

I'm not a bot



























Benefits/Dosage/How fast does it work?/Side effects/Safety/Takeaway/Spirolonactone is a medication usually used for fluid retention, but doctors sometimes use it to treat androgenetic alopecia, a type of hair loss in females.Spirolonactone (Aldactone) is a type of medication known as an aldosterone receptor antagonist. Its FDA-approved for the treatment of fluid retention caused by a variety of conditions, including liver disease and kidney disease. However, it is also used to treat other conditions, including high blood pressure, failure of the adrenal glands, and failure of the adrenal glands. Some doctors may prescribe it for female pattern hair loss caused by androgenetic alopecia. This is a type of hair loss that is associated with the overproduction of male sex hormones. Doctors typically only prescribe it if other treatments do not work.Read on to learn more about how spirolonactone treats female pattern hair loss, how long it takes to work, and the side effects it can cause.All people, regardless of sex, produce some amount of androgens. People with ovaries typically produce much less of them. Overproduction can lead to higher levels of:dihydrotestosterone (DHT) productionheightened levels of 5 alpha-reductaseandrogen receptors on the scalp in areas affected by hair lossThis can cause female pattern baldness or androgenetic alopecia.Spirolonactone can help reduce the production of androgens, slow down the progression of hair loss, and encourage hair to regrow.Keep in mind that it does not treat male pattern baldness. That type of androgenetic alopecia is caused by the actions of another hormone, dihydrotestosterone (DHT).Spirolonactone is usually only prescribed when other treatments, such as minoxidil, dont work.A 2023 review of research found that about 43% of people with female pattern hair loss noticed an improvement in their hair loss after taking spirolonactone. Up to 66% noticed an improvement if spirolonactone was combined with another therapy.In addition, a 2017 pilot study noted significant benefits of a combination of spirolonactone and minoxidil. This combination was associated with reduced shedding and increased hair growth.Its important to note that spirolonactone does not work for female hair loss thats only due to nonhormonal causes, such as:stresschemotherapynutritional deficienciesFor hair loss, a doctor typically prescribes a daily dose of 100 to 200 milligrams (mg). However, they might recommend starting with 25 mg a day and slowly increasing your dose to reduce your risk of side effects.Spirolonactone sometimes causes drowsiness, so its best to take it at night. You can take it with or without food.If you havent gone through menopause, your doctor might also prescribe birth control pills to take with spirolonactone. They might also prescribe minoxidil to take with spirolonactone, regardless of your age.The exact dosage and combination of medications that your doctor suggests can depend on how severe your hair loss is and whether you take other medications for hair loss or other conditions.Spirolonactone takes a while to start working for hair loss, so try not to be discouraged if you dont see improvement right away.Most people need to take it for at least 6 months before they start seeing results. Others might not notice any benefits until theyve taken it for at least a year.Follow up with a doctor after taking spirolonactone for 6 months. Depending on your results, they might increase your dosage or prescribe a different medication to take with or instead of spirolonactone.Spirolonactone is commonly prescribed to lower blood pressure, and it may cause low blood pressure in those taking it for hair loss. You should regularly check your blood pressure while taking spirolonactone, as this can be dangerous if you dont have high blood pressure. Learn how to check your blood pressure at home.Other common side effects of spirolonactone include:drowsinessnauseadiarrheahtheadachedizzinessirregular periodsbreast tendernessweight gainlow sex drive/depresionfatigueMore serious but less common side effects include:gastrointestinal bleedinghigh potassium levelsHigh blood potassium is serious and potentially