

[< Back to results](#) | 1 of 1[Export](#) [Download](#) [Print](#) [E-mail](#) [Save to PDF](#) [Add to List](#) [More... >](#)[Full Text](#) [View at Publisher](#)

Immunobiology

Volume 220, Issue 7, 1 July 2015, Pages 889-898

## Histamine 4 receptor and NF- $\kappa$ B activation through the JAK / STAT signaling pathway downstream of histamine 4 receptor in a rat model of LPS-induced joint inflammation (Article)

Ahmad, S.F.<sup>a</sup> [✉](#), Ansari, M.A.<sup>a</sup>, Zoheir, K.M.A.<sup>a,b</sup>, Bakheet, S.A.<sup>a</sup>, Korashy, H.M.<sup>a</sup>, Nadeem, A.<sup>a</sup>, Ashour, A.E.<sup>a</sup>, Attia, S.M.<sup>a,c</sup> [👤](#)<sup>a</sup>Department of Pharmacology and Toxicology, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia<sup>b</sup>Department of Cell Biology, National Research Centre, Cairo, Egypt<sup>c</sup>Department of Pharmacology and Toxicology, College of Pharmacy, Al-Azhar University, Cairo, Egypt

### Abstract

[View references \(54\)](#)

Histamine 4 receptor (H4R) is a novel target for the pharmacological modulation of histamine-mediated immune signals during inflammatory diseases. The purpose of this study was to assess the effects of the H4R agonist 4-methylhistamine dihydrochloride (4-MeH) and antagonist JNJ7777120 (JNJ) in the inflamed rat knee. Animals were fasted for 18. h before a single dose of 4-MeH or JNJ (30. mg/kg) was administered intraperitoneally (i.p.), both followed by intra-articular (i.a.) injection of LPS 2. h later. Blood and synovial fluid were collected after a short incubation period and TNF- $\alpha$ , NF- $\kappa$ B, and I $\kappa$ B- $\alpha$  levels were measured via flow cytometry. Additionally, we assessed the effects of H4R engagement on the expression of IL-1 $\beta$ , TNF- $\alpha$ , and NF- $\kappa$ B mRNAs and the protein levels of TNF- $\alpha$ , NF- $\kappa$ B, JAK-1, and STAT-3 in the inflamed knee tissue. These results revealed increased TNF- $\alpha$  and NF- $\kappa$ B expression and decreased I $\kappa$ B- $\alpha$  levels in both the LPS alone and 4-MeH treated groups in whole blood and synovial fluid. Further, IL-1 $\beta$ , TNF- $\alpha$ , and NF- $\kappa$ B mRNA levels were significantly increased and western blot analysis confirmed increased expression of TNF- $\alpha$ , NF- $\kappa$ B, JAK-1, and STAT-3 in both LPS and 4-MeH treatment groups. Furthermore, these increases were completely inhibited in the inflamed knee tissue of the JNJ-treated group. Thus, the inhibition of inflammatory mediators and signaling pathways by the H4R antagonist JNJ suggests the anti-arthritis importance of this molecule. © 2015 Elsevier GmbH.

### SciVal Topic Prominence [i](#)

Topic: Receptors, Histamine | Histamine | receptor H4R

Prominence percentile: 87.380 [i](#)

### Reaxys Database Information

[View Compounds](#)

### Author keywords

[4-Methylhistamine dihydrochloride](#) [Histamine 4 receptor](#) [Inflamed rat knee](#) [JAK-STAT signaling pathway](#)  
[JNJ7777120](#) [Lipopolysaccharide](#) [Tumor necrosis factor-alpha](#)

### Indexed keywords

[Metrics](#) [View all metrics >](#)38 Citations in Scopus  
97th percentile4.10 Field-Weighted  
Citation ImpactPlumX Metrics [v](#)Usage, Captures, Mentions,  
Social Media and Citations  
beyond Scopus.

