1. Phylogeny  
   FAM20B belongs to the Fam20 family of secretory pathway kinases that also includes FAM20A and FAM20C, and phylogenetic analyses indicate that its origin is ancient, with orthologs detectable in basal metazoans such as sponges and hydra, thereby underscoring its evolutionary conservation (zhang2018structureandevolution pages 1-2, dudkiewicz2013anovelpredicted pages 8-9).  
   This kinase is classified within a group of secreted kinases that diverged from canonical intracellular protein kinases and has a distinct evolutionary trajectory characterized by its specialization toward glycan substrates rather than peptide substrates (tagliabracci2013secretedproteinkinases pages 7-8, du2023regulationofsecretory pages 11-12).  
   Notably, FAM20B functions as a monomer in contrast to other Fam20 family members such as FAM20C that typically form homodimers or heterodimers with FAM20A, a distinction that reflects its unique evolutionary and functional specialization (zhang2018structureandevolution pages 7-8).  
   Overall, the presence of FAM20B in diverse animal phyla supports its role as an evolutionarily conserved regulator of proteoglycan assembly and extracellular matrix formation (du2023regulationofsecretory pages 11-12, dudkiewicz2013anovelpredicted pages 8-8).
2. Reaction Catalyzed  
   FAM20B catalyzes the ATP-dependent phosphorylation of the xylose residue within the proteoglycan glycosaminoglycan (GAG)–protein linkage region by transferring a phosphate group to the C2 hydroxyl of the xylose moiety (du2023regulationofsecretory pages 12-12, wen2014xylosephosphorylationfunctions pages 3-5).  
   The chemical reaction can be summarized as: ATP plus a xylose-containing GAG–protein linkage substrate yields ADP, a 2-O-phosphorylated xylose in the linkage region, and a proton (koike2014identificationofphosphatase pages 12-13, wen2014xylosephosphorylationfunctions pages 1-1).  
   This phosphorylation event acts as a molecular switch that influences the catalytic activity of downstream glycosyltransferases such as glucuronyltransferase I (GlcAT-I/B3GAT3) essential for completing the precursor tetrasaccharide (du2023regulationofsecretory pages 12-12, wen2014xylosephosphorylationfunctions pages 3-5).
3. Cofactor Requirements  
   FAM20B requires ATP as the phosphate donor, and its kinase activity is dependent on the presence of divalent metal cations, with experimental evidence indicating a specific requirement for Mn²⁺ ions in catalysis (zhang2018structureandevolution pages 10-11, wen2014xylosephosphorylationfunctions pages 1-3).  
   The utilization of manganese ions is consistent with observations from in vitro kinase assays and crystallographic studies in which MnCl₂ was incorporated into the reaction buffers to achieve optimal phosphorylation of glycan substrates (du2023regulationofsecretory pages 12-12).
4. Substrate Specificity  
   FAM20B exhibits stringent substrate specificity by selectively phosphorylating the xylose residue that is embedded within the common GAG–protein linkage region, a structure composed of the sequential monosaccharides GlcUAβ1–3Galβ1–3Galβ1–4Xyl attached to serine residues of core proteins (wen2014xylosephosphorylationfunctions pages 3-3, tagliabracci2013secretedproteinkinases pages 7-8).  
   The enzyme does not efficiently phosphorylate free xylose or noncanonical glycan structures, but rather requires the specific disaccharide or tetrasaccharide context such as the Galβ1–4Xyl motif to achieve its catalytic function (wen2014xylosephosphorylationfunctions pages 3-5, du2023regulationofsecretory pages 12-12).  
   This precise recognition ensures that phosphorylation is restricted to the linkage region during proteoglycan synthesis, thereby modulating the available substrate for subsequent addition of glucuronic acid by GlcAT-I (du2023regulationofsecretory pages 12-12, wen2014xylosephosphorylationfunctions pages 3-5).
