

Genetic Regulation of Tomato Fruit Ripening and Nutritional Quality

James Giovannoni

USDA-ARS and Boyce Thompson Institute for Plant Research, Ithaca, NY USA

Research in the laboratory focuses on understanding key regulatory genes which influence overall-ripening control but also with an interest in those contributing more directly to nutritional attributes. Carotenoids are important plant-derived contributors to human health and nutrition. While the majority of genes involved in carotenoid synthesis and metabolism have been identified, genetic mechanisms underlying regulation of the pathway leading to specific carotenoid profiles of plant tissues remains largely unknown. Ripening tomato fruit accumulate large amounts of carotenoids (especially lycopene and beta-carotene) over a short period of time. This fact combined with rapidly expanding genomics resources for tomato makes this an excellent model system for investigating carotenoid pathway control. Our group is employing a combination of metabolic profiling and genomics approaches to understand the regulation of carotenoid flux during fruit ripening. Specifically, we have identified key ripening genes that regulate numerous ripening pathways including those involved in carotenoid metabolism. We are also examining single-gene carotenoid mutants to assess the regulation of carotenoid genes in response to alterations in metabolite levels. Preliminary results indicate that key steps in the carotenoid pathway are regulated during ripening but that many genes in the pathway are responsive to feedback regulation. Genomics approaches have lead to a number of interesting candidate genes and at least one that appears to have more specific effects on carotenoid levels of ripening fruits when assayed in transgenic plants.