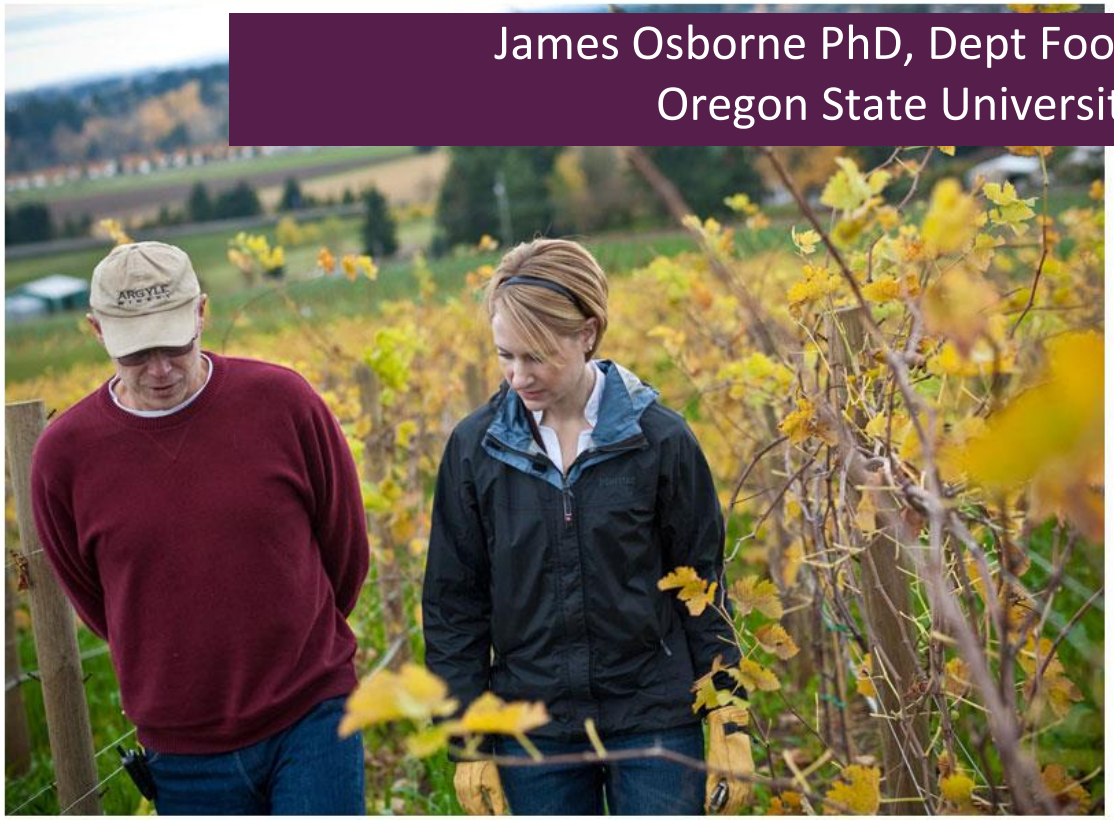
Oregon Wine Research Institute

Rotting Grapes to Perfection: Winemaking

James Osborne PhD, Dept Food Science
Oregon State University



Who I am and how I got here

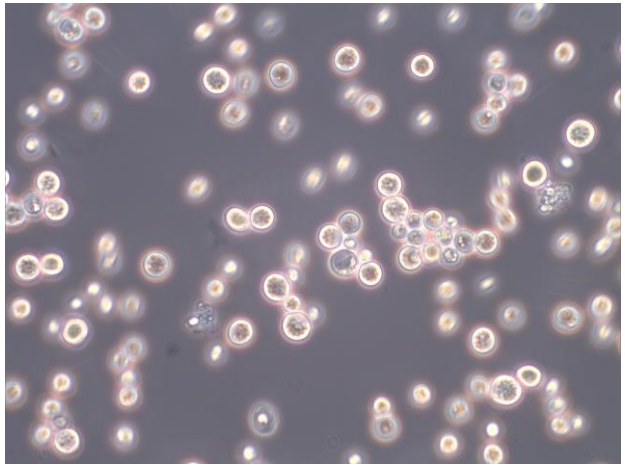
Grew up in Auckland, New Zealand, on a Dairy farm