### Cited by 38 documents

H4 Receptor Inhibits Lipopolysaccharide-induced NF- $\kappa$ B Activation by Interacting with Tumor Necrosis Factor Receptor-Associated Factor 6Shan, Y. , Gao, Y. , Zhang, L. (2019) *Neuroscience*Streptozotocin-induced  $\beta$ -cell damage, high fat diet, and metformin administration regulate Hes3 expression in the adult mouse brainNikolakopoulou, P. , Chatzigeorgiou, A. , Kourtzelis, I. (2018) *Scientific Reports*Differentially expressed non-coding RNAs induced by transmissible gastroenteritis virus potentially regulate inflammation and NF- $\kappa$ B pathway in porcine intestinal epithelial cell line O6 Biological Sciences 0601 Biochemistry and Cell BiologyMa, X. , Zhao, X. , Zhang, Z. (2018) *BMC Genomics*[View all 38 citing documents](#)

Inform me when this document is cited in Scopus:

[Set citation alert >](#)[Set citation feed >](#)

### Related documents

Histamine 4 receptor promotes expression of costimulatory B7.1/B7.2 molecules, CD28 signaling and cytokine

**NEW!** SciVal Topic Prominence is now available in Scopus.Which Topic is this article related to? [View the Topic.](#)

## EMTREE drug terms:

histamine H4 receptor immunoglobulin enhancer binding protein interleukin 1beta  
 Janus kinase Janus kinase 1 lipopolysaccharide messenger RNA STAT protein  
 STAT3 protein tumor necrosis factor alpha  
 1-((5-chloro-1H-indol-2-yl)carbonyl)-4-methylpiperazine 4-methylhistamine  
 antihistaminic agent antiinflammatory agent G protein coupled receptor histamine agonist  
 histamine derivative histamine receptor Hrh4 protein, rat I kappa B IL1B protein, rat  
 immunoglobulin enhancer binding protein indole derivative interleukin 1beta  
 Jak1 protein, rat Janus kinase 1 messenger RNA NF-kappaB inhibitor alpha  
 piperazine derivative STAT3 protein Stat3 protein, rat tumor necrosis factor alpha

## EMTREE medical terms:

adult animal experiment animal model animal tissue arthritis Article  
 blood analysis blood level controlled study disease activity enzyme activity  
 enzyme assay female flow cytometry immune response molecular dynamics  
 molecular pathology nonhuman priority journal protein determination  
 protein expression protein function rat signal transduction synovial fluid  
 Western blotting animal biosynthesis blood enzyme activation  
 gene expression regulation genetics immunology inflammation knee metabolism  
 pathology Wistar rat

## MeSH:

Animals Anti-Inflammatory Agents Enzyme Activation Female  
 Gene Expression Regulation Histamine Agonists Histamine Antagonists I-kappa B Proteins  
 Indoles Inflammation Interleukin-1beta Janus Kinase 1 Knee Joint  
 Lipopolysaccharides Methylhistamines NF-kappa B Piperazines Rats Rats, Wistar  
 Receptors, G-Protein-Coupled Receptors, Histamine RNA, Messenger  
 STAT3 Transcription Factor Tumor Necrosis Factor-alpha

production in stress-induced immune responses

Ahmad, S.F. , Zoheir, K.M.A. , Ansari, M.A. (2015) *Journal of Neuroimmunology*

The activity of JAK/STAT and NF-κB in patients with rheumatoid arthritis

Świerkot, J. , Nowak, B. , Czarny, A. (2016) *Advances in Clinical and Experimental Medicine*

British pharmacological society winter meeting: Focus on histamine H 4 receptor

Lethbridge, N. (2010) *Expert Review of Clinical Pharmacology*

View all related documents based on references

Find more related documents in Scopus based on:

Authors > Keywords >

## Chemicals and CAS Registry Numbers:

histamine H4 receptor, 272100-58-0; Janus kinase, 161384-16-3;

1-((5-chloro-1H-indol-2-yl)carbonyl)-4-methylpiperazine; 4-methylhistamine; Anti-Inflammatory Agents; Histamine Agonists; Histamine Antagonists; Hrh4 protein, rat; I-kappa B Proteins; IL1B protein, rat; Indoles; Interleukin-1beta; Jak1 protein, rat; Janus Kinase 1; Lipopolysaccharides; Methylhistamines; NF-kappa B; NF-kappaB inhibitor alpha; Piperazines; Receptors, G-Protein-Coupled; Receptors, Histamine; RNA, Messenger; Stat3 protein, rat; STAT3 Transcription Factor; Tumor Necrosis Factor-alpha

## Funding details

Funding sponsor	Funding number	Acronym
Deanship of Scientific Research, King Faisal University	RGP-VPP-120	DSR, KFU

## Funding text

The authors extend their appreciation to the Deanship of Scientific Research at King Saud University for funding the work through the research group project No. RGP-VPP-120.

