[SLICE OF MIT THEME MUSIC]

ANNOUNCER: You're listening to the Slice of MIT Podcast, a production of the MIT Alumni Association.

[ARCHIVAL AUDIO]

[MUSIC PLAYING]

ANNOUNCER: Metro-Goldwyn-Mayer joins the world in celebrating the Golden Jubilee of motion pictures and climaxes a half century of entertainment progress by announcing the early exhibition of its miracle in celluloid, the Technicolor extravaganza, *The Wizard of Oz.*

HOST: *The Wizard of Oz* and countless other award-winning films from the Golden Age of Hollywood, like *Gone With the Wind, The Adventures of Robin Hood,* and *Snow White and the Seven Dwarfs,* owe their electric blue skies, golden Yellow Brick Road, ruby red slippers and fiery landscapes to Technicolor, an innovation that came out of MIT.

WILLIAM URICCHIO: *The Wizard of Oz* is probably the one that comes to mind that really used it as a piece of the narrative device, going from black and white-- good old black and white Kansas, plain old black and white Kansas-- to Technicolor Oz.

[ARCHIVAL AUDIO]

DOROTHY GALE: Toto, I have a feeling we're not in Kansas anymore.

ANNOUNCER: The magnificent musical spectacle which highlights the new entertainment season, that's *The Wizard of Oz,* a glorious extravaganza painted with a rainbow of Technicolor.

DOROTHY GALE: (SINGING) Somewhere over the rainbow way up high.

HOST: But what was Technicolor? How did it work? And what role did MIT play in helping create some of the biggest cinematic classics of all time?

In this Slice of MIT Podcast, we take a trip back in time to learn just how Technicolor came to life. We look at the MIT alumni behind those colorful films and their roundabout way of inventing Technicolor. Their story is both one of technical invention and a shocking tale of how a relatively small business transformed the way big production Hollywood studios made films.

URICCHIO: The question is, how do you put these different color layers together? Because film is essentially, I mean, it's monochromatic. You can make that monochromatic red and white or blue and white or green and white or black and white, but you can't make it all of that unless you come up with a very special film.

HOST: That's William Uricchio, a professor of the Comparative Media Studies Writing Department at MIT and the founder of MIT'S Open Documentary Lab.

URICCHIO: I'd say my personal research tends to be about beginnings, so beginnings of cinema, beginnings of telegraphy, beginnings of telephony, beginnings of today's new media VR and AR.

HOST: And as he explains, the beginning of color on the big screen did not happen overnight.

URICCHIO: Retrospectively, when we look at color in the cinema, we think it's always been that way. Almost no innovation enters the world fully born like, you know, Venus rising from the waters.

HOST: Technicolor got its start amongst a sea of competitors, including Brewster Color, Biocolour, and Kodachrome. All were trying to figure out just how to bring natural life-like color to the big screen.

URICCHIO: Those were all just in the first say, 15, 16 years of the film medium.

HOST: What's so interesting about Technicolor is its founders never really set out to bring color to motion pictures in the first place. In 1912, three MIT graduates-- Herbert Kalmus, Daniel Comstock, and Burton Westcott-- formed the design consulting company Kalmus, Comstock, and Westcott, Inc.

The company was formed to research a request from local Boston businessman William Coolidge. He came to them with a malfunctioning Vanascope motion picture projector. Vanascope had lofty plans to market it to the world but--

URICCHIO: It was hopeless in this particular case. But it brought them to the idea of working in color, which was really in the air. There were a lot of systems. And they took their crack in solving it.

HOST: That was the impetus for the new problem they set out to solve, how to bring naturalistic colors to the black and white big screen.

URICCHIO: So you want to see color without noticing color. You want to hear sound without hearing pops

and deformation. You want to hear good clear sound. So I think there was a-- an appetite for the realistic or the naturalistic that emerges in the late '20s, early '30s.

Resisted forcibly by a lot of film theorists who thought that silent black and white was the art form and these other things were just distractions, where they were messing up the aesthetic of film. But for the public and for the studios, sound and color seemed to have a hope of enhancing the experience and enlarging audience size.

HOST: Emboldened by the opportunity to bring color to the movies, the three alumni shifted their direction. They formed Technicolor Motion Picture Corporation in November of 1915 in Boston. And the name Technicolor? In his 1938 article in tech engineering news, Dr. Kalmus explained.

[DRAMATIZATION]

HERBERT KALMUS: As a tech man not too many years beyond graduation, the word technique-- the name of our annual class book, was fresh in my memory. And obviously it was color, so putting the words technique and color together, I invented the name Technicolor.

[END OF DRAMATIZATION]

HOST: Like many startups, Technicolor's next few years were shaded by trial and error. They went through many iterations to reach success. But the team didn't go through it alone.

URICCHIO: Well, company is under-- kind of reinventing its color system. They're really moving around pretty radically in terms of the technologies they're using. That was possible, I think, in large part because it happened here in Boston.

