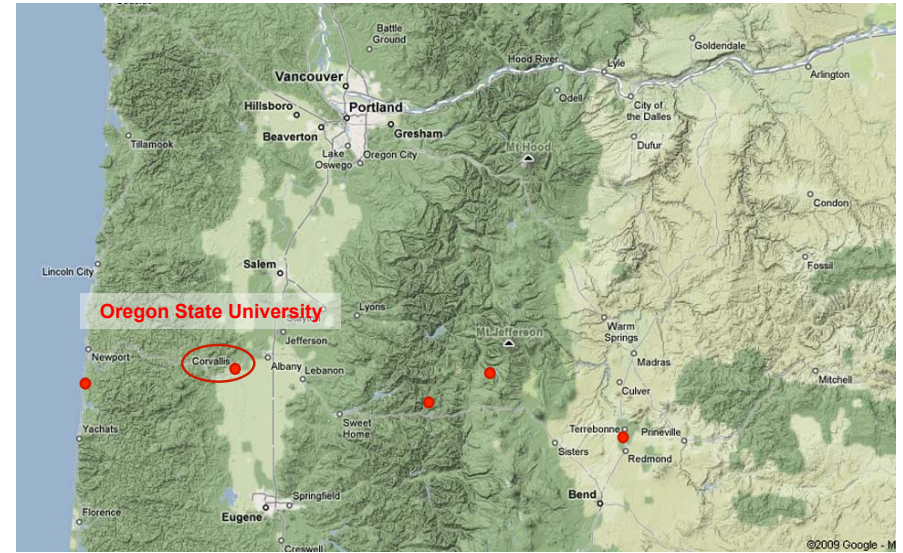


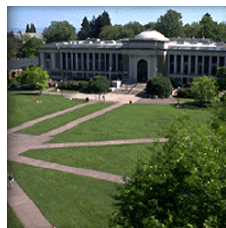
Fermentation Science at Oregon State University

Thomas H. Shellhammer
Professor of Food Science
Nor'Wester Professor of Fermentation Science



Oregon State University

- Formerly Oregon Agricultural College
- 27,000 students
- Forestry, Oceanography, Agriculture Engineering, Linus Pauling Institute



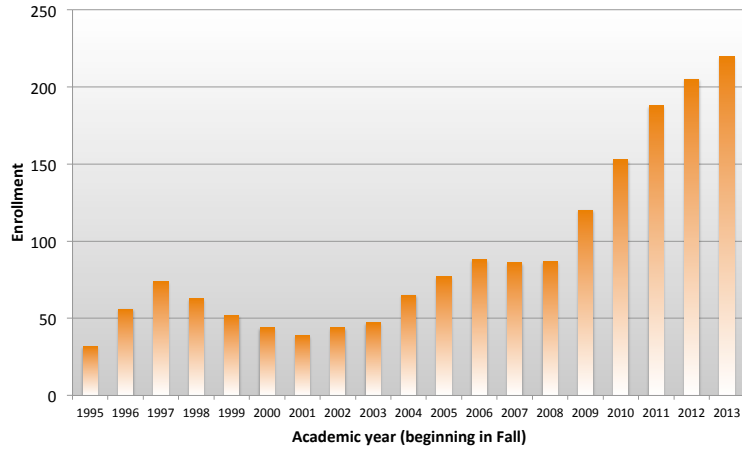
OSU Food Science Undergraduate Degree Program

B.S. Degree in Food Science and Technology

- Food Science 26%
- **Fermentation Science 62%**
- Enology & Viticulture 12%



Undergraduate enrollment



Tapping talent: Oregon bubbles to the top of the craft beer industry

With one of the nation's only teaching breweries and an endowed chair in fermentation science, OSU offers students the opportunity to develop new brews while they learn the subtle chemistry of taste and the innovations of business. Jobs on tap.

