WILD HOPE: MISSION IMPOSSIBLE

	TIME CODE	VIDEO	AUDIO
1.	00:00	The Carbon Ranch house at sunrise **TITLE** Emmet, Arkansas The Carbon Ranch PAT BROWN walking on the ranch	**PAT BROWN:** I feel like one of the biggest problems that limits individuals is that they label themselves in a way that limits the possibilities - counting themselves out, because I'm not the right person for the job from the get-go. And, I never do that.
2.	00:38	PAT BROWN running on the ranch **JOE DERISI OC**	**JOE DERISI:** Pat Brown was an incredibly well-established, preeminent scientist at Stanford University biochemistry department and one of the best in the world.
3.	00:47	Pat Brown on the Carbon Ranch **DAN HOGAN OC**	**DAN HOGAN:** The concept of him leaving all that was pretty shocking.
4.	00:53	Pat Brown on Carbon Ranch	**PAT BROWN:** The juiciest looking morsel here….Do not use this spoon.
5.	01:03	**Sue Klapholz OC**	**SUE KLAPHOLZ:** He decided he wanted to work on something that was really of importance to the world.
6.	01:11	Pat Brown on the Carbon Ranch	**MARK KRASNOW:** He thought about what's the most impactful question that he can pursue.
7.	01:17	Cattle Farm **DAN HOGAN OC**	**DAN HOGAN:** When Pat realized if we can replace animals in the food system, we can have a massive impact on the planet.
8.	01:27	**Joe Derisi OC**	**JOSEPH DERISI:** I heard that he wanted to start a plant-based meat company.

			JOSEPH DERISI: When I first heard about the idea I thought, that is nuts. But if it's Pat Brown he might actually do it.
9.	01:39	**Title:** CBS Sunday Morning clip	**ARCHIVAL NARRATOR:** *This is the Impossible Burger.*
10.	01:41	**CBS Sunday Morning clip**	**ALLISON AUBREY:** *So, do you think you're gonna be putting the conventional meat business out of business?* **PAT BROWN:** *That's the whole purpose of Impossible Foods.*
11.	01:51	Drone shot of ranch	**MARK KRASNOW:** And now, his first step beyond Impossible Foods is to take over an animal farming ranch. What?
12.	02:05	Trees being cleared aerial **MIKE EISEN OC** Trees being planted on Carbon Ranch	**MIKE EISEN:** We are experts at turning forests into ranches. We do not really know how to turn ranches into forests.
13.	02:12	**PAT BROWN OC** PAT BROWN flying drone Drone shot of CARBON RANCH	**PAT BROWN:** Of course, I'm not an expert on any of this, but it doesn't deter me because I feel like, okay, I'm not an expert. Well, first of all, nobody else is an expert anyway. And secondly, that's the most fun kind of project is one where, you know it's doable. Okay. Um, but you don't know how to do it. And, uh, and that's, that's what this is all about here. Yeah.
14.	02:38	**TITLE** WILD HOPE MISSION IMPOSSIBLE	
15.	02:47	PAT BROWN walking through woods	**NARRATOR:**

		Clip from The Unchained Goddess	The long path that would eventually lead Pat to Arkansas began in the 1950s – a time when a few scientists were just beginning to raise concerns about greenhouse gases.
16.	02:59	Clip from The Unchained Goddess **LOWER THIRD:** The Unchained Goddess 1958 - an educational film 1958	**SCIENTIST CHARACTER:** Even now, man may be unwittingly changing the world's climate through the waste products of his civilization. Due to our release through factories and automobiles every year of more than six billion tons of carbon dioxide, our atmosphere seems to be getting warmer. **RICHARD CARLSON CHARACTER:** This is bad? **SCIENTIST CHARACTER:** Well, it's been calculated that a few degrees rise in the earth's temperature would melt the polar ice caps.
17.	03:27	Young PAT BROWN holding flowers	**NARRATOR:** In those days, young Pat Brown was just beginning to explore the world around him.
18.	03:33	**PAT BROWN OC** PAT BROWN with sibling and father Mother of PAT BROWN holding baby in lap with PAT BROWN and brother **PAT BROWN OC** Mother of PAT BROWN in military uniform holding plush bulldog in lap Father of PAT BROWN in military uniform	**PAT BROWN:** My folks were so great. They were so great. Both of them were incredibly curious and about the world and engaged in the world in World War II. Both of them were in WWII. My mom didn't fight in any battles being, being a woman in that era, but she was in the Marines. My dad was in the army, and he was captured by the Germans and in a POW camp. And he weighed less than a hundred pounds when he got out. I think partly because of that experience, he, um, joined the CIA. So he worked for the CIA for his entire career.

