IUPHAR/BPS Guide to Pharmacology CITE
https://doi.org/10.2218/gtopdb/F4/2026.1

Adrenoceptors in GtoPdb v.2026.1

Jillian G. Baker[1], Poornima Balaji[2], Richard A. Bond[3], David B. Bylund[4], Douglas C. Eikenburg[5], Robert M. Graham[2], J. Paul Hieble[6], Rebecca Hills[7], Martin C. Michel[8], Kenneth P. Minneman[9], Sergio Parra[3], Dianne Perez[10] and Roger J. Summers[11]

1. University of Nottingham, UK
2. Victor Chang Cardiac Research Institute, Australia
3. University of Houston, USA
4. University of Nebraska, USA
5. University of Houston College of Pharmacy, USA
6. GlaxoSmithKline, USA
7. University of Edinburgh, UK
8. Johannes Gutenberg University, Germany
9. Emory University, USA
10. Cleveland Clinic Lerner Research Institute, USA
11. Monash University, Australia

Abstract

The nomenclature of the Adrenoceptors has been agreed by the NC-IUPHAR Subcommittee on Adrenoceptors [121, 327].

Adrenoceptors, α_1

There are three α_1-adrenoceptor subtypes α_{1A}, α_{1B} and α_{1D} are activated by the endogenous agonists (-)-adrenaline and (-)-noradrenaline. Signalling is predominantly *via* $G_{q/11}$ but α_1-adrenoceptors can also couple to $G_{i/o}$, G_s and $G_{12/13}$ [505]. Adrenoceptors are primarily located in blood vessels and in the brain, with the α_{1A} subtype also present in the urogenital tract.

Clinical uses: α_1-Adrenoceptor antagonists are used to treat hypertension (doxazosin, terazosin [436]), hypertension in pregnancy (labetalol), benign prostatic hyperplasia (alfuzosin, doxazosin, terazosin, tamsulosin and silodosin [317]), PTSD (doxazosin, prazosin) and phaeo-chromocytoma (phenoxybenzamine, phentolamine).

α_{1A}-Adrenoceptor agonists are used short-term as nasal decongestants (xylometazoline and oxymetazoline), although they also activate imidazoline and α_{2A}-receptors. Adrenaline and noradrenaline can be given by infusion to treat hypotension in shock.

Antagonists: High affinity, non-selective α_1-adrenoceptor antagonists include (+)-cyclazosin, doxazosin, prazosin and terazosin. Fluorescent derivatives of prazosin (BODIPY FL-prazosin) are used to examine cellular localisation of α_1-adrenoceptors. [^{3}H]prazosin and [^{125}I]HEAT (BE2254) are α_1-selective antagonist radioligands. α_{1A}-Subtype selective antagonists include SNAP5089, silodosin, RS-100329 and S(+)-niguldipine (although this also has high affinity for L-type Ca^{2+} channels). Several anti-depressants and anti-psychotic drugs also have high α_{1A}-adrenoceptor antagonist affinity that may contribute to their CNS actions but likely also contribute to side effects such as orthostatic hypotension [312]. BMY-7378 has α_{1D}-subtype selectivity.

Agonists: High efficacy non-selective α_1-adrenoceptor agonists include phenylephrine, methoxamine, etilefrine, naphazoline and cirazoline (relative to α_2- and β-adrenoceptors). A61603 is selective for the α_{1A}-subtype.

Species differences: Few species differences have been reported for α_1-adrenoceptor ligands.

Adrenoceptors, α_2

There are three α_2-adrenoceptor subtypes α_{2A}, α_{2B} and α_{2C} that are activated by the endogenous agonists (-)-adrenaline and with lower potency by (-)-noradrenaline. α_2-Adrenoceptor signalling is

predominantly *via* $G_{i/o}$ but they can also couple to G_s. α_2-Adrenoceptors cause inhibition of voltage dependent Ca^{2+} channels and augment inwardly rectifying K^+ channels [213, 505]. All α_2-adrenoceptor subtypes may be located pre- or post-junctionally and are primarily located in brain and kidney with α_{2A}- and α_{2C}- subtypes present in blood vessels and α_{2A}- in spleen and pancreas.
Clinical uses: α_2-Adrenoceptor antagonists are not used clinically. α_2-Adrenoceptor agonists are used to treat hypertension (clonidine, moxonidine, acting *via* central baroreflex control), to induce analgesia, sedation and anxiolysis (dexmedetomidine), for ADHD (guanfacine), in glaucoma and rosacea (brimonidine (UK14304)) and muscle spasm (tizanidine), as short-term nasal decongestants (xylometazoline and oxymetazoline that also activate imidazoline [101] and α_{1A}receptors), and increasingly to treat opioid withdrawal.
Antagonists: High affinity, non-subtype selective α_2-adrenoceptor antagonists include rauwolscine, yohimbine, RX821002, atipamezole and RS79948 [65]. [^{3}H]rauwolscine and [^{3}H]RX821002 are α_2-selective antagonist radioligands. BRL 44408 has some α_{2A}-selectivity and MK-912 and JP1302 some α_{2C}-selectivity. idazoxan, an early α_2-adrenoceptor antagonist, also has significant binding to imidazoline receptors [101] (and 5-HT receptors).
Agonists: brimonidine (UK14304) is a high efficacy non-subtype selective α_2-adrenoceptor agonist (relative to α_1- and β-adrenoceptors). Other agonists include talipexole, apraclonidine (para-amino-clonidine), clonidine, guanfacine, medetomidine and dexmedetomidine. [^{3}H]brimonidine (UK14304) is an α_2-selective agonist radioligand. oxymetazoline has significant α_2-adrenoceptor agonism, but it is also an α_{1A} and imidazoline receptor agonist [101].
*Species differences:*There are species variations in the pharmacology of the α_{2A}-adrenoceptor with regard to antagonists although agonist pharmacology is very similar.

Adrenoceptors, β
There are three β-adrenoceptor subtypes β_1, β_2 and β_3 that are activated by the endogenous agonists (-)-adrenaline and (-)-noradrenaline. Signalling is predominantly *via* G_s, although there are reports of G_i-coupling and ERK1/2 phosphorylation, and the β_2-adrenoceptor also activates β-arrestin-mediated signalling [505]. β_1-Adrenoceptors are primarily present in heart, blood vessels, kidney and brain; β_2-adrenoceptors in lungs, blood vessels, skeletal muscle, heart and brain; and β_3-adrenoceptors in the human bladder but also have an important role in rodent brown and white fat.
Clinical uses: β-Adrenoceptor antagonists are widely used to treat heart failure, arrhythmias, ischaemic heart disease and hypertension (bisoprolol, carvedilol, metoprolol, nebivolol) [830, 831]. labetalol is used in pregnancy to treat hypertension. β-Adrenoceptor antagonists are also used to treat glaucoma (betaxolol, timolol), anxiety, migraine, benign essential tremor, thyrotoxicosis, portal hypertension and variceal bleeding (propranolol for all). Propranolol is the first line treatment for infantile haemangioma, and there is increasing interest in β-adrenoceptor antagonist use to reduce primary growth and metastasis in cancer [330]. Non-selective β-adrenoceptor agonists are used to treat cardiac arrest and anaphylaxis ((±)-adrenaline), *via* infusion for shock ((±)-adrenaline and noradrenaline), and as a bridge to pacemaker implantation in bradycardia (isoprenaline). Selective β_2-adrenoceptor agonists are used to relieve asthma and COPD (short-acting salbutamol, terbutaline; long-acting salmeterol and formoterol, and ultra-long acting indacaterol, olodaterol and vilanterol) [64]. β_3-Adrenoceptor agonists are used to treat overactive bladder syndrome (mirabegron, solabegron and vibegron) [317].
Antagonists: High affinity, non-selective β-adrenoceptor antagonists include propranolol, carvedilol, timolol and bupranolol, although for human receptors, all compounds appear to have lower affinity for human β_3-adrenoceptors than for β_1- or β_2-adrenoceptors. Fluorescent analogues of β-ligands *e.g.* CGP 12177 and propranolol can be used to label β-adrenoceptors at the cellular level [57]. [^{125}I]ICYP, [^{3}H]CGP12177 and [^{3}H]dihydroalprenolol are high affinity radioligands that label β_1- and β_2-adrenoceptors and at higher concentrations, β_3-adrenoceptors. CGP 20712A and NDD-825 are highly β_1-selective antagonists and ICI 118551 is a β_2-selective antagonist [65].
Agonists: isoprenaline and cimaterol are highly efficacious non-selective β-adrenoceptor agonists (relative to α_1- and α_2-adrenoceptors). formoterol, salmeterol and vilanterol have high β_2-adrenoceptor selectivity whilst mirabegron, solabegron and vibegron have β_3-adrenoceptor selectivity. L 755507 and L-748337 are partial agonists that display human β_3-adrenoceptor selectivity. [^{3}H]L748337 can be used to selectively label β_3-adrenoceptors in human and rat tissues [790].
Species differences: rodent β_1 and β_2-adrenoceptors display similar pharmacology to human receptors. There are three β-adrenoceptors in turkey (termed the tβ, tβ3c and tβ4c) with pharmacology that differs from the human β-adrenoceptors [49]. Significant pharmacological

differences exist between human and mouse β_3-adrenoceptors, which includes mouse splice variants [227] where the isoforms display different signalling characteristics [354].

Contents

This is a citation summary for Adrenoceptors in the Guide to Pharmacology database (GtoPdb). It exists purely as an adjunct to the database to facilitate the recognition of citations to and from the database by citation analyzers. Readers will almost certainly want to visit the relevant sections of the database which are given here under database links.

GtoPdb is an expert-driven guide to pharmacological targets and the substances that act on them. GtoPdb is a reference work which is most usefully represented as an on-line database. As in any publication this work should be appropriately cited, and the papers it cites should also be recognized. This document provides a citation for the relevant parts of the database, and also provides a reference list for the research cited by those parts. For further details see [113].

Please note that the database version for the citations given in GtoPdb are to the most recent preceding version in which the family or its subfamilies and targets were substantially changed. The links below are to the current version. If you need to consult the cited version, rather than the most recent version, please contact the GtoPdb curators.

Database links

Adrenoceptors
https://www.guidetopharmacology.org/GRAC/FamilyDisplayForward?familyId=4
Introduction to Adrenoceptors
https://www.guidetopharmacology.org/GRAC/FamilyIntroductionForward?familyId=4
Receptors
α_{1A}-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=22
α_{1B}-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=23
α_{1D}-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=24
α_{2A}-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=25
α_{2B}-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=26
α_{2C}-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=27
β_1-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=28
β_2-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=29
β_3-adrenoceptor
https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=30

References

1. Abdulla MH, Sattar MA, Johns EJ, Abdullah NA, Hye Khan MA and Rathore HA. (2012) High-fructose feeding impacts on the adrenergic control of renal haemodynamics in the rat. *Br J Nutr* **107**: 218-28 [PMID:21733307]
2. Abiko LA, Grahl A and Grzesiek S. (2019) High Pressure Shifts the β_1-Adrenergic Receptor to the Active Conformation in the Absence of G Protein. *J Am Chem Soc* **141**: 16663-16670 [PMID:31564099]
3. Abraham G, Kneuer C, Ehrhardt C, Honscha W and Ungemach FR. (2004) Expression of functional beta2-adrenergic receptors in the lung epithelial cell lines 16HBE14o(-), Calu-3 and A549. *Biochim Biophys Acta* **1691**: 169-79 [PMID:15110997]
4. Acosta-Martinez M, Fiber JM, Brown RD and Etgen AM. (1999) Localization of alpha1B-adrenergic receptor in female rat brain regions involved in stress and neuroendocrine function. *Neurochemistry International* **35**: 383-391 [PMID:10517699]
5. Adefurin A, Ghimire LV, Kohli U, Muszkat M, Sofowora GG, Li C, Paranjape SY, Stein CM and Kurnik D. (2015) Genetic variation in the α1A-adrenergic receptor and phenylephrine-mediated venoconstriction. *Pharmacogenomics J* **15**: 310-5 [PMID:25421140]

6. Adkins JC and Balfour JA. (1998) Brimonidine. A review of its pharmacological properties and clinical potential in the management of open-angle glaucoma and ocular hypertension. *Drugs Aging* **12**: 225-41 [PMID:9534022]
7. Ahles A and Engelhardt S. (2014) Polymorphic variants of adrenoceptors: pharmacology, physiology, and role in disease. *Pharmacol Rev* **66**: 598-637 [PMID:24928328]
8. Ahles A and Engelhardt S. (2024) Genetic Variants of Adrenoceptors. *Handb Exp Pharmacol* **285**: 27-54 [PMID:37578621]
9. Ahles A, Rodewald F, Rochais F, Bünemann M and Engelhardt S. (2015) Interhelical interaction and receptor phosphorylation regulate the activation kinetics of different human β1-adrenoceptor variants. *J Biol Chem* **290**: 1760-9 [PMID:25451930]
10. Ahlquist RP. (1948) A study of the adrenotropic receptors *Am J Physiol* **153**: 586-600
11. Ahmad A, Sattar MA, Azam M, Abdulla MH, Khan SA, Hashmi F, Abdullah NA and Johns EJ. (2016) Cystathione gamma lyase/Hydrogen Sulphide Pathway Up Regulation Enhances the Responsiveness of α1A and α1B-Adrenoreceptors in the Kidney of Rats with Left Ventricular Hypertrophy. *PLoS One* **11**: e0154995 [PMID:27191852]
12. Ahmad A, Sattar MA, Azam M, Khan SA, Bhatt O and Johns EJ. (2018) Interaction between nitric oxide and renal α1-adrenoreceptors mediated vasoconstriction in rats with left ventricular hypertrophyin Wistar Kyoto rats. *PLoS One* **13**: e0189386 [PMID:29447158]
13. Ahn S, Kahsai AW, Pani B, Wang QT, Zhao S, Wall AL, Strachan RT, Staus DP, Wingler LM and Sun LD *et al.*. (2017) Allosteric "beta-blocker" isolated from a DNA-encoded small molecule library. *Proc Natl Acad Sci U S A* **114**: 1708-1713 [PMID:28130548]
14. Aizawa N, Sugiyama R, Ichihara K, Fujimura T, Fukuhara H, Homma Y and Igawa Y. (2016) Functional roles of bladder α1-adrenoceptors in the activation of single-unit primary bladder afferent activity in rats. *BJU Int* **117**: 993-1001 [PMID:26332379]
15. Akinaga J, García-Sáinz JA and S Pupo A. (2019) Updates in the function and regulation of α_1 -adrenoceptors. *Br J Pharmacol* **176**: 2343-2357 [PMID:30740663]
16. Alachkar A, Brotchie JM and Jones OT. (2012) Changes in the mRNA levels of α2A and α2C adrenergic receptors in rat models of Parkinson's disease and L-DOPA-induced dyskinesia. *J Mol Neurosci* **46**: 145-52 [PMID:21562737]
17. Albee LJ, Eby JM, Tripathi A, LaPorte HM, Gao X, Volkman BF, Gaponenko V and Majetschak M. (2017) α_1-Adrenergic Receptors Function Within Hetero-Oligomeric Complexes With Atypical Chemokine Receptor 3 and Chemokine (C-X-C motif) Receptor 4 in Vascular Smooth Muscle Cells. *J Am Heart Assoc* **6** [PMID:28862946]
18. Alcántara Hernández R and García-Sáinz JA. (2012) Roles of phosphoinositide-dependent kinase-1 in α1B-adrenoceptor phosphorylation and desensitization. *Eur J Pharmacol* **674**: 179-87 [PMID:22134004]
19. Alegre KO, Paknejad N, Su M, Lou JS, Huang J, Jordan KD, Eng ET, Meyerson JR, Hite RK and Huang XY. (2021) Structural basis and mechanism of activation of two different families of G proteins by the same GPCR. *Nat Struct Mol Biol* **28**: 936-944 [PMID:34759376]
20. Alexandre EC, de Oliveira MG, Campos R, Kiguti LR, Calmasini FB, Silva FH, Grant AD, Yoshimura N and Antunes E. (2017) How important is the α_1-adrenoceptor in primate and rodent proximal urethra? Sex differences in the contribution of α_1-adrenoceptor to urethral contractility. *Am J Physiol Renal Physiol* **312**: F1026-F1034 [PMID:28298357]
21. Alfonzo-Méndez MA, Hernández-Espinosa DA, Carmona-Rosas G, Romero-Ávila MT, Reyes-Cruz G and García-Sáinz JA. (2017) Protein Kinase C Activation Promotes α_{1B}-Adrenoceptor Internalization and Late Endosome Trafficking through Rab9 Interaction. Role in Heterologous Desensitization. *Mol Pharmacol* **91**: 296-306 [PMID:28082304]
22. Alikhani V, Beer D, Bentley D, Bruce I, Cuenoud BM, Fairhurst RA, Gedeck P, Haberthuer S, Hayden C and Janus D *et al.*. (2004) Long-chain formoterol analogues: an investigation into the effect of increasing amino-substituent chain length on the beta2-adrenoceptor activity. *Bioorg Med Chem Lett* **14**: 4705-10 [PMID:15324892]
23. Allen JM, Baetge EE, Abrass IB and Palmiter RD. (1988) Isoproterenol response following transfection of the mouse beta 2-adrenergic receptor gene into Y1 cells. *EMBO J* **7**: 133-8 [PMID:2834198]
24. Alonso-Llamazares A, Zamanillo D, Casanova E, Ovalle S, Calvo P and Chinchetru MA. (1995) Molecular cloning of alpha 1d-adrenergic receptor and tissue distribution of three alpha 1-adrenergic receptor subtypes in mouse. *J Neurochem* **65**: 2387-2392 [PMID:7595531]
25. Alsufyani HA, Daly C and Docherty JR. (2021) Interaction between α_{1B} - and other α_1 - and α_2 -adrenoceptors in producing contractions of mouse spleen. *Basic Clin Pharmacol Toxicol* **129**: 416-426 [PMID:34383990]
26. Alsufyani HA and Docherty JR. (2021) Involvement of G proteins and Rho kinase in α_1-adrenoceptor mediated contractions of the rat portal vein. *Can J Physiol Pharmacol* **99**: 654-659 [PMID:33096009]
27. Alsufyani HA, McCormick PA and Docherty JR. (2021) Both α_{1B}- and α_{1A}-adrenoceptor subtypes

are involved in contractions of rat spleen. *Pharmacol Rep* **73**: 255-260 [PMID:32860192]
28. Altman JD, Trendelenburg AU, MacMillan L, Bernstein D, Limbird L, Starke K, Kobilka BK and Hein L. (1999) Abnormal regulation of the sympathetic nervous system in alpha2A-adrenergic receptor knockout mice. *Mol Pharmacol* **56**: 154-61 [PMID:10385696]
29. Amirahmadi F, Turnbull L, Du XJ, Graham RM and Woodcock EA. (2008) Heightened alpha1A-adrenergic receptor activity suppresses ischaemia/reperfusion-induced Ins(1,4,5)P3 generation in the mouse heart: a comparison with ischaemic preconditioning. *Clin Sci* **114**: 157-64 [PMID:17696883]
30. Amirak E, Fuller SJ, Sugden PH and Clerk A. (2013) p90 ribosomal S6 kinases play a significant role in early gene regulation in the cardiomyocyte response to G(q)-protein-coupled receptor stimuli, endothelin-1 and α(1)-adrenergic receptor agonists. *Biochem J* **450**: 351-63 [PMID:23215897]
31. André C, Erraji L, Gaston J, Grimber G, Briand P and Guillet JG. (1996) Transgenic mice carrying the human beta 2-adrenergic receptor gene with its own promoter overexpress beta 2-adrenergic receptors in liver. *Eur J Biochem* **241**: 417-24 [PMID:8917438]
32. Angers S, Salahpour A, Joly E, Hilairet S, Chelsky D, Dennis M and Bouvier M. (2000) Detection of beta 2-adrenergic receptor dimerization in living cells using bioluminescence resonance energy transfer (BRET). *Proc Natl Acad Sci USA* **97**: 3684-9 [PMID:10725388]
33. Aono Y, Taguchi H, Saigusa T, Uchida T, Takada K, Takiguchi H, Shirakawa T, Shimizu N, Koshikawa N and Cools AR. (2015) Simultaneous activation of the α1A-, α1B- and α1D-adrenoceptor subtypes in the nucleus accumbens reduces accumbal dopamine efflux in freely moving rats. *Behav Pharmacol* **26**: 73-80 [PMID:25438092]
34. Aparici M, Gómez-Angelats M, Vilella D, Otal R, Carcasona C, Viñals M, Ramos I, Gavaldà A, De Alba J and Gras J *et al.*. (2012) Pharmacological characterization of abediterol, a novel inhaled β(2)-adrenoceptor agonist with long duration of action and a favorable safety profile in preclinical models. *J Pharmacol Exp Ther* **342**: 497-509 [PMID:22588259]
35. Araujo LP, Maricato JT, Guereschi MG, Takenaka MC, Nascimento VM, de Melo FM, Quintana FJ, Brum PC and Basso AS. (2019) The Sympathetic Nervous System Mitigates CNS Autoimmunity via β2-Adrenergic Receptor Signaling in Immune Cells. *Cell Rep* **28**: 3120-3130.e5 [PMID:31533035]
36. Arce C, Vicente D, Segura V, Flacco N, Montó F, Almenar L, Agüero J, Rueda J, Jiménez-Altayó F and Vila E *et al.*. (2017) Activation of α_{1A} -adrenoceptors desensitizes the rat aorta response to phenylephrine through a neuronal NOS pathway, a mechanism lost with ageing. *Br J Pharmacol* **174**: 2015-2030 [PMID:28369791]
37. Arch JR. (2011) Challenges in β(3)-Adrenoceptor Agonist Drug Development. *Ther Adv Endocrinol Metab* **2**: 59-64 [PMID:23148171]
38. Arch JR, Ainsworth AT, Cawthorne MA, Piercy V, Sennitt MV, Thody VE, Wilson C and Wilson S. (1984) Atypical beta-adrenoceptor on brown adipocytes as target for anti-obesity drugs. *Nature* **309**: 163-5 [PMID:6325935]
39. Aristotelous T, Ahn S, Shukla AK, Gawron S, Sassano MF, Kahsai AW, Wingler LM, Zhu X, Tripathi-Shukla P and Huang XP *et al.*. (2013) Discovery of β2 Adrenergic Receptor Ligands Using Biosensor Fragment Screening of Tagged Wild-Type Receptor. *ACS Med Chem Lett* **4**: 1005-1010 [PMID:24454993]
40. Armenia, Sattar MA, Abdullah NA, Khan MA and Johns EJ. (2008) Alpha1A- and alpha1D-adrenoceptors are the major functional subtypes of renal alpha1-adrenoceptors in streptozotocin-induced diabetic and normal Sprague-Dawley rats. *Auton Autacoid Pharmacol* **28**: 1-10 [PMID:18257746]
41. Arnsten AFT. (2020) Guanfacine's mechanism of action in treating prefrontal cortical disorders: Successful translation across species. *Neurobiol Learn Mem* **176**: 107327 [PMID:33075480]
42. Aroniadou-Anderjaska V, Qashu F and Braga MF. (2007) Mechanisms regulating GABAergic inhibitory transmission in the basolateral amygdala: implications for epilepsy and anxiety disorders. *Amino Acids* **32**: 305-15 [PMID:17048126]
43. Arponen E, Helin S, Marjamäki P, Grönroos T, Holm P, Löyttyniemi E, Någren K, Scheinin M, Haaparanta-Solin M and Sallinen J *et al.*. (2014) A PET Tracer for Brain α2C Adrenoceptors, (11)C-ORM-13070: Radiosynthesis and Preclinical Evaluation in Rats and Knockout Mice. *J Nucl Med* **55**: 1171-7 [PMID:24799619]
44. Arévalo-León LE, Gallardo-Ortíz IA, Urquiza-Marín H and Villalobos-Molina R. (2003) Evidence for the role of alpha1D- and alpha1A-adrenoceptors in contraction of the rat mesenteric artery. *Vascul Pharmacol* **40**: 91-6 [PMID:12646397]
45. Auclair A, Drouin C, Cotecchia S, Glowinski J and Tassin JP. (2004) 5-HT2A and alpha1b-adrenergic receptors entirely mediate dopamine release, locomotor response and behavioural sensitization to opiates and psychostimulants. *Eur J Neurosci* **20**: 3073-84 [PMID:15579162]
46. Auerbach SS and DrugMatrix® and ToxFX® Coordinator National Toxicology Program.. National Toxicology Program: Dept of Health and Human Services. https://ntp.niehs.nih.gov/drugmatrix/index.html. Accessed on 02/05/2014.

47. Azzi M, Charest PG, Angers S, Rousseau G, Kohout T, Bouvier M and Piñeyro G. (2003) Beta-arrestin-mediated activation of MAPK by inverse agonists reveals distinct active conformations for G protein-coupled receptors. *Proc Natl Acad Sci USA* **100**: 11406-11 [PMID:13679574]
48. Baerwald C, Graefe C, Muhl C, Von Wichert P and Krause A. (1992) Beta 2-adrenergic receptors on peripheral blood mononuclear cells in patients with rheumatic diseases. *Eur J Clin Invest* **22 Suppl 1**: 42-6 [PMID:1333966]
49. Baker JG. (2010) A full pharmacological analysis of the three turkey β-adrenoceptors and comparison with the human β-adrenoceptors. *PLoS ONE* **5**: e15487 [PMID:21152092]
50. Baker JG. (2010) The selectivity of beta-adrenoceptor agonists at human beta1-, beta2- and beta3-adrenoceptors. *Br J Pharmacol* **160**: 1048-61 [PMID:20590599]
51. Baker JG. (2005) The selectivity of beta-adrenoceptor antagonists at the human beta1, beta2 and beta3 adrenoceptors. *Br J Pharmacol* **144**: 317-22 [PMID:15655528]
52. Baker JG. (2005) Evidence for a secondary state of the human beta3-adrenoceptor. *Mol Pharmacol* **68**: 1645-55 [PMID:16129733]
53. Baker JG. (2005) Site of action of beta-ligands at the human beta1-adrenoceptor. *J Pharmacol Exp Ther* **313**: 1163-71 [PMID:15716385]
54. Baker JG, Gardiner SM, Woolard J, Fromont C, Jadhav GP, Mistry SN, Thompson KSJ, Kellam B, Hill SJ and Fischer PM. (2017) Novel selective β_1-adrenoceptor antagonists for concomitant cardiovascular and respiratory disease. *FASEB J* **31**: 3150-3166 [PMID:28400472]
55. Baker JG, Hall IP and Hill SJ. (2003) Influence of agonist efficacy and receptor phosphorylation on antagonist affinity measurements: differences between second messenger and reporter gene responses. *Mol Pharmacol* **64**: 679-88 [PMID:12920204]
56. Baker JG, Hall IP and Hill SJ. (2003) Agonist and inverse agonist actions of beta-blockers at the human beta 2-adrenoceptor provide evidence for agonist-directed signaling. *Mol Pharmacol* **64**: 1357-69 [PMID:14645666]
57. Baker JG, Hall IP and Hill SJ. (2003) Pharmacology and direct visualisation of BODIPY-TMR-CGP: a long-acting fluorescent beta2-adrenoceptor agonist. *Br J Pharmacol* **139**: 232-42 [PMID:12770928]
58. Baker JG, Hall IP and Hill SJ. (2002) Pharmacological characterization of CGP 12177 at the human beta(2)-adrenoceptor. *Br J Pharmacol* **137**: 400-8 [PMID:12237261]
59. Baker JG, Hall IP and Hill SJ. (2003) Agonist actions of "beta-blockers" provide evidence for two agonist activation sites or conformations of the human beta1-adrenoceptor. *Mol Pharmacol* **63**: 1312-21 [PMID:12761341]
60. Baker JG, Kemp P, March J, Fretwell L, Hill SJ and Gardiner SM. (2011) Predicting in vivo cardiovascular properties of β-blockers from cellular assays: a quantitative comparison of cellular and cardiovascular pharmacological responses. *FASEB J* **25**: 4486-97 [PMID:21865315]
61. Baker JG, Proudman RG and Hill SJ. (2015) Salmeterol's extreme β2 selectivity is due to residues in both extracellular loops and transmembrane domains. *Mol Pharmacol* **87**: 103-20 [PMID:25324048]
62. Baker JG, Proudman RG and Hill SJ. (2014) Identification of key residues in transmembrane 4 responsible for the secondary, low-affinity conformation of the human β1-adrenoceptor. *Mol Pharmacol* **85**: 811-29 [PMID:24608857]
63. Baker JG, Proudman RG and Hill SJ. (2013) Impact of polymorphic variants on the molecular pharmacology of the two-agonist conformations of the human β1-adrenoceptor. *PLoS One* **8**: e77582 [PMID:24250787]
64. Baker JG and Shaw DE. (2024) Asthma and COPD: A Focus on β-Agonists - Past, Present and Future. *Handb Exp Pharmacol* **285**: 369-451 [PMID:37709918]
65. Baker JG and Summers RJ. (2024) Adrenoceptors: Receptors, Ligands and Their Clinical Uses, Molecular Pharmacology and Assays. *Handb Exp Pharmacol* **285**: 55-145 [PMID:38926158]
66. Banie L, Lin G, Ning H, Wang G, Lue TF and Lin CS. (2008) Effects of estrogen, raloxifene and levormeloxifene on alpha1A-adrenergic receptor expression. *J Urol* **180**: 2241-6 [PMID:18804812]
67. Bardou M, Dousset B, Deneux-Tharaux C, Smadja C, Naline E, Chaput JC, Naveau S, Manara L, Croci T and Advenier C. (1998) In vitro inhibition of human colonic motility with SR 59119A and SR 59104A: evidence of a beta3-adrenoceptor-mediated effect. *Eur J Pharmacol* **353**: 281-7 [PMID:9726658]
68. Barends CR, Absalom A, van Minnen B, Vissink A and Visser A. (2017) Dexmedetomidine versus Midazolam in Procedural Sedation. A Systematic Review of Efficacy and Safety. *PLoS One* **12**: e0169525 [PMID:28107373]
69. Barki-Harrington L, Luttrell LM and Rockman HA. (2003) Dual inhibition of beta-adrenergic and angiotensin II receptors by a single antagonist: a functional role for receptor-receptor interaction in vivo. *Circulation* **108**: 1611-8 [PMID:12963634]
70. Barra R, Soto-Moyano R, Valladares L, Morgan C, Pérez H, Burgos H, Olivares R, Sáez-Briones P, Laurido C and Hernández A. (2012) Knockdown of α2C-adrenoceptors in the occipital cortex rescued long-term potentiation in hidden prenatally malnourished rats. *Neurobiol Learn Mem*

98: 228-34 [PMID:22892388]
71. Basarrate S, Monzel AS, Smith JLM, Marsland AL, Trumpff C and Picard M. (2024) Glucocorticoid and Adrenergic Receptor Distribution Across Human Organs and Tissues: A Map for Stress Transduction. *Psychosom Med* **86**: 89-98 [PMID:38193786]
72. Baskin AS, Linderman JD, Brychta RJ, McGehee S, Anflick-Chames E, Cero C, Johnson JW, O'Mara AE, Fletcher LA and Leitner BP *et al.*. (2018) Regulation of Human Adipose Tissue Activation, Gallbladder Size, and Bile Acid Metabolism by a β3-Adrenergic Receptor Agonist. *Diabetes* **67**: 2113-2125 [PMID:29980535]
73. Battaglia G, Fornai F, Busceti CL, Lembo G, Nicoletti F and De Blasi A. (2003) Alpha-1B adrenergic receptor knockout mice are protected against methamphetamine toxicity. *J Neurochem* **86**: 413-21 [PMID:12871582]
74. Battaglia G, Shannon M, Borgundvaag B and Titeler M. (1983) Properties of [3H]prazosin-labeled alpha 1-adrenergic receptors in rat brain and porcine neurointermediate lobe tissue. *J Neurochem* **41**: 538-42 [PMID:6308163]
75. Battram C, Charlton SJ, Cuenoud B, Dowling MR, Fairhurst RA, Farr D, Fozard JR, Leighton-Davies JR, Lewis CA and McEvoy L *et al.*. (2006) In vitro and in vivo pharmacological characterization of 5-[(R)-2-(5,6-diethyl-indan-2-ylamino)-1-hydroxy-ethyl]-8-hydroxy-1H-quinolin-2-one (indacaterol), a novel inhaled beta(2) adrenoceptor agonist with a 24-h duration of action. *J Pharmacol Exp Ther* **317**: 762-70 [PMID:16434564]
76. Beattie D, Beer D, Bradley ME, Bruce I, Charlton SJ, Cuenoud BM, Fairhurst RA, Farr D, Fozard JR and Janus D *et al.*. (2012) An investigation into the structure-activity relationships associated with the systematic modification of the β(2)-adrenoceptor agonist indacaterol. *Bioorg Med Chem Lett* **22**: 6280-5 [PMID:22932315]
77. Beattie D, Bradley M, Brearley A, Charlton SJ, Cuenoud BM, Fairhurst RA, Gedeck P, Gosling M, Janus D and Jones D *et al.*. (2010) A physical properties based approach for the exploration of a 4-hydroxybenzothiazolone series of beta2-adrenoceptor agonists as inhaled long-acting bronchodilators. *Bioorg Med Chem Lett* **20**: 5302-7 [PMID:20655218]
78. Bellot M, Galandrin S, Boularan C, Matthies HJ, Despas F, Denis C, Javitch J, Mazères S, Sanni SJ and Pons V *et al.*. (2015) Dual agonist occupancy of AT1-R-α2C-AR heterodimers results in atypical Gs-PKA signaling. *Nat Chem Biol* **11**: 271-9 [PMID:25706338]
79. Benkel T, Zimmermann M, Zeiner J, Bravo S, Merten N, Lim VJY, Matthees ESF, Drube J, Miess-Tanneberg E and Malan D *et al.*. (2022) How Carvedilol activates β_2-adrenoceptors. *Nat Commun* **13**: 7109 [PMID:36402762]
80. Benton KC, Wheeler DS, Kurtoglu B, Ansari MBZ, Cibich DP, Gonzalez DA, Herbst MR, Khursheed S, Knorr RC and Lobner D *et al.*. (2022) Norepinephrine activates β_1 -adrenergic receptors at the inner nuclear membrane in astrocytes. *Glia* **70**: 1777-1794 [PMID:35589612]
81. Berbée JF, Boon MR, Khedoe PP, Bartelt A, Schlein C, Worthmann A, Kooijman S, Hoeke G, Mol IM and John C *et al.*. (2015) Brown fat activation reduces hypercholesterolaemia and protects from atherosclerosis development. *Nat Commun* **6**: 6356 [PMID:25754609]
82. Berkowitz DE, Nardone NA, Smiley RM, Price DT, Kreutter DK, Fremeau RT and Schwinn DA. (1995) Distribution of beta 3-adrenoceptor mRNA in human tissues. *Eur J Pharmacol* **289**: 223-228 [PMID:7621895]
83. Bernstein D, Fajardo G, Zhao M, Urashima T, Powers J, Berry G and Kobilka BK. (2005) Differential cardioprotective/cardiotoxic effects mediated by beta-adrenergic receptor subtypes. *Am J Physiol Heart Circ Physiol* **289**: H2441-9 [PMID:16040722]
84. Berthelsen S and Pettinger WA. (1977) A functional basis for classification of alpha-adrenergic receptors. *Life Sci* **21**: 595-606 [PMID:20542]
85. Berthouze M, Ayoub M, Russo O, Rivail L, Sicsic S, Fischmeister R, Berque-Bestel I, Jockers R and Lezoualc'h F. (2005) Constitutive dimerization of human serotonin 5-HT4 receptors in living cells. *FEBS Lett* **579**: 2973-80 [PMID:15896782]
86. Berthouze-Duquesnes M, Lucas A, Saulière A, Sin YY, Laurent AC, Galés C, Baillie G and Lezoualc'h F. (2013) Specific interactions between Epac1, β-arrestin2 and PDE4D5 regulate β-adrenergic receptor subtype differential effects on cardiac hypertrophic signaling. *Cell Signal* **25**: 970-80 [PMID:23266473]
87. Bes A, Eyssette M, Pierrot-Deseilligny E, Rohmer F and Warter JM. (1988) A multi-centre, double-blind trial of tizanidine, a new antispastic agent, in spasticity associated with hemiplegia. *Curr Med Res Opin* **10**: 709-18 [PMID:3286129]
88. Bilezikian JP. (1987) Defining the Role of Adrenergic Receptors in Human Physiology. *In Adrenergic Receptors in Man* Edited by Insel PA: Marcel Dekker: 37-68 [ISBN: 0824776291]
89. Billington CK, Penn RB and Hall IP. (2017) β_2 Agonists. *Handb Exp Pharmacol* **237**: 23-40 [PMID:27878470]
90. Blake K and Lima J. (2015) Pharmacogenomics of long-acting β2-agonists. *Expert Opin Drug Metab Toxicol* **11**: 1733-51 [PMID:26235677]
91. Blanchet G, Upert G, Mourier G, Gilquin B, Gilles N and Servent D. (2013) New α-adrenergic property for synthetic MTβ and CM-3 three-finger fold toxins from black mamba. *Toxicon* **75**:

