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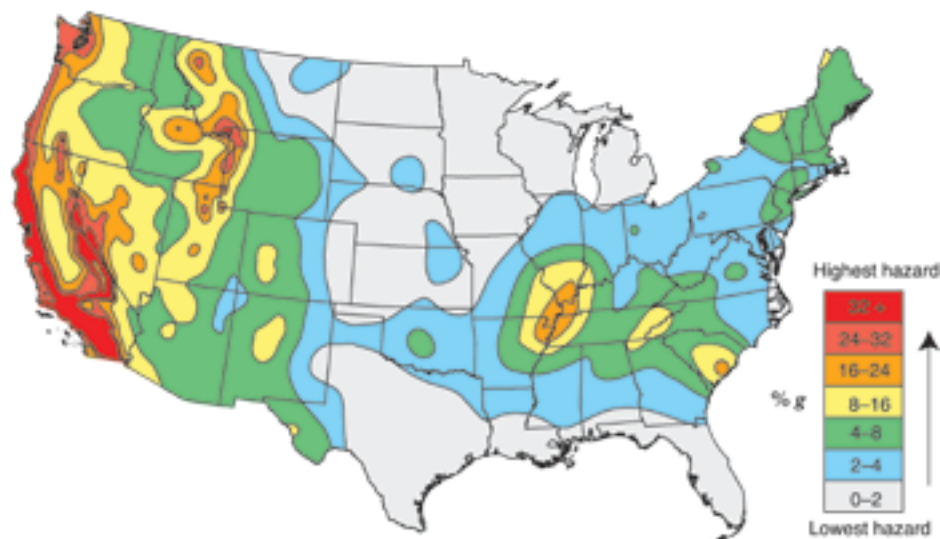
*Natural disasters can destroy cities and leave death in its path - Hurricane Katrina showed us that. So what about the so-called big earthquake predicted for the Mid-South, is it fact or fiction? Researchers at the U of M's Center for Earthquake Research and Information answer that question.*

## Getting CERious about quakes

by Eric Smith

Gary Patterson's phone won't stop ringing. In his office at the Center for Earthquake Research and Information (CERI), Patterson has been fielding calls from the *Chicago Tribune*, *USA Today*, the *St. Louis Post-Dispatch*, Lou Dobbs of CNN and perhaps every television station and print media outfit in the Mid-South.

After instructing one reporter to send him an e-mail, Patterson hangs up, smiles and steps outside his office. To talk in peace without the disruptions of modern



**The 1996 U.S. Geological Survey shaking-hazard maps for the United States are based on current information about the rate at which earthquakes occur in different areas and on how far strong shaking extends from quake sources. Colors on this particular map show the levels of horizontal shaking that have a 1-in-10 chance of being exceeded in a 50-year period. Shaking is expressed as a percentage of g (g is the acceleration of a falling object due to gravity).**

communications, he seeks the quiet of a small sitting area inside the rear building of CERI, a complex of four modest structures on the northeast corner of the University of Memphis campus.

"It has been busier here than it's ever been," Patterson says.

Patterson, the education and outreach director for CERI, understands the flurry of phone calls coming his way. In light of recent events, dealing with numerous media requests and answering myriad questions has become an everyday occurrence.

When Hurricane Katrina struck the Gulf Coast in August 2005 and sent



New Orleans into disarray and disrepair, and when a magnitude 7.6 earthquake struck Pakistan soon after, the residents of Memphis and Shelby County began wondering if their region could handle a natural disaster. With Memphis just 40 miles southeast of the New Madrid seismic zone (NMSZ), people also began wondering if their region was due for a major earthquake and how they could prepare for it.

So Patterson handles inquiries from journalists and concerned citizens in stride.

Because there's no better place to turn than the U of M's own CERI, which has spent the past three decades developing into a world-renowned earthquake research center.

### **CERI's roots**

In the late 1970s, when Dr. Arch Johnston was finishing his PhD studies at the University of Colorado at Boulder, he figured he'd have to get a job somewhere. Then he saw an ad posted on a department bulletin board for the director of a nascent earthquake center at then-Memphis State University. Johnston had graduated from Southwestern at Memphis (now Rhodes College ) in 1967, so he knew about the University. But the idea of an earthquake center at the U of M seemed farcical.

"I was sure my fellow graduate students were just playing a big joke on me," Johnston says.

The job posting and the Center were for real, and in October 1978 Johnston became a founding director of the Tennessee Earthquake Information Center (TEIC), which was renamed CERI in 1984. According to the organization's Web site, TEIC was "chartered in 1977 by the Tennessee Legislature to conduct research on the causes and consequences of earthquakes and provide seismic safety and mitigation information, provide reports, background information, and research on earthquakes and earthquake hazards for citizens and government units." According to Johnston, the impetus for this legislative act was a magnitude 5.0 earthquake that jolted Memphis in 1976. The earthquake caused damage to buildings around the city - and it caused alarm throughout the region.

