

Transcript
Dead Ladies Show Podcast Episode 61
Emmy Noether

(Dead Ladies Show Music - 'Little Lily Swing' by Tri-Tachyon)

SUSAN: Welcome to the Dead Ladies Show Podcast! I'm Susan Stone.

The Dead Ladies Show celebrates women — both overlooked and iconic — who achieved amazing things against the odds while they were alive.

And we do it through women's history storytelling on stage, here in Berlin and beyond. And then we bring you a curated selection of these stories here on the podcast. I'm joined today for episode number sixty by DLS co-founder Katy Derbyshire. Hi Katy!

KATY DERBYSHIRE: Hello Susan! Let nobody say we are past our prime at sixty episodes! It's amazing!

SUSAN STONE: Swinging sixties, baby! It's hard to believe. And in this episode we are going to hear from the very same presenter we launched our podcast with, the wonderful writer and translator Karen Margolis.

KATY DERBYSHIRE: Karen, of course, kicked us off back in episode one by introducing the ancient Greek mathematician Hypatia. In this episode, she is again bringing her analytical skills (and her degree in mathematics) to the stage to talk about Emmy Noether.

SUSAN STONE: Emmy Noether has been called "the most important woman in the history of mathematics," though it must be said, that quote comes via some male mathematicians. Here's Karen from the stage in Berlin's ACUD, with more:

KAREN MARGOLIS FROM ACUD STAGE: I'm going to tell you the story of a remarkable woman who was one of the greatest mathematicians ever. She was a pioneer who battled against immense obstacles all her life, and she won recognition much too late. Today she is hailed as "the mother of modern algebra."

Her name was Amalie Noether, but was known (all the time) as Emmy. She was born in 1882 in southern Germany in the city of Erlangen in Bavaria.

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She was the eldest child in the family, and as you can see from this photo, she was the only girl, with three younger brothers.

At that time women weren't even allowed to enroll at universities and Emmy's parents, Ida and Max, never dreamed that she would one day be honored as a great mathematician.

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Here you can see the plaque at her birthplace at Hauptstrasse No. 23 in Erlangen. It was put up on the façade in 1997.

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And here is her brother Fritz. [AUDIENCE LAUGHS] Oh, it's not, it's her father. Let's start again. Emmy's passion for mathematics grew early on in the family. The picture shows her father, Max, who was a university maths teacher. There he is - he looks very impressive, and he was.

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And here's her brother Fritz, [AUDIENCE REACTS APPRECIATIVELY] who was two years younger and with whom she always had a close relationship. He became a renowned mathematician as well.

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This is the iconic picture of Emmy as a young woman with that charming bow tie. [AUDIENCE LAUGHS] She came from a middle-class Jewish background, and that played a big role in her life and choices. Her family weren't religious, they were open-minded and believed in female education. She was one of the first women in Bavaria to get the secondary school leaving certificate, and then she trained as an English and French teacher. It was one of the few possible careers for educated women at that time. Yet she was determined to do maths.

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So, in 1903 she went to Göttingen University in Prussia. She wasn't allowed to study formally – but she could attend lectures in the maths department, shown here in this building.

Why Göttingen? Because at that time its maths faculty was a leader in Europe. It was headed by Felix Klein, a friend and colleague of Emmy's father, and among its stars was the famous English mathematician, David Hilbert.

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[AUDIENCE REACTS AND LAUGHS]

Wait for it, folks! This photo shows him in his trademark hat.

[AUDIENCE LAUGHS]

Hilbert was a major figure in 20th-century geometry, algebra, and mathematical physics. Göttingen was formative for Emmy and would later become the center of her mathematical career – but first she had to qualify.

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In 1904 she returned to Erlangen, where her father was teaching at the university. They all have these impressive buildings! And she got special permission to do her doctorate in maths – a rare goal for a woman back then. And now...

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In 1908 she received her PhD with the highest distinction. Here you can see the title page of her thesis, written in German. In English it's called – wait for it – *On Complete Systems of Invariants for Ternary Biquadratic Form*.

Basically it established that there are specific quantities which remain unchanged under different conditions.

Emmy's PhD was an immense achievement. But it didn't get her a job. Women were still banned from working in universities, so for seven long years – from 1908 to 1915 – she worked with her father at Erlangen without a contract or payment. You could really say she did it for love. [AUDIENCE REACTS]

Sometimes she even had to publish under a male colleague's name. Meanwhile her fame was spreading and she was invited to join international mathematical societies and give lectures abroad.

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Well, what you're supposed to see here is a typical algebraic formula from Emmy's work. Sorry for the delay folks, but you have to see this one. [AUDIENCE LAUGHS] There it is! A typical algebraic formula from Emmy's work with its Greek letters. It's too difficult to explain here, [AUDIENCE LAUGHS] but I can assure you it was incredibly innovative and exciting.