ISSN: 01712985

CODEN: ZIMMD

Source Type: Journal

Original language: English

DOI: 10.1016/j.imbio.2015.01.008

PubMed ID: 25666529

Document Type: Article

Publisher: Elsevier GmbH

## References (54)

View in search results format >

All  Export  Print  E-mail  Save to PDF  Create bibliography

NEW! SciVal Topic Prominence is now available in Scopus.

Which Topic is this article related to? View the Topic.



- 1 Arend, W.P., Dayer, J.-M.  
Cytokines and cytokine inhibitors or antagonists in rheumatoid arthritis  
(1990) *Arthritis & Rheumatism*, 33 (3), pp. 305-315. Cited 788 times.  
doi: 10.1002/art.1780330302  
[View at Publisher](#)
- 
- 2 Abd-Allah, A.R.A., Ahmad, S.F., Alrashidi, I., Abdel-Hamied, H.E., Zoheir, K.M.A., Ashour, A.E., Bakheet, S.A., (...), Attia, S.M.  
Involvement of histamine 4 receptor in the pathogenesis and progression of rheumatoid arthritis ([Open Access](#))  
(2014) *International Immunology*, 26 (6), art. no. dxt075, pp. 325-340. Cited 12 times.  
<http://intimm.oxfordjournals.org/>  
doi: 10.1093/intimm/dxt075  
[View at Publisher](#)
- 
- 3 Ansari, M.A., Maayah, Z.H., Bakheet, S.A., El-Kadi, A.O., Korashy, H.M.  
The role of aryl hydrocarbon receptor signaling pathway in cardiotoxicity of acute lead intoxication in vivo and in vitro rat model  
(2013) *Toxicology*, 306, pp. 40-49. Cited 32 times.  
doi: 10.1016/j.tox.2013.01.024  
[View at Publisher](#)
- 
- 4 Ahmad, S.F., Bani, S., Sultan, P., Ali, S.A., Bakheet, S.A., Attia, S.M., Abd-Allah, A.R.A.  
TNF- $\alpha$  inhibitory effect of *Euphorbia hirta* in rats  
(2013) *Pharmaceutical Biology*, 51 (4), pp. 411-417. Cited 7 times.  
doi: 10.3109/13880209.2012.734315  
[View at Publisher](#)
- 
- 5 Ahmad, S.F., Zoheir, K.M.A., Abdel-Hamied, H.E., Alrashidi, I., Attia, S.M., Bakheet, S.A., Ashour, A.E., (...), Abd-Allah, A.R.A.  
Role of a histamine 4 receptor as an anti-inflammatory target in carrageenan-induced pleurisy in mice ([Open Access](#))  
(2014) *Immunology*, 142 (3), pp. 374-383. Cited 14 times.  
[http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1365-2567/issues](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1365-2567/issues)  
doi: 10.1111/imm.12257  
[View at Publisher](#)
- 
- 6 Ahmad, S.F., Zoheir, K.M., Ansari, M.A., Korashy, H.M., Bakheet, S.A., Ashour, A.E., Attia, S.M.  
Stimulation of the histamine 4 receptor with 4-methylhistamine modulates the effects of chronic stress on the Th1/Th2 cytokine balance  
(2014) *Immunobiology*  
<http://www.sciencedirect.com/science/article/pii/S0171298514002058>
- 
- 7 Ahmad, S.F., Zoheir, K.M.A., Bakheet, S.A., Ashour, A.E., Attia, S.M.  
Poly(ADP-ribose) polymerase-1 inhibitor modulates T regulatory and IL-17 cells in the prevention of adjuvant induced arthritis in mice model  
(2014) *Cytokine*, 68 (2), pp. 76-85. Cited 27 times.  
<http://www.elsevier.com/inca/publications/store/6/2/2/8/1/5/index.htm>  
doi: 10.1016/j.cyto.2014.04.006  
[View at Publisher](#)