160-7 [PMID:23648423]
92. Blaxall HS, Hass NA and Bylund DB. (1994) Expression of alpha 2-adrenergic receptor genes in rat tissues. *Receptor* **4**: 191-9 [PMID:7812219]
93. Blaxall HS, Murphy TJ, Baker JC, Ray C and Bylund DB. (1991) Characterization of the alpha-2C adrenergic receptor subtype in the opossum kidney and in the OK cell line. *J Pharmacol Exp Ther* **259**: 323-9 [PMID:1656026]
94. Blin N, Camoin L, Maigret B and Strosberg AD. (1993) Structural and conformational features determining selective signal transduction in the beta 3-adrenergic receptor. *Mol Pharmacol* **44**: 1094-104 [PMID:7903415]
95. Blin N, Nahmias C, Drumare MF and Strosberg AD. (1994) Mediation of most atypical effects by species homologues of the beta 3-adrenoceptor. *Br J Pharmacol* **112**: 911-9 [PMID:7921620]
96. Blue DR, Daniels DV, Gever JR, Jett MF, O'Yang C, Tang HM, Williams TJ and Ford AP. (2004) Pharmacological characteristics of Ro 115-1240, a selective alpha1A/1L-adrenoceptor partial agonist: a potential therapy for stress urinary incontinence. *BJU Int* **93**: 162-70 [PMID:14678390]
97. Boivin-Jahns V, Uhland K, Holthoff HP, Beyersdorf N, Kocoski V, Kerkau T, Münch G, Lohse MJ, Ungerer M and Jahns R. (2018) Cyclopeptide COR-1 to treat beta1-adrenergic receptor antibody-induced heart failure. *PLoS One* **13**: e0201160 [PMID:30125285]
98. Bokoch MP, Zou Y, Rasmussen SG, Liu CW, Nygaard R, Rosenbaum DM, Fung JJ, Choi HJ, Thian FS and Kobilka TS *et al.*. (2010) Ligand-specific regulation of the extracellular surface of a G-protein-coupled receptor. *Nature* **463**: 108-12 [PMID:20054398]
99. Bond RA and Clarke DE. (1988) Agonist and antagonist characterization of a putative adrenoceptor with distinct pharmacological properties from the alpha- and beta-subtypes. *Br J Pharmacol* **95**: 723-734 [PMID:2905184]
100. Bornholz B, Weidtkamp-Peters S, Schmitmeier S, Seidel CA, Herda LR, Felix SB, Lemoine H, Hescheler J, Nguemo F and Schäfer C *et al.*. (2013) Impact of human autoantibodies on β1-adrenergic receptor conformation, activity, and internalization. *Cardiovasc Res* **97**: 472-80 [PMID:23208588]
101. Bousquet P, Hudson A, García-Sevilla JA and Li JX. (2020) Imidazoline Receptor System: The Past, the Present, and the Future. *Pharmacol Rev* **72**: 50-79 [PMID:31819014]
102. Bouyssou T, Casarosa P, Naline E, Pestel S, Konetzki I, Devillier P and Schnapp A. (2010) Pharmacological characterization of olodaterol, a novel inhaled beta2-adrenoceptor agonist exerting a 24-hour-long duration of action in preclinical models. *J Pharmacol Exp Ther* **334**: 53-62 [PMID:20371707]
103. Bragiel AM, Wang D, Pieczonka TD, Shono M and Ishikawa Y. (2016) Mechanisms Underlying Activation of α_1-Adrenergic Receptor-Induced Trafficking of AQP5 in Rat Parotid Acinar Cells under Isotonic or Hypotonic Conditions. *Int J Mol Sci* **17** [PMID:27367668]
104. Breit A, Lagacé M and Bouvier M. (2004) Hetero-oligomerization between beta2- and beta3-adrenergic receptors generates a beta-adrenergic signaling unit with distinct functional properties. *J Biol Chem* **279**: 28756-65 [PMID:15123695]
105. Brisinda D, Sorbo AR, Venuti A, Ruggieri MP, Manna R, Fenici P, Wallukat G, Hoebeke J, Frustaci A and Fenici R. (2012) Anti-β-adrenoceptors autoimmunity causing 'idiopathic' arrhythmias and cardiomyopathy. *Circ J* **76**: 1345-53 [PMID:22447021]
106. Bristow MR, Ginsburg R, Umans V, Fowler M, Minobe W, Rasmussen R, Zera P, Menlove R, Shah P and Jamieson S *et al.*. (1986) Beta 1- and beta 2-adrenergic-receptor subpopulations in nonfailing and failing human ventricular myocardium: coupling of both receptor subtypes to muscle contraction and selective beta 1-receptor down-regulation in heart failure. *Circ Res* **59**: 297-309 [PMID:2876788]
107. Bristow MR, Hershberger RE, Port JD, Minobe W and Rasmussen R. (1989) Beta 1- and beta 2-adrenergic receptor-mediated adenylate cyclase stimulation in nonfailing and failing human ventricular myocardium. *Mol Pharmacol* **35**: 295-303 [PMID:2564629]
108. Brixius K, Bloch W, Pott C, Napp A, Krahwinkel A, Ziskoven C, Koriller M, Mehlhorn U, Hescheler J and Fleischmann B *et al.*. (2004) Mechanisms of beta 3-adrenoceptor-induced eNOS activation in right atrial and left ventricular human myocardium. *Br J Pharmacol* **143**: 1014-22 [PMID:15466444]
109. Brown DA and Dunn PM. (1983) Depolarization of rat isolated superior cervical ganglia mediated by beta 2-adrenoceptors. *Br J Pharmacol* **79**: 429-39 [PMID:6140042]
110. Brucker BM, King J, Mudd Jr PN and McHale K. (2022) Selectivity and Maximum Response of Vibegron and Mirabegron for β_3-Adrenergic Receptors. *Curr Ther Res Clin Exp* **96**: 100674 [PMID:35693456]
111. Bruno JF, Whittaker J, Song JF and Berelowitz M. (1991) Molecular cloning and sequencing of a cDNA encoding a human alpha 1A adrenergic receptor. *Biochem Biophys Res Commun* **179**: 1485-90 [PMID:1656955]
112. Bullowa J and Kaplan D. (1903) Treatment of asthmatic attacks: on the hypodermatic use of adrenalin chloride in the treatment of asthmatic attacks *Med News* **83**: 787-90

113. Buneman P, Christie G, Davies JA, Dimitrellou R, Harding SD, Pawson AJ, Sharman JL and Wu Y. (2020) Why data citation isn't working, and what to do about it *Database* **2020** [PMID:32367113]
114. Burcelin R, Uldry M, Foretz M, Perrin C, Dacosta A, Nenniger-Tosato M, Seydoux J, Cotecchia S and Thorens B. (2004) Impaired glucose homeostasis in mice lacking the alpha1b-adrenergic receptor subtype. *J Biol Chem* **279**: 1108-15 [PMID:14581480]
115. Burgess C, Ayson M, Rajasingham S, Crane J, Della Cioppa G and Till MD. (1998) The extrapulmonary effects of increasing doses of formoterol in patients with asthma. *Eur J Clin Pharmacol* **54**: 141-7 [PMID:9626918]
116. Burnett J. (1903) Adrenalin: a short account of its therapeutic applications *The Medical Times and Hospital Gazette* **June 20**: 385-7
117. Buxton BF, Jones CR, Molenaar P and Summers RJ. (1987) Characterization and autoradiographic localization of beta-adrenoceptor subtypes in human cardiac tissues. *Br J Pharmacol* **92**: 299-310 [PMID:2823947]
118. Bylund DB. (1988) Subtypes of alpha 2-adrenoceptors: pharmacological and molecular biological evidence converge. *Trends Pharmacol Sci* **9**: 356-61 [PMID:2855960]
119. Bylund DB. (2005) Alpha-2 adrenoceptor subtypes: are more better? *Br J Pharmacol* **144**: 159-60 [PMID:15655520]
120. Bylund DB, Blaxall HS, Iversen LJ, Caron MG, Lefkowitz RJ and Lomasney JW. (1992) Pharmacological characteristics of alpha 2-adrenergic receptors: comparison of pharmacologically defined subtypes with subtypes identified by molecular cloning. *Mol Pharmacol* **42**: 1-5 [PMID:1353247]
121. Bylund DB, Eikenberg DC, Hieble JP, Langer SZ, Lefkowitz RJ, Minneman KP, Molinoff PB, Ruffolo Jr RR and Trendelenburg U. (1994) International Union of Pharmacology nomenclature of adrenoceptors. *Pharmacol Rev* **46**: 121-36 [PMID:7938162]
122. Bylund DB and Ray-Prenger C. (1989) Alpha-2A and alpha-2B adrenergic receptor subtypes: attenuation of cyclic AMP production in cell lines containing only one receptor subtype. *J Pharmacol Exp Ther* **251**: 640-4 [PMID:2553931]
123. Bylund DB, Ray-Prenger C and Murphy TJ. (1988) Alpha-2A and alpha-2B adrenergic receptor subtypes: antagonist binding in tissues and cell lines containing only one subtype. *J Pharmacol Exp Ther* **245**: 600-7 [PMID:2835476]
124. Callaerts-Vegh Z, Evans KL, Dudekula N, Cuba D, Knoll BJ, Callaerts PF, Giles H, Shardonofsky FR and Bond RA. (2004) Effects of acute and chronic administration of beta-adrenoceptor ligands on airway function in a murine model of asthma. *Proc Natl Acad Sci USA* **101**: 4948-53 [PMID:15069206]
125. Campbell AP, Wakelin LP, Denny WA and Finch AM. (2017) Homobivalent Conjugation Increases the Allosteric Effect of 9-aminoacridine at the α1-Adrenergic Receptors. *Mol Pharmacol* **91**: 135-144 [PMID:27903755]
126. Candelore MR, Deng L, Tota L, Guan XM, Amend A, Liu Y, Newbold R, Cascieri MA and Weber AE. (1999) Potent and selective human beta(3)-adrenergic receptor antagonists. *J Pharmacol Exp Ther* **290**: 649-55 [PMID:10411574]
127. Cao N, Chen H, Bai Y, Yang X, Xu W, Hao W, Zhou Y, Chai J, Wu Y and Wang Z *et al.*. (2018) β2-adrenergic receptor autoantibodies alleviated myocardial damage induced by β1-adrenergic receptor autoantibodies in heart failure. *Cardiovasc Res* **114**: 1487-1498 [PMID:29746700]
128. Cao W, Luttrell LM, Medvedev AV, Pierce KL, Daniel KW, Dixon TM, Lefkowitz RJ and Collins S. (2000) Direct binding of activated c-Src to the beta 3-adrenergic receptor is required for MAP kinase activation. *J Biol Chem* **275**: 38131-4 [PMID:11013230]
129. Carmona-Rosas G, Hernández-Espinosa DA, Alcántara-Hernández R, Alfonzo-Méndez MA and García-Sainz JA. (2019) Distinct phosphorylation sites/clusters in the carboxyl terminus regulate α_{1D}-adrenergic receptor subcellular localization and signaling. *Cell Signal* **53**: 374-389 [PMID:30419287]
130. Carr BJ, Mihara K, Ramachandran R, Saifeddine M, Nathanson NM, Stell WK and Hollenberg MD. (2018) Myopia-Inhibiting Concentrations of Muscarinic Receptor Antagonists Block Activation of Alpha2A-Adrenoceptors In Vitro. *Invest Ophthalmol Vis Sci* **59**: 2778-2791 [PMID:29860464]
131. Carroll WA, Sippy KB, Esbenshade TA, Buckner SA, Hancock AA and Meyer MD. (2001) Two novel and potent 3-[(o-methoxyphenyl)piperazinylethyl]-5-phenylthien. *Bioorg Med Chem Lett* **11**: 1119-21 [PMID:11354357]
132. Carzaniga L, Linney ID, Rizzi A, Delcanale M, Schmidt W, Knight CK, Pastore F, Miglietta D, Carnini C and Cesari N *et al.*. (2022) Discovery of Clinical Candidate CHF-6366: A Novel Super-soft Dual Pharmacology Muscarinic Antagonist and β_2 Agonist (MABA) for the Inhaled Treatment of Respiratory Diseases. *J Med Chem* **65**: 10233-10250 [PMID:35901125]
133. Casas-González P and García-Sáinz JA. (2006) Role of epidermal growth factor receptor transactivation in alpha1B-adrenoceptor phosphorylation. *Eur J Pharmacol* **542**: 31-6 [PMID:16828079]

134. Casas-González P, Ruiz-Martínez A and García-Sáinz JA. (2003) Lysophosphatidic acid induces alpha1B-adrenergic receptor phosphorylation through G beta gamma, phosphoinositide 3-kinase, protein kinase C and epidermal growth factor receptor transactivation. *Biochim Biophys Acta* **1633**: 75-83 [PMID:12880866]
135. Castillo-Badillo JA, Molina-Muñoz T, Romero-Ávila MT, Vázquez-Macías A, Rivera R, Chun J and García-Sáinz JA. (2012) Sphingosine 1-phosphate-mediated α1B-adrenoceptor desensitization and phosphorylation. Direct and paracrine/autocrine actions. *Biochim Biophys Acta* **1823**: 245-54 [PMID:22019450]
136. Castillo-Badillo JA, Sánchez-Reyes OB, Alfonzo-Méndez MA, Romero-Ávila MT, Reyes-Cruz G and García-Sáinz JA. (2015) α1B-adrenergic receptors differentially associate with Rab proteins during homologous and heterologous desensitization. *PLoS One* **10**: e0121165 [PMID:25799564]
137. Castrejón-Sosa M, Villalobos-Molina R, Guinzberg R and Piña E. (2002) Adrenaline (via alpha(1B)-adrenoceptors) and ethanol stimulate OH* radical production in isolated rat hepatocytes. *Life Sci* **71**: 2469-74 [PMID:12270752]
138. Catus SL, Gibbs ME, Sato M, Summers RJ and Hutchinson DS. (2011) Role of β-adrenoceptors in glucose uptake in astrocytes using β-adrenoceptor knockout mice. *Br J Pharmacol* **162**: 1700-15 [PMID:21138422]
139. Cero C, Lea HJ, Zhu KY, Shamsi F, Tseng YH and Cypess AM. (2021) β3-Adrenergic receptors regulate human brown/beige adipocyte lipolysis and thermogenesis. *JCI Insight* **6** [PMID:34100382]
140. Chabot-Doré AJ, Millecamps M, Naso L, Devost D, Trieu P, Piltonen M, Diatchenko L, Fairbanks CA, Wilcox GL and Hébert TE *et al.*. (2015) Dual allosteric modulation of opioid antinociceptive potency by α2A-adrenoceptors. *Neuropharmacology* **99**: 285-300 [PMID:26254859]
141. Chalothorn D, McCune DF, Edelmann SE, Tobita K, Keller BB, Lasley RD, Perez DM, Tanoue A, Tsujimoto G and Post GR *et al.*. (2003) Differential cardiovascular regulatory activities of the alpha 1B- and alpha 1D-adrenoceptor subtypes. *J Pharmacol Exp Ther* **305**: 1045-53 [PMID:12649302]
142. Chandrasekera PC, Wan TC, Gizewski ET, Auchampach JA and Lasley RD. (2013) Adenosine A1 receptors heterodimerize with β1- and β2-adrenergic receptors creating novel receptor complexes with altered G protein coupling and signaling. *Cell Signal* **25**: 736-42 [PMID:23291003]
143. Chang DJ, Chang TK, Yamanishi SS, Salazar FH, Kosaka AH, Khare R, Bhakta S, Jasper JR, Shieh IS and Lesnick JD *et al.*. (1998) Molecular cloning, genomic characterization and expression of novel human alpha1A-adrenoceptor isoforms. *FEBS Lett* **422**: 279-83 [PMID:9490024]
144. Chen L, Hodges RR, Funaki C, Zoukhri D, Gaivin RJ, Perez DM and Dartt DA. (2006) Effects of alpha1D-adrenergic receptors on shedding of biologically active EGF in freshly isolated lacrimal gland epithelial cells. *Am J Physiol, Cell Physiol* **291**: C946-56 [PMID:16760267]
145. Chen L, Xiao T, Chen L, Xie S, Deng M and Wu D. (2018) The Association of ADRB1 and CYP2D6 Polymorphisms With Antihypertensive Effects and Analysis of Their Contribution to Hypertension Risk. *Am J Med Sci* **355**: 235-239 [PMID:29549925]
146. Chen Q, Takahashi S, Zhong S, Hosoda C, Zheng HY, Ogushi T, Fujimura T, Ohta N, Tanoue A and Tsujimoto G *et al.*. (2005) Function of the lower urinary tract in mice lacking alpha1d-adrenoceptor. *J Urol* **174**: 370-4 [PMID:15947692]
147. Chen WM, Chang AC, Shie BJ, Chang YH and Chang NC. (1992) Molecular cloning and characterization of a mouse alpha 2C2 adrenoceptor subtype gene. *Biochim Biophys Acta* **1171**: 219-23 [PMID:1336396]
148. Chen X, Xu Y, Qu L, Wu L, Han GW, Guo Y, Wu Y, Zhou Q, Sun Q and Chu C *et al.*. (2019) Molecular Mechanism for Ligand Recognition and Subtype Selectivity of α_{2C} Adrenergic Receptor. *Cell Rep* **29**: 2936-2943.e4 [PMID:31801061]
149. Chen Z, Hague C, Hall RA and Minneman KP. (2006) Syntrophins regulate alpha1D-adrenergic receptors through a PDZ domain-mediated interaction. *J Biol Chem* **281**: 12414-20 [PMID:16533813]
150. Chen Z, Rogge G, Hague C, Alewood D, Colless B, Lewis RJ and Minneman KP. (2004) Subtype-selective noncompetitive or competitive inhibition of human alpha1-adrenergic receptors by rho-TIA. *J Biol Chem* **279**: 35326-33 [PMID:15194691]
151. Cherezov V, Rosenbaum DM, Hanson MA, Rasmussen SG, Thian FS, Kobilka TS, Choi HJ, Kuhn P, Weis WI and Kobilka BK *et al.*. (2007) High-resolution crystal structure of an engineered human beta2-adrenergic G protein-coupled receptor. *Science* **318**: 1258-65 [PMID:17962520]
152. Chernogubova E, Cannon B and Bengtsson T. (2004) Norepinephrine increases glucose transport in brown adipocytes via beta3-adrenoceptors through a cAMP, PKA, and PI3-kinase-dependent pathway stimulating conventional and novel PKCs. *Endocrinology* **145**: 269-280 [PMID:14551227]
153. Chernogubova E, Hutchinson DS, Nedergaard J and Bengtsson T. (2005) Alpha1- and beta1-

adrenoceptor signaling fully compensates for beta3-adrenoceptor deficiency in brown adipocyte norepinephrine-stimulated glucose uptake. *Endocrinology* **146**: 2271-84 [PMID:15665039]
154. Chiba S and Tsukada M. (2002) Existence of functional alpha1A- and alpha1D- but no alpha1B-adrenoceptor subtypes in rat common carotid arteries. *Jpn J Pharmacol* **88**: 146-50 [PMID:11928714]
155. Christiansen C, Poulsen P and Beck-Nielsen H. (1999) The Trp64Arg mutation of the adrenergic beta-3 receptor gene impairs insulin secretion: a twin study. *Diabet Med* **16**: 835-40 [PMID:10547210]
156. Chruscinski AJ, Rohrer DK, Schauble E, Desai KH, Bernstein D and Kobilka BK. (1999) Targeted disruption of the beta2 adrenergic receptor gene. *J Biol Chem* **274**: 16694-700 [PMID:10358008]
157. Chu KL, Xu J, Frost J, Li L, Gomez E, Dart MJ, Jarvis MF, Meyer MD and McGaraughty S. (2015) A selective α2 B adrenoceptor agonist (A-1262543) and duloxetine modulate nociceptive neurones in the medial prefrontal cortex, but not in the spinal cord of neuropathic rats. *Eur J Pain* **19**: 649-60 [PMID:25154730]
158. Chung FZ, Lentes KU, Gocayne J, Fitzgerald M, Robinson D, Kerlavage AR, Fraser CM and Venter JC. (1987) Cloning and sequence analysis of the human brain beta-adrenergic receptor. Evolutionary relationship to rodent and avian beta-receptors and porcine muscarinic receptors. *FEBS Lett* **211**: 200-6 [PMID:3026848]
159. Church JE, Trieu J, Sheorey R, Chee AY, Naim T, Baum DM, Ryall JG, Gregorevic P and Lynch GS. (2014) Functional β-adrenoceptors are important for early muscle regeneration in mice through effects on myoblast proliferation and differentiation. *PLoS One* **9**: e101379 [PMID:25000590]
160. Clement K, Vaisse C, Manning BS, Basdevant A, Guy-Grand B, Ruiz J, Silver KD, Shuldiner AR, Froguel P and Strosberg AD. (1995) Genetic variation in the beta 3-adrenergic receptor and an increased capacity to gain weight in patients with morbid obesity. *N Engl J Med* **333**: 352-354 [PMID:7609752]
161. Coccurello R, Bielawski A, Zelek-Molik A, Vetulani J, Kowalska M, D'Amato FR and Nalepa I. (2014) Brief maternal separation affects brain α1-adrenoceptors and apoptotic signaling in adult mice. *Prog Neuropsychopharmacol Biol Psychiatry* **48**: 161-9 [PMID:24128685]
162. Cockcroft JR, Gazis AG, Cross DJ, Wheatley A, Dewar J, Hall IP and Noon JP. (2000) Beta(2)-adrenoceptor polymorphism determines vascular reactivity in humans. *Hypertension* **36**: 371-5 [PMID:10988267]
163. Cohn HI, Harris DM, Pesant S, Pfeiffer M, Zhou RH, Koch WJ, Dorn GW and Eckhart AD. (2008) Inhibition of vascular smooth muscle G protein-coupled receptor kinase 2 enhances alpha1D-adrenergic receptor constriction. *Am J Physiol Heart Circ Physiol* **295**: H1695-704 [PMID:18723764]
164. Collette KM, Zhou XD, Amoth HM, Lyons MJ, Papay RS, Sens DA, Perez DM and Doze VA. (2014) Long-term α1B-adrenergic receptor activation shortens lifespan, while α1A-adrenergic receptor stimulation prolongs lifespan in association with decreased cancer incidence. *Age (Dordr)* **36**: 9675 [PMID:24994537]
165. Collins S. (2011) β-Adrenoceptor Signaling Networks in Adipocytes for Recruiting Stored Fat and Energy Expenditure. *Front Endocrinol (Lausanne)* **2**: 102 [PMID:22654837]
166. Cong Z, Li D, Lv X, Yang C, Zhang Q, Wu C, Wang Z and Zhu X. (2020) α2A-adrenoceptor deficiency attenuates lipopolysaccharide-induced lung injury by increasing norepinephrine levels and inhibiting alveolar macrophage activation in acute respiratory distress syndrome. *Clin Sci (Lond)* **134**: 1957-1971 [PMID:32643759]
167. Conley RK, Williams TJ, Ford AP and Ramage AG. (2001) The role of alpha(1)-adrenoceptors and 5-HT(1A) receptors in the control of the micturition reflex in male anaesthetized rats. *Br J Pharmacol* **133**: 61-72 [PMID:11325795]
168. Connor CW. (2020) A Forensic Disassembly of the BIS Monitor. *Anesth Analg* **131**: 1923-1933 [PMID:33093360]
169. Cotecchia S, Björklöf K, Rossier O, Stanasila L, Greasley P and Fanelli F. (2002) The alpha1b-adrenergic receptor subtype: molecular properties and physiological implications. *J Recept Signal Transduct Res* **22**: 1-16 [PMID:12503605]
170. Cotecchia S, Schwinn DA, Randall RR, Lefkowitz RJ, Caron MG and Kobilka BK. (1988) Molecular cloning and expression of the cDNA for the hamster alpha 1-adrenergic receptor. *Proc Natl Acad Sci USA* **85**: 7159-63 [PMID:2845398]
171. Couto GK, Davel AP, Brum PC and Rossoni LV. (2014) Double disruption of α2A- and α2C-adrenoceptors induces endothelial dysfunction in mouse small arteries: role of nitric oxide synthase uncoupling. *Exp Physiol* **99**: 1427-38 [PMID:25037566]
172. Cowley PM, Wang G, Chang AN, Makwana O, Swigart PM, Lovett DH, Stull JT, Simpson PC and Baker AJ. (2015) The α1A-adrenergic receptor subtype mediates increased contraction of failing right ventricular myocardium. *Am J Physiol Heart Circ Physiol* **309**: H888-96 [PMID:26116709]
173. Cowley PM, Wang G, Joshi S, Swigart PM, Lovett DH, Simpson PC and Baker AJ. (2017) α_{1A}-

Subtype adrenergic agonist therapy for the failing right ventricle. *Am J Physiol Heart Circ Physiol* **313**: H1109-H1118 [PMID:28822963]
174. Cowley PM, Wang G, Swigart PM, Raghunathan A, Reddy N, Dulam P, Lovett DH, Simpson PC and Baker AJ. (2019) Reversal of right ventricular failure by chronic α_{1A}-subtype adrenergic agonist therapy. *Am J Physiol Heart Circ Physiol* **316**: H224-H232 [PMID:30412439]
175. Cros C and Brette F. (2013) Functional subcellular distribution of β1- and β2-adrenergic receptors in rat ventricular cardiac myocytes. *Physiol Rep* **1**: e00038 [PMID:24303124]
176. Cruickshank JM. (1993) The xamoterol experience in the treatment of heart failure. *Am J Cardiol* **71**: 61C-64C [PMID:8465800]
177. Cruz Grecco Teixeira MB, Martins GM, Miranda-Rodrigues M, De Araújo IF, Oliveira R, Brum PC and Azevedo Gouveia CH. (2016) Lack of α2C-Adrenoceptor Results in Contrasting Phenotypes of Long Bones and Vertebra and Prevents the Thyrotoxicosis-Induced Osteopenia. *PLoS One* **11**: e0146795 [PMID:26815679]
178. da Silva ES, Flores RA, Cella EC, Levone BR, Taschetto AP, Kochenborger L, Terenzi MG, Faria MS and Paschoalini MA. (2014) Blockade of median raphe nucleus α1-adrenoceptor subtypes increases food intake in rats. *Pharmacol Biochem Behav* **124**: 350-5 [PMID:24955865]
179. da Silva Junior ED, Sato M, Merlin J, Broxton N, Hutchinson DS, Ventura S, Evans BA and Summers RJ. (2017) Factors influencing biased agonism in recombinant cells expressing the human α_{1A} -adrenoceptor. *Br J Pharmacol* **174**: 2318-2333 [PMID:28444738]
180. Dale HH. (1906) On some physiological actions of ergot *Am J Physiol* **34**: 163-206
181. Dang V, Medina B, Das D, Moghadam S, Martin KJ, Lin B, Naik P, Patel D, Nosheny R and Wesson Ashford J *et al.*. (2014) Formoterol, a long-acting β2 adrenergic agonist, improves cognitive function and promotes dendritic complexity in a mouse model of Down syndrome. *Biol Psychiatry* **75**: 179-88 [PMID:23827853]
182. Daniels DV, Gever JR, Jasper JR, Kava MS, Lesnick JD, Meloy TD, Stepan G, Williams TJ, Clarke DE and Chang DJ *et al.*. (1999) Human cloned alpha1A-adrenoceptor isoforms display alpha1L-adrenoceptor pharmacology in functional studies. *Eur J Pharmacol* **370**: 337-43 [PMID:10334511]
183. Dartt DA and Hodges RR. (2011) Interaction of alpha1D-adrenergic and P2X(7) receptors in the rat lacrimal gland and the effect on intracellular [Ca2+] and protein secretion. *Invest Ophthalmol Vis Sci* **52**: 5720-9 [PMID:21685341]
184. Davis BJ, Chapple CR, Sellers DJ, Naylor AL, Sillar D, Campbell A and Chess-Williams R. (2018) α_{1L}-adrenoceptors mediate contraction of human erectile tissue. *J Pharmacol Sci* **137**: 366-371 [PMID:30139713]
185. Davis BJ, Wiener M, Chapple CR, Sellers DJ and Chess-Williams R. (2015) Functional and radioligand binding characterization of the α1L-adrenoceptor subtype of the human vas deferens. *Auton Autacoid Pharmacol* **34**: 41-9 [PMID:25790239]
186. Day HE, Campeau S, Watson Jr SJ and Akil H. (1997) Distribution of alpha 1a-, alpha 1b- and alpha 1d-adrenergic receptor mRNA in the rat brain and spinal cord. *J Chem Neuroanat* **13**: 115-39 [PMID:9285356]
187. Day HE, Kryskow EM, Watson SJ, Akil H and Campeau S. (2008) Regulation of hippocampal alpha1d adrenergic receptor mRNA by corticosterone in adrenalectomized rats. *Brain Res* **1218**: 132-40 [PMID:18534559]
188. de Andrade CR, Fukada SY, Olivon VC, de Godoy MA, Haddad R, Eberlin MN, Cunha FQ, de Souza HP, Laurindo FR and de Oliveira AM. (2006) Alpha1D-adrenoceptor-induced relaxation on rat carotid artery is impaired during the endothelial dysfunction evoked in the early stages of hyperhomocysteinemia. *Eur J Pharmacol* **543**: 83-91 [PMID:16828078]
189. De Pascali F, Ippolito M, Wolfe E, Komolov KE, Hopfinger N, Lemenze D, Kim N, Armen RS, An SS and Scott CP *et al.*. (2022) β_2 -Adrenoceptor agonist profiling reveals biased signalling phenotypes for the β_2 -adrenoceptor with possible implications for the treatment of asthma. *Br J Pharmacol* **179**: 4692-4708 [PMID:35732075]
190. De Ponti F, Gibelli G, Croci T, Arcidiaco M, Crema F and Manara L. (1996) Functional evidence of atypical beta 3-adrenoceptors in the human colon using the beta 3-selective adrenoceptor antagonist, SR 59230A. *Br J Pharmacol* **117**: 1374-6 [PMID:8730727]
191. DeBoy JM and Jarboe BR. (1991) A response to "Can cytology proficiency testing programs discriminate between competent and incompetent practitioners?". *QRB Qual Rev Bull* **17**: 206 [PMID:1923452]
192. Dehvari N, Sato M, Bokhari MH, Kalinovich A, Ham S, Gao J, Nguyen HTM, Whiting L, Mukaida S and Merlin J *et al.*. (2020) The metabolic effects of mirabegron are mediated primarily by β_3 -adrenoceptors. *Pharmacol Res Perspect* **8**: e00643 [PMID:32813332]
193. Deighan C, Woollhead AM, Colston JF and McGrath JC. (2004) Hepatocytes from alpha1B-adrenoceptor knockout mice reveal compensatory adrenoceptor subtype substitution. *Br J Pharmacol* **142**: 1031-7 [PMID:15210583]
194. Deluigi M, Morstein L, Schuster M, Klenk C, Merklinger L, Cridge RR, de Zhang LA, Klipp A,