"That's why we have CERI," Johnston says.

From its inception, the Center flourished. CERI lured top-notch researchers, and six years after opening it became a Tennessee Center of Excellence as scientists began to understand more and more about the New Madrid seismic zone, which then was largely unexplored. For instance, unlike California earthquakes, which occur as the result of colliding plate boundaries, New Madrid earthquakes occur on a stable plate interior. Why earthquakes happen here is still something of a mystery, but it's something that CERI tries to unravel each day at its

headquarters and in the field. Patterson says CERI, which is funded by the state, the United States Geological Survey and organizations like the National Science Foundation, has 55 geologists stationed worldwide, some of whom teach earth sciences classes at the University.

"A lot of high-level scientists have been attracted here as faculty to address a basic question about how the earth works as a system," Patterson says. "If we can figure out the mechanism, that's a huge contribution to earth sciences."

CERI's seismic equipment records approximately 200 New Madrid earthquakes each year, most with a magnitude under 3.0, which is too small to be felt. According to Johnston, New Madrid registers about 10 magnitude 3.0 earthquakes per year; one magnitude 4.0 earthquake every 1-2 years; one magnitude 5.0 earthquake every 20-30 years; and one magnitude 6.0 earthquake every 80-100 years. Magnitude 7.0 and 8.0 earthquakes are "quite rare," according to Johnston. "Roughly speaking, as you go up one magnitude unit, you do down in frequency by a factor of 10," Johnston says.

Over the past decades, CERI has constructed a chronology of large New Madrid quakes, Johnston says. New Madrid 's really big quakes, those measuring above a magnitude 7.0, occur about every 500 years, and the last time an earthquake that big struck the region was nearly 200 years ago. In fact, during a six-month period in 1811-12 there was a sequence of about 1,800 earthquakes in the NMSZ, including a trio of very large quakes, between magnitude 7.3 and 8.0. They were powerful enough to force the Mississippi River to run backward briefly and also form Reelfoot Lake in northwest Tennessee.

"We know that the really big ones have really happened," Patterson says. "We know there were three of them, and they could happen again."

### **CERI's branches**

Many believed the "big one" would hit Dec. 3, 1990. That was the date on which Dr. Iben Browning predicted a major New Madrid earthquake. Some Memphians panicked. Many prepared. They got their earthquake kits ready, strapped down their hot-water heaters and braced for the ground to shake ferociously that winter day. But Dec. 3 came and went without incident, and Johnston worries that Browning's failed prediction caused long-term damage by making people less cautious of earthquakes.

"Of all the people that had their earthquake kits," Johnston asks, "how many do you think do now?"

At the very least, the now-deceased Browning's false prediction helped shed light on the vulnerability shared by thousands of old structures in

Memphis, which led to the 1992 building code revisions that required earthquake-resistant construction.

"We took advantage of it," Johnston admits.

But it took nearly 15 years and the actual devastation of another city - albeit from a different kind of natural disaster - to again open the eyes of Memphians and again bring CERI back into the national spotlight.

Hurricane Katrina's destructive path hit close to home literally and figuratively. For many in the Mid-South, the images of a chaotic post-hurricane New Orleans made them wonder how their hometowns would fare in an emergency. Suddenly, everyone was talking about disaster mitigation and earthquake magnitude, vulnerability studies and building codes, survival kits and seismic provisions. As the scientists and directors at CERI became inundated with requests to appear on nightly newscasts and assess the threat Memphis faced, they decided to spark a community-wide discussion of how Memphis and Shelby County would prepare for - and react to - a major earthquake.

"When Memphis, just like every city in the country, saw what happened with Katrina and asked themselves what is our worst-case natural disaster, the consensus is that it would be a very large New Madrid earthquake," Johnston says.

So CERI associate director Dr. Christine Powell and a University hazards focus group organized a public forum last October at the U of M's Rose Theatre. "Preparing for the Big Earthquake: Memphis ' Katrina?" brought together scientists and politicians to discuss the likelihood of a large New Madrid quake and how the region might handle the aftermath. The forum included U.S. Congressman Harold Ford Jr. and Shelby County Mayor A C Wharton Jr, as well as leaders of local and regional emergency response agencies. Patterson, Johnston and a host of other experts represented the U of M. A few hundred people showed up to hear about, among other issues pertaining to a natural disaster, the lines of communication during a crisis and the probability of a major earthquake striking Memphis.

What they heard is that an earthquake, even a very large one, can occur anytime.