- 8 Ahmad, S.F., Zoheir, K.M.A., Ansari, M.A., Korashy, H.M., Bakheet, S.A., Ashour, A.E., Al-Shabanah, O.A., (...), Attia, S.M.  
The role of poly(ADP-ribose) polymerase-1 inhibitor in carrageenan-induced lung inflammation in mice  
(2015) *Molecular Immunology*, 63 (2), pp. 394-405. Cited 15 times.  
[www.elsevier.com/locate/molimm](http://www.elsevier.com/locate/molimm)  
doi: 10.1016/j.molimm.2014.09.009  
View at Publisher
- 
- 9 Ahmad, S.F., Zoheir, K.M.A., Abdel-Hamied, H.E., Ashour, A.E., Bakheet, S.A., Attia, S.M., Abd-Allah, A.R.A.  
Amelioration of autoimmune arthritis by naringin through modulation of T regulatory cells and Th1/Th2 cytokines  
(2014) *Cellular Immunology*, 287 (2), pp. 112-120. Cited 26 times.  
doi: 10.1016/j.cellimm.2014.01.001  
View at Publisher
- 
- 10 Barakat, A., Szick-Miranda, K., Chang, I.-F., Guyot, R., Blanc, G., Cooke, R., Delseny, M., (...), Bailey-Serres, J.  
The organization of cytoplasmic ribosomal protein genes in the arabidopsis genome (Open Access)  
(2001) *Plant Physiology*, 127 (2), pp. 398-415. Cited 189 times.  
<http://www.plantphysiol.org/>  
doi: 10.1104/pp.010265  
View at Publisher
- 
- 11 Cogé, F., Guénin, S.-P., Rique, H., Boutin, J.A., Galizzi, J.-P.  
Structure and expression of the human histamine H<sub>4</sub>-receptor gene  
(2001) *Biochemical and Biophysical Research Communications*, 284 (2), pp. 301-309. Cited 131 times.  
<http://www.sciencedirect.com/science/journal/0006291X>  
doi: 10.1006/bbrc.2001.4976  
View at Publisher
- 
- 12 Coruzzi, G., Adami, M., Guaita, E., de Esch, I.J.P., Leurs, R.  
Antiinflammatory and antinociceptive effects of the selective histamine H<sub>4</sub>-receptor antagonists JNJ7777120 and VUF6002 in a rat model of carrageenan-induced acute inflammation  
(2007) *European Journal of Pharmacology*, 563 (1-3), pp. 240-244. Cited 102 times.  
doi: 10.1016/j.ejphar.2007.02.026  
View at Publisher
- 
- 13 Csiszar, A., Wang, M., Lakatta, E.G., Ungvari, Z.  
Inflammation and endothelial dysfunction during aging: Role of NF-κB (Open Access)  
(2008) *Journal of Applied Physiology*, 105 (4), pp. 1333-1341. Cited 285 times.  
<http://jap.physiology.org/cgi/reprint/105/4/1333>  
doi: 10.1152/jappphysiol.90470.2008  
View at Publisher
- 
- 14 Cowden, J.M., Zhang, M., Dunford, P.J., Thurmond, R.L.  
The histamine H<sub>4</sub> receptor mediates inflammation and pruritus in Th2-dependent dermal inflammation (Open Access)  
(2010) *Journal of Investigative Dermatology*, 130 (4), pp. 1023-1033. Cited 125 times.  
doi: 10.1038/jid.2009.358  
View at Publisher