Upside down
World Map
LEGEND
Capital City, Town
Hema Maps Pty Ltd
Ph: +61 7 3340 0000 Fax: +61 7 3340 0099
Web: www.hemamaps.com
Email: manager@hemamaps.com.au
Hema Maps NZ Limited
Ph: +64 9 273 6459 Fax: +64 9 273 6479
Email: sales.hema@clear.net.nz
ISBN 1-86500-168-6
9 781865 001685
ANTARCTICA
SOUTHERN OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTH PACIFIC OCEAN
NORTH PACIFIC OCEAN
ARCTIC OCEAN
NORTH ATLANTIC OCEAN
AUSTRALIA
NEW ZEALAND
INDONESIA
PHILIPPINES
MALAYSIA
INDIA
CHINA
MONGOLIA
KAZAKHSTAN
RUSSIAN FEDERATION
JAPAN
UNITED STATES OF AMERICA
CANADA
Alaska U. S. A.
MEXICO
BRAZIL
ARGENTINA
CHILE
BOLIVIA
PERU
COLOMBIA
VENEZUELA
ECUADOR
GREENLAND
ICELAND
UNITED KINGDOM
FRANCE
SPAIN
GERMANY
POLAND
UKRAINE
FINLAND
SWEDEN
NORWAY
TURKEY
IRAN
IRAQ
SAUDI ARABIA
EGYPT
LIBYA
ALGERIA
MOROCCO
NIGERIA
CHAD
SUDAN
ETHIOPIA
KENYA
TANZANIA
ZAMBIA
ANGOLA
REPUBLIC OF SOUTH AFRICA
MADAGASCAR
MALI
NIGER
PAKISTAN
AFGHANISTAN
SRI LANKA
MALDIVES
MAURITIUS
SEYCHELLES
NEW CALEDONIA
FRENCH POLYNESIA
TONGA
SAMOA
FIJI
VANUATU
SOLOMON ISLANDS
PAPUA NEW GUINEA
KIRIBATI
NAURU
TUVALU
MARSHALL ISLANDS
MICRONESIA
NORTHERN MARIANAS
HAWAII
TAIWAN
Tasman Sea
Coral Sea
Arafura Sea
Timor Sea
Bering Sea
Sea of Okhotsk
Sea of Japan
East Sea
Yellow Sea
Bay of Bengal
Arabian Sea
Red Sea
Caspian Sea
Black Sea
Mediterranean Sea
Baffin Bay
Hudson Bay
Labrador Sea
Beaufort Sea
Barents Sea
Weddell Sea
Ross Sea
Equator
Tropic of Cancer
Tropic of Capricorn
Arctic Circle

How I got here

Soil microbiology class got me interested in microbiology

Completed my M.S. in microbiology and PhD in Food Science researching wine microbiology



What am I doing here?

- Associate Professor in Food Sci and Tech Dept - OSU
- Research
  - Wine microbiology and the fermentation process
- Teaching
  - Wine Production
  - Wine analysis and sensory evaluation
- Extension
  - Link between University and Oregon wine industry
  - Technical support
  - Educational programs

Outline

- Overview of winemaking
  - Red vs. White winemaking
- Oregon wine industry
  - What makes us unique?
- Role of research

