1. Phylogeny  
   MSK2 (RPS6KA4-b) is a member of the mitogen- and stress-activated protein kinase (MSK) subfamily within the larger MAPK‐activated protein kinase (MAPKAPK) family, which itself is part of the AGC superfamily of serine/threonine kinases. MSK2 shares approximately 63% amino acid identity with its close homolog MSK1 and exhibits about 40% identity with the RSK family members, which also possess dual kinase domains. This conservation indicates that the structural framework of MSK2 is maintained across vertebrate species, with orthologs identified in all mammalian lineages. Its placement in the kinome reflects an evolutionary history characterized by gene duplication events that gave rise to distinct subfamilies such as the RSKs and MSKs, both of which relay signals from upstream mitogen‐activated protein kinases (MAPKs) like ERK1/2 and p38. Notably, the gene encoding MSK2 maps to the Bardet–Biedl syndrome 1 locus on human chromosome 11, underlining an evolutionarily conserved genomic context among higher eukaryotes (cargnello2011activationandfunction pages 18-19, anjum2008therskfamily pages 2-4, roux2004erkandp38 pages 5-8).
2. Reaction Catalyzed  
   MSK2 catalyzes the transfer of the γ-phosphate group from ATP to serine/threonine residues on its protein substrates. The general chemical reaction can be represented as follows:  
     ATP + [protein]–(L‐serine or L‐threonine) → ADP + [protein]–(L‐serine/threonine)‐phosphate + H⁺.  
   This phosphorylation reaction is central to the kinase’s role in regulating the activity of various nuclear substrates, including transcription factors and chromatin proteins, so that the phosphorylated targets can elicit changes in gene expression in response to extracellular stimuli (cargnello2011activationandfunction pages 19-20, thiriet2013cytoplasmicproteinserinethreonine pages 60-63).
3. Cofactor Requirements  
   The catalytic activity of MSK2 depends on the presence of divalent cations. In particular, Mg²⁺ serves as an essential cofactor by stabilizing ATP in the active site and facilitating the phosphotransfer reaction. This reliance on Mg²⁺ is a conserved feature among protein kinases of the AGC family (thiriet2013cytoplasmicproteinserinethreonine pages 60-63).
4. Substrate Specificity  
   MSK2 exhibits substrate specificity that is characterized by its recognition of consensus sequences enriched in basic amino acids. The kinase predominantly phosphorylates serine and threonine residues within substrates that often display a minimal consensus motif, typically of the form Arg–Xaa–Xaa–p[Ser/Thr]. Its well‐characterized substrates include transcription factors such as CREB1 (phosphorylated on Ser133) and ATF1 (phosphorylated on Ser63), as well as chromatin components like histone H3, which is phosphorylated on Ser10 and potentially on Ser28. Additionally, MSK2 plays a role in modulating the transcriptional activity of the NF-κB subunit RELA in response to TNF, and it mediates the phosphorylation of high mobility group nucleosomal proteins such as HMGN1. This specificity enables MSK2 to translate mitogenic and stress signals into precise changes in gene expression through targeted phosphorylation events (cargnello2011activationandfunction pages 12-13, anjum2008therskfamily pages 2-4, thiriet2013cytoplasmicproteinserinethreonine pages 60-63).
5. Structure  
   MSK2 is structurally distinguished by its dual kinase domain architecture. The amino-terminal kinase domain (NTKD) belongs to the AGC kinase family and is responsible for substrate phosphorylation, while the carboxy-terminal kinase domain (CTKD) exhibits homology to calcium/calmodulin-dependent protein kinases (CaMK) and is crucial for orchestrating autophosphorylation events necessary for full activation. These two kinase domains are connected by a linker region that harbors several conserved phosphorylation sites, which play a pivotal role in regulating the inter-domain communication and overall catalytic activity (cargnello2011activationandfunction pages 18-19, thiriet2013cytoplasmicproteinserinethreonine pages 60-63, lee2007p90ribosomals6 pages 3-5).

In addition, MSK2 contains specific docking sites near its C-terminus that facilitate binding to upstream MAP kinases, such as ERK1/2 and p38, thereby ensuring prompt and accurate signal relay following extracellular stimulation. The presence of a bipartite nuclear localization signal in its C-terminal region explains its predominantly nuclear localization in both quiescent and activated cells. On a molecular level, key catalytic features include the activation loop, which requires phosphorylation to transition from an autoinhibited to an active conformation, and a structurally defined hydrophobic spine that is characteristic of active kinase domains (roux2004erkandp38 pages 13-14, thiriet2013cytoplasmicproteinserinethreonine pages 60-63, lee2007p90ribosomals6 pages 3-5).

