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PRIMARY COLORS

BY THERESA NOVAK

The same stuff that makes raspberries rosy and blueberries blue could put a healthy bloom in your cheek while also fighting cancer, heart disease and even the aging process.

The source of the various colors of berries, apples and cherries are called fruit pigments, and researchers at Oregon State University believe their beauty is more than peel deep. Fruit pigments are suspected of being the mother lode in a gold mine of dietary antioxidants.

To find out which fruit pigments pack the most vitamin value, researchers from OSU's Food Science and Technology Department, under the leadership of internationally recognized food scientist Ron Wrolstad, are isolating and concentrating the anthocyanin pigments and polyphenolic compounds found in pigments.

Balz Frei, a biochemist and director of OSU's Linus Pauling Institute, heads a second research group that will measure the antioxidant levels of these various anthocyanin pigments and polyphenols.

For example, they will find out whether grandmother was right in saying that the "meal is in the peel" when it comes to eating apples.

The two-pronged approach could yield a multitude of benefits for both fruit consumers and Oregon fruit producers. It would be a crucial first step toward identifying and extracting the active health components of blueberries, cherries, strawberries and other fruits and vegetables.

"In addition to vitamin C and other known micronutrients, once identified, these antioxidant components could also be extracted and concentrated," Frei said.

Not only would this provide the public with a convenient source of natural antioxidants, it would provide Oregon growers with a portal into the growing "nutraceuticals" market that already includes garlic, green tea and grape seed extracts.

Such extracts contain the anthocyanin pigments and polyphenolic compounds that also will be the focus of Wrolstad's research.

"This class of compounds is highly correlated with antioxidant activity," Wrolstad said. "It may be one reason why we like colored foods: We may instinctively know they are good for us."

Antioxidants are prized nutritional compounds because they counteract cell-damaging "free radicals" that weaken cells and are suspected of contributing to cancer, heart disease and aging (see sidebar).

The research will provide an analysis of the varying levels of antioxidant activity that may be derived from the pigments of many types of fruits including berries, apples and cherries.

For example, strawberries are right up there with elderberries, blueberries and chokeberries in the ranks of fruits with high antioxidant activity, but it's generally believed that the public eats larger portions of apples. Does that mean people overall are receiving more antioxidant vitamins from apples than from strawberries?

"We need to answer questions about per capita apple consumption, too," said Frei, who is a biochemist as well as director of the Linus Pauling Institute.

Another important question is how various fruit antioxidants are absorbed by the body.

Frei's portion of the project will focus on measuring the varying antioxidant levels in Granny Smith, Fuji and Red Delicious apple varieties.

It is a logical research project for the Linus Pauling Institute, which is named for the two-time Nobel prize-winning OSU alumnus who researched the health benefits and antioxidant properties of vitamin C. This latest project continues Pauling's work to link vitamin and antioxidant consumption to specific health benefits.

The research has potential economic health benefits as well.

"Everyone knows that an apple a day is good for you, but Wrolstad's work will find out why and how that is so," said Jim McFerson, administrator of the Northwest Tree Fruit Growers Association, one of the sponsors of the research.

The Washington Apple Commission, the Northwest Center for Small Fruit Research, the Oregon Cherry Commission and the Fruit Juice Quality Advisory Committee are on a

growing list of research sponsors looking for hard data on the potential of fruit pigments as antioxidants and nature-based medicines also known as "nutraceuticals."

Oregon's cherry growers and its raspberry, blackberry and strawberry commissions also are eager for the results of a Wrolstad's research as a much-needed means to expand fruit markets, said Jan Marie Schroeder, the administrator of the state commissions that represent Oregon's strawberry, raspberry and blackberry growers.

"I think people are so sick of being told what not to eat, but nobody tells them about stuff that is delicious and that they can eat all they want," Schroeder said. "It's good to be able to tell the kids 'Just spread that blackberry jam all over your toast, honey.'"

Schroeder recently returned from a trip to New York where she met with a number of magazine editorial boards in hopes of convincing them to tell the untold story about the vitamin and antioxidant bonanza in berries.

The research from OSU would go a long way in spreading the word about the myriad benefits-as well as pleasures-of eating fruit, she said.

Although in its early stages, the project is generating excitement because of Wrolstad's track record of finding new uses and properties in fruit pigments.

Wrolstad began his career by finding ways to keep strawberry jam from darkening in the jar after processing. More recently, his research team also successfully used natural red dyes extracted from radishes to dye maraschino cherries their characteristic neon-red color. (See "Rooting for Red," *Oregon's Agricultural Progress,* Fall 1995.)

Because Wrolstad now is recognized as an international authority in the composition of fruit juice and other fruit products, OSU recently bestowed on him the title of "Distinguished Professor of Food Science and Technology."

Wrolstad said the title is an honor and hopes that it will help him spread the word about the potential benefits of fruit pigments.

The public already is clamoring for more information on the "fountain-of-youth" health benefits found in fruits and vegetables that are high in antioxidant vitamins.

In the past two decades, antioxidants found in fruits have been linked to everything from slowing the aging process to counteracting the effects of pollution, X-rays and fatty foods.