Grape processing

Fermentation

Post-fermentation processing

Aging, filtering, bottling

Oregon Wine Research Institute

Oregon State University

Harvesting

- Hand harvest
- Machine harvest

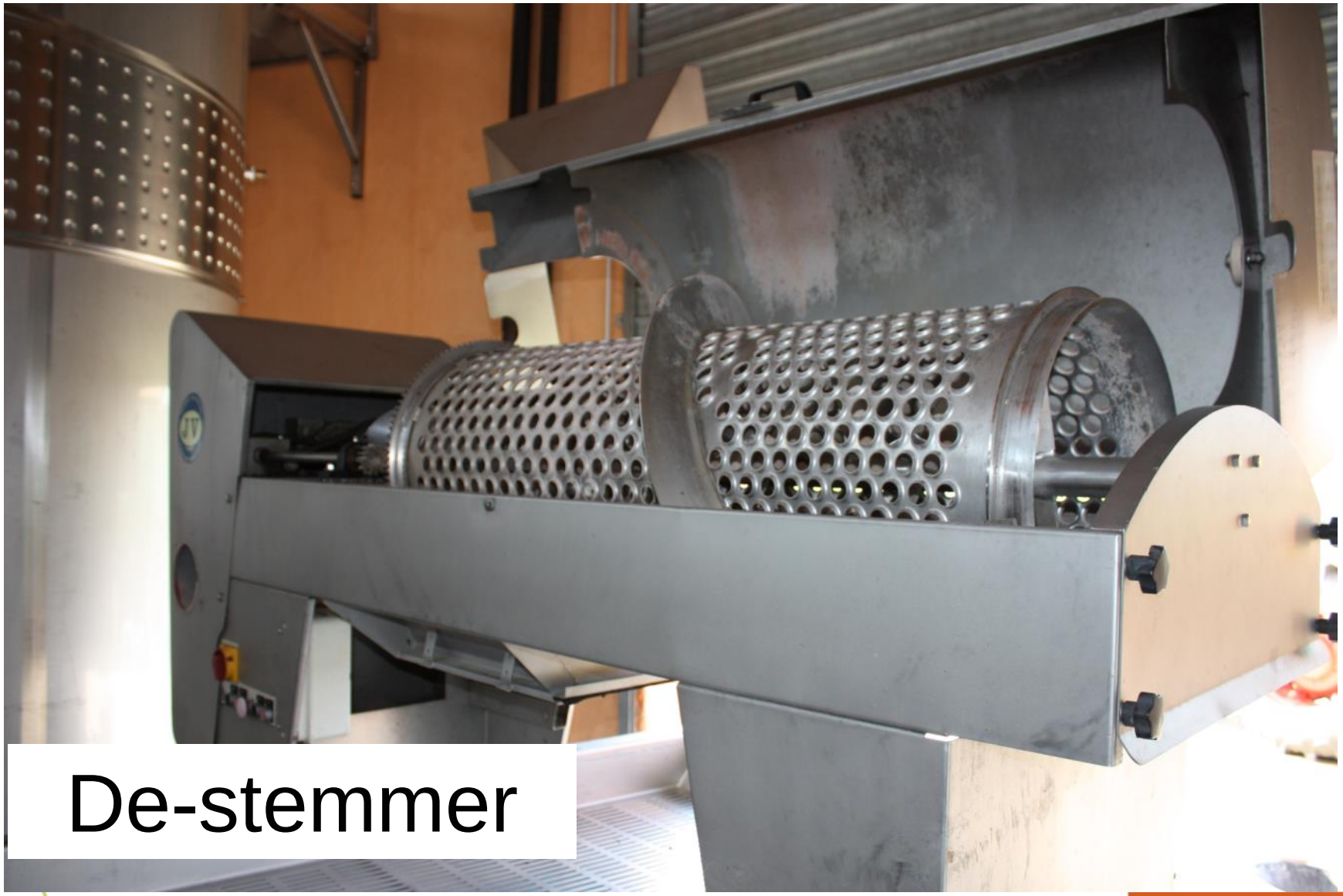
Oregon Wine Research Institute

Fruit processing

At the crush pad

- Weighing
- Sorting
- De-stemming
- Crushing
- Additions

Oregon State UNIVERSITY



De-stemmer

Red vs. white winemaking

Red grapes transferred to tank and fermented with skins and seeds

White grapes pressed to extract juice – juice only fermented

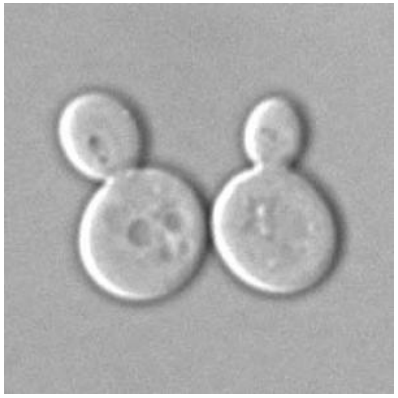
Rose/blush wines

Red grapes pressed after period of skin contact – small amount of color extraction

Can also be produced by blending red and white wine

Winemaking – fermentation 101

+



=

Sugar

Acids

Flavors

Phenolics

LOTS OF STUFF HAPPENS

Ethanol

CO_2

Acids

Phenolics

Flavors and Aromas

Oregon Wine Research Institute

It's a jungle in there

- Raw material for winemaking not pasteurized
  - Contrast to beer or cheese production
  - Luckily grape juice/wine is such a harsh environment that only select microbes can survive and grow
    - No pathogens!!

