UNIVERSITY OF NORTH CAROLINA
SEA GRANT COLLEGE
NEWSLETTER

JANUARY, 1977

1235 Burlington Laboratories
NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Looking at seafood from the inside out

Microbiologists see things a little differently from most people. Where most folks look at fish or beef and think of dinner, microbiologists at North Carolina State University (NCSU) see potential problems.

"Anytime you start with raw foods, you're starting with a loaded situation microbiologically," explains NCSU food scientist Marvin Speck, the man who brought the world sweet acidophilus milk.

Speck and fellow scientists Bibek Ray and Cameron Hackney have been working with UNC Sea Grant to discover the microorganisms lurking in seafood and to find ways to keep the harmful ones out of the food we eat.

"In the seafood industry relatively little emphasis has been placed on this part of the industry, as compared to red meats and poultry. So really, we're starting at a very primitive stage as far as what is known," Speck says.

In addition, the North Carolina seafood business is relatively basic and very scattered. More than 100 handlers and processors operate in North Carolina and many are small family businesses.

"The more people you have handling food, the more people need education," Speck continues. "Combine that with a very sensitive food, like seafood, which is rapidly spoiled and you get a potentially explosive situation."

Recent explosive news about such things as mercury and kepone in fish has pointed out the need to know what other contaminants besides microbes are in seafoods. So NCSU food scientist George Giddings is looking at how processing affects both the heavy metal contaminants and nutrients in seafoods.

Speck, Ray, Giddings and Hackney don't confine their efforts to the laboratory. They are also very aware of the world outside the test tubes. The researchers continuously analyze samples from pro-

(See "Getting the news," p. 4)

Scallop processing

Stalking the wild vibrio
A quest for longer shelflife and better products

Headache, diarrhea, abdominal pain? All-around symptoms of Montezuma's revenge?

If the feelings begin after a hefty seafood dinner, *Vibrio parahaemolyticus* may be to blame.

Vibrio parahaemolyticus is a small, curved bacteria which lives in most coastal waters. It's carried by fish and causes gastroenteritis when consumed in sufficient quantities. Vibrio is also the pathogen most often found in North Carolina's seafood, according to NCSU food scientists Marvin Speck and Bibek Ray.

"We've taken seafood from the coastal area and from local markets here and we've done more than 400 samples looking for indicators such as coliforms and plate counts and done some work looking for injured coliform. We've looked for pathogens such as salmonella, shigella, anaerobic toxogenics and vibrio," Speck says. "And what we've found in most cases is *Vibrio parahaemolyticus* is the main contaminating pathogen.

"Which is to be expected since it is a marine organism," he adds.

A new problem

Scientists on the east coast were surprised, however, when they discovered vibrio—which has plagued Japan for years—was a problem here.

"For some reason we thought the whole problem was a Japanese problem because they ate so much raw fish," Speck says. "Then in 1971 we had our first outbreak of food poisoning traced to vibrio in Maryland. From then on, after the methodology was developed, vibrio was detected about everywhere you looked for it in coastal waters. Now we think we have as much a problem as the Japanese."

The NCSU tests have shown vibrio in about 85 percent of the clams, 80 percent of the shrimp, 75 percent of the oysters, 30 to 40 percent of the sea scallops and varying amounts in finfish.

The amounts of vibrio were not always enough to cause trouble. But vibrio multiplies rapidly, and any mishandling of the seafood could raise the vibrio count to unhealthy numbers.

Fortunately, vibrio is very sensitive to cold and won't appear in water colder than 55 to 60 degrees Farenheit. So it's not surprising that it stops appearing in North Carolina seafood samples after about November and isn't seen again until about March.

Hard to detect

Unfortunately, according to Speck, vibrio often isn't seen anytime of the year using the conventional testing methods now used by the state and other regulatory agencies.

"We've found that the customary indicator, (fecal) coliform, cannot be depended on to find *Vibrio parahaemolyticus*," Speck said. "We think it's because this is a marine organism that it bears no relationship to the indicator organisms. So we will have to look for this organism (vibrio) by itself."