In 1991, for example, the weekly news magazine "60 Minutes" aired a broadcast called "The French Paradox." The paradox is this: Although the French, on average, consume fattier foods, they have a much lower per capita rate of heart disease than their American counterparts.

A likely cause of this phenomenon is the high consumption in France of red wine with lunch and dinner. Red wine grapes contain the same sort of fruit pigments that are now the focus of Wrolstad's research.

Although red wine still is unproven as a counterbalance to a fatty diet, consumers who saw the broadcast sent consumption of red wine soaring in the United States, replacing a decades-long trend of white wine as this nation's favorite. Health food stores now sell grape seed extract as a nutraceutical health supplement.

More recently, cherries were identified as another potential antioxidant bonanza.

A study from Michigan State University indicated that when tart cherries were combined with ground beef, their anti-oxidant properties neutralized some of the cancer-causing ingredients in the meat.

The study was published in the March 15, 1999 edition of the *Journal of Agricultural and Food Chemistry* (http://pubs.acs.org/journals/jafcau/), which has turned out to be good news for Michigan cherry growers and others such as Ray Plevas of Cedar, Mich.

Plevas is the owner and founder of Ray Plevas Products Inc., which combines ground tart cherries with ground beef and other meats.

Plevas said that there is no overt cherry taste in his burgers, just a juicier burger. They have been so well received that they are now on the school lunch menu in 16 states, and Plevas recently announced expansion of his product line into cherry sausage as well.

Wrolstad said he'd like to bring success stories like those home to Oregon.

"We want to know whether sweet cherries have the same (anti-carcinogen) properties as tart cherries," he said.

That's the kind of news that cherry farmer Tom Bailey of The Dalles also would love to hear. "Right now, our markets are stagnant," Bailey said.

Bailey, who with his family oversees thousands of acres of

cherry orchards in Oregon, said Oregon cherry growers primarily produce sweet cherries, the dark ruby variety that is sold to grocery stores fresh. To effectively compete with neighboring cherry powerhouse Washington state, these cherries must be as close to cosmetically perfect as possible.

Less-than-perfect cherries may have as much flavor and nutritional punch, but they have less "eye" appeal for the crucial moment in the produce section when shoppers select fresh cherries, Bailey said.

"We do sell some cherries used to make concentrated cherry juice, but that's about it," he said. This concentrate is sold in industrial-sized containers to food processors who want to add natural cherry flavor to other products, such as juices and candies.

Bailey would like to see cherry burgers on Oregon menus, and maybe cherry extract antioxidant and vitamin pills on store shelves.

With definitive information from Wrolstad's research about the health benefits of sweet cherries, processors would have the fundamental information they need to make such scenarios come true.

The research could present another boon as well.

For example, the crushed pulp from making apple and cherry juice could end up on a health food shelf instead of as animal feed or compost material.

But is it realistic to assume that medicine could be based on fruit?

The idea dates back at least to World War II, Wrolstad said, when British Royal Air Force pilots were given bilberries-a Northern European blueberry-in hopes of improving their night-flying vision.

"Today, the North American Blueberry Association has been quite successful in marketing a variety of blueberry products in Japan," Wrolstad said. Blueberry products are marketed in Japan for sharper vision and eye strain relief.

The lycopene in tomatoes is a new substance that holds promise for improving the health of prostate cancer sufferers.

Have we come full circle in thinking of food as medicine again? If so, then Wrolstad sees many advantages.

"For one thing, the dosage would be self-limiting," he said. "You couldn't really overdose on fruit extracts."

The research might challenge grandma's conventional wisdom as well.

"What if the nutrients in apples aren't just in the peel or the flesh?" Balz Frei said. "What if the best part of the apple is in the core?

Theresa Novak is a science writer in OSU's Department of Extension and Experiment Station Communications.

Free radicals vs. antioxidants

Free radicals in the body act like biochemical terrorists. With every second that we live, every breath we take and everything we eat, we fuel a certain release of these highly reactive compounds.

When released, free radicals bond with the protective coating around healthy cells to break it down. This process is speeded up by air pollution, electromagnetic radiation, smoking, and even the ultraviolet rays found in sunshine.

Free radicals link up with the fats that form cell membranes and actually "spoil" them in much the same way that rust spoils iron, using the same catalyst-oxygen.

Fortunately, three primary antioxidant enzymes in the body link up with free radicals to neutralize their destructive powers. We can boost this natural antioxidant action by consuming foods rich in antioxidants. Chief among them:

* Minerals, such as zinc and selenium, found in broccoli, leeks, garlic and other vegetables.

* Vitamins, notably E, A and C, which are found in both supplements and in foods such as wheat germ, apricots and citrus fruits.

* Phytochemicals such as carotenoids in carrots and lycopene in tomatoes.

The results of Ronald Wrolstad's research project at Oregon State University's Food Science and Technology Department aims to shed a new understanding of which specific antioxidant activities are associated with which fruits and vegetables.

The result could lead to antioxidant forces being enlisted in the public's nutritional arsenal.

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