1. Regulation  
   The regulation of MSK2 is achieved predominantly through phosphorylation events mediated by upstream MAPK pathways. Upon cellular stimulation by mitogens such as epidermal growth factor (EGF), stress agents like UV-C irradiation, or other stimuli such as anisomycin, ERK1/2 and p38 MAPK become activated and associate with MSK2 via designated docking motifs. These upstream kinases phosphorylate several critical residues on MSK2, including sites located in the linker region and within the CTKD (for example, phosphorylation events often occur at residues analogous to Ser360, Thr581, and Thr700 as described in related studies). This phosphorylation relieves the autoinhibitory conformation and allows the CTKD to autophosphorylate the NTKD activation loop, thereby fully activating the kinase. Unlike RSK family members, which require PDK1-mediated phosphorylation to achieve full activation of their NTKD, MSK2 undergoes autophosphorylation for activation, underscoring a unique regulatory mechanism among MAPKAPK family members (cargnello2011activationandfunction pages 18-19, roux2004erkandp38 pages 13-14, thiriet2013cytoplasmicproteinserinethreonine pages 60-63).

Additional regulation may involve phosphorylation by casein kinase 2 (CK2) following UV irradiation, and, like many kinases, MSK2’s activity can be modulated by serine/threonine phosphatases that reverse its phosphorylation state. The balance between kinase and phosphatase activities is critical in determining the duration and intensity of the downstream transcriptional responses (cargnello2011activationandfunction pages 27-27, thiriet2013cytoplasmicproteinserinethreonine pages 63-66).

1. Function  
   MSK2 plays a central role in translating extracellular signals into specific transcriptional outputs. It functions as a serine/threonine protein kinase that is required for the mitogen- or stress-induced phosphorylation of key transcription factors. Specifically, MSK2 phosphorylates CREB1 on Ser133 and ATF1 on Ser63 following stimulation by mitogens such as EGF or by stress signals like UV-C irradiation and anisomycin. This phosphorylation enhances the transcriptional activity of these factors, facilitating the induction of immediate early genes such as c-fos and c-jun, which are critical for subsequent cellular responses. Furthermore, MSK2 is instrumental in regulating the transcription factor RELA, a subunit of NF-κB, in response to TNF, thereby directly influencing inflammatory gene expression (cargnello2011activationandfunction pages 19-20, thiriet2013cytoplasmicproteinserinethreonine pages 60-63, anjum2008therskfamily pages 2-4).

In addition to modulating transcription factors, MSK2 phosphorylates histone H3 at Ser10—and potentially Ser28—which results in the relaxation of chromatin and the activation of gene transcription. This activity is essential for the nucleosomal response in which the structural properties of chromatin are altered to enable rapid changes in gene expression following extracellular stimulation. MSK2 also targets high mobility group proteins, such as HMGN1, contributing to their phosphorylation and subsequent regulation of chromatin accessibility. Expression studies have documented that MSK2 is ubiquitously expressed, with particularly high levels in tissues such as the brain, heart, placenta, and skeletal muscle, which correlates with its widespread role in cell proliferation, differentiation, and stress response signaling (cargnello2011activationandfunction pages 18-19, cargnello2011activationandfunction pages 19-20, thiriet2013cytoplasmicproteinserinethreonine pages 60-63).

1. Other Comments  
   Although several compounds have been reported to inhibit components of the MAPK signaling cascade upstream of MSK2, selective inhibitors that target MSK2 directly have not yet been developed. Inhibition of MSK2 activity is generally achieved by using inhibitors that target ERK1/2 or p38 MAPK, which in turn block the phosphorylation-dependent activation of MSK2. Dysregulation of MSK2 has been implicated in aberrant inflammatory responses as well as in oncogenic processes due to its central role in mediating stress-induced changes in gene expression. Furthermore, while mutations in related kinases such as RSK2 are linked to disorders like Coffin–Lowry syndrome, explicit disease-associated mutations in MSK2 have not been definitively characterized in the current literature. Nonetheless, its contribution to the phosphorylation of transcription factors and chromatin proteins under stress and mitogenic conditions positions MSK2 as a critical regulatory node in cellular signaling and highlights its potential clinical relevance in diseases related to inflammation and cancer (cargnello2011activationandfunction pages 13-15, roux2004erkandp38 pages 15-17, thiriet2013cytoplasmicproteinserinethreonine pages 63-66).