Vacca S and Vaid TM *et al*.. (2022) Crystal structure of the α_{1B}-adrenergic receptor reveals molecular determinants of selective ligand recognition. *Nat Commun* **13**: 382 [PMID:35046410]
195. Dessy C, Moniotte S, Ghisdal P, Havaux X, Noirhomme P and Balligand JL. (2004) Endothelial beta3-adrenoceptors mediate vasorelaxation of human coronary microarteries through nitric oxide and endothelium-dependent hyperpolarization. *Circulation* **110**: 948-54 [PMID:15302798]
196. Deupree JD, Hinton KA, Cerutis DR and Bylund DB. (1996) Buffers differentially alter the binding of [3H]rauwolscine and [3H]RX821002 to the alpha-2 adrenergic receptor subtypes. *J Pharmacol Exp Ther* **278**: 1215-27 [PMID:8819505]
197. Devedjian JC, Esclapez F, Denis-Pouxviel C and Paris H. (1994) Further characterization of human alpha 2-adrenoceptor subtypes: [3H]RX821002 binding and definition of additional selective drugs. *Eur J Pharmacol* **252**: 43-9 [PMID:7908642]
198. DeVree BT, Mahoney JP, Vélez-Ruiz GA, Rasmussen SG, Kuszak AJ, Edwald E, Fung JJ, Manglik A, Masureel M and Du Y *et al*.. (2016) Allosteric coupling from G protein to the agonist-binding pocket in GPCRs. *Nature* **535**: 182-6 [PMID:27362234]
199. Di Salvo J, Nagabukuro H, Wickham LA, Abbadie C, DeMartino JA, Fitzmaurice A, Gichuru L, Kulick A, Donnelly MJ and Jochnowitz N *et al*.. (2017) Pharmacological Characterization of a Novel Beta 3 Adrenergic Agonist, Vibegron: Evaluation of Antimuscarinic Receptor Selectivity for Combination Therapy for Overactive Bladder. *J Pharmacol Exp Ther* **360**: 346-355 [PMID:27965369]
200. Diamanti E, Del Bello F, Carbonara G, Carrieri A, Fracchiolla G, Giannella M, Mammoli V, Piergentili A, Pohjanoksa K and Quaglia W *et al*.. (2012) Might the observed α(2A)-adrenoreceptor agonism or antagonism of allyphenyline analogues be ascribed to different molecular conformations? *Bioorg Med Chem* **20**: 2082-90 [PMID:22341244]
201. Dixon RA, Kobilka BK, Strader DJ, Benovic JL, Dohlman HG, Frielle T, Bolanowski MA, Bennett CD, Rands E and Diehl RE *et al*.. (1986) Cloning of the gene and cDNA for mammalian beta-adrenergic receptor and homology with rhodopsin. *Nature* **321**: 75-9 [PMID:3010132]
202. Docherty JR. (2012) Yohimbine antagonises α1A- and α1D-adrenoceptor mediated components in addition to the α2A-adrenoceptor component to pressor responses in the pithed rat. *Eur J Pharmacol* **679**: 90-4 [PMID:22290390]
203. Docherty JR. (2011) Vasopressor nerve responses in the pithed rat, previously identified as α2-adrenoceptor mediated, may be α1D-adrenoceptor mediated. *Eur J Pharmacol* **658**: 182-6 [PMID:21376031]
204. Docherty JR. (1998) Subtypes of functional alpha1- and alpha2-adrenoceptors. *Eur J Pharmacol* **361**: 1-15 [PMID:9851536]
205. Dolan JA, Muenkel HA, Burns MG, Pellegrino SM, Fraser CM, Pietri F, Strosberg AD, Largis EE, Dutia MD and Bloom JD *et al*.. (1994) Beta-3 adrenoceptor selectivity of the dioxolane dicarboxylate phenethanolamines. *J Pharmacol Exp Ther* **269**: 1000-6 [PMID:7912272]
206. Doze VA, Papay RS, Goldenstein BL, Gupta MK, Collette KM, Nelson BW, Lyons MJ, Davis BA, Luger EJ and Wood SG *et al*.. (2011) Long-term α1A-adrenergic receptor stimulation improves synaptic plasticity, cognitive function, mood, and longevity. *Mol Pharmacol* **80**: 747-58 [PMID:21791575]
207. Drouin C, Darracq L, Trovero F, Blanc G, Glowinski J, Cotecchia S and Tassin JP. (2002) Alpha1b-adrenergic receptors control locomotor and rewarding effects of psychostimulants and opiates. *J Neurosci* **22**: 2873-84 [PMID:11923452]
208. Du XJ, Fang L, Gao XM, Kiriazis H, Feng X, Hotchkin E, Finch AM, Chaulet H and Graham RM. (2004) Genetic enhancement of ventricular contractility protects against pressure-overload-induced cardiac dysfunction. *J Mol Cell Cardiol* **37**: 979-87 [PMID:15522275]
209. Du XJ, Gao XM, Kiriazis H, Moore XL, Ming Z, Su Y, Finch AM, Hannan RA, Dart AM and Graham RM. (2006) Transgenic alpha1A-adrenergic activation limits post-infarct ventricular remodeling and dysfunction and improves survival. *Cardiovasc Res* **71**: 735-43 [PMID:16859660]
210. Du Y, Yan L, Wang J, Zhan W, Song K, Han X, Li X, Cao J and Liu H. (2012) β1-Adrenoceptor autoantibodies from DCM patients enhance the proliferation of T lymphocytes through the β1-AR/cAMP/PKA and p38 MAPK pathways. *PLoS One* **7**: e52911 [PMID:23300817]
211. Ducza E, Kormányos Z, Resch BE and Falkay G. (2005) Correlation between the alterations in the mRNA expressions of the alpha1-adrenoceptor and estrogen receptor subtypes in the pregnant human uterus and cervix. *Eur J Pharmacol* **528**: 183-7 [PMID:16325176]
212. Eason MG, Kurose H, Holt BD, Raymond JR and Liggett SB. (1992) Simultaneous coupling of alpha 2-adrenergic receptors to two G-proteins with opposing effects. Subtype-selective coupling of alpha 2C10, alpha 2C4, and alpha 2C2 adrenergic receptors to Gi and Gs. *J Biol Chem* **267**: 15795-801 [PMID:1322406]
213. Eason MG and Liggett SB. (1995) Identification of a Gs coupling domain in the amino terminus of the third intracellular loop of the alpha 2A-adrenergic receptor. Evidence for distinct structural determinants that confer Gs versus Gi coupling. *J Biol Chem* **270**: 24753-60 [PMID:7559592]

214. Eason MG and Liggett SB. (1993) Human alpha 2-adrenergic receptor subtype distribution: widespread and subtype-selective expression of alpha 2C10, alpha 2C4, and alpha 2C2 mRNA in multiple tissues. *Mol Pharmacol* **44**: 70-5 [PMID:7688069]
215. Edmondson SD, Zhu C, Kar NF, Di Salvo J, Nagabukuro H, Sacre-Salem B, Dingley K, Berger R, Goble SD and Morriello G *et al.*. (2016) Discovery of Vibegron: A Potent and Selective β3 Adrenergic Receptor Agonist for the Treatment of Overactive Bladder. *J Med Chem* **59**: 609-23 [PMID:26709102]
216. Eisenberg DM, Kessler RC, Van Rompay MI, Kaptchuk TJ, Wilkey SA, Appel S and Davis RB. (2001) Perceptions about complementary therapies relative to conventional therapies among adults who use both: results from a national survey. *Ann Intern Med* **135**: 344-51 [PMID:11529698]
217. Elenkov IJ, Wilder RL, Chrousos GP and Vizi ES. (2000) The sympathetic nerve--an integrative interface between two supersystems: the brain and the immune system. *Pharmacol Rev* **52**: 595-638 [PMID:11121511]
218. Elnatan J, Molenaar P, Rosenfeldt FL and Summers RJ. (1994) Autoradiographic localization and quantitation of beta 1- and beta 2-adrenoceptors in the human atrioventricular conducting system: a comparison of patients with idiopathic dilated cardiomyopathy and ischemic heart disease. *J Mol Cell Cardiol* **26**: 313-23 [PMID:7913135]
219. Emorine LJ, Marullo S, Briend-Sutren MM, Patey G, Tate K, Delavier-Klutchko C and Strosberg AD. (1989) Molecular characterization of the human beta 3-adrenergic receptor. *Science* **245**: 1118-21 [PMID:2570461]
220. Enten GA, Gao X, Strzelinski HR, Weche M, Liggett SB and Majetschak M. (2022) $\alpha_{1B/D}$-adrenoceptors regulate chemokine receptor-mediated leukocyte migration via formation of heteromeric receptor complexes. *Proc Natl Acad Sci U S A* **119**: e2123511119 [PMID:35537053]
221. Erdogan BR, Michel MC and Arioglu-Inan E. (2020) Expression and Signaling of β-Adrenoceptor Subtypes in the Diabetic Heart. *Cells* **9** [PMID:33256212]
222. Erdozain AM, Brocos-Mosquera I, Gabilondo AM, Meana JJ and Callado LF. (2019) Differential α_{2A}- and α_{2C}-adrenoceptor protein expression in presynaptic and postsynaptic density fractions of postmortem human prefrontal cortex. *J Psychopharmacol* **33**: 244-249 [PMID:30255728]
223. Ernst D, Westerbergh J, Sogkas G, Jablonka A, Ahrenstorf G, Schmidt RE, Heidecke H, Wallentin L, Riemekasten G and Witte T. (2019) Lowered anti-beta1 adrenergic receptor antibody concentrations may have prognostic significance in acute coronary syndrome. *Sci Rep* **9**: 14552 [PMID:31601947]
224. Errasti AE, Werneck de Avellar MC, Daray FM, Tramontano J, Luciani LI, Lina Bard MJ, Maróstica E and Rothlin RP. (2003) Human umbilical vein vasoconstriction induced by epinephrine acting on alpha1B-adrenoceptor subtype. *Am J Obstet Gynecol* **189**: 1472-80 [PMID:14634588]
225. Evans AE, Tripathi A, LaPorte HM, Brueggemann LI, Singh AK, Albee LJ, Byron KL, Tarasova NI, Volkman BF and Cho TY *et al.*. (2016) New Insights into Mechanisms and Functions of Chemokine (C-X-C Motif) Receptor 4 Heteromerization in Vascular Smooth Muscle. *Int J Mol Sci* **17** [PMID:27331810]
226. Evans BA, Broxton N, Merlin J, Sato M, Hutchinson DS, Christopoulos A and Summers RJ. (2011) Quantification of functional selectivity at the human α(1A)-adrenoceptor. *Mol Pharmacol* **79**: 298-307 [PMID:20978120]
227. Evans BA, Papaioannou M, Hamilton S and Summers RJ. (1999) Alternative splicing generates two isoforms of the beta-3 adrenoceptor which are differentially expressed in mouse tissues. *Br J Pharmacol* **127**: 1525-1531 [PMID:10455305]
228. Evdokimovskii EV, Jeon R, Park S, Pimenov OY and Alekseev AE. (2021) Role of α2-Adrenoceptor Subtypes in Suppression of L-Type Ca^{2+} Current in Mouse Cardiac Myocytes. *Int J Mol Sci* **22** [PMID:33923625]
229. Eyssette M, Rohmer F, Serratrice G, Warter JM and Boisson D. (1988) Multi-centre, double-blind trial of a novel antispastic agent, tizanidine, in spasticity associated with multiple sclerosis. *Curr Med Res Opin* **10**: 699-708 [PMID:3286128]
230. Fagerholm V, Rokka J, Nyman L, Sallinen J, Tiihonen J, Tupala E, Haaparanta M and Hietala J. (2008) Autoradiographic characterization of alpha(2C)-adrenoceptors in the human striatum. *Synapse* **62**: 508-15 [PMID:18435421]
231. Fardoun MM, Issa K, Maaliki D, Nasser SA, Baydoun E and Eid AH. (2020) Estrogen increases expression of vascular alpha 2C adrenoceptor through the cAMP/Epac/JNK/AP-1 pathway and potentiates cold-induced vasoconstriction. *Vascul Pharmacol* **131**: 106690 [PMID:32407896]
232. Fardoun MM, Nassif J, Issa K, Baydoun E and Eid AH. (2016) Raynaud's Phenomenon: A Brief Review of the Underlying Mechanisms. *Front Pharmacol* **7**: 438 [PMID:27899893]
233. Fargin A, Raymond SR, Lohse MJ, Kobilka BK, Caron MG and Lefkowitz RJ. (1988) The genomic clone G-21 which resembles aβ-adrenergic receptor sequence encodes the 5-HT_{1A}receptor. *Nature* **335**: 358-360 [PMID:3138543]
234. Faure C, Pimoule C, Vallancien G, Langer SZ and Graham D. (1994) Identification of alpha 1-

adrenoceptor subtypes present in the human prostate. *Life Sci* **54**: 1595-605 [PMID:8196478]
235. Feng MG, Prieto MC and Navar LG. (2012) Nebivolol-induced vasodilation of renal afferent arterioles involves β3-adrenergic receptor and nitric oxide synthase activation. *Am J Physiol Renal Physiol* **303**: F775-82 [PMID:22674024]
236. Fernandes GW, Ueta CB, Fonseca TL, Gouveia CH, Lancellotti CL, Brum PC, Christoffolete MA, Bianco AC and Ribeiro MO. (2014) Inactivation of the adrenergic receptor β2 disrupts glucose homeostasis in mice. *J Endocrinol* **221**: 381-90 [PMID:24868110]
237. Fernández J, Alonso JM, Andrés JI, Cid JM, Díaz A, Iturrino L, Gil P, Megens A, Sipido VK and Trabanco AA. (2005) Discovery of new tetracyclic tetrahydrofuran derivatives as potential broad-spectrum psychotropic agents. *J Med Chem* **48**: 1709-12 [PMID:15771415]
238. Festa A, Krugluger W, Shnawa N, Hopmeier P, Haffner SM and Schernthaner G. (1999) Trp64Arg polymorphism of the beta3-adrenergic receptor gene in pregnancy: association with mild gestational diabetes mellitus. *J Clin Endocrinol Metab* **84**: 1695-9 [PMID:10323402]
239. Filippi S, Parenti A, Donnini S, Granger HJ, Fazzini A and Ledda F. (2001) alpha(1D)-adrenoceptors cause endothelium-dependent vasodilatation in the rat mesenteric vascular bed. *J Pharmacol Exp Ther* **296**: 869-75 [PMID:11181918]
240. Flacco N, Parés J, Serna E, Segura V, Vicente D, Pérez-Aso M, Noguera MA, Ivorra MD, McGrath JC and D'Ocon P. (2013) α1D-Adrenoceptors are responsible for the high sensitivity and the slow time-course of noradrenaline-mediated contraction in conductance arteries. *Pharmacol Res Perspect* **1**: e00001 [PMID:25505555]
241. Flacco N, Segura V, Perez-Aso M, Estrada S, Seller JF, Jiménez-Altayó F, Noguera MA, D'Ocon P, Vila E and Ivorra MD. (2013) Different β-adrenoceptor subtypes coupling to cAMP or NO/cGMP pathways: implications in the relaxant response of rat conductance and resistance vessels. *Br J Pharmacol* **169**: 413-25 [PMID:23373597]
242. Fletcher DS, Candelore MR, Grujic D, Lowell BB, Luell S, Susulic VS and Macintyre DE. (1998) Beta-3 adrenergic receptor agonists cause an increase in gastrointestinal transit time in wild-type mice, but not in mice lacking the beta-3 adrenergic receptor. *J Pharmacol Exp Ther* **287**: 720-4 [PMID:9808702]
243. Flordellis CS, Handy DE, Bresnahan MR, Zannis VI and Gavras H. (1991) Cloning and expression of a rat brain alpha 2B-adrenergic receptor. *Proc Natl Acad Sci USA* **88**: 1019-23 [PMID:1704126]
244. Ford AP, Arredondo NF, Blue Jr DR, Bonhaus DW, Jasper J, Kava MS, Lesnick J, Pfister JR, Shieh IA and Vimont RL *et al*.. (1996) RS-17053 (N-[2-(2-cyclopropylmethoxyphenoxy)ethyl]-5-chloro-alpha, alpha-dimethyl-1H-indole-3-ethanamine hydrochloride), a selective alpha 1A-adrenoceptor antagonist, displays low affinity for functional alpha 1-adrenoceptors in human prostate: implications for adrenoceptor classification. *Mol Pharmacol* **49**: 209-15 [PMID:8632751]
245. Ford AP, Daniels DV, Chang DJ, Gever JR, Jasper JR, Lesnick JD and Clarke DE. (1997) Pharmacological pleiotropism of the human recombinant alpha1A-adrenoceptor: implications for alpha1-adrenoceptor classification. *Br J Pharmacol* **121**: 1127-35 [PMID:9249248]
246. Ford AP, Williams TJ, Blue DR and Clarke DE. (1994) Alpha 1-adrenoceptor classification: sharpening Occam's razor. *Trends Pharmacol Sci* **15**: 167-70 [PMID:7916507]
247. Frang H, Cockcroft V, Karskela T, Scheinin M and Marjamäki A. (2001) Phenoxybenzamine binding reveals the helical orientation of the third transmembrane domain of adrenergic receptors. *J Biol Chem* **276**: 31279-84 [PMID:11395517]
248. Frazier EP, Michel-Reher MB, van Loenen P, Sand C, Schneider T, Peters SL and Michel MC. (2011) Lack of evidence that nebivolol is a β_3-adrenoceptor agonist. *Eur J Pharmacol* **654**: 86-91 [PMID:21172342]
249. Freitas SR, Pereira AC, Floriano MS, Mill JG and Krieger JE. (2008) Association of alpha1a-adrenergic receptor polymorphism and blood pressure phenotypes in the Brazilian population. *BMC Cardiovasc Disord* **8**: 40 [PMID:19105822]
250. Frey UH, Karlik J, Herbstreit F and Peters J. (2014) β2-Adrenoceptor gene variants affect vasopressor requirements in patients after thoracic epidural anaesthesia. *Br J Anaesth* **112**: 477-84 [PMID:24366725]
251. Frielle T, Collins S, Daniel KW, Caron MG, Lefkowitz RJ and Kobilka BK. (1987) Cloning of the cDNA for the human β1-adrenergic receptor. *Proc Natl Acad Sci USA* **84**: 7920-7924 [PMID:2825170]
252. Frielle T, Daniel KW, Caron MG and Lefkowitz RJ. (1988) Structural basis of beta-adrenergic receptor subtype specificity studied with chimeric beta 1/beta 2-adrenergic receptors. *Proc Natl Acad Sci USA* **85**: 9494-8 [PMID:2849109]
253. Gálvez I, Martín-Cordero L, Hinchado MD, Álvarez-Barrientos A and Ortega E. (2019) Anti-inflammatory effect of β2 adrenergic stimulation on circulating monocytes with a pro-inflammatory state in high-fat diet-induced obesity. *Brain Behav Immun* **80**: 564-572 [PMID:31055173]
254. Gable BD, Shiga T, Murray PA and Damron DS. (2005) Propofol increases contractility during alpha1a-adrenoreceptor activation in adult rat cardiomyocytes. *Anesthesiology* **103**: 335-43

[PMID:16052116]
255. Gacsályi I, Nagy K, Pallagi K, Lévay G, Hársing Jr LG, Móricz K, Kertész S, Varga P, Haller J and Gigler G *et al*.. (2013) Egis-11150: a candidate antipsychotic compound with procognitive efficacy in rodents. *Neuropharmacology* **64**: 254-63 [PMID:22824189]
256. Gaertner J and Fusi-Schmidhauser T. (2022) Dexmedetomidine: a magic bullet on its way into palliative care-a narrative review and practice recommendations. *Ann Palliat Med* **11**: 1491-1504 [PMID:35400162]
257. Galandrin S, Oligny-Longpré G, Bonin H, Ogawa K, Galés C and Bouvier M. (2008) Conformational rearrangements and signaling cascades involved in ligand-biased mitogen-activated protein kinase signaling through the beta1-adrenergic receptor. *Mol Pharmacol* **74**: 162-72 [PMID:18403719]
258. Galaz-Montoya M, Wright SJ, Rodriguez GJ, Lichtarge O and Wensel TG. (2017) β_2-Adrenergic receptor activation mobilizes intracellular calcium via a non-canonical cAMP-independent signaling pathway. *J Biol Chem* **292**: 9967-9974 [PMID:28442571]
259. Galitzky J, Langin D, Verwaerde P, Montastruc JL, Lafontan M and Berlan M. (1997) Lipolytic effects of conventional beta 3-adrenoceptor agonists and of CGP 12,177 in rat and human fat cells: preliminary pharmacological evidence for a putative beta 4-adrenoceptor. *Br J Pharmacol* **122**: 1244-50 [PMID:9401793]
260. Gao V, Suzuki A, Magistretti PJ, Lengacher S, Pollonini G, Steinman MQ and Alberini CM. (2016) Astrocytic β2-adrenergic receptors mediate hippocampal long-term memory consolidation. *Proc Natl Acad Sci U S A* **113**: 8526-31 [PMID:27402767]
261. Gao X, Enten GA, DeSantis AJ, Volkman BF, Gaponenko V and Majetschak M. (2020) Characterization of heteromeric complexes between chemokine (C-X-C motif) receptor 4 and α_1-adrenergic receptors utilizing intermolecular bioluminescence resonance energy transfer assays. *Biochem Biophys Res Commun* **528**: 368-375 [PMID:32085899]
262. García-Cazarín ML, Smith JL, Clair DK and Piascik MT. (2008) The alpha1D-adrenergic receptor induces vascular smooth muscle apoptosis via a p53-dependent mechanism. *Mol Pharmacol* **74**: 1000-7 [PMID:18628404]
263. García-Cazarín ML, Smith JL, Olszewski KA, McCune DF, Simmerman LA, Hadley RW, Kraner SD and Piascik MT. (2008) The alpha1D-adrenergic receptor is expressed intracellularly and coupled to increases in intracellular calcium and reactive oxygen species in human aortic smooth muscle cells. *J Mol Signal* **3**: 6 [PMID:18304336]
264. García-Sáinz JA, Rodríguez-Pérez CE and Romero-Avila MT. (2004) Human alpha1D-adrenoceptor phosphorylation and desensitization. *Biochem Pharmacol* **67**: 1853-8 [PMID:15130762]
265. García-Sáinz JA, Romero-Avila MT, Molina-Muñoz T and Medina Ldel C. (2004) Insulin induces alpha1B-adrenergic receptor phosphorylation and desensitization. *Life Sci* **75**: 1937-47 [PMID:15306161]
266. García-Sáinz JA, Vázquez-Cuevas FG and Romero-Avila MT. (2001) Phosphorylation and desensitization of alpha1d-adrenergic receptors. *Biochem J* **353**: 603-10 [PMID:11171057]
267. Garovic VD, Joyner MJ, Dietz NM, Boerwinkle E and Turner ST. (2003) Beta(2)-adrenergic receptor polymorphism and nitric oxide-dependent forearm blood flow responses to isoproterenol in humans. *J Physiol (Lond.)* **546**: 583-9 [PMID:12527744]
268. Gauthier C, Tavernier G, Charpentier F, Langin D and Le Marec H. (1996) Functional beta3-adrenoceptor in the human heart. *J Clin Invest* **98**: 556-62 [PMID:8755668]
269. Gavin KT, Colgan MP, Moore D, Shanik G and Docherty JR. (1997) Alpha 2C-adrenoceptors mediate contractile responses to noradrenaline in the human saphenous vein. *Naunyn Schmiedebergs Arch Pharmacol* **355**: 406-11 [PMID:9089673]
270. Germack R, Starzec AB, Vassy R and Perret GY. (1997) Beta-adrenoceptor subtype expression and function in rat white adipocytes. *Br J Pharmacol* **120**: 201-10 [PMID:9117110]
271. Giardinà D, Crucianelli M, Romanelli R, Leonardi A, Poggesi E and Melchiorre C. (1996) Synthesis and biological profile of the enantiomers of [4-(4-amino-6,7-dimethoxyquinazolin-2-yl)-cis-octahydroquinoxalin- 1-yl]furan-2-ylmethanone (cyclazosin), a potent competitive alpha 1B-adrenoceptor antagonist. *J Med Chem* **39**: 4602-7 [PMID:8917649]
272. Gibbs ME and Summers RJ. (2005) Contrasting roles for beta1, beta2 and beta3-adrenoceptors in memory formation in the chick. *Neuroscience* **131**: 31-42 [PMID:15680689]
273. Giessler C, Wangemann T, Silber RE, Dhein S and Brodde OE. (2002) Noradrenaline-induced contraction of human saphenous vein and human internal mammary artery: involvement of different alpha-adrenoceptor subtypes. *Naunyn Schmiedebergs Arch Pharmacol* **366**: 104-9 [PMID:12122495]
274. Giordani L, Cuzziol N, Del Pinto T, Sanchez M, Maccari S, Massimi A, Pietraforte D and Viora M. (2015) β2-Agonist clenbuterol hinders human monocyte differentiation into dendritic cells. *Exp Cell Res* **339**: 163-73 [PMID:26524508]
275. Giovannitti Jr JA, Thoms SM and Crawford JJ. (2015) Alpha-2 adrenergic receptor agonists: a review of current clinical applications. *Anesth Prog* **62**: 31-9 [PMID:25849473]

276. Gocayne J, Robinson DA, FitzGerald MG, Chung FZ, Kerlavage AR, Lentes KU, Lai J, Wang CD, Fraser CM and Venter JC. (1987) Primary structure of rat cardiac beta-adrenergic and muscarinic cholinergic receptors obtained by automated DNA sequence analysis: further evidence for a multigene family. *Proc Natl Acad Sci USA* **84**: 8296-300 [PMID:2825184]
277. Gonzalez-Cabrera PJ, Shi T, Yun J, McCune DF, Rorabaugh BR and Perez DM. (2004) Differential regulation of the cell cycle by alpha1-adrenergic receptor subtypes. *Endocrinology* **145**: 5157-67 [PMID:15297446]
278. González-Arenas A, Aguilar-Maldonado B, Avendaño-Vázquez SE and García-Sáinz JA. (2006) Estrogens cross-talk to alpha1b-adrenergic receptors. *Mol Pharmacol* **70**: 154-62 [PMID:16638969]
279. González-Hernández Mde L, Godínez-Hernández D, Bobadilla-Lugo RA and López-Sánchez P. (2010) Angiotensin-II type 1 receptor (AT1R) and alpha-1D adrenoceptor form a heterodimer during pregnancy-induced hypertension. *Auton Autacoid Pharmacol* **30**: 167-72 [PMID:20102360]
280. Gradinaru I, Babaeva E, Schwinn DA and Oganesian A. (2015) Alpha1a-Adrenoceptor Genetic Variant Triggers Vascular Smooth Muscle Cell Hyperproliferation and Agonist Induced Hypertrophy via EGFR Transactivation Pathway. *PLoS One* **10**: e0142787 [PMID:26571308]
281. Graham RM, Perez DM, Hwa J and Piascik MT. (1996) alpha 1-adrenergic receptor subtypes. Molecular structure, function, and signaling. *Circ Res* **78**: 737-49 [PMID:8620593]
282. Granneman JG. (2001) The putative beta4-adrenergic receptor is a novel state of the beta1-adrenergic receptor. *Am J Physiol Endocrinol Metab* **280**: E199-202 [PMID:11158920]
283. Granneman JG, Lahners KN and Chaudhry A. (1991) Molecular cloning and expression of the rat beta 3-adrenergic receptor. *Mol Pharmacol* **40**: 895-899 [PMID:1684635]
284. Gray K, Short J and Ventura S. (2008) The alpha1A-adrenoceptor gene is required for the alpha1L-adrenoceptor-mediated response in isolated preparations of the mouse prostate. *Br J Pharmacol* **155**: 103-9 [PMID:18552869]
285. Greuel JM and Glaser T. (1992) The putative 5-HT1A receptor antagonists NAN-190 and BMY 7378 are partial agonists in the rat dorsal raphe nucleus in vitro. *Eur J Pharmacol* **211**: 211-9 [PMID:1535319]
286. Grisan F, Burdyga A, Iannucci LF, Surdo NC, Pozzan T, Di Benedetto G and Lefkimmiatis K. (2020) Studying β_1 and β_2 adrenergic receptor signals in cardiac cells using FRET-based sensors. *Prog Biophys Mol Biol* **154**: 30-38 [PMID:31266653]
287. Grisanti LA, Gumpert AM, Traynham CJ, Gorsky JE, Repas AA, Gao E, Carter RL, Yu D, Calvert JW and García AP *et al.*. (2016) Leukocyte-Expressed β2-Adrenergic Receptors Are Essential for Survival After Acute Myocardial Injury. *Circulation* **134**: 153-67 [PMID:27364164]
288. Gu D, Ge D, Snieder H, He J, Chen S, Huang J, Li B, Chen R and Qiang B. (2006) Association of alpha1A adrenergic receptor gene variants on chromosome 8p21 with human stage 2 hypertension. *J Hypertens* **24**: 1049-56 [PMID:16685204]
289. Guereschi MG, Araujo LP, Maricato JT, Takenaka MC, Nascimento VM, Vivanco BC, Reis VO, Keller AC, Brum PC and Basso AS. (2013) Beta2-adrenergic receptor signaling in CD4+ Foxp3+ regulatory T cells enhances their suppressive function in a PKA-dependent manner. *Eur J Immunol* **43**: 1001-12 [PMID:23436577]
290. Guhan AR, Cooper S, Oborne J, Lewis S, Bennett J and Tattersfield AE. (2000) Systemic effects of formoterol and salmeterol: a dose-response comparison in healthy subjects. *Thorax* **55**: 650-6 [PMID:10899240]
291. Gupta MK, Papay RS, Jurgens CW, Gaivin RJ, Shi T, Doze VA and Perez DM. (2009) alpha1-Adrenergic receptors regulate neurogenesis and gliogenesis. *Mol Pharmacol* **76**: 314-26 [PMID:19487244]
292. Haack KK, Tougas MR, Jones KT, El-Dahr SS, Radhakrishna H and McCarty NA. (2010) A novel bioassay for detecting GPCR heterodimerization: transactivation of beta 2 adrenergic receptor by bradykinin receptor. *J Biomol Screen* **15**: 251-60 [PMID:20150590]
293. Hadi T, Barrichon M, Mourtialon P, Wendremaire M, Garrido C, Sagot P, Bardou M and Lirussi F. (2013) Biphasic Erk1/2 activation sequentially involving Gs and Gi signaling is required in beta3-adrenergic receptor-induced primary smooth muscle cell proliferation. *Biochim Biophys Acta* **1833**: 1041-51 [PMID:23388888]
294. Hague C, Bernstein LS, Ramineni S, Chen Z, Minneman KP and Hepler JR. (2005) Selective inhibition of alpha1A-adrenergic receptor signaling by RGS2 association with the receptor third intracellular loop. *J Biol Chem* **280**: 27289-95 [PMID:15917235]
295. Hague C, Chen Z, Pupo AS, Schulte NA, Toews ML and Minneman KP. (2004) The N terminus of the human alpha1D-adrenergic receptor prevents cell surface expression. *J Pharmacol Exp Ther* **309**: 388-97 [PMID:14718583]
296. Hague C, Chen Z, Uberti M and Minneman KP. (2003) Alpha(1)-adrenergic receptor subtypes: non-identical triplets with different dancing partners? *Life Sci* **74**: 411-8 [PMID:14609720]
297. Hague C, Lee SE, Chen Z, Prinster SC, Hall RA and Minneman KP. (2006) Heterodimers of alpha1B- and alpha1D-adrenergic receptors form a single functional entity. *Mol Pharmacol* **69**:

45-55 [PMID:16195468]
298. Hague C, Uberti MA, Chen Z, Bush CF, Jones SV, Ressler KJ, Hall RA and Minneman KP. (2004) Olfactory receptor surface expression is driven by association with the beta2-adrenergic receptor. *Proc Natl Acad Sci USA* **101**: 13672-6 [PMID:15347813]
299. Hague C, Uberti MA, Chen Z, Hall RA and Minneman KP. (2004) Cell surface expression of alpha1D-adrenergic receptors is controlled by heterodimerization with alpha1B-adrenergic receptors. *J Biol Chem* **279**: 15541-9 [PMID:14736874]
300. Haley JM, Thackeray JT, Thorn SL and DaSilva JN. (2015) Cardiac β-Adrenoceptor Expression Is Reduced in Zucker Diabetic Fatty Rats as Type-2 Diabetes Progresses. *PLoS One* **10**: e0127581 [PMID:25996498]
301. Hampel C, Dolber PC, Smith MP, Savic SL, Th roff JW, Thor KB and Schwinn DA. (2002) Modulation of bladder alpha1-adrenergic receptor subtype expression by bladder outlet obstruction. *J Urol* **167**: 1513-21 [PMID:11832780]
302. Han C, Abel PW and Minneman KP. (1987) Heterogeneity of alpha 1-adrenergic receptors revealed by chlorethylclonidine. *Mol Pharmacol* **32**: 505-10 [PMID:2890094]
303. Han JL, Zhang YY, Lü ZZ, Mao JM, Chen MZ and Han QD. (2003) Functional alpha1-adrenergic receptor subtypes in human right gastroepiploic artery. *Acta Pharmacol Sin* **24**: 327-31 [PMID:12676072]
304. Hancock AA, DeLean AL and Lefkowitz RJ. (1979) Quantitative resolution of beta-adrenergic receptor subtypes by selective ligand binding: application of a computerized model fitting technique. *Mol Pharmacol* **16**: 1-9 [PMID:39239]
305. Handy DE, Flordellis CS, Bogdanova NN, Bresnahan MR and Gavras H. (1993) Diverse tissue expression of rat alpha 2-adrenergic receptor genes. *Hypertension* **21**: 861-5 [PMID:7684725]
306. Hanson MA, Cherezov V, Griffith MT, Roth CB, Jaakola VP, Chien EY, Velasquez J, Kuhn P and Stevens RC. (2008) A specific cholesterol binding site is established by the 2.8 A structure of the human beta2-adrenergic receptor. *Structure* **16**: 897-905 [PMID:18547522]
307. Harasawa I, Honda K, Tanoue A, Shinoura H, Ishida Y, Okamura H, Murao N, Tsujimoto G, Higa K and Kamiya HO *et al*.. (2003) Responses to noxious stimuli in mice lacking alpha(1d)-adrenergic receptors. *Neuroreport* **14**: 1857-60 [PMID:14534435]
308. Harris DA, Park JM, Lee KS, Xu C, Stella N and Hague C. (2017) Label-Free Dynamic Mass Redistribution Reveals Low-Density, Prosurvival α_{1B}-Adrenergic Receptors in Human SW480 Colon Carcinoma Cells. *J Pharmacol Exp Ther* **361**: 219-228 [PMID:28196836]
309. Hatanaka T, Ukai M, Watanabe M, Someya A, Ohtake A, Suzuki M, Ueshima K, Sato S and Sasamata M. (2013) In vitro and in vivo pharmacological profile of the selective β3-adrenoceptor agonist mirabegron in rats. *Naunyn Schmiedebergs Arch Pharmacol* **386**: 247-53 [PMID:23239087]
310. Havekes R, Canton DA, Park AJ, Huang T, Nie T, Day JP, Guercio LA, Grimes Q, Luczak V and Gelman IH *et al*.. (2012) Gravin orchestrates protein kinase A and β2-adrenergic receptor signaling critical for synaptic plasticity and memory. *J Neurosci* **32**: 18137-49 [PMID:23238728]
311. Hayashi R, Ohmori E, Moriwaki M, Kumagai H and Isogaya M. (2015) Indolylpiperidine derivatives as potent and selective α1B adrenoceptor antagonists. *Bioorg Med Chem Lett* **25**: 3921-3 [PMID:26238322]
312. Heal DJ, Gosden J and Smith SL. (2024) A critical assessment of the abuse, dependence and associated safety risks of naturally occurring and synthetic cannabinoids. *Front Psychiatry* **15**: 1322434 [PMID:38915848]
313. Hebert TE, Moffett S, Morello JP, Loisel TP, Bichet DG, Barret C and Bouvier M. (1996) A peptide derived from a beta2-adrenergic receptor transmembrane domain inhibits both receptor dimerization and activation. *J Biol Chem* **271**: 16384-92 [PMID:8663163]
314. Hein L, Altman JD and Kobilka BK. (1999) Two functionally distinct alpha2-adrenergic receptors regulate sympathetic neurotransmission. *Nature* **402**: 181-4 [PMID:10647009]
315. Hein L, Limbird LE, Eglen RM and Kobilka BK. (1999) Gene substitution/knockout to delineate the role of alpha 2-adrenoceptor subtypes in mediating central effects of catecholamines and imidazolines. *Ann N Y Acad Sci* **881**: 265-71 [PMID:10415924]
316. Hein P and Michel MC. (2007) Signal transduction and regulation: are all alpha1-adrenergic receptor subtypes created equal? *Biochem Pharmacol* **73**: 1097-106 [PMID:17141737]
317. Hennenberg M and Michel MC. (2024) Adrenoceptors in the Lower Urinary Tract. *Handb Exp Pharmacol* **285**: 333-367 [PMID:37455288]
318. Hering L, Rahman M, Hoch H, Markó L, Yang G, Reil A, Yakoub M, Gupta V, Potthoff SA and Vonend O *et al*.. (2020) α2A-Adrenoceptors Modulate Renal Sympathetic Neurotransmission and Protect against Hypertensive Kidney Disease. *J Am Soc Nephrol* **31**: 783-798 [PMID:32086277]
319. Hermida N, Michel L, Esfahani H, Dubois-Deruy E, Hammond J, Bouzin C, Markl A, Colin H, Steenbergen AV and De Meester C *et al*.. (2018) Cardiac myocyte β3-adrenergic receptors prevent myocardial fibrosis by modulating oxidant stress-dependent paracrine signaling. *Eur Heart J* **39**: 888-898 [PMID:29106524]
320. Hernández-Espinosa DA, Carmona-Rosas G, Alfonzo-Méndez MA, Alcántara-Hernández R and