5. Structure  
   FAM20B is synthesized with an N-terminal signal peptide that directs it into the secretory pathway, and the mature protein is predominantly localized in the Golgi apparatus where proteoglycan maturation occurs (zhang2018structureandevolution pages 1-2, du2023regulationofsecretory pages 11-11).  
   Its structural organization comprises a central catalytic kinase domain that adopts a canonical kinase fold modified by unique insertions and disulfide bonds, which together contribute to its specificity for glycan substrates rather than protein substrates (zhang2018structureandevolution pages 7-8, tagliabracci2013secretedproteinkinases pages 7-8).  
   High-resolution crystallography of Fam20B orthologs has identified key residues—such as Thr114, Gln115, Tyr148, Glu149, Gly150, Tyr151, Tyr214, Tyr253, His301, Lys321, and notably Asp299, which functions as the catalytic base—that create a substrate-binding pocket optimized for interacting with the Gal–Xyl disaccharide (zhang2018structureandevolution pages 7-8, zhang2018structureandevolution pages 9-10).  
   Structural comparisons reveal that FAM20B operates as a monomer and lacks the dimerization domains observed in Fam20C, reinforcing its specialized catalytic and regulatory role in glycan phosphorylation (zhang2018structureandevolution pages 7-8, tagliabracci2015asinglekinase pages 1-3).
6. Regulation  
   Regulation of FAM20B occurs through multiple mechanisms that ensure the timely phosphorylation of the xylose residue during proteoglycan assembly; these include both transcriptional regulation and enzyme activity modulation within the secretory pathway (du2023regulationofsecretory pages 11-12, dudkiewicz2013anovelpredicted pages 8-9).  
   A critical regulatory aspect involves the transient nature of xylose phosphorylation, which is balanced by the action of a specific phosphatase—XYLP—that dephosphorylates the 2-O-phosphoxylose residue shortly after its formation, thus permitting efficient further extension of the glycosaminoglycan chain (koike2014identificationofphosphatase pages 13-14, koike2014identificationofphosphatase pages 12-13).  
   Additionally, the localization of FAM20B to the Golgi apparatus inherently positions it in close proximity to other glycosyltransferases, such as GlcAT-I, thereby facilitating a coordinated enzymatic network that governs proteoglycan biosynthesis (du2023regulationofsecretory pages 11-11, koike2014identificationofphosphatase pages 5-7).  
   Although specific post-translational modifications of FAM20B itself have not been extensively characterized, current evidence indicates that its activity is modulated primarily through interactions with downstream processing enzymes and the availability of substrate within the secretory compartment (koike2014identificationofphosphatase pages 7-8).
7. Function  
   FAM20B plays a fundamental role in proteoglycan biosynthesis by mediating the 2-O-phosphorylation of the xylose residue within the common GAG–protein linkage region, a modification that is critical for the proper assembly and maturation of glycosaminoglycan chains such as heparan sulfate and chondroitin sulfate (wen2014xylosephosphorylationfunctions pages 1-1, du2023regulationofsecretory pages 12-12).  
   By phosphorylating xylose, FAM20B acts as a molecular switch that enhances the catalytic efficiency of glucuronyltransferase I (B3GAT3), thereby promoting the sequential addition of sugar residues necessary for constructing the mature GAG chain (wen2014xylosephosphorylationfunctions pages 3-5, du2023regulationofsecretory pages 12-12).  
   Functional studies have demonstrated that disruption of FAM20B activity, whether by genetic inactivation or perturbation of its expression levels, results in drastic reductions in both chondroitin sulfate and heparan sulfate chain formation, which in turn leads to significant abnormalities in cartilage extracellular matrix composition and skeletal development (du2023regulationofsecretory pages 5-7, wen2014xylosephosphorylationfunctions pages 5-5).  
   In addition to its structural role in ensuring proper extracellular matrix assembly, FAM20B is implicated in modulating signaling pathways that govern cell fate decisions during processes such as tooth development and annulus fibrosus formation, thereby influencing tissue architecture and organogenesis (du2023regulationofsecretory pages 5-7, tagliabracci2015asinglekinase pages 15-15).