19.	04:10	Group family photo **PAT BROWN OC**	**PAT BROWN:** I had six siblings. I had four brothers and two sisters. So, it was a big family.
20.	04:19	Young PAT BROWN with siblings and mother Young PAT BROWN with siblings in Paris **RICHARD BROWN OC** **LOWER THIRD** Richard Brown Pat's Brother	**RICHARD BROWN:** Pat was number two. I was number four. I think the, the main thing was that we were free at a very early age to be in charge of what we're doing, unless we got in too much trouble.
21.	04:29	Young PAT BROWN looking mischievous	**RICHARD BROWN:** Pat was probably the biggest troublemaker.
22.	04:30	Vintage film of kids playing in neighborhood	**PAT BROWN:** In that era, especially if you had a big family, kids were very free range. It's basically, you go out the door at some time in the morning, nobody asks, nobody notices. And you come back hopefully alive, uh, um, you know, at the end of the day.
23.	04:48	Group family photo Family photo at Hong Kong airport	**RICHARD BROWN:** We moved quite a bit, Washington, Paris, Falls Church, Virginia, three years, lived in Taipei, Taiwan, four years.
24.	04:56	**PAT BROWN OC** Vintage film of kids playing British Bulldog	**PAT BROWN:** My favorite game when I was in Taiwan, it was called British Bulldog. Basically, the game consists of, you have one person with like 25 boys trying to chase them down and tackle them I could have been a professional British Bulldog player, seriously. Because I wasn't big, but-I was fast and, and slippery and determined.
25.	05:25	Young PAT BROWN with binoculars around his neck	**PAT BROWN:**

		PAT BROWN OC	I would say a very defining characteristic was curiosity. I just really wanted to understand everything I encountered. And I was particularly interested in the natural world.
26.	05:39	**RICHARD BROWN OC** Earth day film from 1970s EUELL GIBBONS 'Stalking the Wild Asparagus' book cover	**RICHARD BROWN:** I remember Pat organizing events at the high school for the initial Earth Day. Around the same time he was reading Euell Gibbons' Stalking the Wild Asparagus.
27.	05:50	EUELL GIBBONS Grape Nuts commercial **LOWER THIRD** Commercial 1974	**EUELL GIBBONS:** Ever eat a pine tree? Many parts are edible.
28.	05:53	**RICHARD BROWN OC**	**RICHARD BROWN:** And going out in the woods and looking for, uh, wild onions or things that might be edible.
29.	05:59	EUELL GIBBONS Grape Nuts commercial	**EUELL GIBBONS:** It's naturally sweet taste reminds me of Wild Hickory nuts.
30.	06:02	**PAT BROWN OC** Photo PAT BROWN with glasses and rugby shirt	**PAT BROWN:** A core feature of my parents is that it was that you're expected to be devoting yourself to making the world better in some way. And so I felt like, okay, an obvious thing to do was to go into medicine.
31.	06:17	Vintage film of students in auditorium room **SUE KLAPHOLZ OC** **LOWER THIRD** Sue Klapholz Pat's Wife Early Impossible Foods scientist	**SUE KLAPHOLZ:** Pat and I met, uh, when we were in graduate school at the University of Chicago. I was in a PhD program and in genetics, and he was an MD PhD student in biochemistry. We got to know each other. We had a similar circle of friends.