- 15 Cowden, J.M., Yu, F., Challapalli, M., Huang, J.-F., Kim, S., Fung-Leung, W.-P., Ma, J.Y., (...), Thurmond, R.L.  
**Antagonism of the histamine H<sub>4</sub> receptor reduces LPS-induced TNF production in vivo** ([Open Access](#))  
(2013) *Inflammation Research*, 62 (6), pp. 599-607. Cited 26 times.  
doi: 10.1007/s00011-013-0612-5  
[View at Publisher](#)
- 
- 16 De Hooge, A.S.K., Van De Loo, F.A.J., Koenders, M.I., Bennink, M.B., Arntz, O.J., Kolbe, T., Van Den Berg, W.B.  
**Local activation of STAT-1 and STAT-3 in the inflamed synovium during zymosan-induced arthritis: Exacerbation of joint inflammation in STAT-1 gene-knockout mice** ([Open Access](#))  
(2004) *Arthritis and Rheumatism*, 50 (6), pp. 2014-2023. Cited 79 times.  
doi: 10.1002/art.20302  
[View at Publisher](#)
- 
- 17 Dallot, E., Méhats, C., Oger, S., Leroy, M.-J., Breuiller-Fouché, M.  
**A role for PKC $\zeta$  in the LPS-induced translocation NF- $\kappa$ B p65 subunit in cultured myometrial cells**  
(2005) *Biochimie*, 87 (6), pp. 513-521. Cited 32 times.  
doi: 10.1016/j.biochi.2005.02.009  
[View at Publisher](#)
- 
- 18 Fridman, J.S., Scherle, P.A., Collins, R., Burn, T.C., Li, Y., Li, J., Covington, M.B., (...), Metcalf, B.  
**OPGL is a key regulator of osteoclastogenesis, lymphocyte development and lymph-node organogenesis**  
(2015) *Nature*, 397, pp. 15-23.
- 
- 19 Firestein, G.S., Zvaifler, N.J.  
**How important are T cells in chronic rheumatoid synovitis? II. T cell-independent mechanisms from beginning to end** ([Open Access](#))  
(2002) *Arthritis and Rheumatism*, 46 (2), pp. 298-308. Cited 163 times.  
doi: 10.1002/art.502  
[View at Publisher](#)
- 
- 20 Ghosh, S., May, M.J., Kopp, E.B.  
**NF- $\kappa$ B and rel proteins: Evolutionarily conserved mediators of immune responses**  
(1998) *Annual Review of Immunology*, 16, pp. 225-260. Cited 4172 times.  
doi: 10.1146/annurev.immunol.16.1.225  
[View at Publisher](#)
- 
- 21 Ghoreschi, K., Laurence, A., O'Shea, J.J.  
**Janus kinases in immune cell signaling**  
(2009) *Immunological Reviews*, 228 (1), pp. 273-287. Cited 497 times.  
doi: 10.1111/j.1600-065X.2008.00754.x  
[View at Publisher](#)
- 
- 22 Han, Z., Boyle, D.L., Manning, A.M., Firestein, G.S.  
**AP-1 and NF- $\kappa$ B regulation in rheumatoid arthritis and murine collagen-induced arthritis**  
(1998) *Autoimmunity*, 28 (4), pp. 197-208. Cited 277 times.  
doi: 10.3109/08916939808995367  
[View at Publisher](#)