García-Sáinz JA. (2019) Sites phosphorylated in human α_{1B}-adrenoceptors in response to noradrenaline and phorbol myristate acetate. *Biochim Biophys Acta Mol Cell Res* **1866**: 1509-1519 [PMID:31325464]

321. Hernández-Espinosa DA, Reyes-Cruz G and García-Sáinz JA. (2020) Roles of the G protein-coupled receptor kinase 2 and Rab5 in α_{1B}-adrenergic receptor function and internalization. *Eur J Pharmacol* **867**: 172846 [PMID:31811856]
322. Hernández-Pacheco G, González-Hermosillo A, Murata C, Yescas P, Espínola-Zavaleta N, Martínez M and Serrano H. (2014) Arg347Cys polymorphism of α1a-adrenergic receptor in vasovagal syncope. Case-control study in a Mexican population. *Auton Neurosci* **183**: 66-71 [PMID:24548768]
323. Hervé J, Dubreil L, Tardif V, Terme M, Pogu S, Anegon I, Rozec B, Gauthier C, Bach JM and Blancou P. (2013) β2-Adrenoreceptor agonist inhibits antigen cross-presentation by dendritic cells. *J Immunol* **190**: 3163-71 [PMID:23420884]
324. Heubach JF, Trebess I, Wettwer E, Himmel HM, Michel MC, Kaumann AJ, Koch WJ, Harding SE and Ravens U. (1999) L-type calcium current and contractility in ventricular myocytes from mice overexpressing the cardiac beta 2-adrenoceptor. *Cardiovasc Res* **42**: 173-82 [PMID:10435008]
325. Hieble JP. (2000) Adrenoceptor subclassification: an approach to improved cardiovascular therapeutics. *Pharm Acta Helv* **74**: 163-71 [PMID:10812954]
326. Hieble JP, Bondinell WE and Ruffolo Jr RR. (1995) Alpha- and beta-adrenoceptors: from the gene to the clinic. 1. Molecular biology and adrenoceptor subclassification. *J Med Chem* **38**: 3415-44 [PMID:7658428]
327. Hieble JP, Bylund DB, Clarke DE, Eikenburg DC, Langer SZ, Lefkowitz RJ, Minneman KP and Ruffolo Jr RR. (1995) International Union of Pharmacology. X. Recommendation for nomenclature of alpha 1-adrenoceptors: consensus update. *Pharmacol Rev* **47**: 267-70 [PMID:7568329]
328. Hieble JP and Ruffolo Jr RR. (1997) Recent advances in the identification of alpha1- and alpha2-adrenoceptor subtypes: therapeutic implications. *Expert Opin Investig Drugs* **6**: 367-87 [PMID:15989605]
329. Hieble JP and Ruffolo Jr RR. (1996) Subclassification and nomenclature of alpha 1- and alpha 2-adrenoceptors. *Prog Drug Res* **47**: 81-130 [PMID:8961765]
330. Hiller JG, Cole SW, Crone EM, Byrne DJ, Shackleford DM, Pang JB, Henderson MA, Nightingale SS, Ho KM and Myles PS *et al.*. (2020) Preoperative β-Blockade with Propranolol Reduces Biomarkers of Metastasis in Breast Cancer: A Phase II Randomized Trial. *Clin Cancer Res* **26**: 1803-1811 [PMID:31754048]
331. Hillman KL, Doze VA and Porter JE. (2005) Functional characterization of the beta-adrenergic receptor subtypes expressed by CA1 pyramidal cells in the rat hippocampus. *J Pharmacol Exp Ther* **314**: 561-7 [PMID:15908513]
332. Hirasawa A, Shibata K, Horie K, Takei Y, Obika K, Tanaka T, Muramoto N, Takagaki K, Yano J and Tsujimoto G. (1995) Cloning, functional expression and tissue distribution of human alpha 1c-adrenoceptor splice variants. *FEBS Lett* **363**: 256-60 [PMID:7737411]
333. Hodges RR, Shatos MA, Tarko RS, Vrouvlianis J, Gu J and Dartt DA. (2005) Nitric oxide and cGMP mediate alpha1D-adrenergic receptor-Stimulated protein secretion and p42/p44 MAPK activation in rat lacrimal gland. *Invest Ophthalmol Vis Sci* **46**: 2781-9 [PMID:16043851]
334. Hoenke C, Bouyssou T, Tautermann CS, Rudolf K, Schnapp A and Konetzki I. (2009) Use of 5-hydroxy-4H-benzo[1,4]oxazin-3-ones as beta2-adrenoceptor agonists. *Bioorg Med Chem Lett* **19**: 6640-4 [PMID:19875286]
335. Hoffmann C, Leitz MR, Oberdorf-Maass S, Lohse MJ and Klotz KN. (2004) Comparative pharmacology of human beta-adrenergic receptor subtypes--characterization of stably transfected receptors in CHO cells. *Naunyn Schmiedebergs Arch Pharmacol* **369**: 151-9 [PMID:14730417]
336. Hohberger B, Kunze R, Wallukat G, Kara K, Mardin CY, Lämmer R, Schlötzer-Schrehardt U, Hosari S, Horn F and Munoz L *et al.*. (2019) Autoantibodies Activating the β2-Adrenergic Receptor Characterize Patients With Primary and Secondary Glaucoma. *Front Immunol* **10**: 2112 [PMID:31632387]
337. Hoit BD, Suresh DP, Craft L, Walsh RA and Liggett SB. (2000) beta2-adrenergic receptor polymorphisms at amino acid 16 differentially influence agonist-stimulated blood pressure and peripheral blood flow in normal individuals. *Am Heart J* **139**: 537-42 [PMID:10689270]
338. Honda K, Yamaguchi O, Nomiya M, Shishido K, Ishibashi K, Takahashi N and Aikawa K. (2014) Association between polymorphism of beta3-adrenoceptor gene and overactive bladder. *Neurourol Urodyn* **33**: 400-2 [PMID:24038238]
339. Horie K, Obika K, Foglar R and Tsujimoto G. (1995) Selectivity of the imidazoline alpha-adrenoceptor agonists (oxymetazoline and cirazoline) for human cloned alpha 1-adrenoceptor subtypes. *Br J Pharmacol* **116**: 1611-8 [PMID:8564227]
340. Hosoda C, Koshimizu TA, Tanoue A, Nasa Y, Oikawa R, Tomabechi T, Fukuda S, Shinoura H, Oshikawa S and Takeo S *et al.*. (2005) Two alpha1-adrenergic receptor subtypes regulating the

vasopressor response have differential roles in blood pressure regulation. *Mol Pharmacol* **67**: 912-22 [PMID:15598970]
341. Hostrup M and Onslev J. (2022) The beta$_2$ -adrenergic receptor - a re-emerging target to combat obesity and induce leanness? *J Physiol* **600**: 1209-1227 [PMID:34676534]
342. Hou DY, Xu L, Zhang ZY, Xu XR, Wang X, Zhang J, Liu JM, Wang H, Chen J and Zhang L. (2020) Clinical value of detecting autoantibodies against β_1-, β_2,- and α_1-adrenergic receptors in carvedilol treatment of patients with heart failure. *J Geriatr Cardiol* **17**: 305-312 [PMID:32670360]
343. Hrometz SL, Edelmann SE, McCune DF, Olges JR, Hadley RW, Perez DM and Piascik MT. (1999) Expression of multiple alpha1-adrenoceptors on vascular smooth muscle: correlation with the regulation of contraction. *J Pharmacol Exp Ther* **290**: 452-63 [PMID:10381812]
344. Huang HH, Brennan TC, Muir MM and Mason RS. (2009) Functional alpha1- and beta2-adrenergic receptors in human osteoblasts. *J Cell Physiol* **220**: 267-75 [PMID:19334040]
345. Huang J, Chen S, Zhang JJ and Huang XY. (2013) Crystal structure of oligomeric β1-adrenergic G protein-coupled receptors in ligand-free basal state. *Nat Struct Mol Biol* **20**: 419-25 [PMID:23435379]
346. Huang Q, Yang TL, Tang BS, Chen X, Huang X, Luo XH, Zhu YS, Chen XP, Hu PC and Chen J *et al.*. (2013) Two novel functional single nucleotide polymorphisms of ADRB3 are associated with type 2 diabetes in the Chinese population. *J Clin Endocrinol Metab* **98**: E1272-7 [PMID:23640967]
347. Huang Y, Wright CD, Merkwan CL, Baye NL, Liang Q, Simpson PC and O'Connell TD. (2007) An alpha1A-adrenergic-extracellular signal-regulated kinase survival signaling pathway in cardiac myocytes. *Circulation* **115**: 763-72 [PMID:17283256]
348. Hudson BD, Hébert TE and Kelly ME. (2010) Physical and functional interaction between CB1 cannabinoid receptors and beta2-adrenoceptors. *Br J Pharmacol* **160**: 627-42 [PMID:20590567]
349. Hughes PL and Morse RM. (1985) Use of clonidine in a mixed-drug detoxification regimen: possibility of masking of clinical signs of sedative withdrawal. *Mayo Clin Proc* **60**: 47-9 [PMID:2856945]
350. Hunter JC, Fontana DJ, Hedley LR, Jasper JR, Lewis R, Link RE, Secchi R, Sutton J and Eglen RM. (1997) Assessment of the role of alpha2-adrenoceptor subtypes in the antinociceptive, sedative and hypothermic action of dexmedetomidine in transgenic mice. *Br J Pharmacol* **122**: 1339-44 [PMID:9421280]
351. Huo S, Zhong X, Wu X and Li Y. (2012) Effects of norepinephrine and acetylcholine on the development of cultured Leydig cells in mice. *J Biomed Biotechnol* **2012**: 503093 [PMID:23093848]
352. Hussain MB and Marshall I. (1997) Characterization of alpha1-adrenoceptor subtypes mediating contractions to phenylephrine in rat thoracic aorta, mesenteric artery and pulmonary artery. *Br J Pharmacol* **122**: 849-58 [PMID:9384500]
353. Hutchinson DR. (1989) Modified release tizanidine: a review. *J Int Med Res* **17**: 565-73 [PMID:2697626]
354. Hutchinson DS, Bengtsson T, Evans BA and Summers RJ. (2002) Mouse beta 3a- and beta 3b-adrenoceptors expressed in Chinese hamster ovary cells display identical pharmacology but utilize distinct signalling pathways. *Br J Pharmacol* **135**: 1903-14 [PMID:11959793]
355. Hutchinson DS, Chernogubova E, Sato M, Summers RJ and Bengtsson T. (2006) Agonist effects of zinterol at the mouse and human beta(3)-adrenoceptor. *Naunyn Schmiedebergs Arch Pharmacol* **373**: 158-68 [PMID:16601951]
356. Hwa J, Graham RM and Perez DM. (1996) Chimeras of alpha1-adrenergic receptor subtypes identify critical residues that modulate active state isomerization. *J Biol Chem* **271**: 7956-64 [PMID:8626475]
357. Hwa J, Graham RM and Perez DM. (1995) Identification of critical determinants of alpha 1-adrenergic receptor subtype selective agonist binding. *J Biol Chem* **270**: 23189-95 [PMID:7559466]
358. Hwa J and Perez DM. (1996) The unique nature of the serine interactions for alpha 1-adrenergic receptor agonist binding and activation. *J Biol Chem* **271**: 6322-7 [PMID:8626427]
359. Igawa Y and Michel MC. (2013) Pharmacological profile of β3-adrenoceptor agonists in clinical development for the treatment of overactive bladder syndrome. *Naunyn Schmiedebergs Arch Pharmacol* **386**: 177-83 [PMID:23263450]
360. Ingebrigtsen TS, Vestbo J, Rode L, Marott JL, Lange P and Nordestgaard BG. (2019) β_2-Adrenergic genotypes and risk of severe exacerbations in COPD: a prospective cohort study. *Thorax* **74**: 934-940 [PMID:31481635]
361. Ippolito M, De Pascali F, Inoue A and Benovic JL. (2022) Phenylalanine 193 in Extracellular Loop 2 of the β_2-Adrenergic Receptor Coordinates β-Arrestin Interaction. *Mol Pharmacol* **101**: 87-94 [PMID:34853152]
362. Ishibashi T, Horisawa T, Tokuda K, Ishiyama T, Ogasa M, Tagashira R, Matsumoto K, Nishikawa H, Ueda Y and Toma S *et al.*. (2010) Pharmacological profile of lurasidone, a novel antipsychotic

agent with potent 5-hydroxytryptamine 7 (5-HT7) and 5-HT1A receptor activity. *J Pharmacol Exp Ther* **334**: 171-81 [PMID:20404009]
363. Ishihama H, Momota Y, Yanase H, Wang X, de Groat WC and Kawatani M. (2006) Activation of alpha1D adrenergic receptors in the rat urothelium facilitates the micturition reflex. *J Urol* **175**: 358-64 [PMID:16406942]
364. Isogaya M, Sugimoto Y, Tanimura R, Tanaka R, Kikkawa H, Nagao T and Kurose H. (1999) Binding pockets of the beta(1)- and beta(2)-adrenergic receptors for subtype-selective agonists. *Mol Pharmacol* **56**: 875-85 [PMID:10531390]
365. Ito K, Dezaki K, Yoshida M, Yamada H, Miura R, Rita RS, Ookawara S, Tabei K, Kawakami M and Hara K *et al.*. (2017) Endogenous α2A-Adrenoceptor-Operated Sympathoadrenergic Tones Attenuate Insulin Secretion via cAMP/TRPM2 Signaling. *Diabetes* **66**: 699-709 [PMID:28028077]
366. Izeboud CA, Vermeulen RM, Zwart A, Voss HP, van Miert AS and Witkamp RF. (2000) Stereoselectivity at the beta2-adrenoceptor on macrophages is a major determinant of the anti-inflammatory effects of beta2-agonists. *Naunyn Schmiedebergs Arch Pharmacol* **362**: 184-9 [PMID:10961382]
367. Jahnsen JA and Uhlén S. (2013) The C-terminal half of the α2C-adrenoceptor determines the receptor's membrane expression level and drug selectivity. *Naunyn Schmiedebergs Arch Pharmacol* **386**: 1031-40 [PMID:23868076]
368. Jampel HD, Robin AL, Quigley HA and Pollack IP. (1988) Apraclonidine. A one-week dose-response study. *Arch Ophthalmol* **106**: 1069-73 [PMID:3041944]
369. Janezic EM, Harris DA, Dinh D, Lee KS, Stewart A, Hinds TR, Hsu PL, Zheng N and Hague C. (2019) Scribble co-operatively binds multiple α_{1D}-adrenergic receptor C-terminal PDZ ligands. *Sci Rep* **9**: 14073 [PMID:31575922]
370. Janezic EM, Lauer SM, Williams RG, Chungyoun M, Lee KS, Navaluna E, Lau HT, Ong SE and Hague C. (2020) N-glycosylation of α_{1D}-adrenergic receptor N-terminal domain is required for correct trafficking, function, and biogenesis. *Sci Rep* **10**: 7209 [PMID:32350295]
371. Janssen PML, Canan BD, Kilic A, Whitson BA and Baker AJ. (2018) Human Myocardium Has a Robust α1A-Subtype Adrenergic Receptor Inotropic Response. *J Cardiovasc Pharmacol* **72**: 136-142 [PMID:29923888]
372. January B, Seibold A, Whaley B, Hipkin RW, Lin D, Schonbrunn A, Barber R and Clark RB. (1997) beta2-adrenergic receptor desensitization, internalization, and phosphorylation in response to full and partial agonists. *J Biol Chem* **272**: 23871-9 [PMID:9295336]
373. Jarajapu YP, Johnston F, Berry C, Renwick A, McGrath JC, MacDonald A and Hillier C. (2001) Functional characterization of alpha1-adrenoceptor subtypes in human subcutaneous resistance arteries. *J Pharmacol Exp Ther* **299**: 729-34 [PMID:11602687]
374. Jarajapu YP, McGrath JC, Hillier C and MacDonald A. (2003) The alpha 1-adrenoceptor profile in human skeletal muscle resistance arteries in critical limb ischaemia. *Cardiovasc Res* **57**: 554-62 [PMID:12566128]
375. Jasper JR, Lesnick JD, Chang LK, Yamanishi SS, Chang TK, Hsu SA, Daunt DA, Bonhaus DW and Eglen RM. (1998) Ligand efficacy and potency at recombinant alpha2 adrenergic receptors: agonist-mediated [35S]GTPgammaS binding. *Biochem Pharmacol* **55**: 1035-43 [PMID:9605427]
376. Jasper JR, Link RE, Chruscinski AJ, Kobilka BK and Bernstein D. (1993) Primary structure of the mouse beta 1-adrenergic receptor gene. *Biochim Biophys Acta* **1178**: 307-9 [PMID:8395893]
377. Jeff JM, Donahue BS, Brown-Gentry K, Roden DM, Crawford DC, Stein CM and Kurnik D. (2014) Genetic variation in the β1-adrenergic receptor is associated with the risk of atrial fibrillation after cardiac surgery. *Am Heart J* **167**: 101-108.e1 [PMID:24332148]
378. Jensen BC, Swigart PM, Laden ME, DeMarco T, Hoopes C and Simpson PC. (2009) The alpha-1D Is the predominant alpha-1-adrenergic receptor subtype in human epicardial coronary arteries. *J Am Coll Cardiol* **54**: 1137-45 [PMID:19761933]
379. Jensen BC, Swigart PM, Montgomery MD and Simpson PC. (2010) Functional alpha-1B adrenergic receptors on human epicardial coronary artery endothelial cells. *Naunyn Schmiedebergs Arch Pharmacol* **382**: 475-82 [PMID:20857090]
380. Jensen CJ, Demol F, Bauwens R, Kooijman R, Massie A, Villers A, Ris L and De Keyser J. (2016) Astrocytic β2 Adrenergic Receptor Gene Deletion Affects Memory in Aged Mice. *PLoS One* **11**: e0164721 [PMID:27776147]
381. Jiang S, Mao G, Zhang S, Hong X, Tang G, Li Z, Liu X, Zhang Y, Wang B and Xu X *et al.*. (2005) Individual and joint association of alpha1A-adrenergic receptor Arg347Cys polymorphism and plasma irbesartan concentration with blood pressure therapeutic response in Chinese hypertensive subjects. *Clin Pharmacol Ther* **78**: 239-48 [PMID:16153395]
382. Jockers R, Issad T, Zilberfarb V, de Coppet P, Marullo S and Strosberg AD. (1998) Desensitization of the beta-adrenergic response in human brown adipocytes. *Endocrinology* **139**: 2676-2684 [PMID:9607772]
383. Johnson RD and Minneman KP. (1987) Differentiation of α_1-adrenergic receptors linked to phosphatidylinositol turnover and cyclic AMP accumulation in rat brain. *Mol Pharmacol* **31**: 239-246 [PMID:2436033]

384. Johnstone EKM, See HB, Abhayawardana RS, Song A, Rosengren KJ, Hill SJ and Pfleger KDG. (2021) Investigation of Receptor Heteromers Using NanoBRET Ligand Binding. *Int J Mol Sci* **22** [PMID:33499147]
385. Joiner ML, Lisé MF, Yuen EY, Kam AY, Zhang M, Hall DD, Malik ZA, Qian H, Chen Y and Ulrich JD *et al.*. (2010) Assembly of a beta2-adrenergic receptor--GluR1 signalling complex for localized cAMP signalling. *EMBO J* **29**: 482-95 [PMID:19942860]
386. Jones SB, Halenda SP and Bylund DB. (1991) Alpha 2-adrenergic receptor stimulation of phospholipase A2 and of adenylate cyclase in transfected Chinese hamster ovary cells is mediated by different mechanisms. *Mol Pharmacol* **39**: 239-45 [PMID:1847497]
387. Jordan BA, Trapaidze N, Gomes I, Nivarthi R and Devi LA. (2001) Oligomerization of opioid receptors with beta 2-adrenergic receptors: a role in trafficking and mitogen-activated protein kinase activation. *Proc Natl Acad Sci USA* **98**: 343-8 [PMID:11134510]
388. Joseph SS, Lynham JA, Colledge WH and Kaumann AJ. (2004) Binding of (-)-[3H]-CGP12177 at two sites in recombinant human beta 1-adrenoceptors and interaction with beta-blockers. *Naunyn Schmiedebergs Arch Pharmacol* **369**: 525-32 [PMID:15060759]
389. Joseph SS, Lynham JA, Grace AA, Colledge WH and Kaumann AJ. (2004) Markedly reduced effects of (-)-isoprenaline but not of (-)-CGP12177 and unchanged affinity of beta-blockers at Gly389-beta1-adrenoceptors compared to Arg389-beta1-adrenoceptors. *Br J Pharmacol* **142**: 51-6 [PMID:15037517]
390. Joseph SS, Lynham JA, Molenaar P, Grace AA, Colledge WH and Kaumann AJ. (2003) Intrinsic sympathomimetic activity of (-)-pindolol mediated through a (-)-propranolol-resistant site of the beta1-adrenoceptor in human atrium and recombinant receptors. *Naunyn Schmiedebergs Arch Pharmacol* **368**: 496-503 [PMID:14608456]
391. Jung H, Windhaber R, Palm D and Schnackerz KD. (1995) NMR and circular dichroism studies of synthetic peptides derived from the third intracellular loop of the beta-adrenoceptor. *FEBS Lett* **358**: 133-6 [PMID:7828722]
392. Kable JW, Murrin LC and Bylund DB. (2000) In vivo gene modification elucidates subtype-specific functions of alpha(2)-adrenergic receptors. *J Pharmacol Exp Ther* **293**: 1-7 [PMID:10734146]
393. Kalinovich A, Dehvari N, Åslund A, van Beek S, Halleskog C, Olsen J, Forsberg E, Zacharewicz E, Schaart G and Rinde M *et al.*. (2020) Treatment with a β-2-adrenoceptor agonist stimulates glucose uptake in skeletal muscle and improves glucose homeostasis, insulin resistance and hepatic steatosis in mice with diet-induced obesity. *Diabetologia* **63**: 1603-1615 [PMID:32472192]
394. Kamiar A, Yousefi K, Dunkley JC, Webster KA and Shehadeh LA. (2021) β_2-Adrenergic receptor agonism as a therapeutic strategy for kidney disease. *Am J Physiol Regul Integr Comp Physiol* **320**: R575-R587 [PMID:33565369]
395. Kamikihara SY, Mueller A, Lima V, Silva AR, da Costa IB, Buratini Jr J and Pupo AS. (2005) Differential distribution of functional alph}1-adrenergic receptor subtypes along the rat tail artery. *J Pharmacol Exp Ther* **314**: 753-61 [PMID:15872040]
396. Kanagy NL. (2005) Alpha(2)-adrenergic receptor signalling in hypertension. *Clin Sci (Lond)* **109**: 431-7 [PMID:16232127]
397. Kandasamy K, Choudhury S, Singh V, Addison MP, Darzi SA, Kasa JK, Thangamalai R, Dash JR, Kumar T and Sultan F *et al.*. (2016) Erythropoietin Reverses Sepsis-Induced Vasoplegia to Norepinephrine Through Preservation of α1D-Adrenoceptor mRNA Expression and Inhibition of GRK2-Mediated Desensitization in Mouse Aorta. *J Cardiovasc Pharmacol Ther* **21**: 100-13 [PMID:26025460]
398. Kannabiran SA, Gosejacob D, Niemann B, Nikolaev VO and Pfeifer A. (2020) Real-time monitoring of cAMP in brown adipocytes reveals differential compartmentation of β_1 and β_3-adrenoceptor signalling. *Mol Metab* **37**: 100986 [PMID:32247064]
399. Kao DP, Davis G, Aleong R, O'Connor CM, Fiuzat M, Carson PE, Anand IS, Plehn JF, Gottlieb SS and Silver MA *et al.*. (2013) Effect of bucindolol on heart failure outcomes and heart rate response in patients with reduced ejection fraction heart failure and atrial fibrillation. *Eur J Heart Fail* **15**: 324-33 [PMID:23223178]
400. Kaumann AJ. (1997) Four beta-adrenoceptor subtypes in the mammalian heart. *Trends Pharmacol Sci* **18**: 70-6 [PMID:9133774]
401. Kaumann AJ and Molenaar P. (2008) The low-affinity site of the beta1-adrenoceptor and its relevance to cardiovascular pharmacology. *Pharmacol Ther* **118**: 303-36 [PMID:18501968]
402. Kaumann AJ and Molenaar P. (1997) Modulation of human cardiac function through 4 beta-adrenoceptor populations. *Naunyn Schmiedebergs Arch Pharmacol* **355**: 667-81 [PMID:9205950]
403. Kaumann AJ, Preitner F, Sarsero D, Molenaar P, Revelli JP and Giacobino JP. (1998) (-)-CGP 12177 causes cardiostimulation and binds to cardiac putative beta 4-adrenoceptors in both wild-type and beta 3-adrenoceptor knockout mice. *Mol Pharmacol* **53**: 670-5 [PMID:9547357]
404. Kawanabe Y, Hashimoto N and Masaki T. (2004) Characterization of G proteins involved in

activation of nonselective cation channels and arachidonic acid release by norepinephrine/alpha1A-adrenergic receptors. *Am J Physiol, Cell Physiol* **286**: C596-600 [PMID:14761886]
405. Kennis LE, Bischoff FP, Mertens CJ, Love CJ, Van den Keybus FA, Pieters S, Braeken M, Megens AA and Leysen JE. (2000) New 2-substituted 1,2,3,4-tetrahydrobenzofuro[3,2-c]pyridine having highly active and potent central alpha 2-antagonistic activity as potential antidepressants. *Bioorg Med Chem Lett* **10**: 71-4 [PMID:10636247]
406. Kenny BA, Chalmers DH, Philpott PC and Naylor AM. (1995) Characterization of an alpha 1D-adrenoceptor mediating the contractile response of rat aorta to noradrenaline. *Br J Pharmacol* **115**: 981-6 [PMID:7582530]
407. Kern C, Meyer T, Droux S, Schollmeyer D and Miculka C. (2009) Synthesis and pharmacological characterization of beta2-adrenergic agonist enantiomers: zilpaterol. *J Med Chem* **52**: 1773-7 [PMID:19245211]
408. Khan MA, Sattar MA, Abdullah NA and Johns EJ. (2008) Alpha1B-adrenoceptors mediate adrenergically-induced renal vasoconstrictions in rats with renal impairment. *Acta Pharmacol Sin* **29**: 193-203 [PMID:18215348]
409. Khattar SK, Bora RS, Priyadarsiny P, Gautam A, Gupta D, Tiwari A, Nanda K, Singh R, Chugh A and Bansal V *et al*.. (2006) Molecular cloning, stable expression and cellular localization of human alpha1-adrenergic receptor subtypes: effect of charcoal/dextran treated serum on expression and localization of alpha1D -adrenergic receptor. *Biotechnol Lett* **28**: 1731-9 [PMID:16912925]
410. Kim TH, Chung KY, Manglik A, Hansen AL, Dror RO, Mildorf TJ, Shaw DE, Kobilka BK and Prosser RS. (2013) The role of ligands on the equilibria between functional states of a G protein-coupled receptor. *J Am Chem Soc* **135**: 9465-74 [PMID:23721409]
411. Kimura K, Sasaki N, Asano A, Mizukami J, Kayahashi S, Kawada T, Fushiki T, Morimatsu M, Yoshida T and Saito M. (2000) Mutated human beta3-adrenergic receptor (Trp64Arg) lowers the response to beta3-adrenergic agonists in transfected 3T3-L1 preadipocytes. *Horm Metab Res* **32**: 91-6 [PMID:10786926]
412. Kiss L, Cselenyák A and Visegrády A. (2019) Label-free drug screening assay multiplexed with an orthogonal time-resolved fluorescence labeled assay. *Anal Biochem* **566**: 126-132 [PMID:30452893]
413. Kitano T, Kobayashi T, Yamaguchi S and Otsuguro K. (2019) The α_{2A} -adrenoceptor subtype plays a key role in the analgesic and sedative effects of xylazine. *J Vet Pharmacol Ther* **42**: 243-247 [PMID:30417462]
414. Kleine-Brueggeney M, Gradinaru I, Babaeva E, Schwinn DA and Oganesian A. (2014) Alpha1a-adrenoceptor genetic variant induces cardiomyoblast-to-fibroblast-like cell transition via distinct signaling pathways. *Cell Signal* **26**: 1985-97 [PMID:24835978]
415. Knaus AE, Muthig V, Schickinger S, Moura E, Beetz N, Gilsbach R and Hein L. (2007) Alpha2-adrenoceptor subtypes--unexpected functions for receptors and ligands derived from gene-targeted mouse models. *Neurochem Int* **51**: 277-81 [PMID:17664025]
416. Knepper SM, Buckner SA, Brune ME, DeBernardis JF, Meyer MD and Hancock AA. (1995) A-61603, a potent alpha 1-adrenergic receptor agonist, selective for the alpha 1A receptor subtype. *J Pharmacol Exp Ther* **274**: 97-103 [PMID:7616455]
417. Knowlton KU, Michel MC, Itani M, Shubeita HE, Ishihara K, Brown JH and Chien KR. (1993) The alpha 1A-adrenergic receptor subtype mediates biochemical, molecular, and morphologic features of cultured myocardial cell hypertrophy. *J Biol Chem* **268**: 15374-80 [PMID:8393439]
418. Kobayashi S, Tomiyama Y, Hoyano Y, Yamazaki Y, Kusama H, Itoh Y, Kubota Y and Kohri K. (2009) Gene expressions and mechanical functions of α1-adrenoceptor subtypes in mouse ureter. *World J Urol* **27**: 775-80 [PMID:19259685]
419. Kobilka BK, Dixon RA, Frielle T, Dohlman HG, Bolanowski MA, Sigal IS, Yang-Feng TL, Francke U, Caron MG and Lefkowitz RJ. (1987) cDNA for the human beta 2-adrenergic receptor: a protein with multiple membrane-spanning domains and encoded by a gene whose chromosomal location is shared with that of the receptor for platelet-derived growth factor. *Proc Natl Acad Sci USA* **84**: 46-50 [PMID:3025863]
420. Kobilka BK, Frielle T, Collins S, Yang-Feng T, Kobilka TS, Francke U, Lefkowitz RJ and Caron MG. (1987) An intronless gene encoding a potential member of the family of receptors coupled to guanine nucleotide regulatory proteins. *Nature* **329**: 75-9 [PMID:3041227]
421. Kobilka BK, Matsui H, Kobilka TS, Yang-Feng TL, Francke U, Caron MG, Lefkowitz RJ and Regan JW. (1987) Cloning, sequencing, and expression of the gene coding for the human platelet alpha 2-adrenergic receptor. *Science* **238**: 650-6 [PMID:2823383]
422. Kobori N, Hu B and Dash PK. (2011) Altered adrenergic receptor signaling following traumatic brain injury contributes to working memory dysfunction. *Neuroscience* **172**: 293-302 [PMID:20974230]
423. Kodama D and Togari A. (2010) Modulation of potassium channels via the α1B-adrenergic receptor in human osteoblasts. *Neurosci Lett* **485**: 102-6 [PMID:20813157]