8. Other Comments  
   Currently, no specific small molecule inhibitors targeting FAM20B have been reported in the literature; however, its pivotal role in glycosaminoglycan biosynthesis makes it an attractive candidate for therapeutic intervention in diseases associated with defective proteoglycan assembly, including osteoarthritis and chondrosarcoma (du2023regulationofsecretory pages 12-12, tagliabracci2015asinglekinase pages 15-15).  
   Alterations in FAM20B expression or activity have been associated with various developmental anomalies, particularly in cartilage, bone, and dental tissues, highlighting its significance in maintaining extracellular matrix integrity and proper cellular communication (du2023regulationofsecretory pages 5-7, wen2014xylosephosphorylationfunctions pages 5-5).  
   Given the well‐defined catalytic mechanism and the unique substrate specificity of FAM20B, further investigations into its regulation and potential for selective inhibition could provide valuable insights into novel strategies for modulating proteoglycan biosynthesis in pathological contexts (tagliabracci2013secretedproteinkinases pages 12-14, wen2014xylosephosphorylationfunctions pages 3-5).
9. References
10. Du, S., Zhu, C., Ren, X., Chen, X., Cui, X., & Guan, S. (2023). Regulation of secretory pathway kinase or kinase-like proteins in human cancers. Frontiers in Immunology. (du2023regulationofsecretory pages 11-12, du2023regulationofsecretory pages 11-11, du2023regulationofsecretory pages 12-12, du2023regulationofsecretory pages 5-7)
11. Dudkiewicz, M., Lenart, A., & Pawłowski, K. (2013). A novel predicted calcium-regulated kinase family implicated in neurological disorders. PLoS ONE, 8:e66427. (dudkiewicz2013anovelpredicted pages 8-9, dudkiewicz2013anovelpredicted pages 8-8)
12. Koike, T., Izumikawa, T., Sato, B., & Kitagawa, H. (2014). Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708. (koike2014identificationofphosphatase pages 1-2, koike2014identificationofphosphatase pages 12-13, koike2014identificationofphosphatase pages 13-14, koike2014identificationofphosphatase pages 4-5, koike2014identificationofphosphatase pages 5-7)
13. Tagliabracci, V. S., Pinna, L. A., & Dixon, J. E. (2013). Secreted protein kinases. Trends in Biochemical Sciences, 38:121-130. (tagliabracci2013secretedproteinkinases pages 7-8, tagliabracci2013secretedproteinkinases pages 12-14, tagliabracci2013secretedproteinkinases pages 15-21)
14. Wen, J., Xiao, J., Rahdar, M., Choudhury, B. P., Cui, J., Taylor, G. S., Esko, J. D., & Dixon, J. E. (2014). Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728. (wen2014xylosephosphorylationfunctions pages 1-1, wen2014xylosephosphorylationfunctions pages 1-3, wen2014xylosephosphorylationfunctions pages 3-3, wen2014xylosephosphorylationfunctions pages 3-5, wen2014xylosephosphorylationfunctions pages 5-5, wen2014xylosephosphorylationfunctions pages 5-6)
15. Zhang, H., Zhu, Q., Cui, J., Wang, Y., Chen, M. J., Guo, X., Tagliabracci, V. S., Dixon, J. E., & Xiao, J. (2018). Structure and evolution of the fam20 kinases. Nature Communications. (zhang2018structureandevolution pages 1-2, zhang2018structureandevolution pages 6-7, zhang2018structureandevolution pages 7-8, zhang2018structureandevolution pages 9-10, zhang2018structureandevolution pages 10-11, zhang2018structureandevolution pages 11-11, zhang2018structureandevolution pages 2-3, zhang2018structureandevolution pages 4-6, zhang2018structureandevolution pages 6-7, zhang2018structureandevolution pages 7-8, zhang2018structureandevolution pages 8-9, zhang2018structureandevolution pages 9-10)
16. Tagliabracci, V. S., Wiley, S., Guo, X., Kinch, L., Durrant, E., Wen, J., Xiao, J., Cui, J., Nguyen, K., Engel, J., Coon, J., Grishin, N., Pinna, L. A., Pagliarini, D., & Dixon, J. E. (2015). A single kinase generates the majority of the secreted phosphoproteome. Cell, 161:1619-1632. (tagliabracci2015asinglekinase pages 1-3, tagliabracci2015asinglekinase pages 15-15)

References

1. (du2023regulationofsecretory pages 11-12): Shaonan Du, Chen Zhu, Xiaolin Ren, Xin Chen, Xiaohui Cui, and Shu Guan. Regulation of secretory pathway kinase or kinase-like proteins in human cancers. Frontiers in Immunology, Feb 2023. URL: https://doi.org/10.3389/fimmu.2023.942849, doi:10.3389/fimmu.2023.942849. This article has 3 citations and is from a peer-reviewed journal.
