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Chelmsford scientist's work led path to CD

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Mr. McGuire: I want to say one word to you. Just one word.

Benjamin: Yes, sir.

Mr. McGuire: Are you listening?

Benjamin: Yes, I am.

Mr. McGuire: Plastics.

The exchange famously took place at a party in the 1967 Dustin Hoffman film, *The Graduate.*

The same year, Dieter Freitag received his doctorate summa cum laude from the University of Frankfurt, in Germany. His thesis was on "The Chemistry of Polycyclopentadienones and Polyphenylenes Synthesized Therefrom."

Plastics.

Years later, the world would be listening to plastics. Freitag was among a team of chemists and scientists for Bayer AG in Krefeld-Uerdinger, Germany, which greased the path for the "Big Bang" of the digital revolution.

The compact disc celebrates 25 years on the market this year.

Without Freitag, lots of folks would have never dumped their turntable.

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Freitag's desk at Triton Systems in Chelmsford holds neat piles of papers.

The man behind the desk is 68, dressed in faded jeans and a light-blue shirt. He has thick gray hair and his clothing matches his eyes.

"Plastics are everywhere," says Freitag, who speaks gently with a German accent. "They are light and stable."

He ambles to the corner of the office and picks up an empty five-gallon water jug and slams it to the ground.

It cracks.

"Well, that was a bad experiment," he mutters, then chuckles. Three weeks ago, he appeared on German TV and similarly slammed down a plastic ball, which remained intact.

"It was live TV," he says. "If that had happened then, nobody would trust me."

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The bad experiments have been few.

As inventor or co-inventor, Freitag holds 431 patents.

Freitag's work with at Bayer with the hi-tech plastic Makrolon allowed the errant water container to be manufactured, too.

He's been decorated with medals in Russia, Italy, Austria, and last year was inducted into the Plastics Hall of Fame in Chicago.

In 2001, he retired from Bayer after 33 years. He joined Triton, the materials development company, first as a consultant and was wooed to full-time status in 2002. He is Triton's chief technology officer.

An avid swimmer and cyclist, he lives in Chelmsford some of the year, in Germany, near Dusseldorf, with his wife of 40 years, Katharina, the rest.

Dieter Freitag was one of the German scientists whose work paved the way for the compact disc 25 years ago.

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While in Germany, he consults with Triton by cell phone and laptop.

"Both plastic," he notes.

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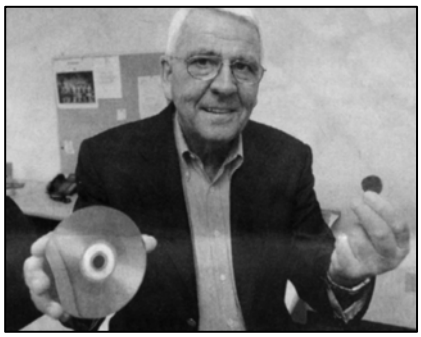
In 1981, when vinyl albums and 45s were the music industry staple, representatives from Philips Electronics approached Bayer. They had a breakthrough and a problem.

"We have a big invention," they told Freitag and his associates. They held a small metal disc, touting it as the LP of the future.



Dieter Freitag says a compact disc and a Roman coin have plenty in common because they both provide plenty of information. The difference? The information is on the raised surfaces of the coin and in the grooves of the disc.

Within 4 billion microscopic holes, or pits, that held digital information, was a Beethoven symphony.

"They said it would work with a laser instead of a needle," Freitag recalls. "With no needle to scratch it," they said, "it will live forever."

"We said, it's a wonderful invention but ... why are you here?" Freitag says. "We are a chemical company, not metals."

The problem was, the disc was a master recording, a unique product.

They needed a way to mass-duplicate it.

"I had no idea what a CD was or what it could be," Freitag says. "But when you are looking for one thing, sometimes you find another one."

And sometimes you already have the answer on the shelf.

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Freitag and his team -- Hartmut Lower, Claus Burkhardt and Werner Nouvertne --set out to find the answer.

A few years earlier, Freitag had further developed polycarbonate for Bayer's existing Makrolon to make molded parts with the sort of precision no one had imagined. And the materials flowed evenly and quickly and could be demolded, or removed from an injection mold, quickly.

But in what became a battle of temperature stability and the toughness of polycarbonate, the trials hadn't gone well, and Bayer had considered dropping the project. But Freitag persisted.

But when he applied the process to CD manufacturing, with modification, it worked.

Because the laser beams used to read information would have gone right through transparent polycarbonate, a thin coating of aluminum was added.

And when the conductor Herbert von Karajan excitedly lavished praise upon the new technology, "that gave us a lot of help and support," says Freitag. And you didn't have to flip the LP to hear the whole thing.

In 1982, the first mass produced pop CD -- ABBA's The Visitors -- hit the market.

At first, a disc could be manufactured every 27 seconds. These days, it takes three seconds.

More than 90 billion units in all formats were manufactured from 1982 to 2006.

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"What I invented in the laboratory was basic, but my colleagues helped me," stresses Freitag, whose other inventions include a plastic that could be produced to make large products that are hollow, like the water jug, and massive hollow plastic sheets used in greenhouses and stadium roofs. "It was never me alone. With any invention, you always need a team for success."

Freitag also invented APEC, a polycarbonate with unprecedented heat resistance that has been used in medicine and automotive lighting.

At Bayer, he rose through the ranks, heading the Plastics Applications Department, then headed its Research and Development branch and the Material Research Department.

The company made $1.5 billion in worldwide over the years from his inventions.

"What a business!" he says.

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Freitag and his wife had two sons, both physicians. The oldest died five years ago in a car accident, which devastated the couple. They have three grandchildren, a fourth due next month.

His own musical tastes run toward Mozart, Beethoven and opera. He loves Boston's Symphony Hall.

The technology Freitag and his colleagues developed has been further modified over the years, and capacities have grown by leaps and bounds. The basics of their invention still applies in CD-ROM, DVD and Blue-Ray applications.

Bayer, he says, is now working on holographic applications.

"It's just unbelievable, and the possibilities are endless," he says.

Freitag heads a new company whose partners include Triton. It's called FRX Polymers, and using LOI (Limited Oxygen Index), they're producing a plastic that melts, but does not produce toxic black smoke. It is also self-extinguishing, once a flame is removed.

He produces a small jeweler's box and pulls a round object from the felt interior. It's a Roman coin, 1,800 years old. He collects them.

In a sense, the coins were the CDs of their day, though the information they contain was raised from the coin, not read by laser. Freitag passionately explains the codes emperors used on the coins. It is stored history.

In a Triton hallway, Freitag passes a cubicle, grabs an empty five-gallon water jug from a rack.

He slams it to the ground. It bounces.

Workers poke their heads from office doorways to see what the commotion is all about.

Freitag looks at the blue jug. It is intact.

"That was better," he says, smiling.