What basic plant physiology knowledge do we need to find into actionable solutions to agricultural problems? And, how may engineering approaches help find these solutions?

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Do you know the one about the agronomist talking with the phloem genomicist, physiological ecologist and fluidics engineer? No? Neither do we, but we aim to find out. Without bringing disparate disciplines together, we will not find realistic solutions to adapting agriculture to climate change and increasing productivity whilst still providing nutritious food. Achieving these goals requires bringing together basic knowledge of the phenotypic or genotypic factors at play with an engineers' assembly line approach to measuring plant performance. The panel on Plant Physiology, Flow and Nutrient Transport does this by bringing three experts together representing cutting edge knowledge of plant stress responses, nutrient dynamics within the plant and microfluidics chip based systems for studying plants and nutrients.

Basic knowledge of a plant stress response, embolism and refilling, defines if, and how, plants recover from stresses predicted to be more severe under future climates. Maciej Zwieniecki and colleagues have pushed the study of embolism refilling to the limits of current biological methods, thus transformative physical approaches are needed to further our knowledge of this core process of field and tree crop recovery from stress.

The study of the physiology of metal ion accumulation, or exclusion from plants, will have impacts that range from affecting the nutritive value of food, to allowing us to broaden the soil environments that crops are grown in. David Mendoza-Cozatl is addressing these problems using biochemical and genomic perspectives to ultimately engineer crops with coordinated systems of enzymes and transporters to sequester ions in specific tissues, including the grains we eat. How may we help him?

Engineering approaches to solving problems, such as assembly lines, have led to cheap and efficient production of cars, computers and other technologies. Analogously, Liang Dong has used the engineering workhorse, a chip, to allow rapid and very directed phenotyping of plant traits. Liang is also developing soil environmental sensors based upon chip technology – where else may they be of use in solving agricultural problems?