2. (dudkiewicz2013anovelpredicted pages 8-9): Małgorzata Dudkiewicz, Anna Lenart, and Krzysztof Pawłowski. A novel predicted calcium-regulated kinase family implicated in neurological disorders. PLoS ONE, 8:e66427, Jun 2013. URL: https://doi.org/10.1371/journal.pone.0066427, doi:10.1371/journal.pone.0066427. This article has 56 citations and is from a peer-reviewed journal.
3. (koike2014identificationofphosphatase pages 1-2): Toshiyasu Koike, Tomomi Izumikawa, Ban Sato, and Hiroshi Kitagawa. Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708, Mar 2014. URL: https://doi.org/10.1074/jbc.m113.520536, doi:10.1074/jbc.m113.520536. This article has 92 citations and is from a domain leading peer-reviewed journal.
4. (koike2014identificationofphosphatase pages 13-14): Toshiyasu Koike, Tomomi Izumikawa, Ban Sato, and Hiroshi Kitagawa. Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708, Mar 2014. URL: https://doi.org/10.1074/jbc.m113.520536, doi:10.1074/jbc.m113.520536. This article has 92 citations and is from a domain leading peer-reviewed journal.
5. (tagliabracci2013secretedproteinkinases pages 7-8): Vincent S. Tagliabracci, Lorenzo A. Pinna, and Jack E. Dixon. Secreted protein kinases. Trends in Biochemical Sciences, 38:121-130, Mar 2013. URL: https://doi.org/10.1016/j.tibs.2012.11.008, doi:10.1016/j.tibs.2012.11.008. This article has 126 citations and is from a domain leading peer-reviewed journal.
6. (wen2014xylosephosphorylationfunctions pages 1-1): Jianzhong Wen, Junyu Xiao, Meghdad Rahdar, Biswa P. Choudhury, Jixin Cui, Gregory S. Taylor, Jeffrey D. Esko, and Jack E. Dixon. Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728, Oct 2014. URL: https://doi.org/10.1073/pnas.1417993111, doi:10.1073/pnas.1417993111. This article has 130 citations.
7. (wen2014xylosephosphorylationfunctions pages 1-3): Jianzhong Wen, Junyu Xiao, Meghdad Rahdar, Biswa P. Choudhury, Jixin Cui, Gregory S. Taylor, Jeffrey D. Esko, and Jack E. Dixon. Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728, Oct 2014. URL: https://doi.org/10.1073/pnas.1417993111, doi:10.1073/pnas.1417993111. This article has 130 citations.
8. (wen2014xylosephosphorylationfunctions pages 3-3): Jianzhong Wen, Junyu Xiao, Meghdad Rahdar, Biswa P. Choudhury, Jixin Cui, Gregory S. Taylor, Jeffrey D. Esko, and Jack E. Dixon. Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728, Oct 2014. URL: https://doi.org/10.1073/pnas.1417993111, doi:10.1073/pnas.1417993111. This article has 130 citations.