The big change came for Emmy in 1915, when the physicist Albert Einstein asked David Hilbert and Felix Klein for help with some maths problems in theoretical physics. (I hope you agree that we can skip the portrait of Einstein here – I think he gets enough publicity as it is.) Emmy was asked to work on the project and she joined the Göttingen maths department right away – as the only woman. But still unpaid. [AUDIENCE REACTS] It took three years for her to get even a modest fee for her work. During that time she had a hard battle for her habilitation, the highest qualification to teach in a university. In the end she was only granted it as a complete exception.

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After a fierce debate in the maths faculty and two rejections, Emmy finally received her habilitation in 1919. It includes the summary shown here of her career to date, written in her own neat, precise handwriting.

All the while, David Hilbert – remember, the one with the hat? He was her strongest ally. Once he protested that he didn't understand why the sex of a teacher should be a problem. After all, he said, "this is a university, not a public swimming pool."

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This picture from around that time shows Emmy content at last. She had achieved her goal of a permanent paid teaching post at Göttingen. The First World War had ended the previous year – but there was to be no real peace. Now she had only 14 years to do her cherished work until the next storms broke.

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This lively group photo shows a meeting of the Göttingen maths faculty at a local restaurant with Emmy right in the center. She was an inspiring and highly popular teacher, the life and soul of faculty dances and parties. She loved taking long walks and boat trips with colleagues and students. On hikes in the woods she would race ahead, talking maths incessantly, spinning theories and winning points, leaving her companions breathless.

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Emmy's devoted groups of students were known as Noether Boys [AUDIENCE LAUGHS] – and later, with her strong support for women in maths, increasingly as Noether Girls. Some of her students went on to become great mathematicians themselves. By her death she was described as "the founder and head of a large scientific school".

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Emmy was already 40 years old when she began publishing the papers that made her name in the scientific world. Most famous is her pioneering work in abstract algebra – and, of course, the Noether Theorem, shown here on screen. Her unique approach made her see relationships that traditional experts couldn't.

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This equation is a key part of Noether's Theorem. It states that for every continuous symmetry, we can construct a conserved quantity, something that remains constant. And this is a great

help in solving equations in maths and physics. It looks mysterious, until you realize that maths is based on a coded language – it makes sense once you've learned the vocabulary and grammar.

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Mathematicians use poetic terms like “beautiful symmetry”, “rhythmic”, and “elegant” to describe Emmy's work. She herself simply said, “I always went my own way.” Interestingly, it's a remark usually associated with famous men like politicians, movie actors, and rock stars.

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But unlike some of the leading male scientists of her time, such as Einstein and Nils Bohr, Emmy was NOT a public intellectual. In fact, she was very much a private person. We know almost nothing about her love life. Her letters are mostly about maths, maths, and more maths. [AUDIENCE LAUGHS] Many portraits, like this one, show her sitting at her desk, deep in thought.

We do know that she was a convinced pacifist in the First World War and had close ties to progressive circles, to communists and to mathematicians in the Soviet Union. In the 1920s and '30s they all watched the rise of Adolf Hitler and fascism with fear. But Emmy quietly persisted on her path in maths, and hoped till the last to be able to hold onto what she had won so dearly.

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The philosopher Hannah Arendt, shown here, later gave a striking description of what Jewish and anti-fascist academics like Emmy and herself faced as Hitler's persecution threatened the existence of Germany's Jewish population and the political opposition:

This is what she said:

“You know about the idea of conforming, people accepting Nazi politics. What it meant was that our friends conformed! The problem for us personally was not what our enemies did, but what our friends did. Our intellectual friends. The rush to conform actually occurred fairly voluntarily, or at least, people weren't acting under the threat of terror yet. It was like an empty room taking shape around you.”

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When Hitler took power in 1933, Jews were immediately expelled from public service in Germany. The Nazis published the Law of 7th April 1933 you can see here, banning Jews from employment in places like government offices, hospitals, and universities.

Jewish and left-wing academics rushed to leave Germany. Some of Emmy Noether's colleagues at Göttingen fought – in vain – to keep her there. Her brother Fritz emigrated to the Soviet Union and became a maths professor in Siberia. Emmy hastily applied for posts abroad and eventually accepted a professorship in the United States at Bryn Mawr, a distinguished women's college in Pennsylvania.

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This is a photo of Emmy Noether at Göttingen Station in 1933 shortly before she emigrated to the USA. It seems to portend the sadness to come.

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As you can see from the picture, Bryn Mawr is beautiful, and it welcomed Emmy warmly. But it was still exile.

She also lectured occasionally at the Institute of Advanced Study at Princeton, where Einstein worked. Emmy commented that she didn't feel comfortable in that elite male academic conclave.

Then, suddenly and tragically, after just two years at Bryn Mawr, Emmy died in 1935 from complications after a fibroid operation. She was only 53.

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Today you can visit Emmy's simple grave here at the college cloisters. Some fans think she deserves at least a statue.

