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Grape and Wine Genomics

Status	Approved
Competition	Applied Genomics in Bioproducts or Crops
Sector	Agriculture - Crops
Genome Centre	Genome British Columbia
Project Leaders	Steven T. Lund, UBC / Hennie J.J. van Vuuren, UBC

Project Description

Wine brings pleasure and is also becoming an important Canadian agricultural product. The Canadian wine industry, accounting for about $4.2B in sales each year, began to thrive on the world stage in the 1990s following a switch from the native Labrusca grapes to the European Vinifera varietals. Exports of Canadian wine, primarily to the U.S. and Taiwan markets, accounted for $832M. Canadian wine making creates many jobs among the growers, suppliers, distributors, and service providers that comprise the industry.

Wine making traditionally has been regarded as more of an art than a science, subject to the vagaries of nature and insulated from the advantages of scientific study. This is changing rapidly. The application of new genomics and related techniques now make it possible to uncover fundamental gene functions in wine grapes and yeasts. These methods are already leading to the development of protein biomarkers that can assist viticulturists to monitor how the vine and berries respond to natural and human-made environmental changes along each season, ultimately allowing greater consistency in high value wine grape production.

Yeast has been studied as a model organism for more than 40 years and was the first eukaryote whose genome was fully sequenced. The functions of 5,000 of the 6,000 genes in *S. cerevisiae* have been elucidated. During wine making, yeasts are exposed to many stress conditions such as osmotic pressure, nutrient limitation and ethanol. We have recently discovered that yeast cells adapt to wine making stress conditions by switching on 62 genes of unknown functions which we named Fermentation Stress Response genes. Our objective is to discover function for each of these 62 genes.

Our project will apply genomic and genetic techniques to the study of important wine varietals. Specifically, we will do the following: 1) clarify how nitrogen fertilization affects hormone regulation of metabolic pathways important for berry ripening, chemical composition and wine quality; 2) determine the relationship between gene expression patterns and variation in amino acid composition at maturity in ripening berries; 3) develop biomarkers for vineyard monitoring of vine water stress. 4) use a systems biology approach to identify functions for each of the genes involved in the fermentation-stress response and the regulation of molecular sugar and amino-acid transporters during wine fermentation; and 5) deliver knowledge that leads to understanding the complex scientific, policy, industry and public issues involved in the application of genomics to the wine industry.