



EHS Stories: Dramatic Tales From the 50-Year History of Environmental Health and Safety at Princeton University

Episode 2

Blue's Clues: A Medical Mystery, a Shocking Diagnosis and the Hunt For a Cure

A police car rushes through downtown Princeton, lights flashing, in a race to deliver a peculiar potion to a dying man. The hoped-for cure discovered in the unlikeliest of places after a desperate nationwide search hindered by a snowstorm. A mysterious illness that baffles doctors until solved by a nurse's hunch. This might sound like something right out of the fictional TV show 'House'—which, after all, was set in Princeton—but is in fact 100 percent true.

We'll explore the ins and outs of a strange medical mystery and EHS's surprising role in the story in this episode of **EHS Stories: Dramatic Tales From the 50-Year History of Environmental Health and Safety at Princeton University**. I'm your host, Jim Sturdivant. Please join me as we once again dive into the colorful and sometimes shocking annals of the ongoing effort to mitigate hazards, prevent illness and injury, prepare for the unexpected, and keep people safe at one of the world's great research universities.

MUSIC

It was a normal day in the EHS office on January 25, 2011, when Robin Izzo took a call from the Princeton Medical Center.

"My name is Robin Izzo. I'm the Assistant Vice President for Environmental Health and Safety for Princeton, and I've been here for 30 years. I started in May of 1992, as an assistant industrial hygienist, and then I was promoted over time, to the university industrial hygienist, to assistant director, associate director, director, now I am the AVP. Over those 30 years, I've seen a lot."

Izzo, who began her career in EHS at the University of Vermont, where she was also an EMT and worked for poison control, had seen her share of sensational incidents and oddball requests over the years, but none as strange as this.

"It was January 2011. And out of the blue, I got a phone call from someone from the Princeton hospital. This is back when it was on Witherspoon Street in Princeton. And they called and said that they were looking for Prussian blue. And was it possible that any of our labs might have Prussian blue? Because they had a patient who needed it."

You heard that right. A hospital was calling the office of Environmental Health and Safety at Princeton University, looking for—medicine. And not just any medicine, but medicine with a name that sounds more like something out of an alchemist's manual than a book of pharmacology.

What was this all about? What is Prussian blue, and why did the doctors at Princeton Medical think EHS would have any clue where to find it?



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To tell this story, we need to rewind a bit. Eleven days before Izzo took that call, on January 14, 2011, a man came into the Princeton Medical Center complaining of flu-like symptoms and abdominal pain.

Thirty-nine-year-old Xiaoye Wang lived in Monroe Township, a suburban community in Central New Jersey, with his wife of 9 years and 2-year-old son. He worked as a computer engineer in New York City, and his wife, Tianle Li, 40, was a chemist at Bristol-Myers Squibb.

Wang was admitted right away, but doctors could not identify the cause of his illness. Tests for viruses, infections and other conditions came back negative. There was no sign of violence or physical injury, and nothing in the patient's health history suggested an explanation.

Over the next 12 days, Wang's condition steadily worsened. Further tests were done and treatments attempted for a distressing array of symptoms.

The medical team was baffled and frustrated until a nurse recalled a story she had heard about a similarly confounding medical case from the 1990s. Wang's symptoms were consistent with such a possibility, however remote. A urine sample was sent out of state, as no labs in New Jersey were equipped to even run such a test. Amazingly, the nurse's hunch proved correct. The sample came back positive for high levels of thallium.

INTERLUDE

Steven Marcus, executive director of New Jersey Poison Control, took the call from Princeton Medical Center on the morning of January 25. What the doctor at the other end of the line had to say nearly knocked him flat. It was only the second case of thallium poisoning Marcus had encountered in his 43-year medical career.

"It's either attempted suicide," Marcus told the doctor, "or homicide."

The metallic element thallium was discovered in the 1860s using the then-newly perfected method of flame spectroscopy. The bright green flame associated with thallium suggested a name derived from the Greek *thallos*: green shoot or twig.

Thallium does not exist freely in nature and is most often derived in trace amounts from other metals. It is highly toxic; odorless, tasteless and soluble in water, it was soon recognized as a powerful rodent killer and insecticide.

It was also recognized as something else. As little as one gram of thallium sulfate is enough to kill an adult human, and in addition to a number of accidental poisonings, the substance acquired a reputation for murder. Symptoms of thallium poisoning, including vomiting and abdominal pain, mirror other afflictions. Before it was widely banned in the 1960s and 70s, it was readily available in commercial rat poisons. Hard to trace and easy to get, it was dubbed "The Poisoner's Poison."