life threatening. Call your doctor right away if you notice any of the following symptoms while taking spirolonactone:muscle fatigueweaknessabnormal heart ratenauseaparalysisSpirolonactone is generally safe, but it can lead to health problems if not taken correctly. As with any medication, some people may also be allergic or sensitive to it.Talk with your doctor before taking any other medications while taking spirolonactone. That includes nutritional supplements (especially potassium) and diuretics.Before taking spirolonactone, tell your doctor if youre pregnant, nursing, planning to become pregnant, or have:Talk with a doctor right away if you become sick while taking spirolonactone, especially if you have severe or persistent nausea, vomiting, or diarrhea. These can all cause dangerously low blood pressure when taking spirolonactone.Make sure you drink plenty of water while taking spirolonactone, especially in hot weather or during exercise. Know how to recognize the signs of dehydration, which include:extreme thirstinfrequent urinationdark-colored urineconfusionGet emergency medical treatment if you experience any signs or symptoms of a severe allergic reaction to spirolonactone, including:trouble breathingrapid or weak heartbeats seizuressloss of consciousnessSpirolonactone is an effective treatment for hair loss due to androgenetic alopecia in women. However, it can take up to a year to work.If youre interested in trying spirolonactone for hair loss, talk with your doctor. Make sure to tell them about any medical conditions you have and the kinds of hair loss treatments youve tried in the past.Drug class:Mineralocorticoid receptor antagonist:Drug class:Spirolonactone, the most widely used anti-mineralocorticoid.Class identifiers:KynonesAldosterone antagonist; Mineralocorticoid antagonist:UsreDiuretic; Chronic heart failure; Hypertension; Hyperaldosteronism; Conn's syndrome:Biological target:Mineralocorticoid receptor:Chemical class:Steroid; Nonsteroidal:Legal status:IN Wikidata:A mineralocorticoid receptor antagonist (MRA or MCRA)[1] or aldosterone antagonist, is a diuretic drug which antagonizes the action of aldosterone at mineralocorticoid receptors. This group of drugs is often used as adjunctive therapy, in combination with other drugs, for the management of chronic heart failure. Spirolonactone, the first member of the class, is also used in the management of hyperaldosteronism (including Conn's syndrome) and female hirsutism (due to additional antiandrogen actions). Most anti-mineralocorticoids, including spirolonactone, are steroidal spirolactones. Finerenone is a nonsteroidal anti-mineralocorticoid.Mineralocorticoid receptor antagonists are diuretic drugs that work primarily on the kidneys. They decrease sodium reabsorption, which leads to increased water excretion by the kidneys.[2] By regulating water excretion, mineralocorticoid receptor antagonists lower blood pressure and reduce fluid around the heart which can be very beneficial in some cardiovascular conditions.[3] Mineralocorticoid receptor antagonists have been used for many clinical conditions in the cardiovascular system. It has proven beneficial for disease like primary aldosteronism, primary and resistant hypertension, heart failure and chronic kidney disease [2] They are often used with other medications, such as ACE inhibitors or beta blockers.[4]Increased excretion is a commonly reported side effect, particularly during the following treatment period. The essential amino acid lysine and the essential amino acid methionine are commonly used in the treatment of chronic kidney disease. However, it is also possible, and likely, that the amino acid lysine and methionine are also used in the treatment of chronic kidney disease. The pathophysiology of hyperkalemia is that anti-mineralocorticoid medications reduce potassium (K) excretion.Anti-mineralocorticoid mechanism of actionAldosterone is a mineralocorticoid which is synthesized in the adrenal glands.[5] When aldosterone is secreted from the adrenal glands, it binds to the mineralocorticoid receptor in the renal tubule cell and forms a complex.