- 23 Hill, S.J.  
Distribution, properties, and functional characteristics of three classes of histamine receptor  
(1990) *Pharmacological Reviews*, 42 (1), pp. 45-83. Cited 536 times.  
[View at Publisher](#)
- 
- 24 Hawiger, J.  
Innate immunity and inflammation: A transcriptional paradigm  
(2001) *Immunologic Research*, 23 (2-3), pp. 99-109. Cited 173 times.  
[View at Publisher](#)
- 
- 25 Kwon, H.-J., Breese, E.H., Vig-Varga, E., Luo, Y., Lee, Y., Goebel, M.G., Harrington, M.A.  
Tumor necrosis factor alpha induction of NF- $\kappa$ B requires the novel coactivator SIMPL  
([Open Access](#))  
(2004) *Molecular and Cellular Biology*, 24 (21), pp. 9317-9326. Cited 24 times.  
doi: 10.1128/MCB.24.21.9317-9326.2004  
[View at Publisher](#)
- 
- 26 Hinz, M., Arslan, S.C., Scheidereit, C.  
It takes two to tango: I $\kappa$ Bs, the multifunctional partners of NF- $\kappa$ B  
(2012) *Immunological Reviews*, 246 (1), pp. 59-76. Cited 90 times.  
doi: 10.1111/j.1600-065X.2012.01102.x  
[View at Publisher](#)
- 
- 27 Ivashkiv, L.B., Hu, X.  
The JAK/STAT pathway in rheumatoid arthritis: Pathogenic or protective? ([Open Access](#))  
(2003) *Arthritis and Rheumatism*, 48 (8), pp. 2092-2096. Cited 67 times.  
doi: 10.1002/art.11095  
[View at Publisher](#)
- 
- 28 Joosten, L.A.B., Helsen, M.M.A., Saxne, T., Van De Loo, F.A.J., Heinegård, D., Van Den Berg, W.B.  
IL-1 $\alpha$  blockade prevents cartilage and bone destruction in murine type II collagen-induced arthritis, whereas TNF- $\alpha$  blockade only ameliorates joint inflammation  
(1999) *Journal of Immunology*, 163 (9), pp. 5049-5055. Cited 384 times.  
[View at Publisher](#)
- 
- 29 Kong, Y.-Y., Yoshida, H., Sarosi, I., Tan, H.-L., Timms, E., Capparelli, C., Morony, S., (...), Penninger, J.M.  
OPGL is a key regulator of osteoclastogenesis, lymphocyte development and lymph-node organogenesis  
(1999) *Nature*, 397 (6717), pp. 315-323. Cited 2446 times.  
doi: 10.1038/16852  
[View at Publisher](#)
- 
- 30 Krause, A., Scaletta, N., Ji, J.-D., Ivashkiv, L.B.  
Rheumatoid arthritis synoviocyte survival is dependent on Stat3 ([Open Access](#))  
(2002) *Journal of Immunology*, 169 (11), pp. 6610-6616. Cited 92 times.  
<http://www.jimmunol.org/>  
doi: 10.4049/jimmunol.169.11.6610  
[View at Publisher](#)

- 31 Katoh, N., Soga, F., Nara, T., Masuda, K., Kishimoto, S.  
Histamine induces the generation of monocyte-derived dendritic cells that express CD14 but not CD1a [\(Open Access\)](#)

(2005) *Journal of Investigative Dermatology*, 125 (4), pp. 753-760. Cited 18 times.  
doi: 10.1111/j.0022-202X.2005.23891.x

[View at Publisher](#)

- 32 Li, Q., Verma, I.M.  
NF- $\kappa$ B regulation in the immune system

(2002) *Nature Reviews Immunology*, 2 (10), pp. 725-734. Cited 2677 times.  
doi: 10.1038/nri910

[View at Publisher](#)

- 33 Ivashkiv, L.B., Hu, X.  
Signaling by STATs

(2004) *Arthritis Research and Therapy*, 6 (4), pp. 159-168. Cited 90 times.

[View at Publisher](#)

- 34 Mcdonnell, J., Hoerrner, L.A., Lark, M.W., Harper, C., Dey, T., Lobner, J., Eiermann, G., (...), Moore, V.L.  
Recombinant human interleukin-1  $\beta$ -induced increase in levels of proteoglycans, stromelysin, and leukocytes in rabbit synovial fluid

(1992) *Arthritis & Rheumatism*, 35 (7), pp. 799-805. Cited 61 times.  
doi: 10.1002/art.1780350714

[View at Publisher](#)

- 35 May, M.J., Ghosh, S.  
Signal transduction through NF- $\kappa$ B

(1998) *Immunology Today*, 19 (2), pp. 80-88. Cited 981 times.  
doi: 10.1016/S0167-5699(97)01197-3

[View at Publisher](#)

- 36 Morse, K.L., Behan, J., Laz, T.M., West Jr., R.E., Greenfeder, S.A., Anthes, J.C., Umland, S., (...), Monsma Jr., F.J.  
Cloning and characterization of a novel human histamine receptor

(2001) *Journal of Pharmacology and Experimental Therapeutics*, 296 (3), pp. 1058-1066. Cited 253 times.