There were friends and colleagues at the institute to fall back on. They both worked at MIT for a time, among other places. And, by coming back here, they were able to tap a pool of expertise and creative problem-solving. The discussions you can after work at a bar that wind up solving major problems, hard stuff to account for in terms of the written record, but that's how it happens.

HOST: Over time, even more MIT alumni join Technicolor. In order to recreate multiple colors on the big screen, the company experimented with an additive process combining red green and eventually blue light. They used these colors of light because, when combined in different amounts, they produce a large spectrum of natural colors visible to the human eye.

In one of its first iterations, the company projected two separate beams of red and green light on black and white film through two separate parts of the projector. This could work, but it was all up to the skill set of the projectionist responsible for playing the film reel. Kalmus later remarked that the skill set needed to be--

[DRAMATIZATION]

KALMUS: A cross between a college professor and an acrobat.

[END OF DRAMATIZATION]

HOST: Very often, it didn't work and caused a mistake called color fringing. Moviegoers would see a scene with a horse and two tails, one red and the other green. The team went back to the laboratory to do more research. As Kalmus recalled--

[DRAMATIZATION]

KALMUS: Technicolor was born of research and now more research was required to save it.

[END OF DRAMATIZATION]

HOST: Technicolor's first lab was built in a functioning railway car with all the equipment they needed to develop negatives and make prints. They even rode down to Florida with it during the production of the 1917 film *The Gulf Between.*

URICCHIO: When they were starting, they had to keep inventing the technology and it meant the physical plant was a little bit wanting.

HOST: In future iterations, the team created etched-in color reliefs on different sides of the film. The technique received praise in early reviews of the 1923 film *Toll of the Sea.* Said one reviewer--

[DRAMATIZATION]

REVIEWER: "They have humanized the movies so much so that characters upon the screen seem like real flesh and blood human beings rather than shadows."

[END OF DRAMATIZATION]

HOST: Unfortunately, this technique made the actual film material itself too thick. Projectionists complained that the heat from the projector made the filmstrips curl and bend back and forth, rendering the movie unwatchable.

The alumni and their team went back to the laboratory. This time, they created the same technique, but etching the color reliefs only one side of the film. From 1929 to 1930, Technicolor brought color to 40 films this way, including *The King of Jazz, Song of the West,* and *The Wax Museum.* And then finally in 1932, nearly 20 years since Technicolor was formed, the team landed on a solution that worked.

URICCHIO: The kind of pinnacle was they used the three-strip system where they would literally exposed three strips of film. And they would color each of them distinctively and then make a composite.

HOST: What's interesting about Technicolor is the actual process of making color film ensured the film's longevity.

URICCHIO: With Technicolor, you could always go back to the masters, those three-- the one thing that was just filtered for the reds, or just filtered for the greens or whatever-- and remaster and get a perfectly vivid color print. The composite might fade in color, but they always had those original colored negatives to go back to.

So their color, really, it's bold, it's bright. And it didn't fade the way Eastman color, for example, tended to turn pink.

HOST: All of the coloring took place within a special three strip Technicolor camera the company built. The company established themselves in Hollywood and joined forces with another emerging innovator, Walt Disney. The companies teamed up to provide color for Disney's 1933 animated cartoon *Three Little Pigs.*

[MUSIC - "WHO'S AFRAID OF THE BIG BAD WOLF?"]

FIDDLER PIG AND FIFER PIG: (SINGING) Who's afraid of the big bad wolf, big bad wolf, big bad wolf? Who's afraid of the big bad wolf? He's a great big sissy.

HOST: In the 1933 article, "Science Aids Mickey Mouse," *Technology Review* praised Technicolor's work.

[DRAMATIZATION]

TECHNOLOGY REVIEW: Those who laughed so easily at *Three Little Pigs,* not to mention *The Big Bad Wolf,* pause to think of the intensive research and technical skill which contributed to that laugh. You recall the amusing touch when the wicked wolf, huffing and puffing in an effort to blow the brick house in, turns blue in the face?

[ARCHIVAL AUDIO]

[WIND HOWLING]

[MUSIC PLAYING]

[WIND HOWLING]

[MUSIC PLAYING]

[WIND HOWLING]

[MUSIC PLAYING]

[WIND HOWLING]

In such subtle ways does science make its contributions to the amusement industry.

[WIND HOWLING]

[MUSIC PLAYING]

[END OF DRAMATIZATION]

HOST: *Three Little Pigs* would go to win the 1934 Oscar for Best Animated Short Film. Technicolor teamed up again with Disney to make the sequel cartoon, *The Big Bad Wolf.* And then, in 1937, they provided the color for Disney's first feature-length cartoon, *Snow White and the Seven Dwarfs.*

[MUSIC - "Heigh-Ho"]

SEVEN DWARFS: (SINGING) Heigh-ho, heigh-ho, heigh-ho, it's home from work we go.

[WHISTLING]

Heigh-ho, heigh-ho, heigh-ho, heigh-ho.

