Plant Immunity

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Recently developed Open Tools and Resources for Arabidopsis Researchers

- PlantPepDB: A manually curated plant peptide database https://www.nature.com/articles/s41598-020-59165-2 PlantPepDB is a manually curated database of plant peptides having different functions and therapeutic activities

- OpenPlantNLR: a research community on plant NLR immune receptors https://zenodo.org/communities/openplantnlr/?page=1&size=20 NLRs (nucleotide-binding leucine-rich repeat) proteins are intracellular immune receptors that constitute the main class of disease resistance (R) genes in plants. The OpenPlantNLR community collects research outputs on plant NLR biology

- The transcriptional landscape of *Arabidopsis thaliana* pattern-triggered immunity. Transcriptomics. (https://doi.org/10.1038/s41477-021-00874-5)

- NLR-Annotator (Plant Physiology, June 2020, Vol. 183, pp. 468–482,; https://doi.org/10.1104/pp.19.01273)

- Bioeffectors as Biotechnological Tools to Boost Plant Innate Immunity: Signal Transduction Pathways Involved. Plants (Basel). 2020 Dec; 9(12): 1731. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7762609/

- NLGenomeSweeper: A Tool for Genome-Wide NBS-LRR Resistance Gene Identification. https://pubmed.ncbi.nlm.nih.gov/32245073/

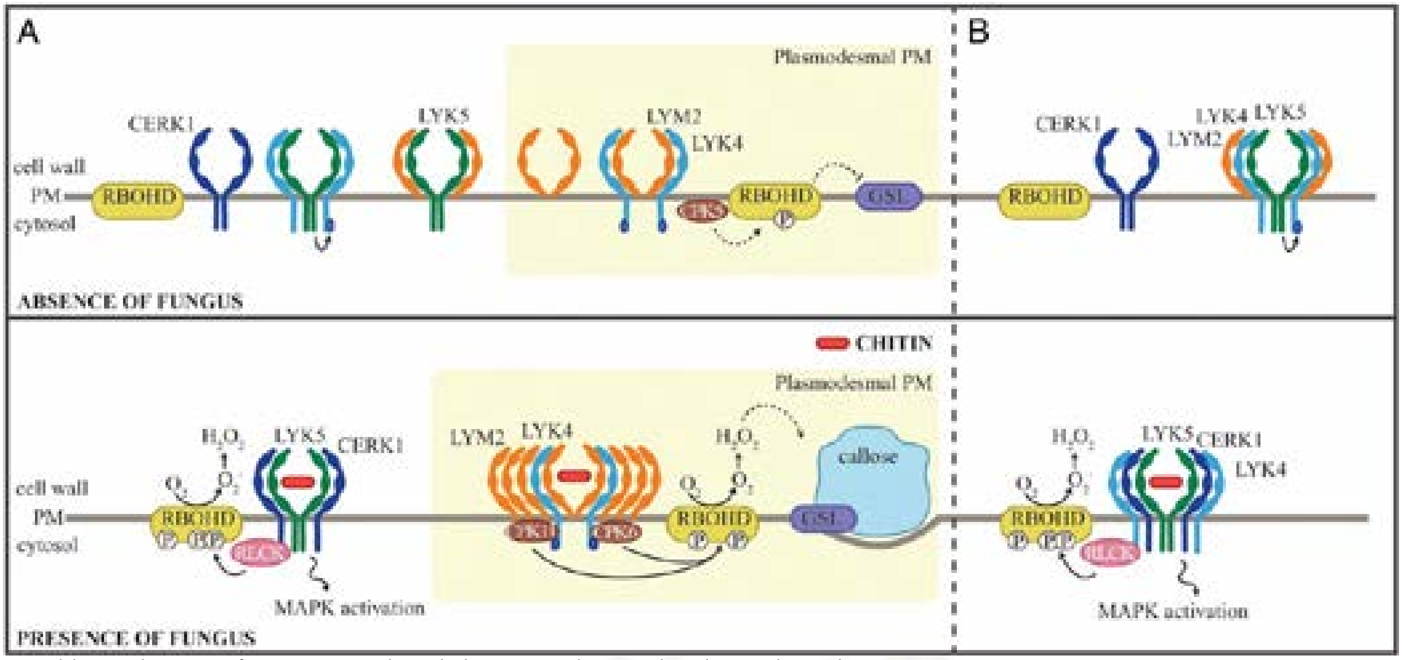
- Monitoring Plant Health with Near-Infrared Fluorescent H 2 O 2 Nanosensors. https://pubmed.ncbi.nlm.nih.gov/32097014/

Recent or Future activities of Subcommittee members

Due to the global COVID-19 situation, most of the last year's conferences were either canceled, postponed, or held in an online (shorter) version. Prior to the lockdown, the subcommittee members Organized and chaired an inaugural workshop on Machine learning and systems biology at Plant and Animal Genome Meeting, San Diego, Jan 2020.

The members of this subcommittee also presented talks in the proteomics workshop at Plant and Animal Genome meeting as well as presented a poster in an education workshop at Plant and Animal Genome Meeting, San Diego, Jan 2020.