2. References
3. cargnello2011activationandfunction pages 18-19
4. cargnello2011activationandfunction pages 19-20
5. poomakkoth2016p90ribosomals6 pages 2-4
6. roux2004erkandp38 pages 13-14
7. roux2004erkandp38 pages 14-15
8. roux2004erkandp38 pages 5-8
9. thiriet2013cytoplasmicproteinserinethreonine pages 60-63
10. anjum2008therskfamily pages 2-4
11. cargnello2011activationandfunction pages 1-2
12. cargnello2011activationandfunction pages 10-12
13. cargnello2011activationandfunction pages 12-13
14. cargnello2011activationandfunction pages 13-15
15. cargnello2011activationandfunction pages 16-17
16. cargnello2011activationandfunction pages 27-27
17. cargnello2011activationandfunction pages 32-33
18. chrysostomou2020rsk4targetinga pages 137-141
19. chrysostomou2020rsk4targetinga pages 54-58
20. doehn2004p90ribosomals6 pages 6-7
21. lee2007p90ribosomals6 pages 3-5
22. moens2013theroleof pages 1-4
23. roux2004erkandp38 pages 1-1
24. roux2004erkandp38 pages 8-9
25. sapkota2007bid1870isa pages 1-2
26. thiriet2013cytoplasmicproteinserinethreonine pages 57-60
27. thiriet2013cytoplasmicproteinserinethreonine pages 63-66
28. utepbergenov2013theunusualmechanism pages 4-5
29. anjum2008therskfamily pages 1-2
30. anjum2008therskfamily pages 4-4
31. cargnello2011activationandfunction pages 15-16
32. cargnello2011activationandfunction pages 28-29
33. chrysostomou2020rsk4targetinga pages 145-148
34. chrysostomou2020rsk4targetinga pages 186-189
35. chrysostomou2020rsk4targetinga pages 58-61
36. doehn2004p90ribosomals6 pages 7-7
37. lee2007p90ribosomals6 pages 1-3
38. lee2007p90ribosomals6 pages 8-9
39. roux2003phosphorylationofp90 pages 8-9
40. roux2004erkandp38 pages 11-12
41. roux2004erkandp38 pages 12-13
42. roux2004erkandp38 pages 15-17
43. roux2004erkandp38 pages 21-21
44. sapkota2007bid1870isa pages 9-10
45. utepbergenov2013theunusualmechanism pages 8-9
46. cargnello2011activationandfunction pages 29-29
47. cargnello2011activationandfunction pages 29-30
48. cargnello2011activationandfunction pages 30-31
49. cargnello2011activationandfunction pages 32-32
50. chrysostomou2020rsk4targetinga pages 141-145
51. chrysostomou2020rsk4targetinga pages 148-150

References

1. (cargnello2011activationandfunction pages 18-19): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
2. (cargnello2011activationandfunction pages 19-20): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
3. (poomakkoth2016p90ribosomals6 pages 2-4): Noufira Poomakkoth, Aya Issa, Nabeel Abdulrahman, Somaia Gamal Abdelaziz, and Fatima Mraiche. P90 ribosomal s6 kinase: a potential therapeutic target in lung cancer. Journal of Translational Medicine, Jan 2016. URL: https://doi.org/10.1186/s12967-016-0768-1, doi:10.1186/s12967-016-0768-1. This article has 45 citations and is from a peer-reviewed journal.
4. (roux2004erkandp38 pages 13-14): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
5. (roux2004erkandp38 pages 14-15): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
6. (roux2004erkandp38 pages 5-8): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
7. (thiriet2013cytoplasmicproteinserinethreonine pages 60-63): M Thiriet M Thiriet. Cytoplasmic protein serine/threonine kinases. Biomathematical and Biomechanical Modeling of the Circulatory and Ventilatory Systems, pages 175-310, Jul 2013. URL: https://doi.org/10.1007/978-1-4614-4370-4\_5, doi:10.1007/978-1-4614-4370-4\_5. This article has 11 citations.
8. (anjum2008therskfamily pages 2-4): Rana Anjum and John Blenis. The rsk family of kinases: emerging roles in cellular signalling. Nature Reviews Molecular Cell Biology, 9:747-758, Oct 2008. URL: https://doi.org/10.1038/nrm2509, doi:10.1038/nrm2509. This article has 964 citations and is from a domain leading peer-reviewed journal.
9. (cargnello2011activationandfunction pages 1-2): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
10. (cargnello2011activationandfunction pages 10-12): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
11. (cargnello2011activationandfunction pages 12-13): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
12. (cargnello2011activationandfunction pages 13-15): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
13. (cargnello2011activationandfunction pages 16-17): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
14. (cargnello2011activationandfunction pages 27-27): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
15. (cargnello2011activationandfunction pages 32-33): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
16. (chrysostomou2020rsk4targetinga pages 137-141): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.