[ARCHIVAL AUDIO]

ANNOUNCER: *Snow White and the Seven Dwarfs,* adapted from Grimm's Fairy tales by that master of movie entertainment-- the creator of Mickey Mouse, Minnie Mouse, Donald Duck, and scores of screen entertainers-- Walt Disney.

[MUSIC PLAYING]

HOST: A classic today, the film gave Technicolor a name in Hollywood. By a year later, the company had sold more than 80 million feet of color prints. And that number ballooned to 560 million feet by 1953.

URICCHIO: Color by Technicolor was not just a great brand, it actually meant that the colors were going to be punchy, fantastic. That world of illusion that we associate with the cinema, even though it's a kind of hyper-real world, was made possible thanks to Technicolor.

HOST: Technicolor films were typically larger productions because lighting could be more easily controlled inside indoor studios.

URICCHIO: It was expensive. So you were not going to do this unless it was a real-- going to be a box office bonanza type film. I guess where it did best was in spectacle type films. So costume dramas, that sort of thing. *Gone With the Wind* would be a great example of the kind of spectacle that needed Technicolor to sort of get off the ground.

[AUDIO FROM GONE WITH THE WIND]

SCARLETT O'HARA: I'll think of some way to get him back.

[MUSIC PLAYING]

After all, tomorrow is another day.

[MUSIC - "GONE WITH THE WIND"]

HOST: But there was a side effect to the brightness and the intensity of colors Technicolor brought to

the big screen, heat.

URICCHIO: The Technicolor process required huge amounts of light. So, again, if we're thinking about either the two-strip or three-strip process, the light had-- was-- you're basically talking about light going into the camera and being split by a prism into two or three sectors. That means you need an enormous amount of light on the set in order to pull that off.

And that means heat. So, I mean, rumor has it that the set of *The Wizard of Oz* had something like hundred degree temperatures.

HOST: With temperatures that high, actors routinely fainted and were carried off set. This was a challenge for the makeup department. Actors were frequently glossy with perspiration or even experienced melting makeup.

URICCHIO: But that's where Technicolor was really great, you know, thinking of, well, what kind of makeup forms do we need to sort of stabilize the actors' appearance.

HOST: Technicolor brought its own makeup, cameras, lights, and technicians. Natalie Kalmus, Herbert Kalmus' first wife, was Technicolor's Color Director. She was on the set for almost every color decision in a given film. And, to this day, she has more film credits to her name than anyone else in film history. In a sense, Technicolor ushered in a whole new business model to big production studios.

URICCHIO: What it brought in terms of kind of autonomy in a systems that hates any autonomy other than its own? The studios were obsessive about control. Here's an entity that was able to come in and to make demands about makeup, lighting.

At the same time, they were able to co-brand. Their technicians used to wear like jumpsuits. The cameras were massive, but they were the Technicolor camera.

HOST: And Technicolor never let their cameras out of their control. Studios that wanted Technicolor's signature punchy colors did not have to invest in costly equipment, though.

URICCHIO: Technicolor solved that problem by saying, we're not even going to sell you the equipment. We're going to rent to you the equipment. And we're going to rent you the technicians to make it happen. And we're going to guarantee that the color is great. You know, the studios hated that. They wanted to own the equipment.

But being in control of the production pipeline from shooting all the way through post-production, that gave them the ability to guarantee an outcome, a good color outcome. So the studios, in that sense, were willing to make some concessions. That really is at odds with the whole way Hollywood works, and a real testament to their vision and power as a company.

[MUSIC PLAYING]

HOST: In 1960, Herbert Kalmus sold Technicolor to a more diversified company. Comstock had left two years earlier, and no records remain on Westcott's departure.

Today, the company continues to be a bustling powerhouse with a broadened focus beyond color to sound production, animation, post-production, Virtual Reality, and archival restoration. In 2015, the company celebrated its centennial anniversary.

In its heyday, color by Technicolor promised moviegoers a hyper-real cinematic experience where they could escape reality.

URICCHIO: Something like Marilyn Monroe in *Gentlemen Prefer Blondes,* I mean, it's just striking in that film. The color of her dresses. That scene, that wonderful dancing, *Diamonds Are a Girl's Best Friend,* where she's in that scarlet silk dress and a bunch of guys in tuxedos and blonde hair. I mean, it's just iconic. It becomes iconic.

[MUSIC - MARILYN MONROE, "DIAMONDS ARE A GIRL'S BEST FRIEND"]

MARILYN MONROE: (SINGING) --at the end. But square cut or pear shape, these rocks don't lose their shape. Diamonds are a girl's best friend. Diamonds are a--

HOST: Thousands of films have been produced with color by Technicolor. And many believe that the MIT factor was key to success. In fact, a handful of MIT alumni work for the company today.

URICCHIO: I think MIT's great potential, great power is that it's able to sort of broker technology in culturally cutting-edge ways.

[MUSIC PLAYING]

HOST: What are your favorite Technicolor films? Tweet us your thoughts on this episode to @mit_alumni.

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