who threw a stone at his forehead (Samuel 17:49). This gives further evidence that he suffered from pituitary gland dysfunction; a pituitary tumour pressing on his optic chiasm, and consequent visual disturbance due to pressure on his optic nerve, would have made it difficult for him to see the stone in his lateral vision. Pituitary giants look impressive in terms of stature, but may not have speed and agility to match their perceived strength. David, having agility, particularly having declined the heavy set of armour that was offered to him, and being skilled at sling shots, may have found a way around the fearsome looking giant by firing a sling shot from the side of the battlefield. The fact that Goliath may have had a pituitary tumour was recognised by Vladimir Berginer in a paper in 2000<sup>3</sup>. In his description of the condition, he notes a painting of David and Goliath by Puget in the 18th century noting the appearance of acromegaly in the severed head of Goliath, and remarks that the painting was done more than one hundred years before Marie originally described the condition in 1886. He also helpfully comments that Goliath was killed by David severing his head, not from the impact of the stone which felled him, possibly due to brain contusion, but did not actually kill him directly.

TABLE I

*Bible references for the relatives in figure 1*

Name	Position in Pedigree	Bible Reference
Lahmi	II:1	Samuel 21:19 Chronicles 20:5
Ishbi-Benob	III:1	Samuel 21:16
Sippai (Sath)	III:2	Samuel 21:18 Chronicles 20:4
‘Exadactylous’	III:3	Samuel 21:20-21 Chronicles 20:6-7

Gigantism results when a growth hormone-secreting pituitary adenoma is present before epiphyseal fusion. Pituitary adenomas can be present in a number of genetic conditions, such as multiple endocrine neoplasia type 1, Carney complex, and Familial Isolated Pituitary Adenoma (FIPA). FIPA is an autosomal dominant condition with incomplete penetrance, caused by germline mutations of the aryl hydrocarbon receptor interacting protein (AIP) gene<sup>4</sup>. Patients with AIP mutations have an earlier mean age at diagnosis than AIP mutation-negative patients<sup>4</sup>. The age of Goliath is not clear, but early onset of pituitary tumours is typical of hereditary gigantism and limitation of lateral vision is common. Goliath himself had a shield bearer precede him, possibly to indicate to Goliath the direction of the approaching foe.

Polydactyly has not been described in association with FIPA. The AIP gene lies on chromosome 11q13.3. The Bardet-

Biedl gene, BBS1, is located close by on chromosome 11q13.2. Bardet-Biedl syndrome type I is characterized by rod-cone dystrophy, truncal obesity, cognitive impairment and postaxial polydactyly<sup>5</sup>. The protein encoded by BBS1 is thought to play a role in limb development. It is unlikely that Goliath’s family had FIPA caused by a microdeletion which also involved BBS1, as the genetic distance between the BBS1 and AIP genes is separated by a 1 Mb gene-packed region. Such a gap makes an inherited contiguous gene syndrome unlikely as there would have been too many other features. Very rarely BBS1 patients have symmetric exadactyly; most commonly it is present in one or two extremities, upper and lower - not in all four. We are not given much other detail about Exadactylus so a new BBS1 mutation due to some complex rearrangement is unlikely – a new mutation in an autosomal dominant polydactyly gene might explain his symmetrical phenotype. If he had pituitary disease and six digits – he may have looked an intimidating foe - but he may not have been a great warrior in action.

Interestingly, the book of Samuel refers to five stones that David carefully selected for his sling from the nearby stream, and further reading of the surrounding passages shows that David’s relatives were all involved in the deaths of the other giants in Goliath’s family. There can be other interpretations for this and various types of symbolism, but it appears likely that several giants may have been from Goliath’s family, further suggesting autosomal dominant inheritance. The reverse also almost happened - Ishbibenob, Goliath’s son, is credited with almost killing David until the swift intervention of David’s nephew Abishai (2 Samuel 21.16), so clearly intellect or agility was not deficient in some of the giants, and myopathy seen in some cases of pituitary disease in later life, not a direct issue in the younger giants.

The giants from Gath were present after the Flood. One possible answer to the often raised question of why the Nephilim giants, present before the Flood were not eradicated by it, could be that new mutations in the AIP gene (or other genes) caused new families of giants to appear. There is no evidence in the Bible to suggest that the Nephilim, Rephaim or Anakim were directly related but they may have had some relations and intertwined lineage. If Goliath was the son of Rapha – he is likely to be descended from the Rephaim, but being brought up in Gath, an ancient stronghold of the Anakim, could suggest he may also have had some Anakim relatives, making his champion status even more significant in the ancient world.

Families of giants have been described in the medical literature<sup>6</sup>, but this may be one of the oldest and most famous examples to be documented. Perusal of the archaeological literature of that period gives evidence of giants being excavated but numerous fakes exist. Technology now exists to extract DNA from giant skeletons<sup>2</sup>, and if any new excavations in the Middle East unearth a skeleton suggestive of Goliath, or of Og or similar biblical giants, more proof may be obtained by careful DNA analysis and it may be possible

in the future to delineate the exact relations between different giant lineages in the bible, and dissect them further.

In conclusion, Goliath may have had an AIP mutation causing early onset autosomal dominant pituitary gigantism and one of his sons may have had a syndrome involving both AIP and BBS1, which could some way account for the physical characteristics of his family and their good success rate on the battle field until they met David.

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