		Photos of PAT BROWN and SUE KLAPHOLZ from the 1970s PAT BROWN and SUE KLAPHOLZ wedding photo	
32.	06:33	**MARK KRASNOW OC** PAT BROWN and SUE KLAPHOLZ on the train **LOWER THIRD:** Mark Krasnow Biochemist, Stanford University	**MARK KRASNOW:** He was a couple years ahead of me. Already at that stage it was clear that he was super creative, super talented at the bench, super passionate about his, the, the research that he was doing and and extremely capable of, of, of, of doing that research.
33.	06:51	PAT BROWN and SUE KLAPHOLZ in school Photo of PAT BROWN with big hair Photo of MICHAEL BISHOP and HAROLD VARMUS Photos of PAT BROWN and SUE KLAPHOLZ holding twins	**NARRATOR:** Trained as a pediatrician and a biochemist, Pat had a choice to make – medicine or science? He decided to accept a post-doctoral research fellowship studying viruses in the lab of future Nobel Prize winners Michael Bishop and Harold Varmus. He and Sue moved to San Francisco. It was 1985.
34.	07:16	People protesting in SF streets Person or people with AIDS Archival footage of candlelight march	**PAT BROWN:** The AIDS epidemic epidemic was absolutely exploding in San Francisco. It was clearly, uh, an important problem from a medical and public health perspective. It was devastating for a lot of people in the city.
35.	07:31	People protesting in SF streets	**SUE KRASNOW:** And it was just very sad, you know, and there was this awareness that there weren't drugs to treat AIDS.
36.	07:39	**PAT BROWN OC**	**PAT BROWN:** I was working on trying to understand a fundamental part of how the HIV virus reproduces itself. And

			nobody knew how that happened. And so I said, okay, I'm gonna work on that.
37.	07:54	**PAT BROWN OC** Archive Footage science labs	**PAT BROWN:** I had an idea for how to get it to work in a test tube. Because once you can do that, then you can start picking it apart in molecular detail. **PAT BROWN:** If I told you some of the time I spent, you'd say like, that sounds like the most boring thing I could possibly imagine. But when you're doing these really boring things, but the bigger picture is it's driving you, is, there's something exciting. If you can get through it, you know, you're, it's fun and you're motivated.
38.	08:22	Archive Footage science labs	**PAT BROWN:** Finally, after one year I had confirmed, this is exactly, no question, this had all the molecular hallmarks of a retrovirus insertion and basically now you can test for drugs that block this reaction.
39.	08:39	Archive HIV virus Photo of PAT BROWN with feet up on desk **LOWER THIRD** Dan Hogan Biochemist	**DAN HOGAN:** Figuring out how HIV integrates early in his career, gave him that sort of self-belief that, you know, he could solve complicated problems. And even if, you know, there they're long stretches where things aren't working or you don't know how you're gonna get there.
40.	08:58	Photo of PAT BROWN young Photo of BROWN LAB website Photo of PAT BROWN with lab students	**NARRATOR:** In 1990s, Pat joined the biomedical faculty at Stanford University. For the first time, he'd be putting together his own lab.
41.	09:10	Photo of PAT BROWN with young colleague	**MARK KRASNOW:** He could do anything he wanted, Then he came up with this idea that transformed genomics.

42.	09:19	Cold Spring Harbor Lab Archive Photo DNA Microarray	**NARRATOR:** In those days, scientists were largely limited to studying genes one at a time. Then, Pat's lab invented the DNA microarray.
43.	09:31	Cold Spring Harbor Laboratory Pat Speaking on Microarrays Archive	**PAT BROWN:** We realized that the microarrays could be used to look at the whole genome, all the genes in the genome.
44.	09:38	Cold Spring Harbor Laboratory Pat Speaking on Microarrays Archive	**NARRATOR:** Pat's idea was to attach the DNA from thousands of genes to tiny spots on a microscope slide and then use florescent dyes to reveal which genes were active lighting up the spots with different colors.
45.	09:51	Cold Spring Harbor Laboratory Pat Speaking on Microarrays Archive	**PAT BROWN:** This gives us a way to, whenever we look at a cell or a tissue sample, to recognize which genes are being used and how they are being used in a particular cell or tissue or process.
46.	10:03	Cold Spring Harbor Laboratory Pat Speaking on Microarrays Archive	**NARRATOR:** The DNA microarray became a powerful tool in understanding the genetic origins and behaviors of certain cancers, including leukemia, lymphoma, and breast cancer.
47.	10:18	**MIKE EISEN OC** **LOWER THIRD:** Mike Eisen Molecular Biologist, UC Berkeley	**MIKE EISEN:** You know, the breakthrough was really just looking at the world and seeing a problem. Saying, look, we can do this. Let's just go into the lab for a year or two or whatever it takes and figure out how to do it right.
48.	10:29	Photo PAT BROWN, MIKE EISEN, AND HAROLD VARMUS on Genome Technology Magazine Cover	**NARRATOR:** Some years later, Pat became outraged at the way established scientific journals restricted access to important research.