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While lesser known than its toxic cousin, arsenic, thallium is the stuff of gruesome legend. It has been used by serial killers, despots, spies and assassins. A notorious cluster of murders by thallium occurred in Australia in the 1950s. The substance became well-known to both criminals and those who would thwart them through the Agatha Christie novel *The Pale Horse*, published in 1961.

One of the most sensational thallium poisoning cases occurred in China in 1994. A chemistry student at Tsinghua University in Beijing, Zhu Ling, fell ill during her sophomore year. Doctors were stumped, and her friends, desperate for help, posted about her affliction on a computer message board in what is widely believed to be the internet's first case of crowdsourcing a diagnosis. The break came just in time: Ling's life was saved by aggressive treatment, though Ling would remain partially paralyzed and unable to speak, with significant brain damage.

Suspicious immediately fell on Ling's roommate, another chemistry major who had access to thallium. The suspect was interviewed but never charged with a crime, leading many in China to suspect the political connections of her family shielded her from prosecution. The case continues to spark anger and controversy in China to this day.

After nearly two weeks in the hospital, Xiaoye Wang was at death's door, but doctors finally had what they had so desperately sought: a diagnosis. They could now pivot to treatment, which sparked the frantic call to New Jersey Poison Control.

Steven Marcus knew exactly what to tell the doctors at Princeton Medical. They needed to get their hands on something called Prussian blue.

Most people have never heard of Prussian blue, but it is on the World Health Organization's list of essential medicines. It is a powerful detoxifying agent, bonding to certain metal ions when ingested and removing them from the body through excretion. These include thallium and radioactive caesium, and Prussian blue is the antidote of choice for both. But because poisoning from either is extremely rare, Prussian blue can be very hard to come by.

This was the dilemma confronting doctors at Princeton Medical as they rushed to save the life of Xiaoye Wang. Marcus at Poison Control began calling around—first to a former colleague at Oak Ridge National Laboratory in Tennessee. Oak Ridge had the goods, but a [major winter storm](#), the second of three blizzards to hit the eastern U.S. that month, was in the process of dumping as much as 20 inches of snow on New Jersey, closing highways and airports. The timing could not have been worse.

Marcus dug his way out and began a perilous drive to Princeton, making phone calls the whole way to anyone and everyone he could think of who might have some Prussian blue. Desperate, he eventually recommended the hospital contact facilities in the area that did work with chemicals, figuring a non-medical grade dose was better than none at all.



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The medical team thought immediately of their close neighbor Princeton University, and this is how Robin Izzo found herself unexpectedly talking to a doctor.

“The hospital was taking the chance that perhaps we would have some.”

EHS, with its broad knowledge of research activity across the University, was a good place to direct this inquiry, and Izzo, at the time assistant director overseeing the chemical safety, lab safety and industrial hygiene programs, was the best person to take the call.

“I had been there and been doing this for more than 20 years at the university. So over that time, I really got to know where you can find any sort of chemical.”

“Several labs, particularly in life sciences, like molecular biology, will use Coomassie blue,” — a commercial dye used to stain proteins in biochemistry — “Prussian blue, other materials like that. And so the hospital was taking the chance that perhaps we would have some.”

“So I reached out to the labs and departments that I thought might have something like this. None of them did. And I went on to just to look through our inventories, looked through all the information that we had, and I couldn't find any indication that we had any Prussian blue in our laboratories.”

It seemed likely that the hospital would come up short here as elsewhere. Until Izzo had an idea.

“So as I was thinking more about it, I remembered that our art museum conservation lab often has pigments, such as Prussian blue and chromium yellow and some other metal pigments that they use to restore old paintings, particularly old oil paintings.”

Prussian blue was *not* originally formulated as a medicine. It was discovered in 1709 in Germany for use as a pigment, its deep blue color the perfect replacement for pricey lapis lazuli in paints and dyes. Prussian blue is used in “The Great Wave off Kanagawa” by Hokusai. It is well known for its use by many masters of the 18th-century French Rococo style, including François Boucher, whose *Arion on the Dolphin* is in the collection of the Princeton University Art Museum.