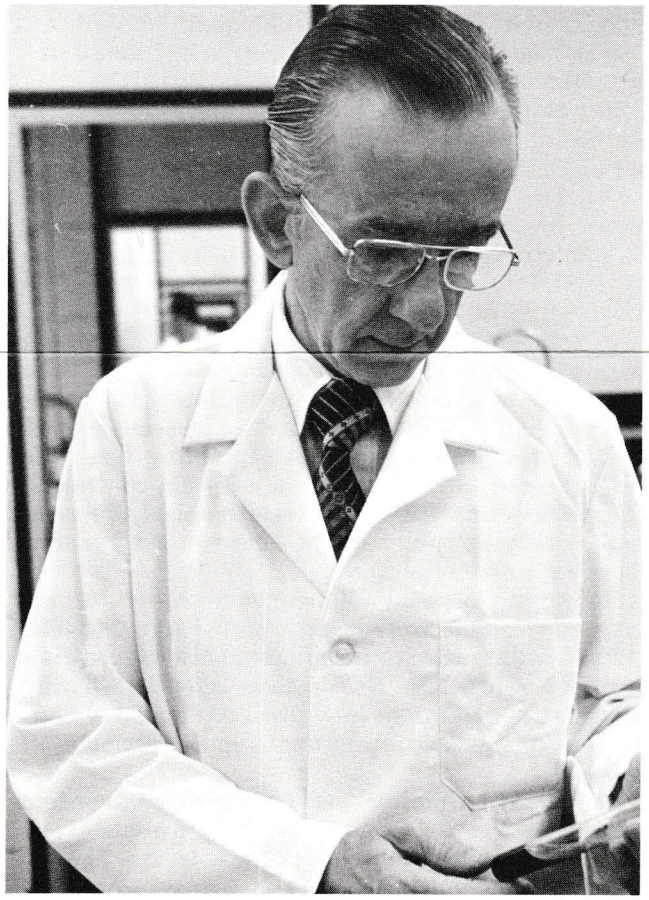
The most promising way to find vibrio—Speck and Ray have been developing the method with Sea Grant funds for the past two years—is called the repair method. Vibrio is sensitive to cold and heat and becomes "injured" when it is refrigerated or heated to a certain degree. But the injured bacteria remain harmful and can repair themselves.

Another approach

Using the new method—which determines the number of injured and uninjured bacteria—Speck and Ray have gotten very different results from the tests now recommended by the Food and Drug Administration.

"Where under the FDA method we'll find no vibrio, using the repair method there will be 43 to 200," says Hackney. "Or with FDA we'll find 23-100 and the repair method will find a 1,100 count. There's really that much of a difference. We think we have a very good method."

Once their study is complete, researchers plan to recommend their method to the state.



Marvin Speck

Heavy metals: elements to watch

Pollution means problems for the seafood industry. Already almost a fifth of the state's shellfishing waters are closed due to pollution. And attention is turning to possible new pollutants—like heavy metals—which may cause trouble in the future.

North Carolina's waters are in no danger from metal pollution now, according to Ford A. Cross, of the National Marine Fisheries Service (NMFS) in Beaufort. But a combination of factors compels scientists to keep an eye on the elements.

First, heavy metals can be harmful to man and marine life. Second, it appears that estuaries concentrate metals. It also seems that the metals are more toxic to young forms of marine life, making the estuarine "nursery" particularly vulnerable to increased metal levels. Metals occur naturally in the estuaries and are added through pollution. With developers and power plant builders—a source of many metal contaminants—eyeing the estuarine shores, many suspect pollution will increase.

Complicated

Heavy metals are also incredibly complex. Some lose their toxicity as the water gets dirtier, some—like cadmium—gain toxicity as salinity increases. Arsenic is less dangerous when it's "methylated" but mercury is more harmful in the methyl form. And copper, while as necessary to shellfish as iron is to man, can be lethal to larval forms.

To complicate things even more, different species of fish react differently to metals. Menhaden, for example, can tolerate much more copper than spot can.

And there are disagreements among scientists about whether heavy metals are even a pollutant.

"While we don't have a problem now, it's possible if precautions aren't taken and we don't stay on top of things, we could get into a mess," comments Bruce Fowler of the National Institute of Environmental Health Sciences.

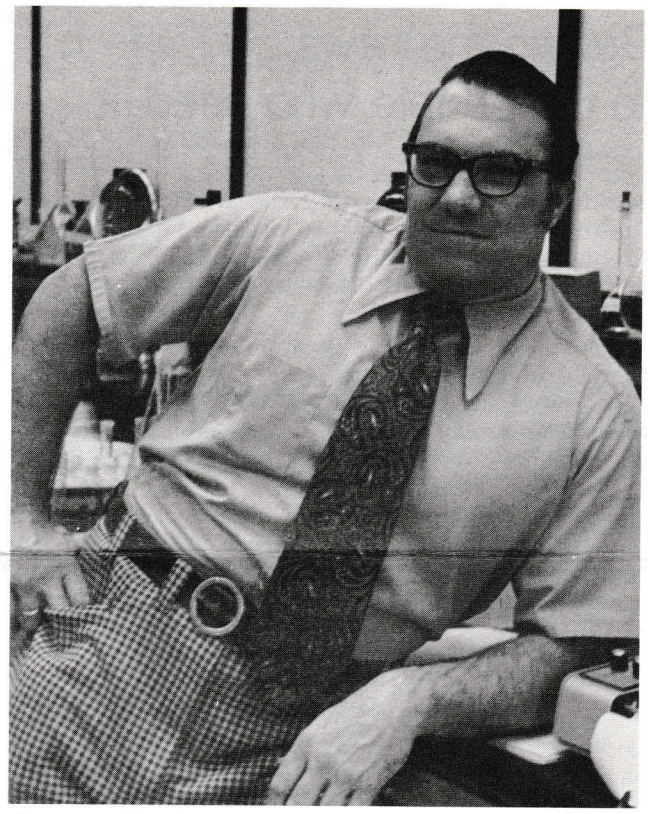
Under Study

Cross and the NMFS are keeping track of how metals get into the estuaries and marine life and figuring out how the metals react and under what conditions they become toxic.