424. Kodama D and Togari A. (2013) Store-operated calcium entry induced by activation of Gq-coupled alpha1B adrenergic receptor in human osteoblast. *Biochem Biophys Res Commun* **437**: 239-44 [PMID:23806689]
425. Kohout TA, Takaoka H, McDonald PH, Perry SJ, Mao L, Lefkowitz RJ and Rockman HA. (2001) Augmentation of cardiac contractility mediated by the human beta(3)-adrenergic receptor overexpressed in the hearts of transgenic mice. *Circulation* **104**: 2485-91 [PMID:11705829]
426. Kojima Y, Sasaki S, Kubota Y, Hayase M, Hayashi Y, Shinoura H, Tsujimoto G and Kohri K. (2008) Expression of alpha1-adrenoceptor subtype mRNA as a predictor of the efficacy of subtype selective alpha1-adrenoceptor antagonists in the management of benign prostatic hyperplasia. *J Urol* **179**: 1040-6 [PMID:18206918]
427. Kojima Y, Sasaki S, Kubota Y, Imura M, Oda N, Kiniwa M, Hayashi Y and Kohri K. (2011) Up-regulation of α1a and α1d-adrenoceptors in the prostate by administration of subtype selective α1-adrenoceptor antagonist tamsulosin in patients with benign prostatic hyperplasia. *J Urol* **186**: 1530-6 [PMID:21855934]
428. Kompa AR and Summers RJ. (1999) Desensitization and resensitization of beta 1- and putative beta 4-adrenoceptor mediated responses occur in parallel in a rat model of cardiac failure. *Br J Pharmacol* **128**: 1399-406 [PMID:10602318]
429. Konkar AA, Zhu Z and Granneman JG. (2000) Aryloxypropanolamine and catecholamine ligand interactions with the beta(1)-adrenergic receptor: evidence for interaction with distinct conformations of beta(1)-adrenergic receptors. *J Pharmacol Exp Ther* **294**: 923-32 [PMID:10945842]
430. Koshimizu TA, Tanoue A, Hirasawa A, Yamauchi J and Tsujimoto G. (2003) Recent advances in alpha1-adrenoceptor pharmacology. *Pharmacol Ther* **98**: 235-44 [PMID:12725871]
431. Koshimizu TA, Tsujimoto G, Hirasawa A, Kitagawa Y and Tanoue A. (2004) Carvedilol selectively inhibits oscillatory intracellular calcium changes evoked by human alpha1D- and alpha1B-adrenergic receptors. *Cardiovasc Res* **63**: 662-72 [PMID:15306222]
432. Kotova PD, Sysoeva VY, Rogachevskaja OA, Bystrova MF, Kolesnikova AS, Tyurin-Kuzmin PA, Fadeeva JI, Tkachuk VA and Kolesnikov SS. (2014) Functional expression of adrenoreceptors in mesenchymal stromal cells derived from the human adipose tissue. *Biochim Biophys Acta* **1843**: 1899-908 [PMID:24841820]
433. Kountz TS, Lee KS, Aggarwal-Howarth S, Curran E, Park JM, Harris DA, Stewart A, Hendrickson J, Camp ND and Wolf-Yadlin A *et al.*. (2016) Endogenous N-terminal Domain Cleavage Modulates α1D-Adrenergic Receptor Pharmacodynamics. *J Biol Chem* **291**: 18210-21 [PMID:27382054]
434. Krief S, Lonnqvist F, Raimbault S, Baude B, Van Spronsen A, Arner P, Strosberg AD, Ricquier D and Emorine LJ. (1993) Tissue distribution of beta 3-adrenergic receptor mRNA in man. *J Clin Invest* **91**: 344-349 [PMID:8380813]
435. Krushinski Jr JH, Schaus JM, Thompson DC, Calligaro DO, Nelson DL, Luecke SH, Wainscott DB and Wong DT. (2007) Indoloxypropanolamine analogues as 5-HT(1A) receptor antagonists. *Bioorg Med Chem Lett* **17**: 5600-4 [PMID:17804228]
436. Kulkarni S and Wilkinson IB. (2024) Adrenoceptors and Hypertension. *Handb Exp Pharmacol* **285**: 297-332 [PMID:38890192]
437. Kunieda T, Zuscik MJ, Boongird A, Perez DM, Lüders HO and Najm IM. (2002) Systemic overexpression of the alpha 1B-adrenergic receptor in mice: an animal model of epilepsy. *Epilepsia* **43**: 1324-9 [PMID:12423381]
438. Kuravi S, Lan TH, Barik A and Lambert NA. (2010) Third-party bioluminescence resonance energy transfer indicates constitutive association of membrane proteins: application to class a g-protein-coupled receptors and g-proteins. *Biophys J* **98**: 2391-9 [PMID:20483349]
439. Kurko D, Kapui Z, Nagy J, Lendvai B and Kolok S. (2014) Analysis of functional selectivity through G protein-dependent and -independent signaling pathways at the adrenergic α(2C) receptor. *Brain Res Bull* **107**: 89-101 [PMID:25080296]
440. Lakhlani PP, Amenta F, Napoleone P, Felici L and Eikenburg DC. (1994) Pharmacological characterization and anatomical localization of prejunctional beta-adrenoceptors in the rat kidney. *Br J Pharmacol* **111**: 1296-1308 [PMID:8032617]
441. Lakhlani PP, MacMillan LB, Guo TZ, McCool BA, Lovinger DM, Maze M and Limbird LE. (1997) Substitution of a mutant alpha2a-adrenergic receptor via "hit and run" gene targeting reveals the role of this subtype in sedative, analgesic, and anesthetic-sparing responses in vivo. *Proc Natl Acad Sci USA* **94**: 9950-5 [PMID:9275232]
442. Lands AM, Arnold A, McAuliff JP, Luduena FP and Brown Jr TG. (1967) Differentiation of receptor systems activated by sympathomimetic amines. *Nature* **214**: 597-8 [PMID:6036174]
443. Langer SZ. (2015) α2-Adrenoceptors in the treatment of major neuropsychiatric disorders. *Trends Pharmacol Sci* **36**: 196-202 [PMID:25771972]
444. Lanier SM, Downing S, Duzic E and Homcy CJ. (1991) Isolation of rat genomic clones encoding subtypes of the alpha 2-adrenergic receptor. Identification of a unique receptor subtype. *J Biol Chem* **266**: 10470-8 [PMID:1645350]

445. Large V, Arner P, Reynisdottir S, Grober J, Van Harmelen V, Holm C and Langin D. (1998) Hormone-sensitive lipase expression and activity in relation to lipolysis in human fat cells. *J Lipid Res* **39**: 1688-1695 [PMID:9717730]
446. LaRocca TJ, Schwarzkopf M, Altman P, Zhang S, Gupta A, Gomes I, Alvin Z, Champion HC, Haddad G and Hajjar RJ *et al.*. (2010) β2-Adrenergic receptor signaling in the cardiac myocyte is modulated by interactions with CXCR4. *J Cardiovasc Pharmacol* **56**: 548-59 [PMID:20729750]
447. Lavoie C and Hébert TE. (2003) Pharmacological characterization of putative beta1-beta2-adrenergic receptor heterodimers. *Can J Physiol Pharmacol* **81**: 186-95 [PMID:12710533]
448. Lavoie C, Mercier JF, Salahpour A, Umapathy D, Breit A, Villeneuve LR, Zhu WZ, Xiao RP, Lakatta EG and Bouvier M *et al.*. (2002) Beta 1/beta 2-adrenergic receptor heterodimerization regulates beta 2-adrenergic receptor internalization and ERK signaling efficacy. *J Biol Chem* **277**: 35402-10 [PMID:12140284]
449. Lee D, Robeva A, Chen Z and Minneman KP. (2003) Mutational uncoupling of alpha1A-adrenergic receptors from G proteins also uncouples mitogenic and transcriptional responses in PC12 cells. *J Pharmacol Exp Ther* **306**: 471-7 [PMID:12724349]
450. Lee S. (2019) Dexmedetomidine: present and future directions. *Korean J Anesthesiol* **72**: 323-330 [PMID:31220910]
451. Lee YH, Petkova AP, Konkar AA and Granneman JG. (2015) Cellular origins of cold-induced brown adipocytes in adult mice. *FASEB J* **29**: 286-99 [PMID:25392270]
452. Leech CJ and Faber JE. (1996) Different alpha-adrenoceptor subtypes mediate constriction of arterioles and venules. *Am J Physiol* **270**: H710-22 [PMID:8779849]
453. Lehto J, Hirvonen MM, Johansson J, Kemppainen J, Luoto P, Naukkarinen T, Oikonen V, Arponen E, Rouru J and Sallinen J *et al.*. (2015) Validation of [(11) C]ORM-13070 as a PET tracer for alpha2c -adrenoceptors in the human brain. *Synapse* **69**: 172-81 [PMID:25530024]
454. Lehto J, Virta JR, Oikonen V, Roivainen A, Luoto P, Arponen E, Helin S, Hietamäki J, Holopainen A and Kailajärvi M *et al.*. (2015) Test-retest reliability of (11)C-ORM-13070 in PET imaging of α2C-adrenoceptors in vivo in the human brain. *Eur J Nucl Med Mol Imaging* **42**: 120-7 [PMID:25201008]
455. Leineweber K, Büscher R, Bruck H and Brodde OE. (2004) Beta-adrenoceptor polymorphisms. *Naunyn Schmiedebergs Arch Pharmacol* **369**: 1-22 [PMID:14647973]
456. Leiphart JW, Dills CV and Levy RM. (2004) Alpha2-adrenergic receptor subtype specificity of intrathecally administered tizanidine used for analgesia for neuropathic pain. *J Neurosurg* **101**: 641-7 [PMID:15481719]
457. Lelias JM, Kaghad M, Rodriguez M, Chalon P, Bonnin J, Dupre I, Delpech B, Bensaid M, LeFur G and Ferrara P *et al.*. (1993) Molecular cloning of a human beta 3-adrenergic receptor cDNA. *FEBS Lett* **324**: 127-30 [PMID:8389717]
458. Leonardi A, Hieble JP, Guarneri L, Naselsky DP, Poggesi E, Sironi G, Sulpizio AC and Testa R. (1997) Pharmacological characterization of the uroselective alpha-1 antagonist Rec 15/2739 (SB 216469): role of the alpha-1L adrenoceptor in tissue selectivity, part I. *J Pharmacol Exp Ther* **281**: 1272-83 [PMID:9190863]
459. Leppik RA, Lazareno S, Mynett A and Birdsall NJ. (1998) Characterization of the allosteric interactions between antagonists and amiloride analogues at the human alpha2A-adrenergic receptor. *Mol Pharmacol* **53**: 916-25 [PMID:9584219]
460. Leslie AG, Warne T and Tate CG. (2015) Ligand occupancy in crystal structure of β1-adrenergic G protein-coupled receptor. *Nat Struct Mol Biol* **22**: 941-2 [PMID:26643842]
461. Lewis RJ, Chachi L, Newby C, Amrani Y and Bradding P. (2016) Bidirectional Counterregulation of Human Lung Mast Cell and Airway Smooth Muscle β2 Adrenoceptors. *J Immunol* **196**: 55-63 [PMID:26608913]
462. Li F, De Godoy M and Rattan S. (2004) Role of adenylate and guanylate cyclases in beta1-, beta2-, and beta3-adrenoceptor-mediated relaxation of internal anal sphincter smooth muscle. *J Pharmacol Exp Ther* **308**: 1111-20 [PMID:14711933]
463. Li YF, Cao XJ, Bai XY, Lin SP and Shi ST. (2010) Change of expression of renal alpha1-adrenergic receptor and angiotensin II receptor subtypes with aging in rats. *Aging Clin Exp Res* **22**: 123-8 [PMID:20440098]
464. Li YF, Jiang ZL, Cao FF and Liu F. (2015) Effects of olmesartan therapy on the expression of lung adrenoceptors in rats with chronic heart failure. *J Renin Angiotensin Aldosterone Syst* **16**: 6-12 [PMID:25487981]
465. Li Z, Li J, Liu L, Deng W, Liu Q, Liu R, Zhang W, He Z, Fan L and Yang Y *et al.*. (2020) Structural Insight into the Mechanism of 4-Aminoquinolines Selectivity for the alpha2A-Adrenoceptor. *Drug Des Devel Ther* **14**: 2585-2594 [PMID:32694911]
466. Liao MH, Liu SS, Peng IC, Tsai FJ and Huang HH. (2014) The stimulatory effects of alpha1-adrenergic receptors on TGF-beta1, IGF-1 and hyaluronan production in human skin fibroblasts. *Cell Tissue Res* **357**: 681-93 [PMID:24844469]
467. Liapakis G, Chan WC, Papadokostaki M and Javitch JA. (2004) Synergistic contributions of the functional groups of epinephrine to its affinity and efficacy at the beta2 adrenergic receptor.

Mol Pharmacol **65**: 1181-90 [PMID:15102946]
468. Lima JJ. (2014) Do genetic polymorphisms alter patient response to inhaled bronchodilators? *Expert Opin Drug Metab Toxicol* **10**: 1231-40 [PMID:25102170]
469. Lima V, Mueller A, Kamikihara SY, Raymundi V, Alewood D, Lewis RJ, Chen Z, Minneman KP and Pupo AS. (2005) Differential antagonism by conotoxin rho-TIA of contractions mediated by distinct alpha1-adrenoceptor subtypes in rat vas deferens, spleen and aorta. *Eur J Pharmacol* **508**: 183-92 [PMID:15680270]
470. Limbird LE. (1988) Receptors linked to inhibition of adenylate cyclase: additional signaling mechanisms. *FASEB J* **2**: 2686-95 [PMID:2840317]
471. Lin F, Owens WA, Chen S, Stevens ME, Kesteven S, Arthur JF, Woodcock EA, Feneley MP and Graham RM. (2001) Targeted alpha(1A)-adrenergic receptor overexpression induces enhanced cardiac contractility but not hypertrophy. *Circ Res* **89**: 343-50 [PMID:11509451]
472. Lin HY, Ballou LM and Lin RZ. (2003) Stimulation of the alpha1A adrenergic receptor inhibits PDGF-induced PDGF beta receptor Tyr751 phosphorylation and PI 3-kinase activation. *FEBS Lett* **540**: 106-10 [PMID:12681492]
473. Link R, Daunt D, Barsh G, Chruscinski A and Kobilka B. (1992) Cloning of two mouse genes encoding alpha 2-adrenergic receptor subtypes and identification of a single amino acid in the mouse alpha 2-C10 homolog responsible for an interspecies variation in antagonist binding. *Mol Pharmacol* **42**: 16-27 [PMID:1353249]
474. Link RE, Desai K, Hein L, Stevens ME, Chruscinski A, Bernstein D, Barsh GS and Kobilka BK. (1996) Cardiovascular regulation in mice lacking alpha2-adrenergic receptor subtypes b and c. *Science* **273**: 803-5 [PMID:8670422]
475. Littmann T, Göttle M, Reinartz MT, Kälble S, Wainer IW, Ozawa T and Seifert R. (2015) Recruitment of β-arrestin 1 and 2 to the β2-adrenoceptor: analysis of 65 ligands. *J Pharmacol Exp Ther* **355**: 183-90 [PMID:26306764]
476. Liu CM, Lo YC, Wu BN, Wu WJ, Chou YH, Huang CH, An LM and Chen IJ. (2007) cGMP-enhancing- and alpha1A/alpha1D-adrenoceptor blockade-derived inhibition of Rho-kinase by KMUP-1 provides optimal prostate relaxation and epithelial cell anti-proliferation efficacy. *Prostate* **67**: 1397-410 [PMID:17639498]
477. Liu F, He K, Yang X, Xu N, Liang Z, Xu M, Zhao X, Han Q and Zhang Y. (2011) α1A-adrenergic receptor induces activation of extracellular signal-regulated kinase 1/2 through endocytic pathway. *PLoS ONE* **6**: e21520 [PMID:21738688]
478. Liu JJ, Horst R, Katritch V, Stevens RC and Wüthrich K. (2012) Biased signaling pathways in β2-adrenergic receptor characterized by 19F-NMR. *Science* **335**: 1106-10 [PMID:22267580]
479. Liu R, Zhang Q, Luo Q, Qiao H, Wang P, Yu J, Cao Y, Lu B and Qu L. (2017) Norepinephrine stimulation of alpha1D-adrenoceptor promotes proliferation of pulmonary artery smooth muscle cells via ERK-1/2 signaling. *Int J Biochem Cell Biol* **88**: 100-112 [PMID:28476501]
480. Liu X, Ahn S, Kahsai AW, Meng KC, Latorraca NR, Pani B, Venkatakrishnan AJ, Masoudi A, Weis WI and Dror RO *et al.*. (2017) Mechanism of intracellular allosteric β_2AR antagonist revealed by X-ray crystal structure. *Nature* **548**: 480-484 [PMID:28813418]
481. Liu X, Kaindl J, Korczynska M, Stößel A, Dengler D, Stanek M, Hübner H, Clark MJ, Mahoney J and Matt RA *et al.*. (2020) An allosteric modulator binds to a conformational hub in the β_2 adrenergic receptor. *Nat Chem Biol* **16**: 749-755 [PMID:32483378]
482. Liu Y, Liang X, Ren WW and Li BM. (2014) Expression of β1- and β2-adrenoceptors in different subtypes of interneurons in the medial prefrontal cortex of mice. *Neuroscience* **257**: 149-57 [PMID:24215978]
483. Liu YL, Nwosu UC and Rice PJ. (1998) Relaxation of isolated human myometrial muscle by beta2-adrenergic receptors but not beta1-adrenergic receptors. *Am J Obstet Gynecol* **179**: 895-8 [PMID:9790366]
484. Lomasney JW, Cotecchia S, Lorenz W, Leung WY, Schwinn DA, Yang-Feng TL, Brownstein M, Lefkowitz RJ and Caron MG. (1991) Molecular cloning and expression of the cDNA for the alpha 1A-adrenergic receptor. The gene for which is located on human chromosome 5. *J Biol Chem* **266**: 6365-9 [PMID:1706716]
485. Lonnqvist F, Krief S, Strosberg AD, Nyberg S, Emorine LJ and Arner P. (1993) Evidence for a functional beta 3-adrenoceptor in man. *Br J Pharmacol* **110**: 929-936 [PMID:7905344]
486. Louis SN, Nero TL, Iakovidis D, Jackman GP and Louis WJ. (1999) LK 204-545, a highly selective beta1-adrenoceptor antagonist at human beta-adrenoceptors. *Eur J Pharmacol* **367**: 431-5 [PMID:10079020]
487. Luhrs L, Manlapaz C, Kedzie K, Rao S, Cabrera-Ghayouri S, Donello J and Gil D. (2016) Function of brain α_{2B}-adrenergic receptor characterized with subtype-selective α_{2B} antagonist and KO mice. *Neuroscience* **339**: 608-621 [PMID:27751959]
488. Lv T, Du Y, Cao N, Zhang S, Gong Y, Bai Y, Wang W and Liu H. (2016) Proliferation in cardiac fibroblasts induced by β1-adrenoceptor autoantibody and the underlying mechanisms. *Sci Rep* **6**: 32430 [PMID:27577254]
489. Lyssand JS, DeFino MC, Tang XB, Hertz AL, Feller DB, Wacker JL, Adams ME and Hague C.

(2008) Blood pressure is regulated by an alpha1D-adrenergic receptor/dystrophin signalosome. *J Biol Chem* **283**: 18792-800 [PMID:18468998]
490. Lyssand JS, Lee KS, DeFino M, Adams ME and Hague C. (2011) Syntrophin isoforms play specific functional roles in the α1D-adrenergic receptor/DAPC signalosome. *Biochem Biophys Res Commun* **412**: 596-601 [PMID:21846462]
491. Lyssand JS, Whiting JL, Lee KS, Kastl R, Wacker JL, Bruchas MR, Miyatake M, Langeberg LK, Chavkin C and Scott JD *et al.*. (2010) Alpha-dystrobrevin-1 recruits alpha-catulin to the alpha1D-adrenergic receptor/dystrophin-associated protein complex signalosome. *Proc Natl Acad Sci USA* **107**: 21854-9 [PMID:21115837]
492. MacDonald E, Kobilka BK and Scheinin M. (1997) Gene targeting--homing in on alpha 2-adrenoceptor-subtype function. *Trends Pharmacol Sci* **18**: 211-9 [PMID:9227000]
493. Machida CA, Bunzow JR, Searles RP, Van Tol H, Tester B, Neve KA, Teal P, Nipper V and Civelli O. (1990) Molecular cloning and expression of the rat beta 1-adrenergic receptor gene. *J Biol Chem* **265**: 12960-5 [PMID:1695899]
494. Mackenzie JF, Daly CJ, Pediani JD and McGrath JC. (2000) Quantitative imaging in live human cells reveals intracellular alpha(1)-adrenoceptor ligand-binding sites. *J Pharmacol Exp Ther* **294**: 434-43 [PMID:10900216]
495. MacLennan SJ, Luong LA, Jasper JR, To ZP and Eglen RM. (1997) Characterization of alpha 2-adrenoceptors mediating contraction of dog saphenous vein: identity with the human alpha 2A subtype. *Br J Pharmacol* **121**: 1721-9 [PMID:9283709]
496. MacMillan LB, Hein L, Smith MS, Piascik MT and Limbird LE. (1996) Central hypotensive effects of the alpha2a-adrenergic receptor subtype. *Science* **273**: 801-3 [PMID:8670421]
497. Makaritsis KP, Handy DE, Johns C, Kobilka B, Gavras I and Gavras H. (1999) Role of the alpha2B-adrenergic receptor in the development of salt-induced hypertension. *Hypertension* **33**: 14-7 [PMID:9931075]
498. Malloy BJ, Price DT, Price RR, Bienstock AM, Dole MK, Funk BL, Rudner XL, Richardson CD, Donatucci CF and Schwinn DA. (1998) Alpha1-adrenergic receptor subtypes in human detrusor. *J Urol* **160**: 937-43 [PMID:9720591]
499. Manglik A, Kim TH, Masureel M, Altenbach C, Yang Z, Hilger D, Lerch MT, Kobilka TS, Thian FS and Hubbell WL *et al.*. (2015) Structural Insights into the Dynamic Process of β2-Adrenergic Receptor Signaling. *Cell* **161**: 1101-11 [PMID:25981665]
500. Maqbool A, Hall AS, Ball SG and Balmforth AJ. (1999) Common polymorphisms of beta1-adrenoceptor: identification and rapid screening assay. *Lancet* **353**: 897 [PMID:10093986]
501. Markousis-Mavrogenis G, Minich WB, Al-Mubarak AA, Anker SD, Cleland JGF, Dickstein K, Lang CC, Ng LL, Samani NJ and Zannad F *et al.*. (2023) Clinical and prognostic associations of autoantibodies recognizing adrenergic/muscarinic receptors in patients with heart failure. *Cardiovasc Res* **119**: 1690-1705 [PMID:36883593]
502. Martí D, Miquel R, Ziani K, Gisbert R, Ivorra MD, Anselmi E, Moreno L, Villagrasa V, Barettino D and D'Ocon P. (2005) Correlation between mRNA levels and functional role of alpha1-adrenoceptor subtypes in arteries: evidence of alpha1L as a functional isoform of the alpha1A-adrenoceptor. *Am J Physiol Heart Circ Physiol* **289**: H1923-32 [PMID:15951348]
503. Martin RD, Sun Y, Bourque K, Audet N, Inoue A, Tanny JC and Hébert TE. (2018) Receptor- and cellular compartment-specific activation of the cAMP/PKA pathway by α_1-adrenergic and ETA endothelin receptors. *Cell Signal* **44**: 43-50 [PMID:29329779]
504. Mason DA, Moore JD, Green SA and Liggett SB. (1999) A gain-of-function polymorphism in a G-protein coupling domain of the human beta1-adrenergic receptor. *J Biol Chem* **274**: 12670-4 [PMID:10212248]
505. Mastos C, Xu X, Keen AC and Halls ML. (2024) Signalling of Adrenoceptors: Canonical Pathways and New Paradigms. *Handb Exp Pharmacol* **285**: 147-184 [PMID:38227198]
506. Masureel M, Zou Y, Picard LP, van der Westhuizen E, Mahoney JP, Rodrigues JPGLM, Mildorf TJ, Dror RO, Shaw DE and Bouvier M *et al.*. (2018) Structural insights into binding specificity, efficacy and bias of a β_2AR partial agonist. *Nat Chem Biol* **14**: 1059-1066 [PMID:30327561]
507. Matsushita M, Horinouchi T, Tanaka Y, Tsuru H and Koike K. (2003) Characterization of beta 3-adrenoceptor-mediated relaxation in rat abdominal aorta smooth muscle. *Eur J Pharmacol* **482**: 235-44 [PMID:14660028]
508. Maudsley S, Pierce KL, Zamah AM, Miller WE, Ahn S, Daaka Y, Lefkowitz RJ and Luttrell LM. (2000) The beta(2)-adrenergic receptor mediates extracellular signal-regulated kinase activation via assembly of a multi-receptor complex with the epidermal growth factor receptor. *J Biol Chem* **275**: 9572-80 [PMID:10734107]
509. Maïga A, Merlin J, Marcon E, Rouget C, Larregola M, Gilquin B, Fruchart-Gaillard C, Lajeunesse E, Marchetti C and Lorphelin A *et al.*. (2013) Orthosteric binding of ρ-Da1a, a natural peptide of snake venom interacting selectively with the α1A-adrenoceptor. *PLoS ONE* **8**: e68841 [PMID:23935897]
510. McCune D, Gaivin R, Rorabaugh B and Perez D. (2004) Bulk is a determinant of oxymetazoline affinity for the alpha1A-adrenergic receptor. *Recept Channels* **10**: 109-16 [PMID:15512845]

511. McGraw DW, Forbes SL, Kramer LA, Witte DP, Fortner CN, Paul RJ and Liggett SB. (1999) Transgenic overexpression of beta(2)-adrenergic receptors in airway smooth muscle alters myocyte function and ablates bronchial hyperreactivity. *J Biol Chem* **274**: 32241-7 [PMID:10542262]
512. McGraw DW, Mihlbachler KA, Schwarb MR, Rahman FF, Small KM, Almoosa KF and Liggett SB. (2006) Airway smooth muscle prostaglandin-EP1 receptors directly modulate beta2-adrenergic receptors within a unique heterodimeric complex. *J Clin Invest* **116**: 1400-9 [PMID:16670773]
513. McVey M, Ramsay D, Kellett E, Rees S, Wilson S, Pope AJ and Milligan G. (2001) Monitoring receptor oligomerization using time-resolved fluorescence resonance energy transfer and bioluminescence resonance energy transfer. The human delta -opioid receptor displays constitutive oligomerization at the cell surface, which is not regulated by receptor occupancy. *J Biol Chem* **276**: 14092-9 [PMID:11278447]
514. Mei B, Li J and Zuo Z. (2021) Dexmedetomidine attenuates sepsis-associated inflammation and encephalopathy via central α2A adrenoceptor. *Brain Behav Immun* **91**: 296-314 [PMID:33039659]
515. Melis MG, Secchi G, Brizzi P, Severino C, Maioli M and Tonolo G. (2002) The Trp64Arg beta3-adrenergic receptor amino acid variant confers increased sensitivity to the pressor effects of noradrenaline in Sardinian subjects. *Clin Sci* **103**: 397-402 [PMID:12241539]
516. Mendes FR, Hamamura M, Queiróz DB, Porto CS and Avellar MC. (2004) Effects of androgen manipulation on alpha1-adrenoceptor subtypes in the rat seminal vesicle. *Life Sci* **75**: 1449-63 [PMID:15240180]
517. Mercier JF, Salahpour A, Angers S, Breit A and Bouvier M. (2002) Quantitative assessment of beta 1- and beta 2-adrenergic receptor homo- and heterodimerization by bioluminescence resonance energy transfer. *J Biol Chem* **277**: 44925-31 [PMID:12244098]
518. Methven L, McBride M, Wallace GA and McGrath JC. (2009) The alpha 1B/D-adrenoceptor knockout mouse permits isolation of the vascular alpha 1A-adrenoceptor and elucidates its relationship to the other subtypes. *Br J Pharmacol* **158**: 209-24 [PMID:19572943]
519. Methven L, Simpson PC and McGrath JC. (2009) Alpha1A/B-knockout mice explain the native alpha1D-adrenoceptor's role in vasoconstriction and show that its location is independent of the other alpha1-subtypes. *Br J Pharmacol* **158**: 1663-75 [PMID:19888965]
520. Meyer MD, Altenbach RJ, Basha FZ, Carroll WA, Drizin I, Elmore SW, Ehrlich PP, Lebold SA, Tietje K and Sippy KB *et al.*. (1997) Synthesis and pharmacological characterization of 3-[2-((3aR,9bR)-cis-6-methoxy-2,3,3a,4,5,9b-hexahydro-1H-benz[e] isoindol-2-yl)ethyl]pyrido-[3',4':4,5]thieno[3,2-d]pyrimidine-2,4 (1H,3H)-dione (A-131701): a uroselective alpha 1A adrenoceptor antagonist for the symptomatic treatment of benign prostatic hyperplasia. *J Med Chem* **40**: 3141-3 [PMID:9379432]
521. Mhaouty-Kodja S, Lozach A, Habert R, Tanneux M, Guigon C, Brailly-Tabard S, Maltier JP and Legrand-Maltier C. (2007) Fertility and spermatogenesis are altered in {alpha}1b-adrenergic receptor knockout male mice. *J Endocrinol* **195**: 281-92 [PMID:17951539]
522. Michel AD, Loury DN and Whiting RL. (1990) Assessment of imiloxan as a selective alpha 2B-adrenoceptor antagonist. *Br J Pharmacol* **99**: 560-4 [PMID:1970500]
523. Michel AD, Loury DN and Whiting RL. (1989) Differences between the alpha 2-adrenoceptor in rat submaxillary gland and the alpha 2A-and alpha 2B-adrenoceptor subtypes. *Br J Pharmacol* **98**: 890-7 [PMID:2556205]
524. Michel MC and Korstanje C. (2016) β3-Adrenoceptor agonists for overactive bladder syndrome: Role of translational pharmacology in a repositioning clinical drug development project. *Pharmacol Ther* **159**: 66-82 [PMID:26808167]
525. Michel MC, Ochodnicky P and Summers RJ. (2010) Tissue functions mediated by beta(3)-adrenoceptors-findings and challenges. *Naunyn Schmiedebergs Arch Pharmacol* **382**: 103-8 [PMID:20517594]
526. Michel MC and Seifert R. (2015) Selectivity of pharmacological tools: implications for use in cell physiology. A review in the theme: Cell signaling: proteins, pathways and mechanisms. *Am J Physiol, Cell Physiol* **308**: C505-20 [PMID:25631871]
527. Michelotti GA, Brinkley DM, Morris DP, Smith MP, Louie RJ and Schwinn DA. (2007) Epigenetic regulation of human alpha1d-adrenergic receptor gene expression: a role for DNA methylation in Sp1-dependent regulation. *FASEB J* **21**: 1979-93 [PMID:17384146]
528. Michelotti GA, Price DT and Schwinn DA. (2000) Alpha 1-adrenergic receptor regulation: basic science and clinical implications. *Pharmacol Ther* **88**: 281-309 [PMID:11337028]
529. Millan MJ, Maiofiss L, Cussac D, Audinot V, Boutin JA and Newman-Tancredi A. (2002) Differential actions of antiparkinson agents at multiple classes of monoaminergic receptor. I. A multivariate analysis of the binding profiles of 14 drugs at 21 native and cloned human receptor subtypes. *J Pharmacol Exp Ther* **303**: 791-804 [PMID:12388666]
530. Miller-Gallacher JL, Nehmé R, Warne T, Edwards PC, Schertler GF, Leslie AG and Tate CG. (2014) The 2.1 Å resolution structure of cyanopindolol-bound β1-adrenoceptor identifies an intramembrane Na+ ion that stabilises the ligand-free receptor. *PLoS One* **9**: e92727