Agriculture is where food begins.
Learn more at agsci.oregonstate.edu/foodies

**Changing the future.
Right here. Right now.**

Training students to be brewers



Photo's courtesy of Lynn Ketchum

Training students to be brewers



Photo's courtesy of Lynn Ketchum

OSU Pilot Brewery 2 BBL brewhouse, 6 CCV



Photo's courtesy of Steve Werblow

OSU Pilot Brewery Packaging Single head filler + tunnel pasteurizer



Photo's courtesy of Chris Mueller



OSU Minimalter



Photo's courtesy of Lynn Ketchum



Employers of OSU Ferm. Sci. Grads

Anheuser-Busch	Gallo Winery
MillerCoors	(Sonoma Valley, CA)
Boston Beer Company	St. Michele Winery
BridgePort Brewing	Hogue Cellars
Boulevard Brewing	King Estate Winery
Deschutes Brewery	
Full Sail Brewing	Corsair Distillery
McMenamins'	Rogue Spirits
Stone Brewing	
Widmer Brothers Brewing	Tillamook County Creamery
	Rogue Creamery

Fermentation Science at OSU

- **Brewing** – Tom Shellhammer
- **Barley breeding & malting** – Pat Hayes
- **Hops breeding** – Shaun Townsend & John Henning
- **Hops pathology** – Dave Gent
- **Hops & health** – Fred Stevens
- **Wine** – James Osborne, Elizabeth Tomasino
- **Viticulture** – Patti Skinkis, Laurent Deluc, Walt Mahaffe
- **Specialty cheeses** – Lisbeth Goddik
- **Cereals chemistry & bread** – Andrew Ross

Return of the OSU Cheese



Savor Education

Beaver Classic™ is an Oregon State University original .

An artisan cheese made in the tradition of alpine cheeses from Europe while reflecting the characteristic of the Willamette Valley, Beaver Classic has a subtle, nutty taste with creamy, buttery and caramelized flavors.



Student made — start to finish

Oregon State students work at every stage of production for Beaver Classic. Students care for the university's dairy herd. In the creamery, students take milk through the separation of curds and whey, then age the cheese for six months in a painstaking affinage process that gives Beaver Classic its unique flavor and texture.



- Marc Bates: 29 years of experience with production of Cougar Gold at WSU

Fermentation Science at OSU

New Positions

- Distillation professor
- Brewing microbiologist professor
- Instructor/Advisor – Fermentation Science



Beer Analytics

May 1, June 16 – 20

Beer Proficiency

July 15 – 18

Craft Brewery Startup

April, May, September

Cidery Startup

April, May 12 – 16

pace.oregonstate.edu/beer



Beer Analytics

Online + Hands-on learning in the lab and pilot brewery



Beer Analytics

Engage with industry experts – Fred Strachan, Sierra Nevada



Beer Analytics

Learn about hops and OSU's hop breeding facilities



Beer Analytics

Learn about barley/malt and OSU's barley breeding facilities



Beer Analytics

May 1, June 16 – 20

Beer Proficiency

July 15 – 18

Craft Brewery Startup

April, May, September

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April, May 12 – 16

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Close connection to the brewing industry



- MBAA District NW meetings – 200-300 attendees
- 1st International Brewing Symposium, 2007
Hop Flavor and Aroma in Beer
- Hop Research Council



OSU Pilot Brewery – Beer Development



Hops
humulus lupulus



OSU has a long connection to hops

- 1932
 - Oregon largest hop producing region in the world with 34,594 acres (14,000 ha)
 - Downy Mildew discovered in Oregon hop yards
 - U.S. Department of Agriculture establishes hop breeding program
- 1979
 - Hop Research Council created
- 1996
 - Fermentation Science track created within Dept of Food Science



Hop breeding at OSU



Hop breeding at OSU

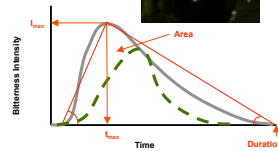


Public hop varieties released by USDA/OSU

Bianca	Newport
Cascade	Nugget
Columbia	Santiam
Comet	Sterling
Crystal	Sunbeam
Horizon	Teamaker
Liberty	Ultra
Mt. Rainier	Willamette
Mt. Hood	

Shellhammer Lab Hops research, recent activity

- Isomerization kinetics
- Bitterness research
 - Native and reduced iso-alpha acids
 - Hop-derived polyphenols
 - Impact, time-intensity, quality
- Foam studies
 - Reduced iso's
- Flavor stability
 - Hop-derived polyphenols
 - Hop acids



Sensory testing Consumer as well as trained panel



Widmer Brewing Company

- Preference Mapping of Widmer Products: Identification of Product Attributes, Consumer Preferences and Psychographics
McDaniels, Orth, Shellhammer – 2002
- Trained panel (12)
+ Consumers (~300)
- Part of development efforts leading to Drop Top Amber Ale



Shellhammer Lab Hops research, current projects

- Investigating the sources of citrus aroma/flavor from hops
- Hop harvest maturity influences on oil quality
- Basic studies on dry hopping
- How hops affect beer flavor stability
- New methods for assessing beer bitterness