Basket press

Oregon Wine Research Institute

n State
NIVERSITY

Membrane/Bag press

Oregon Wine Research Institute

Winemaking

Grapes

↓

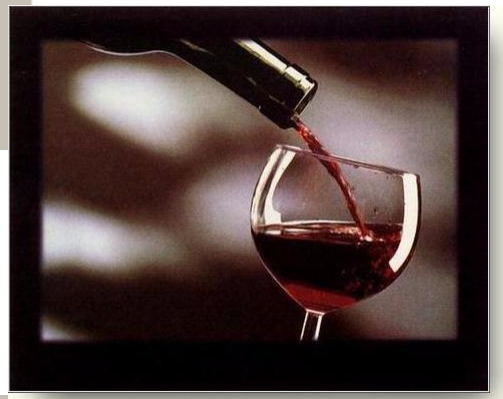
Crushed/Destemmed

↓

Must/Juice

↓

Alcoholic fermentation



White wine fermentation

After pressing juice often cold settled

Sugar and acid adjustments

- Fermentation in closed tanks typically at cooler temperatures – 55 to 60 °F

  Retention of desirable aromas

Barrel fermented Chardonnay an exception

Oregon State
UNIVERSITY

Red wine fermentation

Color (anthocyanins) and mouthfeel (tannins) compounds present in skins and seeds

Higher temperature and ethanol increases extraction

- Fermentation temps. 80-90°F

Requires mixing of “cap” to promote extraction and prevent high temp or spoilage

Winemaking

Grapes

↓

Crushed/Destemmed

↓

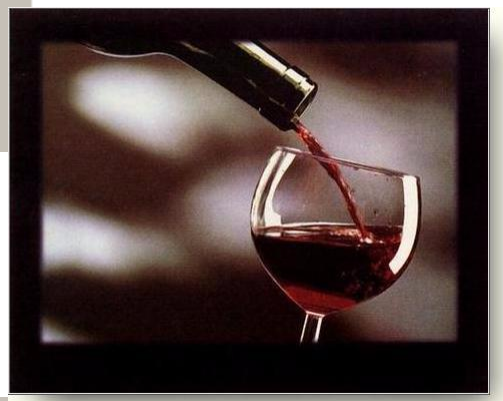
Must/Juice

↓

Alcoholic fermentation

↓

Malolactic fermentation



Winemaking

Grapes

↓

Crushed/Destemmed

↓

Must/Juice

↓

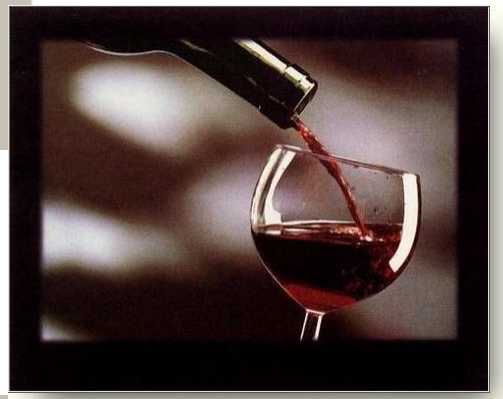
Alcoholic fermentation

↓

Malolactic fermentation

↓

Ageing, Stabilization



Post-fermentation processing - Reds

Barrel aging

Oak barrels ideal storage vessels

Oak aroma/flavor

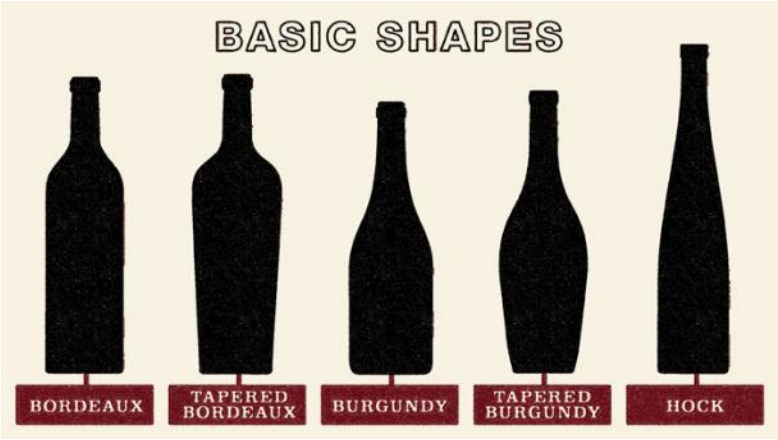
Improves mouthfeel – softens

Flavor development

Barrels

Barrel staves are shaped and formed inside hoops and toasted with flame – various toast levels