“And so I contacted the conservator Norman Mueller, and asked if he might have Prussian blue, and he did. So I called the hospital I said, ‘Hey, we have it, but it's not in laboratory form. It's actually used for art.’ And they said that they would take it, they could try to make it work.”

“At the time, they said that the closest Prussian blue that they could find was somewhere in Indiana, and that they would not be able to get it back here in time to save the patient. So it was worth trying this form of Prussian blue to save this patient who was really on his last moments.”



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It's hard to imagine anyone other than an EHS professional making this connection so quickly, and knowing right away who to call. But art safety is a core part of EHS' mission.

“People don't often think of health and safety when they think of art. They might think about it in terms of sculpture, or when you're using wood, working in the shop with equipment, saws, and things like that, but they often don't think of it in terms of chemical safety. And what's interesting is that when I started here, I started the safety program for visual arts that included training that all of our faculty and students who are getting their certificate or are focusing on art, have to go through.”

That Robin had worked closely with the art conservator is no surprise, as art supplies and pigments historically have contained a variety of heavy metals.

“Art safety is something that I've been very passionate about for many years. I remember when I was at the University of Vermont, I worked with an artist's consortium where they wanted to do an art exhibit where they were pairing scientists with artists and trying to show, particularly with health, how those related. And what I talked about there, what I worked with the artists about was pigments and looking back in the time of Van Gogh and Monet, a lot of the paints that they used, had heavy metals in the paints—that's what gave them the brilliant color. So you'd have chromium, cadmium, lead, and other heavy metals. And oftentimes those metals were making them sick, they would often use their mouth to tip the paintbrush and things like that. And as a matter of fact, the art installation and the project that I did with the artists that I worked with was questioning whether Van Gogh actually died for his art, whether the heavy metal poisoning might have contributed to his mental illness. And so that's something that I've always found very fascinating and I've always been involved with, whether it's visual arts or art conservation.”

As part of her role at Princeton, Robin worked with departments on campus to minimize and eliminate wherever possible exposure to these substances.

“In Visual Arts, our students and our faculty don't use paints that have heavy metals. But in the art museum conservation lab, when they are trying to restore paintings, they often have to try to use the same kind of paints that the original artists used. And so they do sometimes use metals. ... And I'd worked with Norman for many years, looking at the materials that they used, and I knew that he had quite a collection of these dry pigments and thought there was a chance that he would have Prussian blue. And he did.”

The Prussian blue was in a solid form, normally mixed with water and other pigments to achieve the rich blues and deep greens so important in Rococo art. With no time to waste, it was picked up at the art museum and rushed across town.

“I called the Norman Mueller who was the art conservator at the time and he grabbed his his container of Prussian blue met Jim with it at the art museum and then with public safety went as quickly as possible down Witherspoon street to the hospital.”



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“So one of my colleagues, Jim Boehlert ... got in the car with a police escort and they went down to ... Princeton Medical Center to drop off the Prussian blue.”

“It felt like, you know, almost felt like the middle of a television show. It was very exciting. It sounded like we're a part of some kind of police drama, where we're rushing an antidote to the hospital. So I wish I had a better ending, but it did not.”

The powder was dissolved in water, and a double dose administered through a gastric tube as recommended by Marcus, but Wang's condition did not improve. A purer dose arrived by SUV from Albany, N.Y. a few hours later, but it was all too little, too late. Despite the best efforts of doctors, poison control, the state health department, Princeton EHS and others, Xiaoye Wang died the next day, around 3 p.m. on Jan. 26.

“Had this patient gotten the Prussian blue in the right form. and earlier, they might have survived.”

INTERLUDE – MUSIC

The investigation into Xiaoye Wang's death proceeded quickly, and there was little doubt in the minds of investigators as to who was responsible.

While Wang and his wife, Tianle Li, both immigrants from China, seemed to be living their version of the American Dream, all was not well at home. Wang and Li fought frequently, and police were called to their Monroe Township residence on several occasions. Things got so bad that Wang moved out in Spring 2010 and filed for divorce in July of that year, seeking custody of their child. Li counter-sued but asked Wang to move back in to help care for the child, which he did that fall.

After months of back and forth, Wang and Li had a meeting with their attorneys on Jan. 10, 2011, to work out the final terms of their divorce, including the division of property and other matters. The meeting was contentious, and the couple argued loudly, but an agreement was eventually hammered out. A court hearing to finalize the divorce was set for Jan. 14.