			So, along with Harold Varmus and Mike Eisen, he created a free, open-access website. It's called the Public Library of Science, or PLOS.
49.	**10:48**	Photo of PAT BROWN with PLOS shirt **JOE DERISI OC** **LOWER THIRD:** **Joe DeRisi** **Biochemist, UCSF**	**JOE DERISI:** His ability to start something up like the PLOS series of journals, I think really speaks to a subversive nature that is incredibly productive.
50.	10:59	Photo of PAT BROWN with UC Santa Barbara Shirt	**NARRATOR:** By 2009 Pat Brown was at the top of his profession.
51.	11:04	Photo of PAT BROWN with lab students **PAT BROWN OC**	**PAT BROWN:** I'd been at Stanford for, almost 25 years. I absolutely loved my job. And I never imagined really doing anything else. And then I had my sabbatical.
52.	11:21	**PAT BROWN OC**	**PAT BROWN:** What I wanted to do on the sabbatical, was to figure out what was the most important thing I could do to make the best possible world? (laugh)
53.	11:38	**SUE KLAPHOLZ OC** Archival footage of field burning Archival footage of hurricane	**SUE KLAPHOLZ:** He decided he wanted to work on something that was really, really of importance to the Earth, to the world. And he decided that global warming was it.
54.	11:48	Archival footage of devestation	**NARRATOR:** Researching the causes of climate change, Pat started by studying the role of fossil fuels. But soon, an unexpected culprit caught his eye.
55.	12:00	**PAT BROWN OC**	**PAT BROWN:** I was looking at a bunch of sources and there was published evidence out there that animal agriculture was a big problem for climate. And there was very little awareness of this as a problem in the world.

56.	12:19	**Archival footage:** Cattle on crowded field Clearing the land Burning piles of timber Trucks transporting cattle Cattle feeding in crowded cattle pens Butchering houses Refrigerator trucks transporting meat Cattle crowded in pen	**NARRATOR:** Calculating animal agriculture's part in greenhouse gas emissions means adding up each step of the process, -From clearing the land, which often involves burning carbon-rich forests - to growing and harvesting feed crops - to fattening and butchering the animals And as part of their digestion process cows release huge amounts of methane, a heat-trapping gas 28 times more potent than carbon dioxide.
57.	12:52	**GRAPHIC: Animal agriculture's surprising role in greenhouse gasses**	**PAT BROWN:** It was responsible for more greenhouse gas emissions than the entire transportation sector. Every car, bus, train, plane, boat, on earth. combined. Okay. A major greenhouse gas emitter.
58.	13:10		**NARRATOR:** But our demand for meat was fueling a crisis <u>on the ground</u> that alarmed Pat even more.
59.	13:15	**PAT BROWN OC**	**PAT BROWN:** When I started looking at biodiversity, then I realized, okay, that's probably an even worse problem due to the huge land footprint of animal agriculture.
60.	13:26	**Graphic: Land use on the planet**	**NARRATOR:** Of all the ice-free land on earth, the amount used to raise animals for food is 40%.
61.	13:35	**PAT BROWN OC** Montague - diverse species	**PAT BROWN:** And this is at the expense of the biodiverse ecosystems that live there. The total number of wild mammals, birds, reptiles, amphibians, and fish living on earth, each of them is, less than a third what it was 50 years ago. If that doesn't, like, send a chill down your spine, you're, you're not paying attention.