17. (chrysostomou2020rsk4targetinga pages 54-58): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.
18. (doehn2004p90ribosomals6 pages 6-7): Ulrik DOEHN, Steen GAMMELTOFT, Shi-Hsiang SHEN, and Claus J. JENSEN. P90 ribosomal s6 kinase 2 is associated with and dephosphorylated by protein phosphatase 2cδ. Biochemical Journal, 382:425-431, Aug 2004. URL: https://doi.org/10.1042/bj20040948, doi:10.1042/bj20040948. This article has 41 citations and is from a domain leading peer-reviewed journal.
19. (lee2007p90ribosomals6 pages 3-5): Kwok Y. Lee, Paola A. Bignone, and Trivadi S. Ganesan. P90 ribosomal s6 kinases‐ eclectic members of the human kinome. Signal Transduction, 7:225-239, Jun 2007. URL: https://doi.org/10.1002/sita.200600091, doi:10.1002/sita.200600091. This article has 4 citations and is from a peer-reviewed journal.
20. (moens2013theroleof pages 1-4): Ugo Moens, Sergiy Kostenko, and Baldur Sveinbjørnsson. The role of mitogen-activated protein kinase-activated protein kinases (mapkapks) in inflammation. Genes, 4:101-133, Mar 2013. URL: https://doi.org/10.3390/genes4020101, doi:10.3390/genes4020101. This article has 284 citations and is from a peer-reviewed journal.
21. (roux2004erkandp38 pages 1-1): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
22. (roux2004erkandp38 pages 8-9): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
23. (sapkota2007bid1870isa pages 1-2): Gopal P. Sapkota, Lorna Cummings, F. Newell, C. Armstrong, J. Bain, M. Frodin, M. Grauert, M. Hoffmann, G. Schnapp, M. Steegmaier, P. Cohen, and D. Alessi. Bi-d1870 is a specific inhibitor of the p90 rsk (ribosomal s6 kinase) isoforms in vitro and in vivo. The Biochemical journal, 401 1:29-38, 2007. URL: https://doi.org/10.1042/bj20061088, doi:10.1042/bj20061088. This article has 364 citations.
24. (thiriet2013cytoplasmicproteinserinethreonine pages 57-60): M Thiriet M Thiriet. Cytoplasmic protein serine/threonine kinases. Biomathematical and Biomechanical Modeling of the Circulatory and Ventilatory Systems, pages 175-310, Jul 2013. URL: https://doi.org/10.1007/978-1-4614-4370-4\_5, doi:10.1007/978-1-4614-4370-4\_5. This article has 11 citations.
25. (thiriet2013cytoplasmicproteinserinethreonine pages 63-66): M Thiriet M Thiriet. Cytoplasmic protein serine/threonine kinases. Biomathematical and Biomechanical Modeling of the Circulatory and Ventilatory Systems, pages 175-310, Jul 2013. URL: https://doi.org/10.1007/978-1-4614-4370-4\_5, doi:10.1007/978-1-4614-4370-4\_5. This article has 11 citations.
26. (utepbergenov2013theunusualmechanism pages 4-5): D. Utepbergenov and Z. Derewenda. The unusual mechanism of inhibition of the p90 ribosomal s6 kinase (rsk) by flavonol rhamnosides. Biochimica et biophysica acta, 1834 7:1285-91, Jul 2013. URL: https://doi.org/10.1016/j.bbapap.2013.03.018, doi:10.1016/j.bbapap.2013.03.018. This article has 9 citations.
27. (anjum2008therskfamily pages 1-2): Rana Anjum and John Blenis. The rsk family of kinases: emerging roles in cellular signalling. Nature Reviews Molecular Cell Biology, 9:747-758, Oct 2008. URL: https://doi.org/10.1038/nrm2509, doi:10.1038/nrm2509. This article has 964 citations and is from a domain leading peer-reviewed journal.
28. (anjum2008therskfamily pages 4-4): Rana Anjum and John Blenis. The rsk family of kinases: emerging roles in cellular signalling. Nature Reviews Molecular Cell Biology, 9:747-758, Oct 2008. URL: https://doi.org/10.1038/nrm2509, doi:10.1038/nrm2509. This article has 964 citations and is from a domain leading peer-reviewed journal.
29. (cargnello2011activationandfunction pages 15-16): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
30. (cargnello2011activationandfunction pages 28-29): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
31. (chrysostomou2020rsk4targetinga pages 145-148): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.
32. (chrysostomou2020rsk4targetinga pages 186-189): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.