[View at Publisher](#)

- 37 Mori, T., Miyamoto, T., Yoshida, H., Asakawa, M., Kawasumi, M., Kobayashi, T., Morioka, H., (...), Yoshimura, A.  
IL-1 $\beta$  and TNF $\alpha$ -initiated IL-6-STAT3 pathway is critical in mediating inflammatory cytokines and RANKL expression in inflammatory arthritis [\(Open Access\)](#)

(2011) *International Immunology*, 23 (11), pp. 701-712. Cited 112 times.  
doi: 10.1093/intimm/dxr077

[View at Publisher](#)

- 38 Migita, K., Izumi, Y., Torigoshi, T., Satomura, K., Izumi, M., Nishino, Y., Jiuchi, Y., (...), Motokawa, S.  
Inhibition of Janus kinase/signal transducer and activator of transcription (JAK/STAT) signalling pathway in rheumatoid synovial fibroblasts using small molecule compounds [\(Open Access\)](#)

(2013) *Clinical and Experimental Immunology*, 174 (3), pp. 356-363. Cited 13 times.  
doi: 10.1111/cei.12190

[View at Publisher](#)

**NEW!** SciVal Topic Prominence is now available in Scopus.

Which Topic is this article related to? [View the Topic.](#)



- 39 Oda, T., Morikawa, N., Saito, Y., Masuho, Y., Matsumoto, S.-I.  
**Molecular cloning and characterization of a novel type of histamine receptor preferentially expressed in leukocytes**  
(2000) *Journal of Biological Chemistry*, 275 (47), pp. 36781-36786. Cited 539 times.  
doi: 10.1074/jbc.M006480200  
[View at Publisher](#)
- 
- 40 Pope, R.M.  
**Apoptosis as a therapeutic tool in rheumatoid arthritis**  
(2002) *Nature Reviews Immunology*, 2 (7), pp. 527-535. Cited 266 times.  
[View at Publisher](#)
- 
- 41 Proudman, S.M., Cleland, L.G., Mayrhofer, G.  
**Effects of tumor necrosis factor- $\alpha$ , interleukin 1 $\beta$ , and activated peripheral blood mononuclear cells on the expression of adhesion molecules and recruitment of leukocytes in rheumatoid synovial xenografts in SCID mice**  
(1999) *Journal of Rheumatology*, 26 (9), pp. 1877-1889. Cited 20 times.
- 
- 42 Singh, H.N., Blancuzzi, V., Greenwood, S., Skiles, J.W., O'Byrne, E.M.  
**Synovial fluid levels of tumor necrosis factor-alpha in the inflamed rat knee: Modulation by dexamethasone and inhibitors of matrix metalloproteinase and phosphodiesterase**  
(1997) *Inflammation Research*, 46 (SUPPL. 2), pp. S153-S154. Cited 14 times.
- 
- 43 Perkins, N.D.  
**Integrating cell-signalling pathways with NF- $\kappa$ B and IKK function**  
(2007) *Nature Reviews Molecular Cell Biology*, 8 (1), pp. 49-62. Cited 1515 times.  
doi: 10.1038/nrm2083  
[View at Publisher](#)
- 
- 44 Passani, M.B., Giannoni, P., Bucherelli, C., Baldi, E., Blandina, P.  
**Histamine in the brain: Beyond sleep and memory**  
(2007) *Biochemical Pharmacology*, 73 (8), pp. 1113-1122. Cited 55 times.  
[www.elsevier.com/locate/biochempharm](http://www.elsevier.com/locate/biochempharm)  
doi: 10.1016/j.bcp.2006.12.002  
[View at Publisher](#)
- 
- 45 Seevaratnam, R., Patel, B.P., Hamadeh, M.J.  
**Comparison of total protein concentration in skeletal muscle as measured by the Bradford and Lowry assays**  
(2009) *Journal of Biochemistry*, 145 (6), pp. 791-797. Cited 34 times.  
doi: 10.1093/jb/mvp037  
[View at Publisher](#)
- 
- 46 Thurmond, R.L., Desai, P.J., Dunford, P.J., Fung-Leung, W.-P., Hofstra, C.L., Jiang, W., Nguyen, S., (...), Karlsson, L.  
**A Potent and Selective Histamine H<sub>4</sub> Receptor Antagonist with Anti-Inflammatory Properties**  
(2004) *Journal of Pharmacology and Experimental Therapeutics*, 309 (1), pp. 404-413. Cited 302 times.  
doi: 10.1124/jpet.103.061754  
[View at Publisher](#)