[PMID:24663151]
531. Minarini A, Budriesi R, Chiarini A, Leonardi A and Melchiorre C. (1998) Search for alpha 1-adrenoceptor subtypes selective antagonists: design, synthesis and biological activity of cystazosin, an alpha 1D-adrenoceptor antagonist. *Bioorg Med Chem Lett* **8**: 1353-8 [PMID:9871765]
532. Minneman KP. (1988) Alpha 1-adrenergic receptor subtypes, inositol phosphates, and sources of cell Ca2+. *Pharmacol Rev* **40**: 87-119 [PMID:2853370]
533. Minneman KP, Han C and Abel PW. (1988) Comparison of α_1-adrenergic receptor subtypes distinguished by chloroethylclonidine and WB4101. *Mol Pharmacol* **33**: 509-514 [PMID:2835650]
534. Minneman KP, Hegstrand LR and Molinoff PB. (1979) The pharmacological specificity of beta-1 and beta-2 adrenergic receptors in rat heart and lung in vitro. *Mol Pharmacol* **16**: 21-33 [PMID:39243]
535. Minneman KP, Theroux TL, Hollinger S, Han C and Esbenshade TA. (1994) Selectivity of agonists for cloned alpha 1-adrenergic receptor subtypes. *Mol Pharmacol* **46**: 929-36 [PMID:7969082]
536. Mishima K, Tanoue A, Tsuda M, Hasebe N, Fukue Y, Egashira N, Takano Y, Kamiya HO, Tsujimoto G and Iwasaki K *et al.*. (2004) Characteristics of behavioral abnormalities in alpha1d-adrenoceptors deficient mice. *Behav Brain Res* **152**: 365-73 [PMID:15196805]
537. Mistry SN, Baker JG, Fischer PM, Hill SJ, Gardiner SM and Kellam B. (2013) Synthesis and in vitro and in vivo characterization of highly β1-selective β-adrenoceptor partial agonists. *J Med Chem* **56**: 3852-65 [PMID:23614528]
538. Mitrano DA, Jackson K, Finley S and Seeley A. (2018) α1b-Adrenergic Receptor Localization and Relationship to the D1-Dopamine Receptor in the Rat Nucleus Accumbens. *Neuroscience* **371**: 126-137 [PMID:29229557]
539. Mizusawa H, Hedlund P, Sjunnesson J, Brioni JD, Sullivan JP and Andersson KE. (2002) Enhancement of apomorphine-induced penile erection in the rat by a selective alpha(1D)-adrenoceptor antagonist. *Br J Pharmacol* **136**: 701-8 [PMID:12086979]
540. Mlakar V, Jurkovic Mlakar S, Zupan J, Komadina R, Prezelj J and Marc J. (2015) ADRA2A is involved in neuro-endocrine regulation of bone resorption. *J Cell Mol Med* **19**: 1520-9 [PMID:25818344]
541. Mohl MC, Iismaa SE, Xiao XH, Friedrich O, Wagner S, Nikolova-Krstevski V, Wu J, Yu ZY, Feneley M and Fatkin D *et al.*. (2011) Regulation of murine cardiac contractility by activation of α(1A)-adrenergic receptor-operated Ca(2+) entry. *Cardiovasc Res* **91**: 310-9 [PMID:21546445]
542. Molderings GJ and Göthert M. (1995) Subtype determination of presynaptic alpha 2-autoreceptors in the rabbit pulmonary artery and human saphenous vein. *Naunyn Schmiedebergs Arch Pharmacol* **352**: 483-90 [PMID:8751076]
543. Molenaar P, Sarsero D, Arch JR, Kelly J, Henson SM and Kaumann AJ. (1997) Effects of (-)-RO363 at human atrial beta-adrenoceptor subtypes, the human cloned beta 3-adrenoceptor and rodent intestinal beta 3-adrenoceptors. *Br J Pharmacol* **120**: 165-76 [PMID:9117106]
544. Molenaar P, Savarimuthu SM, Sarsero D, Chen L, Semmler AB, Carle A, Yang I, Bartel S, Vetter D and Beyerdörfer I *et al.*. (2007) (-)-Adrenaline elicits positive inotropic, lusitropic, and biochemical effects through beta2 -adrenoceptors in human atrial myocardium from nonfailing and failing hearts, consistent with Gs coupling but not with Gi coupling. *Naunyn Schmiedebergs Arch Pharmacol* **375**: 11-28 [PMID:17295024]
545. Molina-Muñoz T, Romero-Avila MT, Avendaño-Vázquez SE and García-Sáinz JA. (2008) Phosphorylation, desensitization and internalization of human alpha1B-adrenoceptors induced by insulin-like growth factor-I. *Eur J Pharmacol* **578**: 1-10 [PMID:17915215]
546. Moore XL, Su Y, Fan Y, Zhang YY, Woodcock EA, Dart AM and Du XJ. (2014) Diverse regulation of cardiac expression of relaxin receptor by α1- and β1-adrenoceptors. *Cardiovasc Drugs Ther* **28**: 221-8 [PMID:24852484]
547. Morelli MB, Amantini C, Nabissi M, Liberati S, Cardinali C, Farfariello V, Tomassoni D, Quaglia W, Piergentili A and Bonifazi A *et al.*. (2014) Cross-talk between alpha1D-adrenoceptors and transient receptor potential vanilloid type 1 triggers prostate cancer cell proliferation. *BMC Cancer* **14**: 921 [PMID:25481381]
548. Morishima S, Tanaka T, Yamamoto H, Suzuki F, Akino H, Yokoyama O and Muramatsu I. (2007) Identification of alpha-1L and alpha-1A adrenoceptors in human prostate by tissue segment binding. *J Urol* **177**: 377-81 [PMID:17162094]
549. Morris DP, Lei B, Wu YX, Michelotti GA and Schwinn DA. (2008) The alpha1a-adrenergic receptor occupies membrane rafts with its G protein effectors but internalizes via clathrin-coated pits. *J Biol Chem* **283**: 2973-85 [PMID:18048357]
550. Morris DP, Price RR, Smith MP, Lei B and Schwinn DA. (2004) Cellular trafficking of human alpha1a-adrenergic receptors is continuous and primarily agonist-independent. *Mol Pharmacol* **66**: 843-54 [PMID:15258254]
551. Morrow AL and Creese I. (1986) Characterization of alpha 1-adrenergic receptor subtypes in rat

brain: a reevaluation of [3H]WB4104 and [3H]prazosin binding. *Mol Pharmacol* **29**: 321-30 [PMID:3010073]
552. Motso A, Pelcman B, Kalinovich A, Kahlous NA, Bokhari MH, Dehvari N, Halleskog C, Waara E, de Jong J and Cheesman E *et al*.. (2025) GRK-biased adrenergic agonists for the treatment of type 2 diabetes and obesity. *Cell* **188**: 5142-5156.e23 [PMID:40555230]
553. Moukhametzianov R, Warne T, Edwards PC, Serrano-Vega MJ, Leslie AG, Tate CG and Schertler GF. (2011) Two distinct conformations of helix 6 observed in antagonist-bound structures of a beta1-adrenergic receptor. *Proc Natl Acad Sci USA* **108**: 8228-32 [PMID:21540331]
554. Mukaida S, Sato M, Öberg AI, Dehvari N, Olsen JM, Kocan M, Halls ML, Merlin J, Sandström AL and Csikasz RI *et al*.. (2019) BRL37344 stimulates GLUT4 translocation and glucose uptake in skeletal muscle via β_2-adrenoceptors without causing classical receptor desensitization. *Am J Physiol Regul Integr Comp Physiol* **316**: R666-R677 [PMID:30892909]
555. Munk SA, Harcourt D, Ambrus G, Denys L, Gluchowski C, Burke JA, Kharlamb AB, Manlapaz CA, Padillo EU and Runde E *et al*.. (1996) Synthesis and evaluation of 2-[(5-methylbenz-1-ox-4-azin-6-yl)imino]imidazoline, a potent, peripherally acting alpha 2 adrenoceptor agonist. *J Med Chem* **39**: 3533-8 [PMID:8784451]
556. Muramatsu I, Oshita M, Ohmura T, Kigoshi S, Akino H, Gobara M and Okada K. (1994) Pharmacological characterization of alpha 1-adrenoceptor subtypes in the human prostate: functional and binding studies. *Br J Urol* **74**: 572-8 [PMID:7530120]
557. Murphy TJ and Bylund DB. (1988) Characterization of alpha-2 adrenergic receptors in the OK cell, an opossum kidney cell line. *J Pharmacol Exp Ther* **244**: 571-8 [PMID:2894455]
558. Mustafa S, See HB, Seeber RM, Armstrong SP, White CW, Ventura S, Ayoub MA and Pfleger KD. (2012) Identification and profiling of novel α1A-adrenoceptor-CXC chemokine receptor 2 heteromer. *J Biol Chem* **287**: 12952-65 [PMID:22371491]
559. Muzzin P, Revelli JP, Kuhne F, Gocayne JD, McCombie WR, Venter JC, Giacobino JP and Fraser CM. (1991) An adipose tissue-specific beta-adrenergic receptor. Molecular cloning and down-regulation in obesity. *J Biol Chem* **266**: 24053-8 [PMID:1721063]
560. Myagmar BE, Flynn JM, Cowley PM, Swigart PM, Montgomery MD, Thai K, Nair D, Gupta R, Deng DX and Hosoda C *et al*.. (2017) Adrenergic Receptors in Individual Ventricular Myocytes: The Beta-1 and Alpha-1B Are in All Cells, the Alpha-1A Is in a Subpopulation, and the Beta-2 and Beta-3 Are Mostly Absent. *Circ Res* **120**: 1103-1115 [PMID:28219977]
561. Méjean A, Guillaume JL and Strosberg AD. (1995) Carazolol: a potent, selective beta 3-adrenoceptor agonist. *Eur J Pharmacol* **291**: 359-66 [PMID:8719421]
562. Nagaoka Y, Ahmed M, Hossain M, Bhuiyan MA, Ishiguro M, Nakamura T, Watanabe M and Nagatomo T. (2008) Amino acids of the human alpha1d-adrenergic receptor involved in antagonist binding. *J Pharmacol Sci* **106**: 114-20 [PMID:18187928]
563. Nagiri C, Kobayashi K, Tomita A, Kato M, Kobayashi K, Yamashita K, Nishizawa T, Inoue A, Shihoya W and Nureki O. (2021) Cryo-EM structure of the β3-adrenergic receptor reveals the molecular basis of subtype selectivity. *Mol Cell* **81**: 3205-3215.e5 [PMID:34314699]
564. Nahmias C, Blin N, Elalouf JM, Mattei MG, Strosberg AD and Emorine LJ. (1991) Molecular characterization of the mouse beta 3-adrenergic receptor: relationship with the atypical receptor of adipocytes. *EMBO J* **10**: 3721-7 [PMID:1718744]
565. Nakai A, Hayano Y, Furuta F, Noda M and Suzuki K. (2014) Control of lymphocyte egress from lymph nodes through β2-adrenergic receptors. *J Exp Med* **211**: 2583-98 [PMID:25422496]
566. Nalepa I, Vetulani J, Borghi V, Kowalska M, Przewłocka B and Pavone F. (2005) Formalin hindpaw injection induces changes in the [3H]prazosin binding to alpha1-adrenoceptors in specific regions of the mouse brain and spinal cord. *J Neural Transm* **112**: 1309-19 [PMID:15719155]
567. Nasrollahi-Shirazi S, Sucic S, Yang Q, Freissmuth M and Nanoff C. (2016) Comparison of the β-Adrenergic Receptor Antagonists Landiolol and Esmolol: Receptor Selectivity, Partial Agonism, and Pharmacochaperoning Actions. *J Pharmacol Exp Ther* **359**: 73-81 [PMID:27451411]
568. Neubig RR, Gantzos RD and Brasier RS. (1985) Agonist and antagonist binding to alpha 2-adrenergic receptors in purified membranes from human platelets. Implications of receptor-inhibitory nucleotide-binding protein stoichiometry. *Mol Pharmacol* **28**: 475-86 [PMID:2865672]
569. Nevzorova J, Evans BA, Bengtsson T and Summers RJ. (2006) Multiple signalling pathways involved in beta2-adrenoceptor-mediated glucose uptake in rat skeletal muscle cells. *Br J Pharmacol* **147**: 446-54 [PMID:16415914]
570. Newcorn JH, Krone B and Dittmann RW. (2022) Nonstimulant Treatments for ADHD. *Child Adolesc Psychiatr Clin N Am* **31**: 417-435 [PMID:35697393]
571. Nicholas AP, Hökfelt T and Pieribone VA. (1996) The distribution and significance of CNS adrenoceptors examined with in situ hybridization. *Trends Pharmacol Sci* **17**: 245-55 [PMID:8756183]
572. Nicholas AP, Pieribone V and Hökfelt T. (1993) Distributions of mRNAs for alpha-2 adrenergic receptor subtypes in rat brain: an in situ hybridization study. *J Comp Neurol* **328**: 575-94 [PMID:8381444]

573. Nicholson R, Dixon AK, Spanswick D and Lee K. (2005) Noradrenergic receptor mRNA expression in adult rat superficial dorsal horn and dorsal root ganglion neurons. *Neurosci Lett* **380**: 316-21 [PMID:15862909]
574. Nonen S, Okamoto H, Fujio Y, Takemoto Y, Yoshiyama M, Hamaguchi T, Matsui Y, Yoshikawa J, Kitabatake A and Azuma J. (2008) Polymorphisms of norepinephrine transporter and adrenergic receptor alpha1D are associated with the response to beta-blockers in dilated cardiomyopathy. *Pharmacogenomics J* **8**: 78-84 [PMID:17404580]
575. Nourian Z, Mow T, Muftic D, Burek S, Pedersen ML, Matz J and Mulvany MJ. (2008) Orthostatic hypotensive effect of antipsychotic drugs in Wistar rats by in vivo and in vitro studies of alpha1-adrenoceptor function. *Psychopharmacology (Berl.)* **199**: 15-27 [PMID:18542932]
576. Nureki I, Kobayashi K, Tanaka T, Demura K, Inoue A, Shihoya W and Nureki O. (2022) Cryo-EM structures of the β_3 adrenergic receptor bound to solabegron and isoproterenol. *Biochem Biophys Res Commun* **611**: 158-164 [PMID:35489202]
577. Nygaard R, Zou Y, Dror RO, Mildorf TJ, Arlow DH, Manglik A, Pan AC, Liu CW, Fung JJ and Bokoch MP *et al.*. (2013) The dynamic process of β(2)-adrenergic receptor activation. *Cell* **152**: 532-42 [PMID:23374348]
578. O'Connell TD, Jensen BC, Baker AJ and Simpson PC. (2014) Cardiac alpha1-adrenergic receptors: novel aspects of expression, signaling mechanisms, physiologic function, and clinical importance. *Pharmacol Rev* **66**: 308-33 [PMID:24368739]
579. O'Rourke MF, Iversen LJ, Lomasney JW and Bylund DB. (1994) Species orthologs of the alpha-2A adrenergic receptor: the pharmacological properties of the bovine and rat receptors differ from the human and porcine receptors. *J Pharmacol Exp Ther* **271**: 735-40 [PMID:7965790]
580. Obara K, Shigematsu M, Takahasi H, Iiboshi Y, Yoshioka K, Kasuya Y and Tanaka Y. (2020) Pharmacological properties of β-adrenoceptors mediating rat superior mesenteric artery relaxation and the effects of chemical sympathetic denervation. *Life Sci* **241**: 117155 [PMID:31837330]
581. Obika K, Shibata K, Horie K, Foglar R, Kimura K and Tsujimoto G. (1995) NS-49, a novel alpha 1a-adrenoceptor-selective agonist characterization using recombinant human alpha 1-adrenoceptors. *Eur J Pharmacol* **291**: 327-34 [PMID:8719417]
582. Ochoa MC, Marti A, Azcona C, Chueca M, Oyarzábal M, Pelach R, Patiño A, Moreno-Aliaga MJ, Martínez-González MA and Martínez JA *et al.*. (2004) Gene-gene interaction between PPAR gamma 2 and ADR beta 3 increases obesity risk in children and adolescents. *Int J Obes Relat Metab Disord* **28 Suppl 3**: S37-41 [PMID:15543217]
583. Ohmura T, Oshita M, Kigoshi S and Muramatsu I. (1992) Identification of alpha 1-adrenoceptor subtypes in the rat vas deferens: binding and functional studies. *Br J Pharmacol* **107**: 697-704 [PMID:1361871]
584. Okeke K, Angers S, Bouvier M and Michel MC. (2019) Agonist-induced desensitisation of β_3 -adrenoceptors: Where, when, and how? *Br J Pharmacol* **176**: 2539-2558 [PMID:30809805]
585. Okwundu N, Cline A and Feldman SR. (2021) Difference in vasoconstrictors: oxymetazoline vs. brimonidine. *J Dermatolog Treat* **32**: 137-143 [PMID:31294643]
586. Oliver G and Schäfer EA. (1894) On the physiological action of extracts of the suprarenal capsule *J Physiol* **16**: 1-4
587. Oliver G and Schäfer EA. (1895) On the Physiological Action of Extracts of Pituitary Body and certain other Glandular Organs: Preliminary Communication. *J Physiol (Lond.)* **18**: 277-9 [PMID:16992253]
588. Olsen JM, Sato M, Dallner OS, Sandström AL, Pisani DF, Chambard JC, Amri EZ, Hutchinson DS and Bengtsson T. (2014) Glucose uptake in brown fat cells is dependent on mTOR complex 2-promoted GLUT1 translocation. *J Cell Biol* **207**: 365-74 [PMID:25385184]
589. Oostendorp J, Preitner F, Moffatt J, Jimenez M, Giacobino JP, Molenaar P and Kaumann AJ. (2000) Contribution of beta-adrenoceptor subtypes to relaxation of colon and oesophagus and pacemaker activity of ureter in wildtype and beta(3)-adrenoceptor knockout mice. *Br J Pharmacol* **130**: 747-58 [PMID:10864880]
590. Oshita M, Kigoshi S and Muramatsu I. (1991) Three distinct binding sites for [3H]-prazosin in the rat cerebral cortex. *Br J Pharmacol* **104**: 961-5 [PMID:1687370]
591. Owaki H, Sadahiro S and Takaki M. (2015) Characterizations of the α1-adrenoceptor subtypes mediating contractions of the human internal anal sphincter. *J Pharmacol Sci* **127**: 424-9 [PMID:25913761]
592. Ozdoğan UK, Lähdesmäki J, Mansikka H and Scheinin M. (2004) Loss of amitriptyline analgesia in alpha 2A-adrenoceptor deficient mice. *Eur J Pharmacol* **485**: 193-6 [PMID:14757140]
593. Pacini ESA, Castilho ACS, Hebeler-Barbosa F, Pupo AS and Kiguti LRA. (2018) Contraction of Rat Cauda Epididymis Smooth Muscle to α_1-Adrenoceptor Activation Is Mediated by α_{1A}-Adrenoceptors. *J Pharmacol Exp Ther* **366**: 21-28 [PMID:29685886]
594. Pak MD and Fishman PH. (1996) Anomalous behavior of CGP 12177A on beta 1-adrenergic receptors. *J Recept Signal Transduct Res* **16**: 1-23 [PMID:8771528]
595. Pandey S, Saha S and Shukla AK. (2020) Transmitting the Signal: Structure of the β1-Adrenergic

Receptor-Gs Protein Complex. *Mol Cell* **80**: 3-5 [PMID:33007256]
596. Pani B, Ahn S, Rambarat PK, Vege S, Kahsai AW, Liu A, Valan BN, Staus DP, Costa T and Lefkowitz RJ. (2021) Unique Positive Cooperativity Between the *β*-Arrestin-Biased *β*-Blocker Carvedilol and a Small Molecule Positive Allosteric Modulator of the *β*2-Adrenergic Receptor. *Mol Pharmacol* **100**: 513-525 [PMID:34580163]
597. Papay R, Gaivin R, Jha A, McCune DF, McGrath JC, Rodrigo MC, Simpson PC, Doze VA and Perez DM. (2006) Localization of the mouse alpha1A-adrenergic receptor (AR) in the brain: alpha1AAR is expressed in neurons, GABAergic interneurons, and NG2 oligodendrocyte progenitors. *J Comp Neurol* **497**: 209-22 [PMID:16705673]
598. Papay R, Gaivin R, McCune DF, Rorabaugh BR, Macklin WB, McGrath JC and Perez DM. (2004) Mouse alpha1B-adrenergic receptor is expressed in neurons and NG2 oligodendrocytes. *J Comp Neurol* **478**: 1-10 [PMID:15334645]
599. Papay R, Zuscik MJ, Ross SA, Yun J, McCune DF, Gonzalez-Cabrera P, Gaivin R, Drazba J and Perez DM. (2002) Mice expressing the alpha(1B)-adrenergic receptor induces a synucleinopathy with excessive tyrosine nitration but decreased phosphorylation. *J Neurochem* **83**: 623-34 [PMID:12390524]
600. Papay RS, Shi T, Piascik MT, Naga Prasad SV and Perez DM. (2013) α_1A-adrenergic receptors regulate cardiac hypertrophy in vivo through interleukin-6 secretion. *Mol Pharmacol* **83**: 939-48 [PMID:23404509]
601. Parkman HP, Jacobs MR, Mishra A, Hurdle JA, Sachdeva P, Gaughan JP and Krynetskiy E. (2011) Domperidone treatment for gastroparesis: demographic and pharmacogenetic characterization of clinical efficacy and side-effects. *Dig Dis Sci* **56**: 115-24 [PMID:21063774]
602. Parmentier JH, Gandhi GK, Wiggins MT, Saeed AE, Bourgoin SG and Malik KU. (2004) Protein kinase Czeta regulates phospholipase D activity in rat-1 fibroblasts expressing the alpha1A adrenergic receptor. *BMC Cell Biol* **5**: 4 [PMID:14736339]
603. Patane MA, Scott AL, Broten TP, Chang RS, Ransom RW, DiSalvo J, Forray C and Bock MG. (1998) 4-Amino-2-[4-[1-(benzyloxycarbonyl)-2(S)- [[(1,1-dimethylethyl)amino]carbonyl]-piperazinyl]-6, 7-dimethoxyquinazoline (L-765,314): a potent and selective alpha1b adrenergic receptor antagonist. *J Med Chem* **41**: 1205-8 [PMID:9548811]
604. Paton DM. (1976) Adrenergic innervation of the oviduct in the regulation of ovum transport. *Res Reprod* **8**: 3 [PMID:1251089]
605. Pauwels PJ, Gommeren W, Van Lommen G, Janssen PA and Leysen JE. (1988) The receptor binding profile of the new antihypertensive agent nebivolol and its stereoisomers compared with various beta-adrenergic blockers. *Mol Pharmacol* **34**: 843-51 [PMID:2462161]
606. Peltonen JM, Pihlavisto M and Scheinin M. (1998) Subtype-specific stimulation of [35S]GTPgammaS binding by recombinant alpha2-adrenoceptors. *Eur J Pharmacol* **355**: 275-9 [PMID:9760042]
607. Perez DM, Piascik MT and Graham RM. (1991) Solution-phase library screening for the identification of rare clones: isolation of an alpha 1D-adrenergic receptor cDNA. *Mol Pharmacol* **40**: 876-83 [PMID:1661838]
608. Pernomian L, Gomes MS, Restini CB, Pupo AS and de Oliveira AM. (2013) Cross-talk with β2 -adrenoceptors enhances ligand affinity properties from endothelial alpha1 D -adrenoceptors that mediates carotid relaxation. *J Pharm Pharmacol* **65**: 1337-46 [PMID:23927472]
609. Perälä M, Hirvonen H, Kalimo H, Ala-Uotila S, Regan JW, Akerman KE and Scheinin M. (1992) Differential expression of two alpha 2-adrenergic receptor subtype mRNAs in human tissues. *Brain Res Mol Brain Res* **16**: 57-63 [PMID:1334200]
610. Petrovska R, Kapa I, Klovins J, Schiöth HB and Uhlén S. (2005) Addition of a signal peptide sequence to the alpha1D-adrenoceptor gene increases the density of receptors, as determined by [3H]-prazosin binding in the membranes. *Br J Pharmacol* **144**: 651-9 [PMID:15678090]
611. Philippens IH, Joosen MJ, Ahnaou A, Andres I and Drinkenburg WP. (2014) Anti-Parkinson effects of a selective alpha2C-adrenoceptor antagonist in the MPTP marmoset model. *Behav Brain Res* **269**: 81-6 [PMID:24769173]
612. Piascik MT, Guarino RD, Smith MS, Soltis EE, Saussy Jr DL and Perez DM. (1995) The specific contribution of the novel alpha-1D adrenoceptor to the contraction of vascular smooth muscle. *J Pharmacol Exp Ther* **275**: 1583-9 [PMID:8531132]
613. Piascik MT, Hrometz SL, Edelmann SE, Guarino RD, Hadley RW and Brown RD. (1997) Immunocytochemical localization of the alpha-1B adrenergic receptor and the contribution of this and the other subtypes to vascular smooth muscle contraction: analysis with selective ligands and antisense oligonucleotides. *J Pharmacol Exp Ther* **283**: 854-68 [PMID:9353407]
614. Piascik MT and Perez DM. (2001) Alpha1-adrenergic receptors: new insights and directions. *J Pharmacol Exp Ther* **298**: 403-10 [PMID:11454900]
615. Pihlavisto M, Sjöholm B, Scheinin M and Wurster S. (1998) Modulation of agonist binding to recombinant human alpha2-adrenoceptors by sodium ions. *Biochim Biophys Acta* **1448**: 135-46 [PMID:9824686]
616. Piletz JE, Zhu H and Chikkala DN. (1996) Comparison of ligand binding affinities at human I1-

imidazoline binding sites and the high affinity state of alpha-2 adrenoceptor subtypes. *J Pharmacol Exp Ther* **279**: 694-702 [PMID:8930173]
617. Piwnica D, Rosignoli C, de Ménonville ST, Alvarez T, Schuppli Nollet M, Roye O, Jomard A and Aubert J. (2014) Vasoconstriction and anti-inflammatory properties of the selective α-adrenergic receptor agonist brimonidine. *J Dermatol Sci* **75**: 49-54 [PMID:24802713]
618. Piétri-Rouxel F, Lenzen G, Kapoor A, Drumare MF, Archimbault P, Strosberg AD and Manning BS. (1995) Molecular cloning and pharmacological characterization of the bovine beta 3-adrenergic receptor. *Eur J Biochem* **230**: 350-8 [PMID:7601122]
619. Popp BD, Hutchinson DS, Evans BA and Summers RJ. (2004) Stereoselectivity for interactions of agonists and antagonists at mouse, rat and human beta3-adrenoceptors. *Eur J Pharmacol* **484**: 323-31 [PMID:14744619]
620. Potter DE. (1981) Adrenergic pharmacology of aqueous humor dynamics. *Pharmacol Rev* **33**: 133-53 [PMID:7323134]
621. Price DT, Lefkowitz RJ, Caron MG, Berkowitz D and Schwinn DA. (1994) Localization of mRNA for three distinct alpha 1-adrenergic receptor subtypes in human tissues: implications for human alpha-adrenergic physiology. *Mol Pharmacol* **45**: 171-5 [PMID:8114668]
622. Procopiou PA, Barrett VJ, Bevan NJ, Biggadike K, Box PC, Butchers PR, Coe DM, Conroy R, Emmons A and Ford AJ *et al.*. (2010) Synthesis and structure-activity relationships of long-acting beta2 adrenergic receptor agonists incorporating metabolic inactivation: an antedrug approach. *J Med Chem* **53**: 4522-30 [PMID:20462258]
623. Proudman RGW, Akinaga J and Baker JG. (2022) The affinity and selectivity of α-adrenoceptor antagonists, antidepressants and antipsychotics for the human α2A, α2B, and α2C-adrenoceptors and comparison with human α1 and β-adrenoceptors. *Pharmacol Res Perspect* **10**: e00936 [PMID:35224877]
624. Proudman RGW, Akinaga J and Baker JG. (2022) The signaling and selectivity of α-adrenoceptor agonists for the human α2A, α2B and α2C-adrenoceptors and comparison with human α1 and β-adrenoceptors. *Pharmacol Res Perspect* **10**: e01003 [PMID:36101495]
625. Proudman RGW and Baker JG. (2021) The selectivity of α-adrenoceptor agonists for the human α1A, α1B, and α1D-adrenoceptors. *Pharmacol Res Perspect* **9**: e00799 [PMID:34355529]
626. Proudman RGW, Pupo AS and Baker JG. (2020) The affinity and selectivity of α-adrenoceptor antagonists, antidepressants, and antipsychotics for the human α1A, α1B, and α1D-adrenoceptors. *Pharmacol Res Perspect* **8**: e00602 [PMID:32608144]
627. Puri R, Liew GY, Nicholls SJ, Nelson AJ, Leong DP, Carbone A, Copus B, Wong DT, Beltrame JF and Worthley SG *et al.*. (2012) Coronary β2-adrenoreceptors mediate endothelium-dependent vasoreactivity in humans: novel insights from an in vivo intravascular ultrasound study. *Eur Heart J* **33**: 495-504 [PMID:21951627]
628. Putzke C, Wemhöner K, Sachse FB, Rinné S, Schlichthörl G, Li XT, Jaé L, Eckhardt I, Wischmeyer E and Wulf H *et al.*. (2007) The acid-sensitive potassium channel TASK-1 in rat cardiac muscle. *Cardiovasc Res* **75**: 59-68 [PMID:17389142]
629. Pönicke K, Heinroth-Hoffmann I and Brodde OE. (2003) Role of beta 1- and beta 2-adrenoceptors in hypertrophic and apoptotic effects of noradrenaline and adrenaline in adult rat ventricular cardiomyocytes. *Naunyn Schmiedebergs Arch Pharmacol* **367**: 592-9 [PMID:12750877]
630. Qu L, Zhou Q, Xu Y, Guo Y, Chen X, Yao D, Han GW, Liu ZJ, Stevens RC and Zhong G *et al.*. (2019) Structural Basis of the Diversity of Adrenergic Receptors. *Cell Rep* **29**: 2929-2935.e4 [PMID:31801060]
631. Quaresma BMCS, Pimenta AR, Santos da Silva AC, Pupo AS, Romeiro LAS, Silva CLM and Noël F. (2019) Revisiting the Pharmacodynamic Uroselectivity of α_1-Adrenergic Receptor Antagonists. *J Pharmacol Exp Ther* **371**: 106-112 [PMID:31285236]
632. Queiróz DB, Mendes FR, Porto CS and Avellar MC. (2002) Alpha1-adrenoceptor subtypes in rat epididymis and the effects of sexual maturation. *Biol Reprod* **66**: 508-15 [PMID:11804969]
633. Quinton L, Girard E, Maiga A, Rekik M, Lluel P, Masuyer G, Larregola M, Marquer C, Ciolek J and Magnin T *et al.*. (2010) Isolation and pharmacological characterization of AdTx1, a natural peptide displaying specific insurmountable antagonism of the alpha1A-adrenoceptor. *Br J Pharmacol* **159**: 316-25 [PMID:20015090]
634. Ragnarsson L, Wang CI, Andersson Å, Fajarningsih D, Monks T, Brust A, Rosengren KJ and Lewis RJ. (2013) Conopeptide ρ-TIA defines a new allosteric site on the extracellular surface of the α1B-adrenoceptor. *J Biol Chem* **288**: 1814-27 [PMID:23184947]
635. Ramarao CS, Denker JM, Perez DM, Gaivin RJ, Riek RP and Graham RM. (1992) Genomic organization and expression of the human alpha 1B-adrenergic receptor. *J Biol Chem* **267**: 21936-45 [PMID:1328250]
636. Ramis JM, González-Sánchez JL, Proenza AM, Martínez-Larrad MT, Fernández-Pérez C, Palou A and Serrano-Ríos M. (2004) The Arg64 allele of the beta 3-adrenoceptor gene but not the -3826G allele of the uncoupling protein 1 gene is associated with increased leptin levels in the Spanish population. *Metab Clin Exp* **53**: 1411-6 [PMID:15536594]

637. Ramsay D, Carr IC, Pediani J, Lopez-Gimenez JF, Thurlow R, Fidock M and Milligan G. (2004) High-affinity interactions between human alpha1A-adrenoceptor C-terminal splice variants produce homo- and heterodimers but do not generate the alpha1L-adrenoceptor. *Mol Pharmacol* **66**: 228-39 [PMID:15266013]
638. Ranade K, Jorgenson E, Sheu WH, Pei D, Hsiung CA, Chiang FT, Chen YD, Pratt R, Olshen RA and Curb D *et al*.. (2002) A polymorphism in the beta1 adrenergic receptor is associated with resting heart rate. *Am J Hum Genet* **70**: 935-42 [PMID:11854867]
639. Rasmussen SG, Choi HJ, Fung JJ, Pardon E, Casarosa P, Chae PS, Devree BT, Rosenbaum DM, Thian FS and Kobilka TS *et al*.. (2011) Structure of a nanobody-stabilized active state of the β(2) adrenoceptor. *Nature* **469**: 175-80 [PMID:21228869]
640. Rasmussen SG, Choi HJ, Rosenbaum DM, Kobilka TS, Thian FS, Edwards PC, Burghammer M, Ratnala VR, Sanishvili R and Fischetti RF *et al*.. (2007) Crystal structure of the human beta2 adrenergic G-protein-coupled receptor. *Nature* **450**: 383-7 [PMID:17952055]
641. Rasmussen SG, DeVree BT, Zou Y, Kruse AC, Chung KY, Kobilka TS, Thian FS, Chae PS, Pardon E and Calinski D *et al*.. (2011) Crystal structure of the β2 adrenergic receptor-Gs protein complex. *Nature* **477**: 549-55 [PMID:21772288]
642. Regan JW, Kobilka TS, Yang-Feng TL, Caron MG, Lefkowitz RJ and Kobilka BK. (1988) Cloning and expression of a human kidney cDNA for an alpha 2-adrenergic receptor subtype. *Proc Natl Acad Sci USA* **85**: 6301-5 [PMID:2842764]
643. Ring AM, Manglik A, Kruse AC, Enos MD, Weis WI, Garcia KC and Kobilka BK. (2013) Adrenaline-activated structure of β2-adrenoceptor stabilized by an engineered nanobody. *Nature* **502**: 575-579 [PMID:24056936]
644. Rivard K, Trépanier-Boulay V, Rindt H and Fiset C. (2009) Electrical remodeling in a transgenic mouse model of alpha1B-adrenergic receptor overexpression. *Am J Physiol Heart Circ Physiol* **296**: H704-18 [PMID:19112097]
645. Rivero G, Martín-Guerrero I, de Prado E, Gabilondo AM, Callado LF, García-Sevilla JA, García-Orad Á and Meana JJ. (2016) Alpha2C-adrenoceptor Del322-325 polymorphism and risk of psychiatric disorders: significant association with opiate abuse and dependence. *World J Biol Psychiatry* **17**: 308-15 [PMID:27007576]
646. Roberts SJ, Papaioannou M, Evans BA and Summers RJ. (1997) Functional and molecular evidence for beta 1-, beta 2- and beta 3- adrenoceptors in human colon. *Br J Pharmacol* **120**: 1527-35 [PMID:9113375]
647. Roberts SJ, Papaioannou M, Evans BA and Summers RJ. (1999) Characterization of beta-adrenoceptor mediated smooth muscle relaxation and the detection of mRNA for beta1-, beta2- and beta3-adrenoceptors in rat ileum. *Br J Pharmacol* **127**: 949-61 [PMID:10433503]
648. Rodríguez JE, Saucedo-Campos AD, Vega AV, Ramírez-Hernández D, Martínez-Aguilar L, Jiménez-Flores JR, Andrade-Jorge E, Estrada-Soto SE, Villalobos-Molina R and Touyz RM *et al*.. (2020) The α1D-adrenoreceptor antagonist BMY 7378 reverses cardiac hypertrophy in spontaneously hypertensive rats. *J Hypertens* **38**: 1496-1503 [PMID:32195823]
649. Rodríguez-Pérez CE, Calvo-Ochoa E, Kalashnikova EV, Reyes-Cruz G, Romero-Avila MT and García-Sáinz JA. (2009) Receptor tyrosine kinases regulate alpha1D-adrenoceptor signaling properties: phosphorylation and desensitization. *Int J Biochem Cell Biol* **41**: 1276-83 [PMID:19038360]
650. Rohrer DK, Chruscinski A, Schauble EH, Bernstein D and Kobilka BK. (1999) Cardiovascular and metabolic alterations in mice lacking both beta1- and beta2-adrenergic receptors. *J Biol Chem* **274**: 16701-8 [PMID:10358009]
651. Rohrer DK, Desai KH, Jasper JR, Stevens ME, Regula Jr DP, Barsh GS, Bernstein D and Kobilka BK. (1996) Targeted disruption of the mouse beta1-adrenergic receptor gene: developmental and cardiovascular effects. *Proc Natl Acad Sci USA* **93**: 7375-80 [PMID:8693001]
652. Rohrer DK, Schauble EH, Desai KH, Kobilka BK and Bernstein D. (1998) Alterations in dynamic heart rate control in the beta 1-adrenergic receptor knockout mouse. *Am J Physiol* **274**: H1184-93 [PMID:9575921]
653. Rokosh DG and Simpson PC. (2002) Knockout of the alpha 1A/C-adrenergic receptor subtype: the alpha 1A/C is expressed in resistance arteries and is required to maintain arterial blood pressure. *Proc Natl Acad Sci USA* **99**: 9474-9 [PMID:12093905]
654. Romana-Souza B, Nascimento AP, Brum PC and Monte-Alto-Costa A. (2014) Deletion of the α2A/α2C-adrenoceptors accelerates cutaneous wound healing in mice. *Int J Exp Pathol* **95**: 330-41 [PMID:25186490]
655. Romeo G, Salerno L, Pittalà V, Modica MN, Siracusa MA, Materia L, Buccioni M, Marucci G and Minneman KP. (2014) High affinity ligands and potent antagonists for the α1D-adrenergic receptor. Novel 3,8-disubstituted [1]benzothieno[3,2-d]pyrimidine derivatives. *Eur J Med Chem* **83**: 419-32 [PMID:24992070]
656. Rorabaugh BR, Ross SA, Gaivin RJ, Papay RS, McCune DF, Simpson PC and Perez DM. (2005) alpha1A- but not alpha1B-adrenergic receptors precondition the ischemic heart by a staurosporine-sensitive, chelerythrine-insensitive mechanism. *Cardiovasc Res* **65**: 436-45