[6]This complex enhances transcription of specific DNA segments in the nucleus, leading to the formation of two protein transporters, Na<sup>+</sup>/K<sup>+</sup> ATPase pump at the basolateral membrane and Na<sup>+</sup> channel called ENaC, located at the apical membrane of the renal tubule cell.[6]These protein transporters increase sodium reabsorption and potassium excretion in the distal tubule and the collecting duct of the kidneys. This helps the body to maintain normal volume and electrolyte balance, increasing the blood pressure.Mineralocorticoid receptor antagonists decrease the aldosterone effect by binding to the mineralocorticoid receptor inhibiting aldosterone. This leads to higher levels of potassium in serum and increased sodium excretion, resulting in decreased body fluid and lower blood pressure.[5]Anti-mineralocorticoidStructureFormula:UsaBrand name:SpirolonactoneC24H32O45Heart failure, Hypertension, nephrotic syndrome, Ascites, antiandrogenicAldactone, Spirix SpiroEplerenoneC24H30O6Hypertension, Heart failure, Central Serous RetinopathyInspraCanrenoneC22H28O3DiureticContare, Lunaur, Phanaurae, SpiroletanFinerenoneC21H22N4O3SPotassium-sparing diuretic, KerenidaMexrenoneC24H32O5When comparing the pharmacokinetic properties of spirolonactone and eplerenone, it is clear that the two drugs differ significantly. Spirolonactone has a half-life of approximately 14.4 hours, while eplerenone has a half-life of approximately 11.5 hours. However, spirolonactone and eplerenone both have a similar effect on the kidneys, with eplerenone being more effective in reducing blood pressure. The information on eplerenone is 100% through kidneys and 32% through the liver. The information about excretion plays a critical role when determining the appropriate doses for patients with renal and/or hepatic dysfunction. It is very important to adjust the doses for patients with renal dysfunction because if they fail to eliminate the drug through their kidneys it could accumulate in the body, causing high concentration of potassium in the blood.[5]Spirolonactone and Eplerenone competitively block the binding of aldosterone to the mineralocorticoid receptor and hindering the reabsorption of sodium and chloride ions. The activity of mineralocorticoid antagonists is dependent on the presence of a γ-lactone ring on the C-17 position. The C-7 position is also important for activity as substituents there sterically hinder the interaction of C-7-substituted agonists such as aldosterone.[7]Anti-mineralocorticoids and highlighted groups that are important for activity. The γ-lactone ring shown in red and the C-7 substituent in pinkEplerenone is a newer drug that was developed as a spirolonactone analog with reduced adverse effects. In addition to the γ-lactone ring and the substituent on C-7, eplerenone has a 9,11-epoxy group. This group is believed to be the reason why eplerenone has a 20-40-fold lower affinity for the mineralocorticoid receptor than spirolonactone.[7]Despite the nonsteroidal nature of finerenone which yields a different lipophilicity and polarity profile for this compound, finerenone's affinity toward mineralocorticoid receptors is equal to that of spirolonactone and 500 times that of eplerenone, hinting that the steroidal core component of most anti-mineralocorticoid receptors is not essential for mineralocorticoid receptor affinity.[8]The main goal of the identification of the first aldosterone antagonists, which happened during the 1950s, was to identify the steroid skeleton that was most effective at blocking the mineralocorticoid receptor. The first aldosterone antagonist, spiroperone, was developed by the Merck company in 1950. It was a steroid derivative of aldosterone that was designed to protect them from aldosterone-induced cardiac stress. The same year, 1959, spirolonactone was launched as a potassium-sparing diuretic. It became a minor years later that aldosterone antagonists inhibit a specific receptor site. This protein has a high affinity for aldosterone but also for cortisol in humans and corticosteron in mice and rats. For this reason, aldosterone antagonists were called mineralocorticoid receptor antagonists.