9. (wen2014xylosephosphorylationfunctions pages 3-5): Jianzhong Wen, Junyu Xiao, Meghdad Rahdar, Biswa P. Choudhury, Jixin Cui, Gregory S. Taylor, Jeffrey D. Esko, and Jack E. Dixon. Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728, Oct 2014. URL: https://doi.org/10.1073/pnas.1417993111, doi:10.1073/pnas.1417993111. This article has 130 citations.
10. (zhang2018structureandevolution pages 1-2): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
11. (zhang2018structureandevolution pages 6-7): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
12. (zhang2018structureandevolution pages 7-8): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
13. (zhang2018structureandevolution pages 9-10): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
14. (du2023regulationofsecretory pages 11-11): Shaonan Du, Chen Zhu, Xiaolin Ren, Xin Chen, Xiaohui Cui, and Shu Guan. Regulation of secretory pathway kinase or kinase-like proteins in human cancers. Frontiers in Immunology, Feb 2023. URL: https://doi.org/10.3389/fimmu.2023.942849, doi:10.3389/fimmu.2023.942849. This article has 3 citations and is from a peer-reviewed journal.
15. (du2023regulationofsecretory pages 12-12): Shaonan Du, Chen Zhu, Xiaolin Ren, Xin Chen, Xiaohui Cui, and Shu Guan. Regulation of secretory pathway kinase or kinase-like proteins in human cancers. Frontiers in Immunology, Feb 2023. URL: https://doi.org/10.3389/fimmu.2023.942849, doi:10.3389/fimmu.2023.942849. This article has 3 citations and is from a peer-reviewed journal.
16. (du2023regulationofsecretory pages 5-7): Shaonan Du, Chen Zhu, Xiaolin Ren, Xin Chen, Xiaohui Cui, and Shu Guan. Regulation of secretory pathway kinase or kinase-like proteins in human cancers. Frontiers in Immunology, Feb 2023. URL: https://doi.org/10.3389/fimmu.2023.942849, doi:10.3389/fimmu.2023.942849. This article has 3 citations and is from a peer-reviewed journal.
17. (dudkiewicz2013anovelpredicted pages 8-8): Małgorzata Dudkiewicz, Anna Lenart, and Krzysztof Pawłowski. A novel predicted calcium-regulated kinase family implicated in neurological disorders. PLoS ONE, 8:e66427, Jun 2013. URL: https://doi.org/10.1371/journal.pone.0066427, doi:10.1371/journal.pone.0066427. This article has 56 citations and is from a peer-reviewed journal.
18. (koike2014identificationofphosphatase pages 12-13): Toshiyasu Koike, Tomomi Izumikawa, Ban Sato, and Hiroshi Kitagawa. Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708, Mar 2014. URL: https://doi.org/10.1074/jbc.m113.520536, doi:10.1074/jbc.m113.520536. This article has 92 citations and is from a domain leading peer-reviewed journal.
19. (koike2014identificationofphosphatase pages 4-5): Toshiyasu Koike, Tomomi Izumikawa, Ban Sato, and Hiroshi Kitagawa. Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708, Mar 2014. URL: https://doi.org/10.1074/jbc.m113.520536, doi:10.1074/jbc.m113.520536. This article has 92 citations and is from a domain leading peer-reviewed journal.
20. (koike2014identificationofphosphatase pages 5-7): Toshiyasu Koike, Tomomi Izumikawa, Ban Sato, and Hiroshi Kitagawa. Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708, Mar 2014. URL: https://doi.org/10.1074/jbc.m113.520536, doi:10.1074/jbc.m113.520536. This article has 92 citations and is from a domain leading peer-reviewed journal.
21. (tagliabracci2013secretedproteinkinases pages 12-14): Vincent S. Tagliabracci, Lorenzo A. Pinna, and Jack E. Dixon. Secreted protein kinases. Trends in Biochemical Sciences, 38:121-130, Mar 2013. URL: https://doi.org/10.1016/j.tibs.2012.11.008, doi:10.1016/j.tibs.2012.11.008. This article has 126 citations and is from a domain leading peer-reviewed journal.
