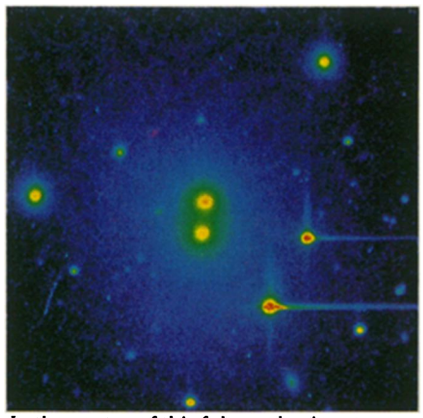
Two Centers Yoked Together in One Galaxy

In the centers of galaxies, extremely energetic physical processes seem to take place. Many astrophysicists believe galactic centers to be the homes of giant black holes or other kinds of high-powered exotica. In consequence of these energetic goings-on, many galactic centers emit jets of energetic matter. One center and two jets per galaxy seem to be the norm. However, scientists have now determined that there is at least one double-yolked galaxy. It has two centers, four jets and lots of unanswered questions.

According to one of its discoverers, Frazer Owen of the National Radio Astronomy Observatory's (NRAO) station in Socorro, N.M., this object, catalogued as 3C75, is the first of its kind available for study. He and his colleagues observed 3C75 with NRAO's Very Large Array of radiotelescopes, near Socorro, and the 36-inch optical telescope of Kitt Peak (Ariz.) National Observatory.

Each of 3C75's centers emits a pair of jets, and unlike most such galactic jets, which tend to be straight, these jets bend and twist. In response to a question of whether 3C75 could be an example of colliding galaxies, Owen replied that in such a case the two centers would coalesce. Here it seems, however, that they are orbiting each other at a separation of about 20,000 light-years. But if the centers are orbiting each other, then the orientations of the jets become hard to explain. Two jets, one from each center, are twisted around each other. The other two are separate but both bend in the same direction. "We don't understand the whole thing," says Owen. The



Owen/White, NRAO

In the center of this false-color image are the two nuclei of 3C75 surrounded by diffuse blue representing the light of 3C75's stars. Other galaxies and foreground stars of our own galaxy also appear.

whole structure is about a million light-years across and lies in the center of the rich cluster of galaxies known as Abell 400, about 300 million light-years from us.

X-ray observations indicate that such clusters have clouds of gas pervading the space between their galaxies. In the case of 3C75 this intergalactic gas may be giving some energy to the jets. In the ordinary case, astrophysicists expect that the material in such jets comes out of the galactic center at speeds near that of light and gradually slows down as it encounters the intergalactic gas. Such a simple theory will not explain the length and appearance of 3C75's jets.These have to be gaining some energy from the intergalactic gas.

This can happen, Owen says, if the intergalactic gas is turbulent. (X-ray observations do not tell how or if the gas is moving.) Then there is a mechanism by which the material in the jets can pick up energy from the surrounding gas and so delay slowing down, provided that the jet material does exit from the centers at speeds near that of light. But whoever theorizes this way must explain why the intergalactic gas is turbulent. A possible explanation is that this cluster has not had enough time since its formation to settle down dynamically.

Owen cites two possible theoretical explanations of why two of the jets twist around each other. One is that dynamically, if they are spewed in the same direction, they would tend to wrap around each other. The second is that an electric current may form in them and cause them to wrap around each other.

"We need more examples of this kind of thing to see how wiggly structures form in clusters," Owen says. This one appeared in a continuing survey of a large number of such clusters. Of the hundreds that the observers have so far examined, 3C75 happens to be the very nearest.

Codiscoverers with Owen are Jean A. Eilek of New Mexico Institute of Mining and Technology in Socorro, Chris O'Dea of NRAO Socorro, Makoto Inoue of Nobeyama Radio Observatory in Japan and Richard White of Computer Sciences Corp. in El Segundo, Calif. They presented their findings at last week's meeting in Tucson, Ariz., of the American Astronomical Society. —*D.E. Thomsen*

A simple sweet from an Aztec herb

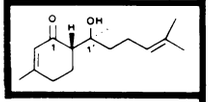
In the 1570s, Spanish physician Francisco Hernández described a remarkably sweet plant known to the Aztecs as *Tzonpelic xihuitl* or "sweet herb." This reference, accompanied by an accurate description and illustration of the plant, now has led pharmacologists to a previously unrecognized, intensely sweet chemical that they expect to be useful in their modern mission — creating new substances that satisfy the sweet tooth without causing tooth decay.

A. Douglas Kinghorn, graduate student Cesar M. Compadre and collaborators at the University of Illinois Medical Center in Chicago isolated the newly identified sweet compound from leaves and flowers of plants, now called *Lippia dulcis* Trev., collected in central Mexico. The researchers determined the chemical structure of the pure, colorless oil, which they have named hernandulcin after the 16th century physician. By subtly modifying the structure, they identified two chemical groups that are essential for the sweet taste — the carbon-oxygen (carbonyl) group at carbon 1 and the hydrogen-oxygen (hydroxyl) group on carbon 1′.

"This is a very simple structure," Kinghorn says. "It should be useful in studies on the relationship between chemical structure and sweetness, and in the rational design of sweeteners."

The purified compound will not go directly into the sugar bowl, however. Although a panel of 17 trained volunteers found hernandulcin to be more than a thousand times sweeter than sucrose, it has some taste drawbacks. It was considered to be "somewhat less pleasant than sucrose and to exhibit perceptible off- and after-tastes as well as some bitterness," the scientists report in the Jan. 25 SCIENCE.

"Natural History of New Spain," Circa 1570



But hernandulcin continues to show promise in its health effects. It did not cause bacterial mutations in the standard test for indications of cancer-causing potential, and, even at a high dose, it did not harm mice. Further tests have indicated that the chemical should not cause dental cavities, Kinghorn says.

The scientists plan to modify hernandulcin in the hope of making it more palatable. They have filed a patent application on the sweetener and are currently negotiating with a food company. —*J.A. Miller*