On the morning of the 14th, Wang called his attorney, distraught, to tell him Li was unavailable for the final hearing—she had to take her aunt to the Princeton hospital. That evening, Wang suddenly took ill himself, and joined his wife's aunt as a patient there. The court hearing was rescheduled for later in the month.

It would later come out that in November, after Wang moved back into their home, Li had ordered four bottles of thallium from the storeroom at Bristol-Myers Squibb. Li initially lied to investigators about this, saying she “had nothing to do with thallium.”



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“What we learned later was that this was a case where there was a woman who had worked for a pharmaceutical company and had poisoned her husband with thallium. She worked with thallium at work, she brought some thallium from work and had poisoned her husband.”

Li is alleged to have administered the poison on multiple occasions, including just after the Jan. 10 meeting. Prosecutors said she continued to feed him doses as he lay sick in the hospital. (Li’s aunt’s illness was found to be unrelated to thallium.)

“One thing that the hospital or the police had shared with me was that it appeared that the wife ... was actually putting thallium in lip balm, and continuing to apply it to his lips while he was at the hospital. So he was getting more and more doses while he was at the hospital, that’s why he was getting sicker and sicker.”

Li came to visit her husband daily at the hospital and took a role in his care, feeding him and praying for his recovery.

A cellmate of Li’s would testify Li told her she administered thallium at the hospital through an IV tube. Investigators also noted that Li kept a bedside journal of Wang’s symptoms.

When Wang fell into a coma, Li applied for a rush visa for her son and attempted to buy two plane tickets to China. She was arrested and charged initially with hindering her own apprehension. To this would soon be added the charge of murder.

The trial was well-covered by the media. Prosecutors said Li deliberately chose a “rare poison” that doctors would not test for. Her motive was to have the house, all finances and full custody of their son—the issues argued about so vehemently just days before Wang took ill. While Li’s defense argued the divorce terms were sufficiently generous as to not suggest a motive, the prosecution asserted she never had any intention of abiding by those terms.

A powerful moment in the trial came when prosecutors asked an FBI toxicologist to compare the amount of thallium needed to kill a person to a packet of Sweet’N Low. Handed a single pink packet by the lawyer, the toxicologist told jurors it was less than the amount she held in her hand.

The jailhouse confession sealed the deal for the prosecution. Li was found guilty and sentenced to life in prison on Sept. 30, 2013.

“Rather than allow her husband to divorce her, Tianle Li chose murder,” Middlesex County Deputy First Assistant Prosecutor Christie Bevacqua told the jury. “She chose death, and she didn’t choose a simple, fast death. She chose one that put him through a lot of pain.”

“She packs a potent punch. Her weapon is her brain,” the prosecutor continued. “She is a chemist with easy access to deadly weapons — many deadly weapons. Her weapon of choice was thallium, that perfect poison.”



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INTERLUDE

How did Li know about thallium and its effects? No one knows for sure, but according to news reports, Li graduated from nearby Peking University in Beijing the same year as the poisoning of Zhu Ling. It's certainly possible that Li was aware of that highly publicized criminal case, and thereby became schooled in the poisonous possibilities of thallium. Coincidentally, the Zhu Ling case was also the instance recalled by the nurse at Princeton Medical Center, leading to Wang's being tested for thallium. The source of Li's knowledge of the poison would also be her undoing.

In another ironic twist, it was Robin Izzo's interest in toxic hazards—specifically, heavy metals in paints—that would lead to her familiarity with the tools of art conservatorship, and the rapid tracking down of a powerful antitoxin.

While this story does not have a happy ending, it is a good illustration of how knowledge of a wide range of risks and hazards allows EHS to play a vital role in the educational mission of Princeton.

And, as fate would have it, a high-profile local murder mystery.

MUSIC

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There you will find a media player, a transcript of this episode and links to sources. You will also find information and resources related to the 50th anniversary of the Princeton University Office of Environmental Health and Safety.

You've been listening to **EHS Stories**, a production of the Princeton University Office of Environmental Health and Safety.

This show is produced, written, edited and narrated by me, Jim Sturdivant. The theme music was written and recorded by me, Jim Sturdivant. Our logo was designed by Chelsea McDonnell.

Thanks to Robin Izzo for sharing her story with me.

The views expressed here do not reflect nor do they represent Princeton University or the Princeton University Office of Environmental Health and Safety.

Thanks so much for listening! And join us for the next episode of EHS Stories, coming soon to your favorite podcast platform.