AR gene

androgen receptor

Normal Function

The *AR* gene provides instructions for making a protein called an androgen receptor. Androgens are hormones (such as testosterone) that are important for normal male sexual development before birth and during puberty. Androgen receptors allow the body to respond appropriately to these hormones.

The receptors are present in many of the body's tissues, where they attach (bind) to androgens. The resulting androgen-receptor complex then binds to DNA and regulates the activity of certain genes that play a role in male sexual development. By turning the genes on or off as necessary, the androgen receptor complex helps direct the development of male sex characteristics. Androgens and androgen receptors also have other important functions in both males and females, such as regulating hair growth and sex drive.

In one region of the *AR* gene, a DNA segment known as CAG is repeated multiple times. This CAG segment is called a triplet or trinucleotide repeat. In most people, the number of CAG repeats in the *AR* gene ranges from fewer than 10 to about 36.

Health Conditions Related to Genetic Changes

Androgen insensitivity syndrome

Hundreds of different variants (also called mutations) in the *AR* gene have been identified in people with androgen insensitivity syndrome, a condition that affects sexual development before birth and during puberty. Most of these variants are changes in single DNA building blocks (base pairs). Other variants insert or delete multiple base pairs in the gene. Some variants lead to the production of an abnormally short version of the androgen receptor protein, while others cause the production of an abnormal receptor that cannot bind to androgens or to DNA.

As a result of these changes, androgen receptors do not work properly, which makes them less able to bind to androgens and regulate gene activity. If androgen receptors cannot bind to androgens, the body cannot use androgens, even if there are normal levels of these hormones in the body..pf0{}

There are three forms of androgen insensitivity syndrome: complete, partial, and mild.

Which form a person has depends on how much the variants affect the function of the androgen receptor. Variants that produce nonfunctional versions of the androgen receptor cause complete androgen insensitivity syndrome, while variants that reduce but do not eliminate the receptor's activity can cause partial or mild androgen insensitivity syndrome.

People with this condition have one X chromosome and one Y chromosome in each cell. Depending on the level of androgen insensitivity, affected individuals may have external sex characteristics that are typical for females or typical for males, or they may have features of both male and female sexual development.

Spinal and bulbar muscular atrophy

Variants in the *AR* gene have been found to cause spinal and bulbar muscular atrophy. This condition affects specialized nerve cells that control muscle movement (motor neurons). The *AR* gene variants that cause spinal and bulbar muscular atrophy are an expansion of the CAG trinucleotide repeat in the *AR* gene. Instead of the typical 10 to 36 repeats, CAG is repeated from 38 to more than 60 times in people with this disorder. Although the extended CAG region changes the structure of the androgen receptor, it is unclear how the altered protein damages nerve cells. Researchers believe that a fragment of the androgen receptor protein that contains the CAG repeats accumulates within these cells and interferes with normal cell functions. This buildup leads to the gradual loss of motor neurons, which results in muscle weakness and wasting (atrophy).

Androgenetic alopecia

Variants in the *AR* gene are associated with an increased risk of androgenetic alopecia, a form of hair loss also known as male pattern baldness in men and female pattern hair loss in women. The variants change the number or order of base pairs that make up the *AR* gene. These genetic changes appear to be most frequent in men with hair loss that begins at an early age. Researchers believe that *AR* gene variants may increase the activity of androgen receptors in the scalp. Although androgenetic alopecia is related to the effects of androgens on hair growth, it remains unclear how changes in the *AR* gene increase the risk of hair loss in people with this condition.

Polycystic ovary syndrome

MedlinePlus Genetics provides information about Polycystic ovary syndrome

Prostate cancer

MedlinePlus Genetics provides information about Prostate cancer

Other Names for This Gene

- AIS
- ANDR_HUMAN

- DHTR
- NR3C4
- TFM

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of AR (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=367[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28AR%5BTI%5D%29+OR+%28androgen+receptor%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- ANDROGEN RECEPTOR; AR (https://omim.org/entry/313700)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/367)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=AR[gene])

References

- Adachi H, Katsuno M, Minamiyama M, Waza M, Sang C, Nakagomi Y, Kobayashi Y, Tanaka F, Doyu M, Inukai A, Yoshida M, Hashizume Y, Sobue G. Widespread nuclearand cytoplasmic accumulation of mutant androgen receptor in SBMA patients. Brain.2005 Mar;128(Pt 3):659-70. doi: 10.1093/brain/awh381. Epub 2005 Jan 19. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15659427)
- Beitel LK, Scanlon T, Gottlieb B, Trifiro MA. Progress in Spinobulbar muscularatrophy research: insights into neuronal dysfunction caused by thepolyglutamine-expanded androgen receptor. Neurotox Res. 2005;7(3):219-30. doi:10.1007/BF03036451. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15897156)
- Bennett NC, Gardiner RA, Hooper JD, Johnson DW, Gobe GC. Molecular cellbiology of androgen receptor signalling. Int J Biochem Cell Biol. 2010Jun;42(6): 813-27. doi: 10.1016/j.biocel.2009.11.013. Epub 2009 Nov 30. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/19931639)

- Gottlieb B, Beitel LK, Nadarajah A, Paliouras M, Trifiro M. The androgenreceptor gene mutations database: 2012 update. Hum Mutat. 2012 May;33(5):887-94.doi: 10.1002/humu.22046. Epub 2012 Mar 13. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/22334387)
- Gottlieb B, Beitel LK, Wu J, Elhaji YA, Trifiro M. Nuclear receptors anddisease: androgen receptor. Essays Biochem. 2004;40:121-36. doi:10.1042/bse0400121. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15242343)
- Hillmer AM, Hanneken S, Ritzmann S, Becker T, Freudenberg J, Brockschmidt FF, Flaquer A, Freudenberg-Hua Y, Jamra RA, Metzen C, Heyn U, Schweiger N, Betz RC,Blaumeiser B, Hampe J, Schreiber S, Schulze TG, Hennies HC, Schumacher J, Propping P, Ruzicka T, Cichon S, Wienker TF, Kruse R, Nothen MM. Geneticvariation in the human androgen receptor gene is the major determinant of commonearly-onset androgenetic alopecia. Am J Hum Genet. 2005 Jul;77(1):140-8. doi:10.1086/431425. Epub 2005 May 18. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15902657) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1226186/)
- Katsuno M, Adachi H, Tanaka F, Sobue G. Spinal and bulbar muscular atrophy: ligand-dependent pathogenesis and therapeutic perspectives. J Mol Med (Berl).2004 May;82(5):298-307. doi: 10.1007/s00109-004-0530-7. Epub 2004 Feb 27. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15133611)
- Levy-Nissenbaum E, Bar-Natan M, Frydman M, Pras E. Confirmation of theassociation between male pattern baldness and the androgen receptor gene. Eur JDermatol. 2005 Sep-Oct;15(5):339-40. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/16172040)
- Poletti A, Negri-Cesi P, Martini L. Reflections on the diseases linked tomutations of the androgen receptor. Endocrine. 2005 Dec;28(3):243-62. doi:10.1385/ENDO:28:3:243. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/16388114)
- Zajac JD, Fui MN. Kennedy's disease: clinical significance of tandem repeatsin the androgen receptor. Adv Exp Med Biol. 2012;769:153-68. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/23560310)

Genomic Location

The *AR* gene is found on the X chromosome (https://medlineplus.gov/genetics/chromosome/x/).

Last updated April 1, 2024