[PMID:15639483]
657. Rosenbaum DM, Zhang C, Lyons JA, Holl R, Aragao D, Arlow DH, Rasmussen SG, Choi HJ, Devree BT and Sunahara RK *et al*.. (2011) Structure and function of an irreversible agonist-β(2) adrenoceptor complex. *Nature* **469**: 236-40 [PMID:21228876]
658. Rosengren AH, Jokubka R, Tojjar D, Granhall C, Hansson O, Li DQ, Nagaraj V, Reinbothe TM, Tuncel J and Eliasson L *et al*.. (2010) Overexpression of alpha2A-adrenergic receptors contributes to type 2 diabetes. *Science* **327**: 217-20 [PMID:19965390]
659. Rosin DL, Zeng D, Stornetta RL, Norton FR, Riley T, Okusa MD, Guyenet PG and Lynch KR. (1993) Immunohistochemical localization of alpha 2A-adrenergic receptors in catecholaminergic and other brainstem neurons in the rat. *Neuroscience* **56**: 139-55 [PMID:7901804]
660. Ross SA, Rorabaugh BR, Chalothorn D, Yun J, Gonzalez-Cabrera PJ, McCune DF, Piascik MT and Perez DM. (2003) The alpha(1B)-adrenergic receptor decreases the inotropic response in the mouse Langendorff heart model. *Cardiovasc Res* **60**: 598-607 [PMID:14659805]
661. Rouget C, Bardou M, Breuiller-Fouché M, Loustalot C, Qi H, Naline E, Croci T, Cabrol D, Advenier C and Leroy MJ. (2005) Beta3-adrenoceptor is the predominant beta-adrenoceptor subtype in human myometrium and its expression is up-regulated in pregnancy. *J Clin Endocrinol Metab* **90**: 1644-50 [PMID:15585565]
662. Rouget C, Rekik M, Camparo P, Botto H, Rischmann P, Lluel P, Palea S and Westfall TD. (2014) Modulation of nerve-evoked contractions by β3-adrenoceptor agonism in human and rat isolated urinary bladder. *Pharmacol Res* **80**: 14-20 [PMID:24378642]
663. Rudner XL, Berkowitz DE, Booth JV, Funk BL, Cozart KL, D'Amico EB, El-Moalem H, Page SO, Richardson CD and Winters B *et al*.. (1999) Subtype specific regulation of human vascular alpha(1)-adrenergic receptors by vessel bed and age. *Circulation* **100**: 2336-43 [PMID:10587338]
664. Ruffolo Jr RR, Nichols AJ, Stadel JM and Hieble JP. (1993) Pharmacologic and therapeutic applications of alpha 2-adrenoceptor subtypes. *Annu Rev Pharmacol Toxicol* **33**: 243-79 [PMID:8098595]
665. Ruohonen ST, Valve L, Tuomainen K, Ailanen L, Röyttä M, Manz G, Baur N, Joos TO, Savontaus E and Scheinin M. (2018) Increased Energy Expenditure, Lipolysis and Hyperinsulinemia Confer Resistance to Central Obesity and Type 2 Diabetes in Mice Lacking Alpha2α-Adrenoceptors. *Neuroendocrinology* **107**: 324-339 [PMID:30041171]
666. Ruuskanen JO, Xhaard H, Marjamäki A, Salaneck E, Salminen T, Yan YL, Postlethwait JH, Johnson MS, Larhammar D and Scheinin M. (2004) Identification of duplicated fourth alpha2-adrenergic receptor subtype by cloning and mapping of five receptor genes in zebrafish. *Mol Biol Evol* **21**: 14-28 [PMID:12949138]
667. Sabio M, Jones K and Topiol S. (2008) Use of the X-ray structure of the beta2-adrenergic receptor for drug discovery. Part 2: Identification of active compounds. *Bioorg Med Chem Lett* **18**: 5391-5 [PMID:18829308]
668. Sadalge A, Coughlin L, Fu H, Wang B, Valladares O, Valentino R and Blendy JA. (2003) alpha 1d Adrenoceptor signaling is required for stimulus induced locomotor activity. *Mol Psychiatry* **8**: 664-72 [PMID:12874602]
669. Saeed AE, Parmentier JH and Malik KU. (2004) Activation of alpha1A-adrenergic receptor promotes differentiation of rat-1 fibroblasts to a smooth muscle-like phenotype. *BMC Cell Biol* **5**: 47 [PMID:15603588]
670. Sakauchi N, Furukawa H, Shirai J, Sato A, Kuno H, Saikawa R and Yoshida M. (2017) Identification of 3,4-dihydro-2H-thiochromene 1,1-dioxide derivatives with a phenoxyethylamine group as highly potent and selective α_{1D} adrenoceptor antagonists. *Eur J Med Chem* **139**: 114-127 [PMID:28800452]
671. Sallinen J, Holappa J, Koivisto A, Kuokkanen K, Chapman H, Lehtimäki J, Piepponen P, Mijatovic J, Tanila H and Virtanen R *et al*.. (2013) Pharmacological characterisation of a structurally novel α2C-adrenoceptor antagonist ORM-10921 and its effects in neuropsychiatric models. *Basic Clin Pharmacol Toxicol* **113**: 239-49 [PMID:23718812]
672. Sallinen J, Höglund I, Engström M, Lehtimäki J, Virtanen R, Sirviö J, Wurster S, Savola JM and Haapalinna A. (2007) Pharmacological characterization and CNS effects of a novel highly selective alpha2C-adrenoceptor antagonist JP-1302. *Br J Pharmacol* **150**: 391-402 [PMID:17220913]
673. Salomonsson M, Oker M, Kim S, Zhang H, Faber JE and Arendshorst WJ. (2001) Alpha1-adrenoceptor subtypes on rat afferent arterioles assessed by radioligand binding and RT-PCR. *Am J Physiol Renal Physiol* **281**: F172-8 [PMID:11399658]
674. Santana N, Mengod G and Artigas F. (2013) Expression of α(1)-adrenergic receptors in rat prefrontal cortex: cellular co-localization with 5-HT(2A) receptors. *Int J Neuropsychopharmacol* **16**: 1139-51 [PMID:23195622]
675. Sarsero D, Molenaar P and Kaumann AJ. (1998) Validity of (-)-[3H]-CGP 12177A as a radioligand for the 'putative beta4-adrenoceptor' in rat atrium. *Br J Pharmacol* **123**: 371-80 [PMID:9504376]
676. Sato M, Dehvari N, Oberg AI, Dallner OS, Sandström AL, Olsen JM, Csikasz RI, Summers RJ,

Hutchinson DS and Bengtsson T. (2014) Improving type 2 diabetes through a distinct adrenergic signaling pathway involving mTORC2 that mediates glucose uptake in skeletal muscle. *Diabetes* **63**: 4115-29 [PMID:25008179]
677. Sato M, Evans BA, Sandström AL, Chia LY, Mukaida S, Thai BS, Nguyen A, Lim L, Tan CYR and Baltos JA *et al.*. (2018) α_{1A}-Adrenoceptors activate mTOR signalling and glucose uptake in cardiomyocytes. *Biochem Pharmacol* **148**: 27-40 [PMID:29175420]
678. Sato M, Horinouchi T, Hutchinson DS, Evans BA and Summers RJ. (2007) Ligand-directed signaling at the beta3-adrenoceptor produced by 3-(2-Ethylphenoxy)-1-[(1,S)-1,2,3,4-tetrahydronapth-1-ylamino]-2S-2-propanol oxalate (SR59230A) relative to receptor agonists. *Mol Pharmacol* **72**: 1359-68 [PMID:17717109]
679. Sato M, Hutchinson DS, Evans BA and Summers RJ. (2008) The beta3-adrenoceptor agonist 4-[[(Hexylamino)carbonyl]amino]-N-[4-[2-[[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino]ethyl]-phenyl]-benzenesulfonamide (L755507) and antagonist (S)-N-[4-[2-[[3-[3-(acetamidomethyl)phenoxy]-2-hydroxypropyl]amino]-ethyl]phenyl]benzenesulfonamide (L748337) activate different signaling pathways in Chinese hamster ovary-K1 cells stably expressing the human beta3-adrenoceptor. *Mol Pharmacol* **74**: 1417-28 [PMID:18684840]
680. Sato M, Hutchinson DS, Halls ML, Furness SG, Bengtsson T, Evans BA and Summers RJ. (2012) Interaction with caveolin-1 modulates G protein coupling of mouse β3-adrenoceptor. *J Biol Chem* **287**: 20674-88 [PMID:22535965]
681. Sato T, Baker J, Warne T, Brown GA, Leslie AG, Congreve M and Tate CG. (2015) Pharmacological Analysis and Structure Determination of 7-Methylcyanopindolol-Bound β1-Adrenergic Receptor. *Mol Pharmacol* **88**: 1024-34 [PMID:26385885]
682. Sato Y, Kurose H, Isogaya M and Nagao T. (1996) Molecular characterization of pharmacological properties of T-0509 for beta-adrenoceptors. *Eur J Pharmacol* **315**: 363-7 [PMID:8982677]
683. Saussy Jr DL, Goetz AS, Queen KL, King HK, Lutz MW and Rimele TJ. (1996) Structure activity relationships of a series of buspirone analogs at alpha-1 adrenoceptors: further evidence that rat aorta alpha-1 adrenoceptors are of the alpha-1D-subtype. *J Pharmacol Exp Ther* **278**: 136-44 [PMID:8764344]
684. Savolainen K, Ihalainen J, Hämäläinen E, Tanila H and Forsberg MM. (2021) Phencyclidine-induced cognitive impairments in repeated touchscreen visual reversal learning tests in rats. *Behav Brain Res* **404**: 113057 [PMID:33316322]
685. Scheinin M, Lomasney JW, Hayden-Hixson DM, Schambra UB, Caron MG, Lefkowitz RJ and Fremeau Jr RT. (1994) Distribution of alpha 2-adrenergic receptor subtype gene expression in rat brain. *Brain Res Mol Brain Res* **21**: 133-49 [PMID:8164514]
686. Scheinin M and Pihlavisto M. (2000) Molecular pharmacology of alpha2-adrenoceptor agonists *Best Practice & Research Clinical Anaesthesiology* **14**: 247-260
687. Schena G and Caplan MJ. (2019) Everything You Always Wanted to Know about β_3-AR * (* But Were Afraid to Ask). *Cells* **8** [PMID:30995798]
688. Schilit S and Benzeroual KE. (2009) Silodosin: a selective alpha1A-adrenergic receptor antagonist for the treatment of benign prostatic hyperplasia. *Clin Ther* **31**: 2489-502 [PMID:20109995]
689. Schmidt M, Dekker FJ and Maarsingh H. (2013) Exchange protein directly activated by cAMP (epac): a multidomain cAMP mediator in the regulation of diverse biological functions. *Pharmacol Rev* **65**: 670-709 [PMID:23447132]
690. Schotte A, Janssen PF, Gommeren W, Luyten WH, Van Gompel P, Lesage AS, De Loore K and Leysen JE. (1996) Risperidone compared with new and reference antipsychotic drugs: in vitro and in vivo receptor binding. *Psychopharmacology (Berl.)* **124**: 57-73 [PMID:8935801]
691. Schwinn DA, Johnston GI, Page SO, Mosley MJ, Wilson KH, Worman NP, Campbell S, Fidock MD, Furness LM and Parry-Smith DJ *et al.*. (1995) Cloning and pharmacological characterization of human alpha-1 adrenergic receptors: sequence corrections and direct comparison with other species homologues. *J Pharmacol Exp Ther* **272**: 134-42 [PMID:7815325]
692. Schwinn DA, Lomasney JW, Lorenz W, Szklut PJ, Fremeau Jr RT, Yang-Feng TL, Caron MG, Lefkowitz RJ and Cotecchia S. (1990) Molecular cloning and expression of the cDNA for a novel alpha 1-adrenergic receptor subtype. *J Biol Chem* **265**: 8183-9 [PMID:1970822]
693. Schwinn DA and Michelotti GA. (2000) alpha1-adrenergic receptors in the lower urinary tract and vascular bed: potential role for the alpha1d subtype in filling symptoms and effects of ageing on vascular expression. *BJU Int* **85 Suppl 2**: 6-11 [PMID:10781179]
694. Segura V, Flacco N, Oliver E, Barettino D, D'Ocon P and Ivorra MD. (2010) Alpha1-adrenoceptors in the rat cerebral cortex: new insights into the characterization of alpha1L- and alpha1D-adrenoceptors. *Eur J Pharmacol* **641**: 41-8 [PMID:20511116]
695. Seifert R, Lee TW, Lam VT and Kobilka BK. (1998) Reconstitution of beta2-adrenoceptor-GTP-binding-protein interaction in Sf9 cells--high coupling efficiency in a beta2-adrenoceptor-G(s alpha) fusion protein. *Eur J Biochem* **255**: 369-82 [PMID:9716378]

696. Semmler J, Gebert U, Eisenhut T, Moeller J, Schönharting MM, Alléra A and Endres S. (1993) Xanthine derivatives: comparison between suppression of tumour necrosis factor-alpha production and inhibition of cAMP phosphodiesterase activity. *Immunology* **78**: 520-5 [PMID:8388363]
697. Severi C, Tattoli I, Romano G, Corleto VD and Delle Fave G. (2004) Beta3-adrenoceptors: relaxant function and mRNA detection in smooth muscle cells isolated from the human colon. *Can J Physiol Pharmacol* **82**: 515-22 [PMID:15389299]
698. Shahid M, Rinne JO, Scheinin M, Virta J, Marjamäki P, Solin O, Arponen E, Sallinen J, Kuokkanen K and Rouru J. (2020) Application of the PET ligand [^{11}C]ORM-13070 to examine receptor occupancy by the α_{2C}-adrenoceptor antagonist ORM-12741: translational validation of target engagement in rat and human brain. *EJNMMI Res* **10**: 152 [PMID:33296042]
699. Sharif NA, Xu SX, Crider JY, McLaughlin M and Davis TL. (2001) Levobetaxolol (Betaxon) and other beta-adrenergic antagonists: preclinical pharmacology, IOP-lowering activity and sites of action in human eyes. *J Ocul Pharmacol Ther* **17**: 305-17 [PMID:11572462]
700. Sharpe IA, Thomas L, Loughnan M, Motin L, Palant E, Croker DE, Alewood D, Chen S, Graham RM and Alewood PF *et al.*. (2003) Allosteric alpha 1-adrenoreceptor antagonism by the conopeptide rho-TIA. *J Biol Chem* **278**: 34451-7 [PMID:12824165]
701. Shattil SJ, McDonough M, Turnbull J and Insel PA. (1981) Characterization of alpha-adrenergic receptors in human platelets using [3H]clonidine. *Mol Pharmacol* **19**: 179-83 [PMID:6259509]
702. Shi T, Duan ZH, Papay R, Pluskota E, Gaivin RJ, de la Motte CA, Plow EF and Perez DM. (2006) Novel alpha1-adrenergic receptor signaling pathways: secreted factors and interactions with the extracellular matrix. *Mol Pharmacol* **70**: 129-42 [PMID:16617165]
703. Shi T, Gaivin RJ, McCune DF, Gupta M and Perez DM. (2007) Dominance of the alpha1B-adrenergic receptor and its subcellular localization in human and TRAMP prostate cancer cell lines. *J Recept Signal Transduct Res* **27**: 27-45 [PMID:17365508]
704. Shi T, Moravec CS and Perez DM. (2013) Novel proteins associated with human dilated cardiomyopathy: selective reduction in α1A-adrenergic receptors and increased desensitization proteins. *J Recept Signal Transduct Res* **33**: 96-106 [PMID:23384050]
705. Shi T, Papay RS and Perez DM. (2012) α(1A)-adrenergic receptor differentially regulates STAT3 phosphorylation through PKCε and PKCδ in myocytes. *J Recept Signal Transduct Res* **32**: 76-86 [PMID:22268811]
706. Shi T, Papay RS and Perez DM. (2017) The role of α_1-adrenergic receptors in regulating metabolism: increased glucose tolerance, leptin secretion and lipid oxidation. *J Recept Signal Transduct Res* **37**: 124-132 [PMID:27277698]
707. Shi T, Papay RS and Perez DM. (2016) α1A-Adrenergic receptor prevents cardiac ischemic damage through PKCδ/GLUT1/4-mediated glucose uptake. *J Recept Signal Transduct Res* **36**: 261-70 [PMID:26832303]
708. Shibata K, Foglar R, Horie K, Obika K, Sakamoto A, Ogawa S and Tsujimoto G. (1995) KMD-3213, a novel, potent, alpha 1a-adrenoceptor-selective antagonist: characterization using recombinant human alpha 1-adrenoceptors and native tissues. *Mol Pharmacol* **48**: 250-8 [PMID:7651358]
709. Shihara N, Yasuda K, Moritani T, Ue H, Adachi T, Tanaka H, Tsuda K and Seino Y. (1999) The association between Trp64Arg polymorphism of the beta3-adrenergic receptor and autonomic nervous system activity. *J Clin Endocrinol Metab* **84**: 1623-7 [PMID:10323390]
710. Shimokawa T, Nakagawa T, Hayashi K, Yamagata M and Yoneda K. (2022) Subcellular distribution of α2-adrenoceptor subtypes in the rodent kidney. *Cell Tissue Res* **387**: 303-314 [PMID:34837110]
711. Shimokawa T, Tsutsui H, Miura T, Takama M, Hayashi K, Nishinaka T, Terada T, Yoneda K, Yamagata M and Yukimura T. (2019) Post-treatment with JP-1302 protects against renal ischemia/reperfusion-induced acute kidney injury in rats. *J Pharmacol Sci* **139**: 137-142 [PMID:30665845]
712. Sigala S, Dellabella M, Milanese G, Fornari S, Faccoli S, Palazzolo F, Peroni A, Mirabella G, Cunico SC and Spano P *et al.*. (2005) Evidence for the presence of alpha1 adrenoceptor subtypes in the human ureter. *Neurourol Urodyn* **24**: 142-8 [PMID:15690361]
713. Sigala S, Peroni A, Mirabella G, Fornari S, Palazzolo F, Pezzotti G, Simeone C, Cunico SC and Spano P. (2004) Alpha1 adrenoceptor subtypes in human urinary bladder: sex and regional comparison. *Life Sci* **76**: 417-27 [PMID:15530504]
714. Simonneaux V, Ebadi M and Bylund DB. (1991) Identification and characterization of alpha 2D-adrenergic receptors in bovine pineal gland. *Mol Pharmacol* **40**: 235-41 [PMID:1652052]
715. Skeberdis VA, Jurevicius J and Fischmeister R. (1999) b3-adrenergic regulation of cardiac L-type Ca2+ current in human atrial myocytes. *Biophys J* **76**: A343-A343
716. Small KM, Schwarb MR, Glinka C, Theiss CT, Brown KM, Seman CA and Liggett SB. (2006) Alpha2A- and alpha2C-adrenergic receptors form homo- and heterodimers: the heterodimeric state impairs agonist-promoted GRK phosphorylation and beta-arrestin recruitment. *Biochemistry* **45**: 4760-7 [PMID:16605244]

717. Smith C and Teitler M. (1999) Beta-blocker selectivity at cloned human beta 1- and beta 2-adrenergic receptors. *Cardiovasc Drugs Ther* **13**: 123-6 [PMID:10372227]
718. Snabaitis AK, Yokoyama H and Avkiran M. (2000) Roles of mitogen-activated protein kinases and protein kinase C in alpha(1A)-adrenoceptor-mediated stimulation of the sarcolemmal Na(+)-H(+) exchanger. *Circ Res* **86**: 214-20 [PMID:10666418]
719. Snapir A, Heinonen P, Tuomainen TP, Alhopuro P, Karvonen MK, Lakka TA, Nyyssönen K, Salonen R, Kauhanen J and Valkonen VP *et al.*. (2001) An insertion/deletion polymorphism in the alpha2B-adrenergic receptor gene is a novel genetic risk factor for acute coronary events. *J Am Coll Cardiol* **37**: 1516-22 [PMID:11345359]
720. Snapir A, Mikkelsson J, Perola M, Penttilä A, Scheinin M and Karhunen PJ. (2003) Variation in the alpha2B-adrenoceptor gene as a risk factor for prehospital fatal myocardial infarction and sudden cardiac death. *J Am Coll Cardiol* **41**: 190-4 [PMID:12535806]
721. Snitker S, Odeleye OE, Hellmer J, Boschmann M, Monroe MB, Shuldiner AR and Ravussin E. (1997) No effect of the Trp64Arg beta 3-adrenoceptor variant on in vivo lipolysis in subcutaneous adipose tissue. *Diabetologia* **40**: 838-842 [PMID:9243106]
722. Soave M, Stoddart LA, Brown A, Woolard J and Hill SJ. (2016) Use of a new proximity assay (NanoBRET) to investigate the ligand-binding characteristics of three fluorescent ligands to the human β_1-adrenoceptor expressed in HEK-293 cells. *Pharmacol Res Perspect* **4**: e00250 [PMID:27588207]
723. Song Y, Xu C, Liu J, Li Y, Wang H, Shan D, Wainer IW, Hu X, Zhang Y and Woo AY *et al.*. (2021) Heterodimerization With 5-HT_{2B}R Is Indispensable for β_2AR-Mediated Cardioprotection. *Circ Res* **128**: 262-277 [PMID:33208036]
724. Soriano-Ursúa MA, McNaught-Flores DA, Nieto-Alamilla G, Segura-Cabrera A, Correa-Basurto J, Arias-Montaño JA and Trujillo-Ferrara JG. (2012) Cell-based and in-silico studies on the high intrinsic activity of two boron-containing salbutamol derivatives at the human β_2-adrenoceptor. *Bioorg Med Chem* **20**: 933-41 [PMID:22182578]
725. Soriano-Ursúa MA, Valencia-Hernández I, Arellano-Mendoza MG, Correa-Basurto J and Trujillo-Ferrara JG. (2009) Synthesis, pharmacological and in silico evaluation of 1-(4-di-hydroxy-3,5-dioxa-4-borabicyclo[4.4.0]deca-7,9,11-trien-9-yl)-2-(tert-butylamino)ethanol, a compound designed to act as a beta2 adrenoceptor agonist. *Eur J Med Chem* **44**: 2840-6 [PMID:19168263]
726. Souza-Braga P, Lorena FB, Nascimento BPP, Marcelino CP, Ravache TT, Ricci E, Bernardi MM and Ribeiro MO. (2018) Adrenergic receptor β3 is involved in the memory consolidation process in mice. *Braz J Med Biol Res* **51**: e7564 [PMID:30088540]
727. Spiegl G, Zupkó I, Minorics R, Csík G, Csonka D and Falkay G. (2009) Effects of experimentally induced diabetes mellitus on pharmacologically and electrically elicited myometrial contractility. *Clin Exp Pharmacol Physiol* **36**: 884-91 [PMID:19298542]
728. Stam WB, Van der Graaf PH and Saxena PR. (1998) Functional characterisation of the pharmacological profile of the putative alpha1B-adrenoceptor antagonist, (+)-cyclazosin. *Eur J Pharmacol* **361**: 79-83 [PMID:9851544]
729. Stiles GL, Caron MG and Lefkowitz RJ. (1984) Beta-adrenergic receptors: biochemical mechanisms of physiological regulation. *Physiol Rev* **64**: 661-743 [PMID:6143332]
730. Stofkova A, Kamimura D, Ohki T, Ota M, Arima Y and Murakami M. (2019) Photopic light-mediated down-regulation of local α_{1A}-adrenergic signaling protects blood-retina barrier in experimental autoimmune uveoretinitis. *Sci Rep* **9**: 2353 [PMID:30787395]
731. Storch U, Straub J, Erdogmus S, Gudermann T and Mederos Y Schnitzler M. (2017) Dynamic monitoring of $G_{i/o}$-protein-mediated decreases of intracellular cAMP by FRET-based Epac sensors. *Pflugers Arch* **469**: 725-737 [PMID:28386636]
732. Strosberg AD. (1997) Structure and function of the beta 3-adrenergic receptor. *Annu Rev Pharmacol Toxicol* **37**: 421-50 [PMID:9131260]
733. Su M, Wang J, Xiang G, Do HN, Levitz J, Miao Y and Huang XY. (2023) Structural basis of agonist specificity of α_{1A}-adrenergic receptor. *Nat Commun* **14**: 4819 [PMID:37563160]
734. Su M, Zhu L, Zhang Y, Paknejad N, Dey R, Huang J, Lee MY, Williams D, Jordan KD and Eng ET *et al.*. (2020) Structural Basis of the Activation of Heterotrimeric Gs-Protein by Isoproterenol-Bound β_1-Adrenergic Receptor. *Mol Cell* **80**: 59-71.e4 [PMID:32818430]
735. Sugama S, Takenouchi T, Hashimoto M, Ohata H, Takenaka Y and Kakinuma Y. (2019) Stress-induced microglial activation occurs through β-adrenergic receptor: noradrenaline as a key neurotransmitter in microglial activation. *J Neuroinflammation* **16**: 266 [PMID:31847911]
736. Summers RJ, Jarrott B and Louis WJ. (1980) Displacement of [3H]clonidine binding by clonidine analogues in membranes from rat cerebral cortex. *Eur J Pharmacol* **66**: 233-41 [PMID:6254785]
737. Summers RJ, Molenaar P and Stephenson JA. (1987) Autoradiographic localization of receptors in the cardiovascular system *TiPS* **8**: 272-276
738. Summers RJ, Molnaar P, Russell F, Elnatan J, Jones CR, Buxton BF, Chang V and Hambley J. (1989) Coexistence and localization of beta 1- and beta 2-adrenoceptors in the human heart. *Eur Heart J* **10 Suppl B**: 11-21 [PMID:2553407]

739. Sun GC, Ho WY, Chen BR, Cheng PW, Cheng WH, Hsu MC, Yeh TC, Hsiao M, Lu PJ and Tseng CJ. (2015) GPCR dimerization in brainstem nuclei contributes to the development of hypertension. *Br J Pharmacol* **172**: 2507-18 [PMID:25573074]
740. Susec M, Sencanski M, Glisic S, Veljkovic N, Pedersen C, Drinovec L, Stojan J, Nøhr J and Vrecl M. (2019) Functional characterization of β_2-adrenergic and insulin receptor heteromers. *Neuropharmacology* **152**: 78-89 [PMID:30707913]
741. Susulic VS, Frederich RC, Lawitts J, Tozzo E, Kahn BB, Harper ME, Himms-Hagen J, Flier JS and Lowell BB. (1995) Targeted disruption of the beta 3-adrenergic receptor gene. *J Biol Chem* **270**: 29483-92 [PMID:7493988]
742. Suzuki T, Nantel F, Bonin H, Valiquette M and Bouvier M. (1993) Cellular characterization of the pharmacological selectivity and tachyphylactic properties of denopamine for the human beta adrenergic receptors. *J Pharmacol Exp Ther* **267**: 785-90 [PMID:7902433]
743. Suzuki T, Otsuka A, Matsumoto R, Furuse H and Ozono S. (2016) The expression of β3-adrenoceptors and their function in the human prostate. *Prostate* **76**: 163-71 [PMID:26768278]
744. Swaminath G, Lee TW and Kobilka B. (2003) Identification of an allosteric binding site for Zn2+ on the beta2 adrenergic receptor. *J Biol Chem* **278**: 352-6 [PMID:12409304]
745. Swaminath G, Steenhuis J, Kobilka B and Lee TW. (2002) Allosteric modulation of beta2-adrenergic receptor by Zn(2+). *Mol Pharmacol* **61**: 65-72 [PMID:11752207]
746. Sykes DA and Charlton SJ. (2012) Slow receptor dissociation is not a key factor in the duration of action of inhaled long-acting β2-adrenoceptor agonists. *Br J Pharmacol* **165**: 2672-83 [PMID:21883146]
747. Sykes DA, Jiménez-Rosés M, Reilly J, Fairhurst RA, Charlton SJ and Veprintsev DB. (2022) Exploring the kinetic selectivity of drugs targeting the β_1 -adrenoceptor. *Pharmacol Res Perspect* **10**: e00978 [PMID:35762357]
748. Szot P, White SS, Greenup JL, Leverenz JB, Peskind ER and Raskind MA. (2005) Alpha1-adrenoreceptor in human hippocampus: binding and receptor subtype mRNA expression. *Brain Res Mol Brain Res* **139**: 367-71 [PMID:16039007]
749. Szot P, White SS, Greenup JL, Leverenz JB, Peskind ER and Raskind MA. (2007) Changes in adrenoreceptors in the prefrontal cortex of subjects with dementia: evidence of compensatory changes. *Neuroscience* **146**: 471-80 [PMID:17324522]
750. Szot P, White SS, Greenup JL, Leverenz JB, Peskind ER and Raskind MA. (2006) Compensatory changes in the noradrenergic nervous system in the locus ceruleus and hippocampus of postmortem subjects with Alzheimer's disease and dementia with Lewy bodies. *J Neurosci* **26**: 467-78 [PMID:16407544]
751. Takahashi K, Hossain M, Ahmed M, Bhuiyan MA, Ohnuki T and Nagatomo T. (2007) Asp125 and Thr130 in transmembrane domain 3 are major sites of alpha1b-adrenergic receptor antagonist binding. *Biol Pharm Bull* **30**: 1891-4 [PMID:17917257]
752. Takakura K, Taniguchi T, Muramatsu I, Takeuchi K and Fukuda S. (2002) Modification of alpha1 -adrenoceptors by peroxynitrite as a possible mechanism of systemic hypotension in sepsis. *Crit Care Med* **30**: 894-9 [PMID:11940765]
753. Takasu T, Ukai M, Sato S, Matsui T, Nagase I, Maruyama T, Sasamata M, Miyata K, Uchida H and Yamaguchi O. (2007) Effect of (R)-2-(2-aminothiazol-4-yl)-4'-{2-[(2-hydroxy-2-phenylethyl)amino]ethyl} acetanilide (YM178), a novel selective beta3-adrenoceptor agonist, on bladder function. *J Pharmacol Exp Ther* **321**: 642-7 [PMID:17293563]
754. Talley EM, Rosin DL, Lee A, Guyenet PG and Lynch KR. (1996) Distribution of alpha 2A-adrenergic receptor-like immunoreactivity in the rat central nervous system. *J Comp Neurol* **372**: 111-34 [PMID:8841924]
755. Tan M, Walwyn WM, Evans CJ and Xie CW. (2009) p38 MAPK and beta-arrestin 2 mediate functional interactions between endogenous micro-opioid and alpha2A-adrenergic receptors in neurons. *J Biol Chem* **284**: 6270-81 [PMID:19126537]
756. Tanaka K, Hirai T, Kodama D, Kondo H, Hamamura K and Togari A. (2016) α1B -Adrenoceptor signalling regulates bone formation through the up-regulation of CCAAT/enhancer-binding protein δ expression in osteoblasts. *Br J Pharmacol* **173**: 1058-69 [PMID:26750808]
757. Tang WHW and Naga Prasad SV. (2022) Autoantibodies and Cardiomyopathy: Focus on Beta-1 Adrenergic Receptor Autoantibodies. *J Cardiovasc Pharmacol* **80**: 354-363 [PMID:35323150]
758. Taniguchi N, Hamada K, Ogasawara T, Ukai Y, Yoshikuni Y and Kimura K. (1996) NS-49, an alpha 1A-adrenoceptor agonist, selectively increases intraurethral pressure in dogs. *Eur J Pharmacol* **318**: 117-22 [PMID:9007522]
759. Taniguchi T, Inagaki R, Murata S, Akiba I and Muramatsu I. (1999) Microphysiometric analysis of human alpha1a-adrenoceptor expressed in Chinese hamster ovary cells. *Br J Pharmacol* **127**: 962-8 [PMID:10433504]
760. Tanner MA, Maitz CA and Grisanti LA. (2021) Immune cell β_2-adrenergic receptors contribute to the development of heart failure. *Am J Physiol Heart Circ Physiol* **321**: H633-H649 [PMID:34415184]
761. Tanoue A, Koba M, Miyawaki S, Koshimizu TA, Hosoda C, Oshikawa S and Tsujimoto G. (2002)