[8]There have been three major waves in the pharmaceutical industry when it comes to research and development of mineralocorticoid receptor antagonists: The first wave took place within Searle Laboratories. This company identified, shortly after the purification of aldosterone, steroid-based spirolonactone as the first anti-mineralocorticoid. The second wave was all about discovering much more specific steroidal anti-mineralocorticoids. The main active companies were Searle, Ciba-Geigy, Roussel Uclaf and Schering AG.[8]Around 50 years after Selye's work, several pharmaceutical companies began drug discovery programs. Their goal was to discover novel non-steroidal mineralocorticoid receptor antagonists for use as efficacious and safe drugs with the pharmacodynamics and pharmacokinetics well defined. Their goal was to use these candidates for a broad spectrum of diseases. This was essentially the third wave. The first mineralocorticoid receptor antagonists were all discovered and identified by *in vivo* experiments whereas the identification of novel non-steroidal mineralocorticoid receptor antagonists were done with high-throughput screening of millions of chemical compounds in various pharmaceutical companies.[8]Skeletal formulae of aldosterone antagonists.Members of this class in clinical use:Widespread useSpirolonactone the first and most widely used member of this classEplerenone much more selective than spirolonactone on target, but somewhat less potent and efficaciousCommon use to (date)Canrenone and potassium canrenoate very limited useFinerenone nonsteroidal mineralocorticoid receptor antagonist (MRA) (2015) (2016) (2017) (2018) (2019) (2020) (2021) (2022) (2023) (2024) (2025) (2026) (2027) (2028) (2029) (2030) (2031) (2032) (2033) (2034) (2035) (2036) (2037) (2038) (2039) (2040) (2041) (2042) (2043) (2044) (2045) (2046) (2047) (2048) (2049) (2050) (2051) (2052) (2053) (2054) (2055) (2056) (2057) (2058) (2059) (2060) (2061) (2062) (2063) (2064) (2065) (2066) (2067) (2068) (2069) (2070) (2071) (2072) (2073) (2074) (2075) (2076) (2077) (2078) (2079) (2080) (2081) (2082) (2083) (2084) (2085) (2086) (2087) (2088) (2089) (2090) (2091) (2092) (2093) (2094) (2095) (2096) (2097) (2098) (2099) (2100) (2101) (2102) (2103) (2104) (2105) (2106) (2107) (2108) (2109) (2110) (2111) (2112) T140, doi:10.1530/OJE-16-0600, PMC5488394, PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 321–331. doi:10.2147/VHRM.S33759. PMC3699348. PMID2386977. ^ "List of Aldosterone receptor antagonists - Drugs.com". *Drugs.com*. Retrieved 27 September 2018. ^ a b Maron, Bradley A.; Leuch, Jane A. (23 February 2010). "Aldosterone Receptor Antagonists". *Circulation*. **121** (7): 934939. doi:10.1161/CIRCULATIONAHA.109.895235. PMC2282634. PMID20177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September 2018. ^ a b Lemke, Thomas L.; Williams, David A.; Roche, Victoria F.; Zito, S. William. *Foye's Principles of Medicinal Chemistry*. Wolters Kluwer - Lippincott Williams and Wilkins. ^ a b c d Kolkhof, Peter; Bräcker, Lars (July 2017). "30 YEARS OF THE MINERALOCORTICOID RECEPTOR: Mineralocorticoid receptor antagonists: 60 years of research and development". *Journal of Endocrinology*. **234** (1): T125–T140. doi:10.1530/OJE-16-0600. PMC5488394. PMID28634268. ^ Kosaka H, Hirayama K, Yoda N, Sasaki K, Kitayama T, Kusaka H, Matsubara M (2010). "The L-, N-, and T-type triple calcium channel blocker bendipidine acts as an antagonist of mineralocorticoid receptor in the rat adrenal gland". *Endocrinology*. **146**: 1023–1029. doi:10.1210/EN.2009-1107. PMC2828634. PMID2177008. ^ a b Nappi, Jean; Sie (June 2011). "Aldosterone and aldosterone receptor antagonists in patients with chronic heart failure". *Vascular Health and Risk Management*. **9**: 353–363. doi:10.2147/VHRM.S131779. PMC3119593. PMID27131887. ^ a b Furman, Brian L. (1 January 2017). "Mineralocorticoid Antagonists". *Mineralocorticoid Antagonists*. doi:10.1016/B978-0-12-8102128-3-98012-7. ISBN9780128012383. Retrieved 27 September

**Spirolactone hair. Spirolactone hair loss success. Spirolactone hair cafe. Spiro hair loss. Does spironolactone help with hair loss. How long does it take for spironolactone to work for hair loss. How well does spironolactone work for hair loss. Spirolactone hair loss. Does spironolactone help with female hair loss.**