33. (chrysostomou2020rsk4targetinga pages 58-61): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.
34. (doehn2004p90ribosomals6 pages 7-7): Ulrik DOEHN, Steen GAMMELTOFT, Shi-Hsiang SHEN, and Claus J. JENSEN. P90 ribosomal s6 kinase 2 is associated with and dephosphorylated by protein phosphatase 2cδ. Biochemical Journal, 382:425-431, Aug 2004. URL: https://doi.org/10.1042/bj20040948, doi:10.1042/bj20040948. This article has 41 citations and is from a domain leading peer-reviewed journal.
35. (lee2007p90ribosomals6 pages 1-3): Kwok Y. Lee, Paola A. Bignone, and Trivadi S. Ganesan. P90 ribosomal s6 kinases‐ eclectic members of the human kinome. Signal Transduction, 7:225-239, Jun 2007. URL: https://doi.org/10.1002/sita.200600091, doi:10.1002/sita.200600091. This article has 4 citations and is from a peer-reviewed journal.
36. (lee2007p90ribosomals6 pages 8-9): Kwok Y. Lee, Paola A. Bignone, and Trivadi S. Ganesan. P90 ribosomal s6 kinases‐ eclectic members of the human kinome. Signal Transduction, 7:225-239, Jun 2007. URL: https://doi.org/10.1002/sita.200600091, doi:10.1002/sita.200600091. This article has 4 citations and is from a peer-reviewed journal.
37. (roux2003phosphorylationofp90 pages 8-9): Philippe P. Roux, Stephanie A. Richards, and John Blenis. Phosphorylation of p90 ribosomal s6 kinase (rsk) regulates extracellular signal-regulated kinase docking and rsk activity. Molecular and Cellular Biology, 23:4796-4804, Jul 2003. URL: https://doi.org/10.1128/mcb.23.14.4796-4804.2003, doi:10.1128/mcb.23.14.4796-4804.2003. This article has 249 citations and is from a domain leading peer-reviewed journal.
38. (roux2004erkandp38 pages 11-12): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
39. (roux2004erkandp38 pages 12-13): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
40. (roux2004erkandp38 pages 15-17): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
41. (roux2004erkandp38 pages 21-21): Philippe P. Roux and John Blenis. Erk and p38 mapk-activated protein kinases: a family of protein kinases with diverse biological functions. Microbiology and Molecular Biology Reviews, 68:320-344, Jun 2004. URL: https://doi.org/10.1128/mmbr.68.2.320-344.2004, doi:10.1128/mmbr.68.2.320-344.2004. This article has 3360 citations and is from a domain leading peer-reviewed journal.
42. (sapkota2007bid1870isa pages 9-10): Gopal P. Sapkota, Lorna Cummings, F. Newell, C. Armstrong, J. Bain, M. Frodin, M. Grauert, M. Hoffmann, G. Schnapp, M. Steegmaier, P. Cohen, and D. Alessi. Bi-d1870 is a specific inhibitor of the p90 rsk (ribosomal s6 kinase) isoforms in vitro and in vivo. The Biochemical journal, 401 1:29-38, 2007. URL: https://doi.org/10.1042/bj20061088, doi:10.1042/bj20061088. This article has 364 citations.
43. (utepbergenov2013theunusualmechanism pages 8-9): D. Utepbergenov and Z. Derewenda. The unusual mechanism of inhibition of the p90 ribosomal s6 kinase (rsk) by flavonol rhamnosides. Biochimica et biophysica acta, 1834 7:1285-91, Jul 2013. URL: https://doi.org/10.1016/j.bbapap.2013.03.018, doi:10.1016/j.bbapap.2013.03.018. This article has 9 citations.
44. (cargnello2011activationandfunction pages 29-29): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
45. (cargnello2011activationandfunction pages 29-30): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
46. (cargnello2011activationandfunction pages 30-31): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
47. (cargnello2011activationandfunction pages 32-32): Marie Cargnello and Philippe P. Roux. Activation and function of the mapks and their substrates, the mapk-activated protein kinases. Microbiology and Molecular Biology Reviews, 75:50-83, Mar 2011. URL: https://doi.org/10.1128/mmbr.00031-10, doi:10.1128/mmbr.00031-10. This article has 4026 citations and is from a domain leading peer-reviewed journal.
48. (chrysostomou2020rsk4targetinga pages 141-145): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.
49. (chrysostomou2020rsk4targetinga pages 148-150): S Chrysostomou. Rsk4 targeting: a new therapeutic strategy against drug resistance and metastasis in non-small cell lung cancer. Unknown journal, 2020.