However, after the lock-down was enforced, the subcommittee members attended the MPMI virtual seminar series (https://apsjournals.apsnet.org/virtualseminars) and the 2021 IS-MPMI Congress: eSymposia Series (https://www.ismpmi.org/Events/2021Congress/Pages/default.aspx). The members also presented a poster at the Plant Biology Worldwide Summit, July 2020.



Possible mechanisms for LYM2-mediated chitin signaling in the plasmodesmal PM.

This cartoon illustrates two possibilities for some key elements of LysM protein chitin signaling in the PM and plasmodesmal PM. Top represents the relevant associations and localizations we have identified under mock conditions (absence of fungus). Here, LYK5 (green) interacts with LYK4 (light blue), and LYM2 (orange) in the PM and LYK5 mediates modification of a pool of LYK4. This could occur via a population of bipartite complexes (A) or a tripartite LYM2-LYK4-LYK5 complex (B) in the PM. CPK5 negatively regulates callose synthesis in the plasmodesmal PM via a specific phosphorylation pattern (P) (white) of RBOHD. In response to chitin (Lower, presence of fungus), a pool of LYK4 and LYM2 dissociate from LYK5. LYK5 associates with CERK1 (dark blue) (A) or both CERK1 and LYK4 (B) to mediate signaling at the PM, and LYM2 accumulates at plasmodesmata, where it forms a higher-order complex or a signaling platform. This complex recruits LYK4 and CPK6 and -11 (brown) to phosphorylate (P) (white) RBOHD (yellow) at Ser133 and Ser347 and induces callose (blue) synthesis via a glucan synthase-like enzyme (GSL) (purple) to close PD. The PM LYK5-containing complex signals, in part, via RLCKs that phosphorylate (P) (white) RBOHD (yellow) at Ser39, Ser339, and Ser343 (P) (white). While not represented here, RLCKs might constitutively associate with LysM receptor complexes in the PM as for LRR-RKs

Finally, the members also attended CRISPR in the Classroom - Virtual Workshop for Undergraduate Educators. In summary, the combined efforts of subcommittee members have contributed tremendously in the field of plant immunity, enhanced national and international collaborations, contributed in the development of novel and innovative tools, and participated in outreach activities. In summary, the combined efforts of subcommittee members have contributed tremendously in the field of plant immunity, enhanced national and international collaborations, contributed in the development of novel and innovative tools, and participated in outreach activities.

Selected Publications

1. Schultink A, Qi T, Lee A, Steinbrenner AD, Staskawicz B. Structure of the activated ROQ1 resistosome directly recognizing the pathogen effector XopQ. (2020; Science; DOI: 10.1126/science.abd9993)

2. Ma S, Lapin D, Liu L, Sun Y, Song W, Zhang X, Logemann E, Yu D, Wang J, Jirschitzka J, Han Z, Schulze-Lefert P, Parker JE, Chai J. Direct pathogen-induced assembly of an NLR immune receptor complex to form a holoenzyme (2020; Science; DOI: 10.1126/science.abe3069)

3. Wang, W., Withers, J., Li, H., Zwack, P. J., Rusnac, D-V., Shi, H., Liu, L., Yan, S., Hinds, T. R. , Guttman, M., Dong, X., Zheng, N. (2020) Structural basis of salicylic acid perception by Arabidopsis NPR proteins. Nature volume 586, pages311–316

4. Cheval, C., Samwald, S., Johnston, M.G., Keijzer, J.D., Breakspear, A., Liu, X., Bellandi, A., Kadota, Y., Zipfel, C., Faulkner, C. (2020) Chitin perception in plasmodesmata characterizes submembrane immune-signaling specificity in plants. Proc Natl Acad Sci U S A. 117: 9621–9629.

5. Thor, K., Jiang, S., Michard, E., George, J., Scherzer, S., Huang, S., Dindas, J., Derbyshire, P., Leitão, N., DeFalco, T.A., Köster, P., Hunter, K., Kimura, S., Gronnier, J., Stransfeld, L., Kadota, Y., Bücherl, C.A., Charpentier, M., Wrzaczek, M., MacLean, D., Oldroyd, G.E.D., Menke, F.L.H., Roelfsema, M.R.G., Hedrich, R., Feijó, J., Zipfel, C.(2020) The calcium-permeable channel OSCA1.3 regulates plant stomatal immunity. Nature 585:569-573.

Planning for Fourth Decadal Roadmap

- Identification of MAMPs from pathogens and their receptors from plants, and development of resistant crops by the expression of MAMP receptors.

- Identification of avirulent effectors from pathogens and NLR receptors from plants, and development of resistant crops by the expression of NLR receptors.

- How can we collect and standardize imaging data and the images' metadata (not only of published images but also of for example an entire experiment of a published imaging analysis) and provide this information to the wider community?

- Understanding the eco-evolutionary dynamics of pathogens in natural plant communities from a mechanistic and molecular point of view.

- Understanding of uORFs in plant immunity and their roles in crop improvement.

- Integration of diverse -omics in plant-pathogens interactions.