"Basically what we're trying to do is learn about metals so rational decisions can be made about them based on data," Cross says.

Over at NCSU, George Giddings is also staying on top of the heavy metals. Giddings, a seafood scientist with a bit of Boston in his speech, is using Sea Grant funds to find out how and why processing affects potentially harmful heavy metals and healthful trace elements in seafood.

Giddings is concentrating on shellfish since they get the most processing in North Carolina and are



George Giddings

an important part of the state's industry. Shellfish are also most prone to the effects of pollution since they are relatively stationary and live in the areas close to shore which are most easily affected by man.

Giddings has looked most closely at the calico scallop and found that, indeed, processing can affect the amount of metal in the food.

When the scallops Giddings studied entered a processing plant they contained essential trace elements manganese and zinc—which are important for human health. The scallops also contained cadmium—a heavy metal that can cause kidney damage in test animals and may be a carcinogen.

But when the scallops left the plant they were lower in both cadmium and the trace elements. Giddings traced the losses to the fluming method of transportation. And he says that with this information—and results from future tests—processors can change their methods to improve the nutritional value of their products and decrease the risk of heavy metal contamination.

The University of North Carolina Sea Grant College Newsletter is published monthly by the University of North Carolina Sea Grant College Program, 1235 Burlington Laboratories, Yarborough Drive, North Carolina State University, Raleigh, N.C. 27607. Vol. 4, No. 1, January, 1977. B. J. Copeland, director. Written and edited by Karen Jurgensen and Johanna Seltz. Second-class postage paid at Raleigh, N.C. 27611.

Getting the news to the people who need it

(Continued from page 1)

cessing plants at the coast. And anytime research findings point a way toward practical solutions to problems, they are quick to phone the Sea Grant advisory agents at the Seafood Lab in Morehead City.

From the Lab, the suggestions go straight to seafood handlers and processors, who are equally swift in putting the advice to work.

Sometimes the suggestions are as simple as advising people to clean their trash cans.

"In crab plants they have a process that virtually kills all the bacteria. No pathogens or indicators of pathogens are present," Hackney explains. "But after the crab has been handled by humans we're finding both pathogens and their indicators in the cooked, picked crab meat. We wanted to know how the crab was being recontaminated."

After considerable head-scratching, sample-taking and plant-viewing, Hackney thinks he may have the answer: the waste cans may be bringing in contamination after they are emptied.

"What's important is that we've established that the microorganisms aren't surviving in the cooked meat but are there afterwards," Speck says. "Now our job is to refine our focus so we can pinpoint the sources of contamination."

Another problem area which has been isolated by both Hackney and Giddings is the flume used to move scallops at some processing plants. Hackney has found that the final edible scallop muscle coming out of the flume, while still within legal limits, has a higher bacterial count than the whole scallop has before it is eviscerated or cleaned.

Why? One possible reason is that the flumes are dirty. Research will continue more easily on the causes, though, now that the site of contamination has been identified.

Research in the lab has also shown some unsuspected plusses in seafood processing. After visiting several oyster plants and taking samples, Hackney found that the new heat shock method of preparing oysters—soaking the whole oysters in hot water for seven minutes to make the shell partially open—not only makes shucking easier but also cuts down on bacterial contamination and increases shelflife.

"The method wasn't developed for microbiological reasons, but it still kills surface contamination," Hackney says. "Of course, we want to go back and make sure they're not creating other problems with this process, but so far comparing the two processes the newer method gets a much better product."

"This whole field is very new," Speck adds. "But we do have a competence that has developed some new information that can be applied really more rapidly than I had anticipated."

Wanchese harbor

There will be a seminar series at the North Carolina Marine Resources Center on Roanoke Island on the upcoming Wanchese Harbor development. Sessions are open to the public and begin at 8 p.m. For more information, contact Jim List at 919-473-3493.

Jan. 27—Wanchese Harbor, a history
Feb. 3—Seafood, a commercial market
Feb. 10—Estuarine ecology and the effects of Wanchese Harbor development
Feb. 17—What to do with the waste: the Wanchese solution
Feb. 24—Natural coastal processes and inlet stabilization
March 3—A harbor comes to town
March 10—Possible open panel discussion

University of North Carolina
Sea Grant College Program
1235 Burlington Laboratories
North Carolina State University
Raleigh, N.C. 27607

Second-class postage paid at Raleigh N.C. 27611