Bottles and closures



Bottle shapes and colors

Bag-in-box

Cork – cork taint issues

Synthetic cork – lower quality, sealing issues

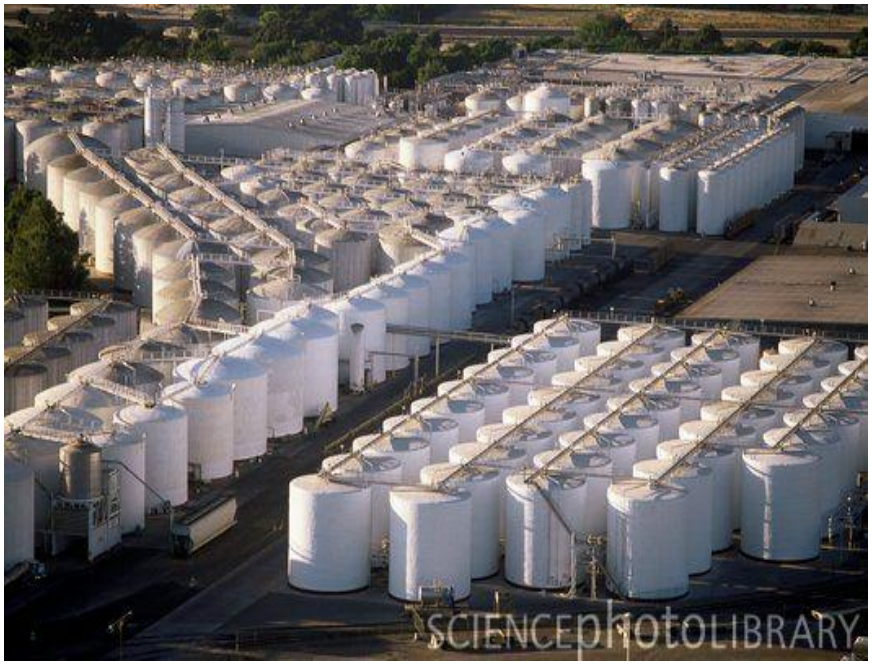
Screw-cap – public perception

Oregon Wine Industry

Oregon wine industry

- Oregon 3rd most wineries, 4th in production
- BUT……. CA accounts for 90% + of US wine production
- 600+ wineries – average 5000 cases (3 million total)
  - Gallo 70 million cases
  - 3600 wineries in CA
  - 240 million cases CA
- New Zealand – 28 million cases
- Australia – 136 million cases

Winery or Refinery??



Oregon Wine Research Institute

Oregon State University

How does the Oregon wine industry survive?

- **Cannot compete on volume**
  - Climate does not allow full ripening of large crop
- Oregon industry based on smaller, family owned producers
  - ➢Focus on premium quality & premium price
  - ➢Avg. price grapes per tonne = $2300 vs $713 for CA
  - ➢Approx 60% Pinot noir
  - ➢60% of grapes grown in Willamette Valley – growing acreage in Sth Oregon and Columbia Gorge

Role of Research in Oregon Wine Industry

- OSU has long history of conducting industry directed and funded research projects
- Oregon Wine Research Institute made up of scientists from Oregon State University and USDA-ARS
  - Soil science, plant pathology, plant genomics and metabolomics, plant physiology, entomology, microbiology, analytical chemistry, sensory
- Collaboration with colleagues at a number of US and International Universities and Research Institutes

Role of Research in Oregon Wine Industry

- Oregon wine can only compete in a the ultra competitive wine market environment because of premium quality products
- What is unique about Oregon wines?
- How can this be harnessed?
- Research strives to better understand quality factors and provide vineyard managers and winemakers with the tools they need

Oregon Wine Research Institute

Oregon State UNIVERSITY