22. (tagliabracci2013secretedproteinkinases pages 15-21): Vincent S. Tagliabracci, Lorenzo A. Pinna, and Jack E. Dixon. Secreted protein kinases. Trends in Biochemical Sciences, 38:121-130, Mar 2013. URL: https://doi.org/10.1016/j.tibs.2012.11.008, doi:10.1016/j.tibs.2012.11.008. This article has 126 citations and is from a domain leading peer-reviewed journal.
23. (tagliabracci2015asinglekinase pages 1-3): V. Tagliabracci, S. Wiley, Xiao Guo, L. Kinch, Eric Durrant, Jianzhong Wen, Junyu Xiao, J. Cui, K. Nguyen, J. Engel, J. Coon, N. Grishin, L. Pinna, D. Pagliarini, and J. Dixon. A single kinase generates the majority of the secreted phosphoproteome. Cell, 161:1619-1632, Jun 2015. URL: https://doi.org/10.1016/j.cell.2015.05.028, doi:10.1016/j.cell.2015.05.028. This article has 345 citations and is from a highest quality peer-reviewed journal.
24. (wen2014xylosephosphorylationfunctions pages 5-5): Jianzhong Wen, Junyu Xiao, Meghdad Rahdar, Biswa P. Choudhury, Jixin Cui, Gregory S. Taylor, Jeffrey D. Esko, and Jack E. Dixon. Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728, Oct 2014. URL: https://doi.org/10.1073/pnas.1417993111, doi:10.1073/pnas.1417993111. This article has 130 citations.
25. (wen2014xylosephosphorylationfunctions pages 5-6): Jianzhong Wen, Junyu Xiao, Meghdad Rahdar, Biswa P. Choudhury, Jixin Cui, Gregory S. Taylor, Jeffrey D. Esko, and Jack E. Dixon. Xylose phosphorylation functions as a molecular switch to regulate proteoglycan biosynthesis. Proceedings of the National Academy of Sciences, 111:15723-15728, Oct 2014. URL: https://doi.org/10.1073/pnas.1417993111, doi:10.1073/pnas.1417993111. This article has 130 citations.
26. (zhang2018structureandevolution pages 10-11): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
27. (zhang2018structureandevolution pages 11-11): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
28. (zhang2018structureandevolution pages 2-3): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
29. (zhang2018structureandevolution pages 4-6): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
30. (zhang2018structureandevolution pages 8-9): Hui Zhang, Qinyu Zhu, Jixin Cui, Yuxin Wang, Mark J. Chen, Xing Guo, Vincent S. Tagliabracci, Jack E. Dixon, and Junyu Xiao. Structure and evolution of the fam20 kinases. Nature Communications, Mar 2018. URL: https://doi.org/10.1038/s41467-018-03615-z, doi:10.1038/s41467-018-03615-z. This article has 80 citations and is from a highest quality peer-reviewed journal.
31. (koike2014identificationofphosphatase pages 7-8): Toshiyasu Koike, Tomomi Izumikawa, Ban Sato, and Hiroshi Kitagawa. Identification of phosphatase that dephosphorylates xylose in the glycosaminoglycan-protein linkage region of proteoglycans. Journal of Biological Chemistry, 289:6695-6708, Mar 2014. URL: https://doi.org/10.1074/jbc.m113.520536, doi:10.1074/jbc.m113.520536. This article has 92 citations and is from a domain leading peer-reviewed journal.
32. (tagliabracci2015asinglekinase pages 15-15): V. Tagliabracci, S. Wiley, Xiao Guo, L. Kinch, Eric Durrant, Jianzhong Wen, Junyu Xiao, J. Cui, K. Nguyen, J. Engel, J. Coon, N. Grishin, L. Pinna, D. Pagliarini, and J. Dixon. A single kinase generates the majority of the secreted phosphoproteome. Cell, 161:1619-1632, Jun 2015. URL: https://doi.org/10.1016/j.cell.2015.05.028, doi:10.1016/j.cell.2015.05.028. This article has 345 citations and is from a highest quality peer-reviewed journal.