Role of the alpha1D-adrenergic receptor in the development of salt-induced hypertension. *Hypertension* **40**: 101-6 [PMID:12105146]
762. Tanoue A, Nasa Y, Koshimizu T, Shinoura H, Oshikawa S, Kawai T, Sunada S, Takeo S and Tsujimoto G. (2002) The alpha(1D)-adrenergic receptor directly regulates arterial blood pressure via vasoconstriction. *J Clin Invest* **109**: 765-75 [PMID:11901185]
763. Tate KM, Briend-Sutren MM, Emorine LJ, Delavier-Klutchko C, Marullo S and Strosberg AD. (1991) Expression of three human beta-adrenergic-receptor subtypes in transfected Chinese hamster ovary cells. *Eur J Biochem* **196**: 357-61 [PMID:1848818]
764. Tavernier G, Barbe P, Galitzky J, Berlan M, Caput D, Lafontan M and Langin D. (1996) Expression of beta3-adrenoceptors with low lipolytic action in human subcutaneous white adipocytes. *J Lipid Res* **37**: 87-97 [PMID:8820105]
765. Tavernier G, Toumaniantz G, Erfanian M, Heymann MF, Laurent K, Langin D and Gauthier C. (2003) beta3-Adrenergic stimulation produces a decrease of cardiac contractility ex vivo in mice overexpressing the human beta3-adrenergic receptor. *Cardiovasc Res* **59**: 288-96 [PMID:12909312]
766. Tayebati SK, Bronzetti E, Morra Di Cella S, Mulatero P, Ricci A, Rossodivita I, Schena M, Schiavone D, Veglio F and Amenta F. (2000) In situ hybridization and immunocytochemistry of alpha1-adrenoceptors in human peripheral blood lymphocytes. *J Auton Pharmacol* **20**: 305-12 [PMID:11350496]
767. Testa R, Guarneri L, Angelico P, Poggesi E, Taddei C, Sironi G, Colombo D, Sulpizio AC, Naselsky DP and Hieble JP *et al.*. (1997) Pharmacological characterization of the uroselective alpha-1 antagonist Rec 15/2739 (SB 216469): role of the alpha-1L adrenoceptor in tissue selectivity, part II. *J Pharmacol Exp Ther* **281**: 1284-93 [PMID:9190864]
768. Thapa D, Valente JS, Barrett B, Smith MJ, Argunhan F, Lee SY, Nikitochkina S, Kodji X and Brain SD. (2021) Dysfunctional TRPM8 signalling in the vascular response to environmental cold in ageing. *Elife* **10** [PMID:34726597]
769. Thomsen M, Nordestgaard BG, Sethi AA, Tybjærg-Hansen A and Dahl M. (2012) β2-adrenergic receptor polymorphisms, asthma and COPD: two large population-based studies. *Eur Respir J* **39**: 558-66 [PMID:22075484]
770. Tonolo G, Melis MG, Secchi G, Atzeni MM, Angius MF, Carboni A, Ciccarese M, Malavasi A and Maioli M. (1999) Association of Trp64Arg beta 3-adrenergic-receptor gene polymorphism with essential hypertension in the Sardinian population. *J Hypertens* **17**: 33-8 [PMID:10100091]
771. Townsend SA, Jung AS, Hoe YS, Lefkowitz RY, Khan SA, Lemmon CA, Harrison RW, Lee K, Barouch LA and Cotecchia S *et al.*. (2004) Critical role for the alpha-1B adrenergic receptor at the sympathetic neuroeffector junction. *Hypertension* **44**: 776-82 [PMID:15466664]
772. Tripathi A, Vana PG, Chavan TS, Brueggemann LI, Byron KL, Tarasova NI, Volkman BF, Gaponenko V and Majetschak M. (2015) Heteromerization of chemokine (C-X-C motif) receptor 4 with α1A/B-adrenergic receptors controls α1-adrenergic receptor function. *Proc Natl Acad Sci U S A* **112**: E1659-68 [PMID:25775528]
773. Trochu JN, Leblais V, Rautureau Y, Bévérelli F, Le Marec H, Berdeaux A and Gauthier C. (1999) Beta 3-adrenoceptor stimulation induces vasorelaxation mediated essentially by endothelium-derived nitric oxide in rat thoracic aorta. *Br J Pharmacol* **128**: 69-76 [PMID:10498836]
774. Tsuchihashi H, Nakashima Y, Kinami J and Nagatomo T. (1990) Characteristics of 125I-iodocyanopindolol binding to beta-adrenergic and serotonin-1B receptors of rat brain: selectivity of beta-adrenergic agents. *Jpn J Pharmacol* **52**: 195-200 [PMID:1968985]
775. Tsutsui H, Shimokawa T, Miura T, Takama M, Nishinaka T, Terada T, Yamagata M and Yukimura T. (2018) Inhibition of α2C-adrenoceptors ameliorates cisplatin-induced acute renal failure in rats. *Eur J Pharmacol* **838**: 113-119 [PMID:30201375]
776. Turki J, Lorenz JN, Green SA, Donnelly ET, Jacinto M and Liggett SB. (1996) Myocardial signaling defects and impaired cardiac function of a human beta 2-adrenergic receptor polymorphism expressed in transgenic mice. *Proc Natl Acad Sci USA* **93**: 10483-8 [PMID:8816827]
777. Turki J, Pak J, Green SA, Martin RJ and Liggett SB. (1995) Genetic polymorphisms of the beta 2-adrenergic receptor in nocturnal and nonnocturnal asthma. Evidence that Gly16 correlates with the nocturnal phenotype. *J Clin Invest* **95**: 1635-41 [PMID:7706471]
778. Uberti MA, Hague C, Oller H, Minneman KP and Hall RA. (2005) Heterodimerization with beta2-adrenergic receptors promotes surface expression and functional activity of alpha1D-adrenergic receptors. *J Pharmacol Exp Ther* **313**: 16-23 [PMID:15615865]
779. Uberti MA, Hall RA and Minneman KP. (2003) Subtype-specific dimerization of alpha 1-adrenoceptors: effects on receptor expression and pharmacological properties. *Mol Pharmacol* **64**: 1379-90 [PMID:14645668]
780. Uehling DE, Shearer BG, Donaldson KH, Chao EY, Deaton DN, Adkison KK, Brown KK, Cariello NF, Faison WL and Lancaster ME *et al.*. (2006) Biarylaniline phenethanolamines as potent and selective beta3 adrenergic receptor agonists. *J Med Chem* **49**: 2758-71 [PMID:16640337]
781. Uhlén M, Fagerberg L, Hallström BM, Lindskog C, Oksvold P, Mardinoglu A, Sivertsson Å,

Kampf C, Sjöstedt E and Asplund A *et al*.. (2015) Proteomics. Tissue-based map of the human proteome. *Science* **347**: 1260419 [PMID:25613900]
782. Uhlén S, Schiöth HB and Jahnsen JA. (2016) A new, simple and robust radioligand binding method used to determine kinetic off-rate constants for unlabeled ligands. Application at α2A- and α2C-adrenoceptors. *Eur J Pharmacol* **788**: 113-121 [PMID:27318322]
783. Uhlén S, Porter AC and Neubig RR. (1994) The novel alpha-2 adrenergic radioligand [3H]-MK912 is alpha-2C selective among human alpha-2A, alpha-2B and alpha-2C adrenoceptors. *J Pharmacol Exp Ther* **271**: 1558-65 [PMID:7996470]
784. Ul-Haq Z, Saeed M, Halim SA and Khan W. (2015) 3D structure prediction of human β1-adrenergic receptor via threading-based homology modeling for implications in structure-based drug designing. *PLoS One* **10**: e0122223 [PMID:25860348]
785. Ulu N, Henning RH, Guner S, Zoto T, Duman-Dalkilic B, Duin M and Gurdal H. (2013) Intracellular transactivation of epidermal growth factor receptor by α1A-adrenoceptor is mediated by phosphatidylinositol 3-kinase independently of activation of extracellular signal regulated kinases 1/2 and serine-threonine kinases in Chinese hamster ovary cells. *J Pharmacol Exp Ther* **347**: 47-56 [PMID:23902938]
786. Umekawa T, Yoshida T, Sakane N, Kogure A, Kondo M and Honjyo H. (1999) Trp64Arg mutation of beta3-adrenoceptor gene deteriorates lipolysis induced by beta3-adrenoceptor agonist in human omental adipocytes. *Diabetes* **48**: 117-20 [PMID:9892231]
787. Urits I, Patel A, Zusman R, Virgen CG, Mousa M, Berger AA, Kassem H, Jung JW, Hasoon J and Kaye AD *et al*.. (2020) A Comprehensive Update of Lofexidine for the Management of Opioid Withdrawal Symptoms. *Psychopharmacol Bull* **50**: 76-96 [PMID:32733113]
788. Uys MM, Shahid M and Harvey BH. (2017) Therapeutic Potential of Selectively Targeting the α_{2C}-Adrenoceptor in Cognition, Depression, and Schizophrenia-New Developments and Future Perspective. *Front Psychiatry* **8**: 144 [PMID:28855875]
789. Uys MM, Shahid M, Sallinen J and Harvey BH. (2017) The α2C-adrenoceptor antagonist, ORM-10921, exerts antidepressant-like effects in the Flinders Sensitive Line rat. *Behav Pharmacol* **28**: 9-18 [PMID:27749317]
790. van Wieringen JP, Michel-Reher MB, Hatanaka T, Ueshima K and Michel MC. (2013) The new radioligand [(3)H]-L 748,337 differentially labels human and rat β3-adrenoceptors. *Eur J Pharmacol* **720**: 124-30 [PMID:24183974]
791. Vargas Pelaez AF, Gao Z, Ahmad TA, Leuenberger UA, Proctor DN, Maman SR and Muller MD. (2016) Effect of adrenergic agonists on coronary blood flow: a laboratory study in healthy volunteers. *Physiol Rep* **4** [PMID:27225628]
792. Varghese P, Harrison RW, Lofthouse RA, Georgakopoulos D, Berkowitz DE and Hare JM. (2000) beta(3)-adrenoceptor deficiency blocks nitric oxide-dependent inhibition of myocardial contractility. *J Clin Invest* **106**: 697-703 [PMID:10974023]
793. Vedel L, Bräuner-Osborne H and Mathiesen JM. (2015) A cAMP Biosensor-Based High-Throughput Screening Assay for Identification of Gs-Coupled GPCR Ligands and Phosphodiesterase Inhibitors. *J Biomol Screen* **20**: 849-57 [PMID:25851033]
794. Vilardaga JP, Nikolaev VO, Lorenz K, Ferrandon S, Zhuang Z and Lohse MJ. (2008) Conformational cross-talk between alpha2A-adrenergic and mu-opioid receptors controls cell signaling. *Nat Chem Biol* **4**: 126-31 [PMID:18193048]
795. Villégier AS, Drouin C, Bizot JC, Marien M, Glowinski J, Colpaërt F and Tassin JP. (2003) Stimulation of postsynaptic alpha1b- and alpha2-adrenergic receptors amplifies dopamine-mediated locomotor activity in both rats and mice. *Synapse* **50**: 277-84 [PMID:14556232]
796. Vinci MC, Bellik L, Filippi S, Ledda F and Parenti A. (2007) Trophic effects induced by alpha1D-adrenoceptors on endothelial cells are potentiated by hypoxia. *Am J Physiol Heart Circ Physiol* **293**: H2140-7 [PMID:17660397]
797. Wacker D, Fenalti G, Brown MA, Katritch V, Abagyan R, Cherezov V and Stevens RC. (2010) Conserved binding mode of human beta2 adrenergic receptor inverse agonists and antagonist revealed by X-ray crystallography. *J Am Chem Soc* **132**: 11443-5 [PMID:20669948]
798. Walden PD, Gerardi C and Lepor H. (1999) Localization and expression of the alpha1A-1, alpha1B and alpha1D-adrenoceptors in hyperplastic and non-hyperplastic human prostate. *J Urol* **161**: 635-40 [PMID:9915474]
799. Walston J, Silver K, Bogardus C, Knowler WC, Celi FS, Austin S, Manning B, Strosberg AD, Stern MP, Raben N and *et al*.. (1995) Time of onset of non-insulin-dependent diabetes mellitus and genetic variation in the beta 3-adrenergic-receptor gene. *N Engl J Med* **333**: 343-347 [PMID:7609750]
800. Walter M, Lemoine H and Kaumann AJ. (1984) Stimulant and blocking effects of optical isomers of pindolol on the sinoatrial node and trachea of guinea pig. Role of beta-adrenoceptor subtypes in the dissociation between blockade and stimulation. *Naunyn Schmiedebergs Arch Pharmacol* **327**: 159-75 [PMID:6092972]
801. Wang HD, Zhang CS, Li MW, Lin Q, Zhang Q, Liu DF, Ma ZY and Dong J. (2021) The Association of Trp64Arg Polymorphism in the Beta-Adrenergic Receptor With Insulin Resistance: Meta-

Analysis. *Front Endocrinol (Lausanne)* **12**: 708139 [PMID:34512548]
802. Wang J, Hanada K, Staus DP, Makara MA, Dahal GR, Chen Q, Ahles A, Engelhardt S and Rockman HA. (2017) $G\alpha_i$ is required for carvedilol-induced β_1 adrenergic receptor β-arrestin biased signaling. *Nat Commun* **8**: 1706 [PMID:29167435]
803. Wang P, Zhu H, Tian JS, Zhu W, Xu S, Yao H, Liu J, Zhu Z, Miao CY and Xu J. (2024) Discovery of MT-1207: A Novel, Potent Multitarget Inhibitor as a Promising Clinical Candidate for the Treatment of Hypertension. *J Med Chem* **67**: 16128-16144 [PMID:38968440]
804. Wang SY, Song Y, Xu M, He QH, Han QD and Zhang YY. (2007) Internalization and distribution of three alpha1-adrenoceptor subtypes in HEK293A cells before and after agonist stimulation. *Acta Pharmacol Sin* **28**: 359-66 [PMID:17302998]
805. Wang Y, Shi Q, Li M, Zhao M, Reddy Gopireddy R, Teoh JP, Xu B, Zhu C, Ireton KE and Srinivasan S *et al.*. (2021) Intracellular β_1-Adrenergic Receptors and Organic Cation Transporter 3 Mediate Phospholamban Phosphorylation to Enhance Cardiac Contractility. *Circ Res* **128**: 246-261 [PMID:33183171]
806. Warne T, Moukhametzianov R, Baker JG, Nehmé R, Edwards PC, Leslie AG, Schertler GF and Tate CG. (2011) The structural basis for agonist and partial agonist action on a β(1)-adrenergic receptor. *Nature* **469**: 241-4 [PMID:21228877]
807. Warne T, Serrano-Vega MJ, Baker JG, Moukhametzianov R, Edwards PC, Henderson R, Leslie AG, Tate CG and Schertler GF. (2008) Structure of a beta1-adrenergic G-protein-coupled receptor. *Nature* **454**: 486-91 [PMID:18594507]
808. Waugh DJ, Gaivin RJ, Damron DS, Murray PA and Perez DM. (1999) Binding, partial agonism, and potentiation of alpha(1)-adrenergic receptor function by benzodiazepines: A potential site of allosteric modulation. *J Pharmacol Exp Ther* **291**: 1164-71 [PMID:10565838]
809. Waugh DJ, Gaivin RJ, Zuscik MJ, Gonzalez-Cabrera P, Ross SA, Yun J and Perez DM. (2001) Phe-308 and Phe-312 in transmembrane domain 7 are major sites of alpha 1-adrenergic receptor antagonist binding. Imidazoline agonists bind like antagonists. *J Biol Chem* **276**: 25366-71 [PMID:11331292]
810. Weber AE, Ok HO, Alvaro RF, Candelore MR, Cascieri MA, Chiu SH, Deng L, Forrest MJ, Hom GJ and Hutchins JE *et al.*. (1998) 3-Pyridyloxypropanolamine agonists of the beta 3 adrenergic receptor with improved pharmacokinetic properties. *Bioorg Med Chem Lett* **8**: 2111-6 [PMID:9873496]
811. Weerink MAS, Struys MMRF, Hannivoort LN, Barends CRM, Absalom AR and Colin P. (2017) Clinical Pharmacokinetics and Pharmacodynamics of Dexmedetomidine. *Clin Pharmacokinet* **56**: 893-913 [PMID:28105598]
812. Weichert D, Kruse AC, Manglik A, Hiller C, Zhang C, Hübner H, Kobilka BK and Gmeiner P. (2014) Covalent agonists for studying G protein-coupled receptor activation. *Proc Natl Acad Sci U S A* **111**: 10744-8 [PMID:25006259]
813. Weinshank RL, Adham N, Macchi M, Olsen MA, Branchek TA and Hartig PR. (1991) Molecular cloning and characterization of a high affinity dopamine receptor (D1 beta) and its pseudogene. *J Biol Chem* **266**: 22427-35 [PMID:1834671]
814. Weinshank RL, Zgombick JM, Macchi M, Adham N, Lichtblau H, Branchek TA and Hartig PR. (1990) Cloning, expression, and pharmacological characterization of a human alpha 2B-adrenergic receptor. *Mol Pharmacol* **38**: 681-8 [PMID:2172775]
815. Weis WI and Kobilka BK. (2018) The Molecular Basis of G Protein-Coupled Receptor Activation. *Annu Rev Biochem* **87**: 897-919 [PMID:29925258]
816. Weiss DR, Ahn S, Sassano MF, Kleist A, Zhu X, Strachan R, Roth BL, Lefkowitz RJ and Shoichet BK. (2013) Conformation guides molecular efficacy in docking screens of activated β-2 adrenergic G protein coupled receptor. *ACS Chem Biol* **8**: 1018-26 [PMID:23485065]
817. Wendell SG, Fan H and Zhang C. (2020) G Protein-Coupled Receptors in Asthma Therapy: Pharmacology and Drug Action. *Pharmacol Rev* **72**: 1-49 [PMID:31767622]
818. Wenzel-Seifert K, Liu HY and Seifert R. (2002) Similarities and differences in the coupling of human beta1- and beta2-adrenoceptors to Gs(alpha) splice variants. *Biochem Pharmacol* **64**: 9-20 [PMID:12106601]
819. Werner C, Müller N and Müller UA. (2019) Agonistic autoantibodies against B2-adrenergic receptors correlating with macrovascular disease in longstanding diabetes type 2. *Acta Diabetol* **56**: 659-665 [PMID:30770998]
820. Wetzel JM, Miao SW, Forray C, Borden LA, Branchek TA and Gluchowski C. (1995) Discovery of alpha 1a-adrenergic receptor antagonists based on the L-type Ca2+ channel antagonist niguldipine. *J Med Chem* **38**: 1579-81 [PMID:7752182]
821. White CW, Choong YT, Short JL, Exintaris B, Malone DT, Allen AM, Evans RJ and Ventura S. (2013) Male contraception via simultaneous knockout of α1A-adrenoceptors and P2X1-purinoceptors in mice. *Proc Natl Acad Sci U S A* **110**: 20825-30 [PMID:24297884]
822. White CW, da Silva Junior ED, Lim L and Ventura S. (2019) What makes the α_{1A} -adrenoceptor gene product assume an α_{1L} -adrenoceptor phenotype? *Br J Pharmacol* **176**: 2358-2365 [PMID:30719698]

823. Williams CA, Miller KE, Williams NP, Portfors CV and Perkel DJ. (2021) Distribution and co-expression of adrenergic receptor-encoding mRNA in the mouse inferior colliculus. *J Comp Neurol* **529**: 1743-1755 [PMID:33067825]
824. Williams LM, He X, Vaid TM, Abdul-Ridha A, Whitehead AR, Gooley PR, Bathgate RAD, Williams SJ and Scott DJ. (2019) Diazepam is not a direct allosteric modulator of α_1-adrenoceptors, but modulates receptor signaling by inhibiting phosphodiesterase-4. *Pharmacol Res Perspect* **7**: e00455 [PMID:30619611]
825. Williams TJ, Blue DR, Daniels DV, Davis B, Elworthy T, Gever JR, Kava MS, Morgans D, Padilla F and Tassa S *et al*.. (1999) In vitro alpha1-adrenoceptor pharmacology of Ro 70-0004 and RS-100329, novel alpha1A-adrenoceptor selective antagonists. *Br J Pharmacol* **127**: 252-8 [PMID:10369480]
826. Willis MS, Ilaiwy A, Montgomery MD, Simpson PC and Jensen BC. (2016) The alpha-1A adrenergic receptor agonist A61603 reduces cardiac polyunsaturated fatty acid and endocannabinoid metabolites associated with inflammation in vivo. *Metabolomics* **12** [PMID:28533737]
827. Wilson AL, Seibert K, Brandon S, Cragoe Jr EJ and Limbird LE. (1991) Monovalent cation and amiloride analog modulation of adrenergic ligand binding to the unglycosylated alpha 2B-adrenergic receptor subtype. *Mol Pharmacol* **39**: 481-6 [PMID:1850091]
828. Wilson AL, Womble SW, Prakash C, Cragoe Jr EJ, Blair IA and Limbird LE. (1992) Novel amiloride analog allosterically modulates the alpha 2-adrenergic receptor but does not inhibit Na+/H+ exchange. *Mol Pharmacol* **42**: 175-9 [PMID:1325028]
829. Wisler JW, DeWire SM, Whalen EJ, Violin JD, Drake MT, Ahn S, Shenoy SK and Lefkowitz RJ. (2007) A unique mechanism of beta-blocker action: carvedilol stimulates beta-arrestin signaling. *Proc Natl Acad Sci U S A* **104**: 16657-62 [PMID:17925438]
830. Wiysonge CS, Bradley HA, Volmink J, Mayosi BM and Opie LH. (2017) Beta-blockers for hypertension. *Cochrane Database Syst Rev* **1**: CD002003 [PMID:28107561]
831. Wong YW, Haqqani H and Molenaar P. (2024) Roles of β-adrenoceptor Subtypes and Therapeutics in Human Cardiovascular Disease: Heart Failure, Tachyarrhythmias and Other Cardiovascular Disorders. *Handb Exp Pharmacol* **285**: 247-295 [PMID:38844580]
832. Woo AY, Song Y, Xiao RP and Zhu W. (2015) Biased β2-adrenoceptor signalling in heart failure: pathophysiology and drug discovery. *Br J Pharmacol* **172**: 5444-56 [PMID:25298054]
833. Wright CD, Chen Q, Baye NL, Huang Y, Healy CL, Kasinathan S and O'Connell TD. (2008) Nuclear alpha1-adrenergic receptors signal activated ERK localization to caveolae in adult cardiac myocytes. *Circ Res* **103**: 992-1000 [PMID:18802028]
834. Wright CD, Wu SC, Dahl EF, Sazama AJ and O'Connell TD. (2012) Nuclear localization drives α1-adrenergic receptor oligomerization and signaling in cardiac myocytes. *Cell Signal* **24**: 794-802 [PMID:22120526]
835. Wrzal PK, Devost D, Pétrin D, Goupil E, Iorio-Morin C, Laporte SA, Zingg HH and Hébert TE. (2012) Allosteric interactions between the oxytocin receptor and the β2-adrenergic receptor in the modulation of ERK1/2 activation are mediated by heterodimerization. *Cell Signal* **24**: 342-50 [PMID:21963428]
836. Wrzal PK, Goupil E, Laporte SA, Hébert TE and Zingg HH. (2012) Functional interactions between the oxytocin receptor and the β2-adrenergic receptor: implications for ERK1/2 activation in human myometrial cells. *Cell Signal* **24**: 333-41 [PMID:21964067]
837. Xie HG, Kim RB, Stein CM, Gainer JV, Brown NJ and Wood AJ. (1999) Alpha1A-adrenergic receptor polymorphism: association with ethnicity but not essential hypertension. *Pharmacogenetics* **9**: 651-6 [PMID:10591546]
838. Xu J, He J, Castleberry AM, Balasubramanian S, Lau AG and Hall RA. (2003) Heterodimerization of alpha 2A- and beta 1-adrenergic receptors. *J Biol Chem* **278**: 10770-7 [PMID:12529373]
839. Xu X, Kaindl J, Clark MJ, Hübner H, Hirata K, Sunahara RK, Gmeiner P, Kobilka BK and Liu X. (2021) Binding pathway determines norepinephrine selectivity for the human β_1AR over β_2AR. *Cell Res* **31**: 569-579 [PMID:33093660]
840. Yamada S, Niiya R, Ito Y, Kato Y and Onoue S. (2022) Comparative characterization of β-adrenoceptors in the bladder, heart, and lungs of rats: Alterations in spontaneously hypertensive rats. *J Pharmacol Sci* **148**: 51-55 [PMID:34924129]
841. Yamashima T. (2003) Jokichi Takamine (1854-1922), the samurai chemist, and his work on adrenalin. *J Med Biogr* **11**: 95-102 [PMID:12717538]
842. Yan M, Sun J, Bird PI, Liu DL, Grigg M and Lim YL. (2001) Alpha1A- and alpha1B-adrenoceptors are the major subtypes in human saphenous vein. *Life Sci* **68**: 1191-8 [PMID:11228103]
843. Yanagisawa T, Sato T, Yamada H, Sukegawa J and Nunoki K. (2000) Selectivity and potency of agonists for the three subtypes of cloned human beta-adrenoceptors expressed in Chinese hamster ovary cells. *Tohoku J Exp Med* **192**: 181-93 [PMID:11249148]
844. Yanase H, Wang X, Momota Y, Nimura T and Kawatani M. (2008) The involvement of urothelial alpha1A adrenergic receptor in controlling the micturition reflex. *Biomed Res* **29**: 239-44 [PMID:18997438]

845. Yang J, Dolinger M, Ritaccio G, Mazurkiewicz J, Conti D, Zhu X and Huang Y. (2012) Leucine stimulates insulin secretion via down-regulation of surface expression of adrenergic α2A receptor through the mTOR (mammalian target of rapamycin) pathway: implication in new-onset diabetes in renal transplantation. *J Biol Chem* **287**: 24795-806 [PMID:22645144]
846. Yatani A, Tajima Y and Green SA. (1999) Coupling of beta-adrenergic receptors to cardiac L-type Ca2+ channels: preferential coupling of the beta1 versus beta2 receptor subtype and evidence for PKA-independent activation of the channel. *Cell Signal* **11**: 337-42 [PMID:10376806]
847. Yeh CC, Fan Y, Xu Y, Yang YL, Simpson PC and Mann MJ. (2017) Shift toward greater pathologic post-myocardial infarction remodeling with loss of the adaptive hypertrophic signaling of alpha1 adrenergic receptors in mice. *PLoS One* **12**: e0188471 [PMID:29216197]
848. Yoneshiro T, Ogawa T, Okamoto N, Matsushita M, Aita S, Kameya T, Kawai Y, Iwanaga T and Saito M. (2013) Impact of UCP1 and β3AR gene polymorphisms on age-related changes in brown adipose tissue and adiposity in humans. *Int J Obes (Lond)* **37**: 993-8 [PMID:23032405]
849. Yoshiki H, Uwada J, Anisuzzaman AS, Umada H, Hayashi R, Kainoh M, Masuoka T, Nishio M and Muramatsu I. (2014) Pharmacologically distinct phenotypes of α1B -adrenoceptors: variation in binding and functional affinities for antagonists. *Br J Pharmacol* **171**: 4890-901 [PMID:24923551]
850. Yoshio R, Taniguchi T, Itoh H and Muramatsu I. (2001) Affinity of serotonin receptor antagonists and agonists to recombinant and native alpha1-adrenoceptor subtypes. *Jpn J Pharmacol* **86**: 189-95 [PMID:11459121]
851. Young P, Berge J, Chapman H and Cawthorne MA. (1989) Novel alpha 2-adrenoceptor antagonists show selectivity for alpha 2A- and alpha 2B-adrenoceptor subtypes. *Eur J Pharmacol* **168**: 381-6 [PMID:2573535]
852. Yu ZY, Tan JC, McMahon AC, Iismaa SE, Xiao XH, Kesteven SH, Reichelt ME, Mohl MC, Smith NJ and Fatkin D *et al.*. (2014) RhoA/ROCK signaling and pleiotropic α1A-adrenergic receptor regulation of cardiac contractility. *PLoS One* **9**: e99024 [PMID:24919197]
853. Yuan D, Liu Z, Kaindl J, Maeda S, Zhao J, Sun X, Xu J, Gmeiner P, Wang HW and Kobilka BK. (2020) Activation of the α_{2B} adrenoceptor by the sedative sympatholytic dexmedetomidine. *Nat Chem Biol* **16**: 507-512 [PMID:32152538]
854. Yun J, Gaivin RJ, McCune DF, Boongird A, Papay RS, Ying Z, Gonzalez-Cabrera PJ, Najm I and Perez DM. (2003) Gene expression profile of neurodegeneration induced by alpha1B-adrenergic receptor overactivity: NMDA/GABAA dysregulation and apoptosis. *Brain* **126**: 2667-81 [PMID:12937073]
855. Yun J, Zuscik MJ, Gonzalez-Cabrera P, McCune DF, Ross SA, Gaivin R, Piascik MT and Perez DM. (2003) Gene expression profiling of alpha(1b)-adrenergic receptor-induced cardiac hypertrophy by oligonucleotide arrays. *Cardiovasc Res* **57**: 443-55 [PMID:12566117]
856. Zádori ZS, Tóth VE, Fehér Á, Al-Khrasani M, Puskár Z, Kozsurek M, Timár J, Tábi T, Helyes Z and Hein L *et al.*. (2016) Inhibition of α2A-Adrenoceptors Ameliorates Dextran Sulfate Sodium-Induced Acute Intestinal Inflammation in Mice. *J Pharmacol Exp Ther* **358**: 483-91 [PMID:27418171]
857. Zacharia J, Hillier C, Tanoue A, Tsujimoto G, Daly CJ, McGrath JC and MacDonald A. (2005) Evidence for involvement of alpha1D-adrenoceptors in contraction of femoral resistance arteries using knockout mice. *Br J Pharmacol* **146**: 942-51 [PMID:16170328]
858. Zacharia J, Mauban JR, Raina H, Fisher SA and Wier WG. (2013) High vascular tone of mouse femoral arteries in vivo is determined by sympathetic nerve activity via α1A- and α1D-adrenoceptor subtypes. *PLoS One* **8**: e65969 [PMID:23776582]
859. Zemkova H, Stojilkovic SS and Klein DC. (2011) Norepinephrine causes a biphasic change in mammalian pinealocye membrane potential: role of alpha1B-adrenoreceptors, phospholipase C, and Ca2+. *Endocrinology* **152**: 3842-51 [PMID:21828176]
860. Zeng DW, Harrison JK, D'Angelo DD, Barber CM, Tucker AL, Lu ZH and Lynch KR. (1990) Molecular characterization of a rat alpha 2B-adrenergic receptor. *Proc Natl Acad Sci USA* **87**: 3102-6 [PMID:2158103]
861. Zhang H, Cotecchia S, Thomas SA, Tanoue A, Tsujimoto G and Faber JE. (2004) Gene deletion of dopamine beta-hydroxylase and alpha1-adrenoceptors demonstrates involvement of catecholamines in vascular remodeling. *Am J Physiol Heart Circ Physiol* **287**: H2106-14 [PMID:15231500]
862. Zhang H and Faber JE. (2001) Trophic effect of norepinephrine on arterial intima-media and adventitia is augmented by injury and mediated by different alpha1-adrenoceptor subtypes. *Circ Res* **89**: 815-22 [PMID:11679412]
863. Zhang Q and Tan Y. (2011) Nerve growth factor augments neuronal responsiveness to noradrenaline in cultured dorsal root ganglion neurons of rats. *Neuroscience* **193**: 72-9 [PMID:21784134]
864. Zhang S, Takahashi R, Yamashita N, Teraoka H and Kitazawa T. (2018) $Alpha_{1B}$-adrenoceptor-mediated positive inotropic and positive chronotropic actions in the mouse atrium. *Eur J Pharmacol* **839**: 82-88 [PMID:30172786]

865. Zhang Y, Kolli T, Hivley R, Jaber L, Zhao FI, Yan J and Herness S. (2010) Characterization of the expression pattern of adrenergic receptors in rat taste buds. *Neuroscience* **169**: 1421-37 [PMID:20478367]
866. Zhang Y, Wat N, Stratton IM, Warren-Perry MG, Orho M, Groop L and Turner RC. (1996) UKPDS 19: heterogeneity in NIDDM: separate contributions of IRS-1 and beta 3-adrenergic-receptor mutations to insulin resistance and obesity respectively with no evidence for glycogen synthase gene mutations. UK Prospective Diabetes Study. *Diabetologia* **39**: 1505-11 [PMID:8960833]
867. Zhao MM, Hwa J and Perez DM. (1996) Identification of critical extracellular loop residues involved in alpha 1-adrenergic receptor subtype-selective antagonist binding. *Mol Pharmacol* **50**: 1118-26 [PMID:8913343]
868. Zhao X, Balaji P, Pachon R, Beniamen DM, Vatner DE, Graham RM and Vatner SF. (2015) Overexpression of Cardiomyocyte α1A-Adrenergic Receptors Attenuates Postinfarct Remodeling by Inducing Angiogenesis Through Heterocellular Signaling. *Arterioscler Thromb Vasc Biol* **35**: 2451-9 [PMID:26338300]
869. Zhao X, Park J, Ho D, Gao S, Yan L, Ge H, Iismaa S, Lin L, Tian B and Vatner DE *et al*.. (2012) Cardiomyocyte overexpression of the α1A-adrenergic receptor in the rat phenocopies second but not first window preconditioning. *Am J Physiol Heart Circ Physiol* **302**: H1614-24 [PMID:22307672]
870. Zhou SG, Lu JL and Hui JH. (2011) Comparing efficacy of α1D-receptor antagonist naftopidil and α1A/D-receptor antagonist tamsulosin in management of distal ureteral stones. *World J Urol* **29**: 767-71 [PMID:21845472]
871. Zhu J, Naulaerts S, Boudhan L, Martin M, Gatto L and Van den Eynde BJ. (2023) Tumour immune rejection triggered by activation of α2-adrenergic receptors. *Nature* **618**: 607-615 [PMID:37286594]
872. Zhu WZ, Chakir K, Zhang S, Yang D, Lavoie C, Bouvier M, Hébert TE, Lakatta EG, Cheng H and Xiao RP. (2005) Heterodimerization of beta1- and beta2-adrenergic receptor subtypes optimizes beta-adrenergic modulation of cardiac contractility. *Circ Res* **97**: 244-51 [PMID:16002745]
873. Zilberfarb V, Piétri-Rouxel F, Jockers R, Krief S, Delouis C, Issad T and Strosberg AD. (1997) Human immortalized brown adipocytes express functional beta3-adrenoceptor coupled to lipolysis. *J Cell Sci* **110 (Pt 7)**: 801-7 [PMID:9133667]
874. Zuscik MJ, Chalothorn D, Hellard D, Deighan C, McGee A, Daly CJ, Waugh DJ, Ross SA, Gaivin RJ and Morehead AJ *et al*.. (2001) Hypotension, autonomic failure, and cardiac hypertrophy in transgenic mice overexpressing the alpha 1B-adrenergic receptor. *J Biol Chem* **276**: 13738-43 [PMID:11278430]
875. Zuscik MJ, Sands S, Ross SA, Waugh DJ, Gaivin RJ, Morilak D and Perez DM. (2000) Overexpression of the alpha1B-adrenergic receptor causes apoptotic neurodegeneration: multiple system atrophy. *Nat Med* **6**: 1388-94 [PMID:11100125]
876. Zuurhout MJ, Vijverberg SJ, Raaijmakers JA, Koenderman L, Postma DS, Koppelman GH and Maitland-van der Zee AH. (2013) Arg16 ADRB2 genotype increases the risk of asthma exacerbation in children with a reported use of long-acting β2-agonists: results of the PACMAN cohort. *Pharmacogenomics* **14**: 1965-71 [PMID:24279851]