After Emmy's death her mostly male colleagues paid lavish tribute to her – and never failed to mention how outstanding she was – at the same time as emphasizing that she was still, after all, a woman.

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This mix of admiration and sexism [AUDIENCE REACTS] is typified by Emmy's friend Pavel Alexandrov – shown here. They met in 1923 in Göttingen and he later became president of the Moscow mathematical society in Soviet Russia. At a memorial soon after her death, he commented: "No one could contend that the Graces had stood by Emmy's cradle."

Well... just look at his hardly flattering portrait and digest that. [AUDIENCE LAUGHS]

Alexandrov went on to extol Emmy's great capacity for love: "She loved people, science, life, with all the warmth, all the joy, all the selflessness and all the tenderness of which a deeply feeling heart – and a woman's heart – was capable." [AUDIENCE LAUGHS]

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Isn't there something pathetic about men trying to reassure us that deep down, exceptional women who succeed in traditional male domains are still womanly?

On the other hand, we could ask if that isn't the greatest tribute to Emmy's special way of doing things. Whoever said geniuses shouldn't have hearts?

And today, almost 90 years since her death, the quietly brilliant figure of the mathematician Emmy Noether has become a fount of legacy and legend. Emmy would probably have laughed at all the modern hype and projections.

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Sometimes it can be embarrassing. [AUDIENCE LAUGHS AND BOOS] Like the pun on this poster: *Girls can't do math? You have a Noether think coming.* [AUDIENCE GROANS AND LAUGHS]

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Naturally there's the merchandising and spin-offs: Emmy Noether T-shirts, scarves, slogans, buttons, pencils, graphic novels, fellowships, professorships, conferences, commemorations, the *TIME* magazine cover, a Google doodle, and even a moon crater named after her. Emmy is gradually becoming established in her rightful place as a major figure in the history of maths.

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Meanwhile closer to home, Berlin has a living memorial to this great lady of maths: the Emmy Noether Gymnasium shown here – a secondary school in Treptow-Köpenick that specializes in science education.

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And then there are the publications, of course. These are just a few of the multitude on Emmy and her work. Incidentally, like most maths books, they cost far too much for the average student. Note the title on the far left: "Proving It Her Way." Emmy's personal motto still resonates today.

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Lastly, I want to share why Emmy Noether is a particular hero of mine. As a young woman studying mathematics in London in the 1970s I dreamed of a theorem that would bear my name. In 1976 I got a grant to do a PhD on theories of infinity. On my first visit to the professor's office, he took one look at me and said, "What's gone wrong? – I asked for a doctoral student and they sent me a woman!" [AUDIENCE BOOS AND REACTS]

I'm sorry to say I gave up quickly. Now I believe things might have been different if I had known Emmy Noether's story – if I had known about the obstacles she faced and conquered.

I'm very glad things have changed since then. Still, there's a long way to go for women in science to make up the vast and infinitely deplorable gender gap – and that's why it's so important for us to celebrate remarkable Dead Ladies of science like Emmy Noether.

[AUDIENCE CHEERS AND APPLAUDS]

KATY DERBYSHIRE: Karen Margolis on the remarkable Emmy Noether. Thanks to Thomas Beckmann and Johannes Braun of ACUD for their kind assistance.

KAREN MARGOLIS: And one last word, my thanks to the team. I'd like to say a big thank you to my fantastic Dead Ladies Show hosts Katy and Florian, and Susan Stone there at the back for inspiration, and especially my husband Thomas Schliesser, who helped with everything.

[AUDIENCE APPLAUDS]

KATY DERBYSHIRE: And...thank you Karen! To see pictures of Emmy and find out more about her work, have a look at our episode page, which you can get to via the link in the show notes in your podcast app, or by visiting deadladiesshow.com/podcast.

SUSAN STONE: Yes, thanks you to Karen for introducing many of us to Emmy Noether, who should be known by all, for sharing her personal story, and for being such a good friend and supporter of the Dead Ladies Show.

KATY DERBYSHIRE: That's true!

SUSAN STONE: She is! You can also support us by sharing our show with others, or with a contribution over at Patreon.com/deadladiesshowpodcast. And thanks to you, Katy for joining me in podcast-land today.

KATY DERBYSHIRE: You are welcome! And thank you as well to everybody out there listening!

If you're listening in New York, you can go see a live Dead Ladies Show at DLS NYC very soon — on March 29, at the KGB Bar Red Room. To find out more about that, pop over to our website, deadladiesshow.com where you can also sign up for *their* newsletter, or our newsletter from Berlin.

Our podcast will be back again next month with another fabulous Dead Lady!

SUSAN STONE: We certainly will! And I have to tell you that the Dead Ladies Show was founded by Florian Duijsens and Katy Derbyshire. The podcast is created, produced, and edited by me, Susan Stone. Our theme tune is 'Little Lily Swing' by Tri-Tachyon. See you next time!

(Dead Ladies Show Music - 'Little Lily Swing' by Tri-Tachyon)