"For a reality check, Katrina is a one-in-50-year event, statistically," Patterson says. "A catastrophic New Madrid earthquake is a one-in-500-year event, statistically. But statistics don't tell you that a Katrina hurricane could happen again tomorrow, so these are long-range forecasts, best scientific guesses." Based on patterns of recurrence and probability, Patterson says scientists estimate a 7-10 percent chance of a large New Madrid earthquake in the next 50 years.

In spite of the earthquake risk, the panel concluded that Memphis had a long way to go toward being prepared. Johnston told the crowd that

vulnerability studies are out of date, and that many of the city's older buildings are at high risk. Wharton said the county is one to five years away from having a comprehensive disaster plan. But CERI and the U of M - including other departments like earth sciences and criminology - are working with political leaders to help the region prepare for this worst-case scenario disaster.

"The University of Memphis is in a position to support a collaborative effort to develop effective mitigation plans," Patterson says.

### **In case of an earthquake...**

Dr. Paul Bodin freely admits that his office, located on the second floor of a CERI building, isn't prepared for an earthquake. After all, a tall shelf filled with heavy books hasn't been tied down. But he uses this oversight to discuss his grand idea of producing an earthquake-preparation video along the lines of "Extreme Makeover," in which a television crew would film Bodin getting his office earthquake-ready, replete with 'before' and 'after' footage.

#### **EARTHQUAKE SURVIVAL**

**What to do before, during and after an earthquake**

##### **PREPARE YOURSELF AND YOUR FAMILY NOW**

- Have an earthquake survival kit on hand.
- All family members should know how to turn off gas, water and electricity.
- Plan family emergency procedures, and make plans for reuniting your family.
- Know emergency telephone numbers (doctor, hospital, police, 911, etc)
- Anchor heavy objects to walls (bookcases, wall units, mirrors, cabinets, etc.)
- Never place heavy objects over beds, and keep heavy objects lower than head height of shortest member of family.

##### **DURING AN EARTHQUAKE, STAY CALM**

- Inside, stand in doorway, or crouch under a desk or table, well away from windows or glass dividers.

"We would take people through the steps that they would do to assess what needs to be fixed," says Bodin, a U of M geophysics professor.

Bodin and other scientists believe even a 5.5 magnitude earthquake, if it struck a nearby place like Marked Tree, Ark., the southern end of the NMSZ, would have damaging effects, especially for those who aren't ready.

"In the context of thinking about Memphis ' Katrina, it doesn't take much to prepare yourself for a much more moderate event,"

- Outside, stand away from buildings, trees, telephones and electrical lines.
- On the road, drive away from underpasses and overpasses; stop in safe area; stay in vehicle.

#### **AFTER AN EARTHQUAKE**

- Check for injuries - provide first aid.
- Check for safety - check for gas, water, sewage breaks; check for downed power lines and shorts; turn off appropriate utilities.
- Check for building damage and potential problems during aftershocks.
- Clean up dangerous spills.
- Wear shoes.
- Turn on the radio and listen for instructions from public safety agencies.
- Use telephone for emergencies, only.

Bodin says. "It really pays off."

A moderate New Madrid event could be more damaging than an equally sized earthquake in California because of liquefaction, or ground shaking. Due to this area's relatively soft sediments, liquefaction is a major concern and would cause the most trouble in an earthquake.

"We can expect it to be twice as powerful, to have twice as much punch as the same magnitude in California," Bodin says. "This is one

thing we are not sure of, but the evidence we have suggests we should be prepared for that. It just means that earthquakes are going to be a little bit more powerful, will radiate a little bit more."

Obviously, being able to predict earthquakes would mitigate the disaster for nearly everyone. Unfortunately, that day is long off. So Bodin, who says damaging waves from a New Madrid quake would take a full minute to get to Memphis, envisions a time when a computerized detection system could send rapid warnings to fire departments, schools, large machines, office buildings with elevators - they all could be designed to brace for the coming shock with a timely signal.

"I think this is something we can do," he says. "These kind of early warning systems are, effectively, predictions, but of a different character."

Until that happens, preparation is essential for surviving a major earthquake. If attendees at that public forum learned anything, it's that they shouldn't rely on government to come to their aid, and that preparation is up to each individual household. According to Wharton, "Should we suffer a significant seismic event, in the first 72 hours or so, our citizens will be on their own."

CERI filled its Web site ([www.ceri.memphis.edu](http://www.ceri.memphis.edu)) with tips on how to prepare for and survive an earthquake. And CERI continues to work with agencies throughout the region - like FEMA, MLG&W and the Memphis Police Department - in preparation for an earthquake that may or may not happen in our lifetime. But for the researchers at CERI, even if another large quake doesn't strike in this century, preparing and educating the local governments and citizens remains mission critical.

"The benefit of having a good strategy in place and implementing it might not be paid off for generations to come," Johnston says. "But that doesn't mean it shouldn't be done."

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