- 47 Wang, T., Zhang, X., Li, J.J.  
The role of NF- $\kappa$ B in the regulation of cell stress responses  
(2002) *International Immunopharmacology*, 2 (11), pp. 1509-1520. Cited 238 times.  
doi: 10.1016/S1567-5769(02)00058-9  
[View at Publisher](#)
- 
- 48 Ware, C.F.  
Network communications: Lymphotoxins, LIGHT, and TNF  
(2005) *Annual Review of Immunology*, 23, pp. 787-819. Cited 321 times.  
doi: 10.1146/annurev.immunol.23.021704.115719  
[View at Publisher](#)
- 
- 49 Walker, J.G., Ahern, M.J., Coleman, M., Weedon, H., Papangelis, V., Beroukas, D., Roberts-Thomson, P.J., (...), Smith, M.D.  
Changes in synovial tissue Jak-STAT expression in rheumatoid arthritis in response to successful DMARD treatment  
(2006) *Annals of the Rheumatic Diseases*, 65 (12), pp. 1558-1564. Cited 54 times.  
doi: 10.1136/ard.2005.050385  
[View at Publisher](#)
- 
- 50 West, K.  
CP-690550, a JAK3 inhibitor as an immunosuppressant for the treatment of rheumatoid arthritis, transplant rejection, psoriasis and other immune-mediated disorders  
(2009) *Current Opinion in Investigational Drugs*, 10 (5), pp. 491-504. Cited 89 times.  
[View at Publisher](#)
- 
- 51 Wang, Z.-M., Zhu, S.-G., Wu, Z.-W., Lu, Y., Fu, H.-Z., Qian, R.-Q.  
Kirenol upregulates nuclear Annexin-1 which interacts with NF- $\kappa$ B to attenuate synovial inflammation of collagen-induced arthritis in rats  
(2011) *Journal of Ethnopharmacology*, 137 (1), pp. 774-782. Cited 30 times.  
doi: 10.1016/j.jep.2011.06.037  
[View at Publisher](#)
- 
- 52 Yamasaki, S., Migita, K., Kawabe, Y., Koji, T., Furuichi, I., Aoyagi, T., Eguchi, K., (...), Ida, H.  
Importance of NF- $\kappa$ B in rheumatoid synovial tissues: In situ NF- $\kappa$ B expression and in vitro study using cultured synovial cells ([Open Access](#))  
(2001) *Annals of the Rheumatic Diseases*, 60 (7), pp. 678-684. Cited 46 times.  
doi: 10.1136/ard.60.7.678  
[View at Publisher](#)
- 
- 53 Varga, C., Horvath, K., Berko, A., Thurmond, R.L., Dunford, P.J., Whittle, B.J.R.  
Inhibitory effects of histamine H<sub>4</sub> receptor antagonists on experimental colitis in the rat  
(2005) *European Journal of Pharmacology*, 522 (1-3), pp. 130-138. Cited 97 times.  
doi: 10.1016/j.ejphar.2005.08.045  
[View at Publisher](#)
-

□ 54 Yu, F., Bonaventure, P., Thurmond, R.L.

## The future antihistamines: Histamine H<sub>3</sub> and H<sub>4</sub> receptor ligands

(2010) *Advances in Experimental Medicine and Biology*, 709, pp. 125-140. Cited 14 times.

ISBN: 978-144198055-7

doi: 10.1007/978-1-4419-8056-4-12

[View at Publisher](#)

🔍 Ahmad, S.F.; Department of Pharmacology and Toxicology, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia; email:s\_fayazahmad@yahoo.com

© Copyright 2017 Elsevier B.V., All rights reserved.

< Back to results | 1 of 1

^ Top of page

### About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

### Language

[日本語に切り替える](#)

[切换到简体中文](#)

[切换到繁體中文](#)

[Русский язык](#)

### Customer Service

[Help](#)

[Contact us](#)

**ELSEVIER**

[Terms and conditions](#) ↗ [Privacy policy](#) ↗

Copyright © 2018 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies.

 RELX Group™

**NEW!** SciVal Topic Prominence is now available in Scopus.