62.	13:57	**GRAPHIC: Biomass of Mammals on Earth / cows replacing wild animals**	**NARRATOR:** Comparing the relative biomass of all the mammals on earth…scientists estimate the planet is made up of: humans? 36% livestock? 60% - mostly cows and all wild mammals combined? just 4%
63.	14:22	**DAN HOGAN OC** Cows, pigs, chickens	**DAN HOGAN:** We've basically replaced, um, wildlife with cows and pigs and chickens.
64.	14:34	Pigs in crowded pen Cattle in crowded quarters **SUE KLAPHOLZ OC**	**SUE KLAPHOLZ:** So, the more he researched it and realized that animal agriculture was terrible for the planet, he started thinking about how he might have an impact there, what he could do to change things.
65.	14:46	**PAT BROWN OC** Archive of deforestation	**PAT BROWN:** My feeling was, the environmental impact of the animal ag industry was completely unacceptable, and no one was seriously trying to make it go away completely. And, um, so that's what I decided I was gonna do.
66.	15:02	**DAN HOGAN OC**	**DAN HOGAN:** And so then, okay, he started thinking, telling people not to eat animals isn't gonna work. What we need to do is find a more efficient technology to make meat. That's sort of where it all clicked for him, I think.
67.	15:15	**PAT BROWN OC** Archive Footage Meat in Test Tube **PAT BROWN OC**	**PAT BROWN:** I realized that the most important scientific challenge in the world is figuring out what makes meat taste like meat. If you can figure out what makes meat taste like meat, and find the necessary components to deliver that, you basically save us from the two biggest threats the planet is facing.
68.	15:39	Archive Footage Testing Meat **PAT BROWN OC**	**PAT BROWN:**

			And I was pretty confident that it would be possible to make cheaper, more delicious, healthier, vastly more sustainable meat directly from plants.
69.	15:50	PAT BROWN researching on laptop 'On Food And Cooking' book cover	**NARRATOR:** Pat began reaching out to experts. One of those was Harold McGee.
70.	15:57	**HAROLD MCGEE OC** Photo of PAT BROWN'S book cover	**HAROLD MCGEE:** Pat thought of contacting me because beginning in the 1970s, I started writing about the, the science of cooking.
71.	16:06	Black and white film of scientists working in lab Glacier halving from Unchained Goddess film	**HAROLD MCGEE:** His idea was if he could find a way to make something that was as delicious and appealing as meat, but without the environmental costs, that would be a project worth doing.
72.	16:22	**HAROLD MCGEE OC**	**HAROLD MCGEE:** So it was hugely ambitious because, uh, how are you gonna do that? (laughs)
73.	16:27	**PAT BROWN OC**	**PAT BROWN:** You need optimism to be a scientist because you don't know you're going in the right direction until you get there, basically.
74.	16:34	**PAT BROWN OC**	**PAT BROWN:** It's much more interesting if you're doing something in science that everybody thinks is crazy. So, you know, bring it on.
75.	16:42	Scientist holds up beakers filled with liquid in lab Scientists cooking burger patty in a pan	**NARRATOR:** Pat had a hunch that a single molecule might be key to unlocking the secret of meat's flavor.
76.	16:49	Heme animation **PAT BROWN OC**	**PAT BROWN:** Right from the start, I was interested in a red molecule called heme. Heme is one of the most essential molecules for all forms of life. Literally, I

		Pat holding up Heme model	think you could say it's essential for all life on Earth. It's what carries oxygen in your blood from your lungs to all the tissues. It's what makes your blood red and it's what makes muscle red or pink and so forth. Actually, I have a model of heme here. This is what heme molecule looks like. These are oxygen atoms. These are ni, blue is nitrogen, white is hydrogen, black is carbon. Um, but it's a, it's a, it's kind of a beautiful molecule, I think just in its own right.
77.	17:29	**SUE KLAPHOLZ OC**	**SUE KLAPHOLZ:** It's part of myoglobin, it's part of hemoglobin. So when you think of blood and meat, you know, you think heme is, is really important.
78.	17:37	**PAT BROWN OC** Pool ball break Fireworks in night sky	**PAT BROWN:** Heme is also one of the best catalysts. And a catalyst is a molecule that helps cause chemical reactions to happen.
79.	17:49	**PAT BROWN OC** Heme animation	**PAT BROWN:** People care about the color, but I suspected it was gonna be the critical catalyst for flavor, because first of all, it has a bloody taste.
80.	17:57	**PAT BROWN OC** Heme animation	**PAT BROWN:** And so, it's like screaming at you that one of the best catalysts in nature, is one of the most abundant molecules in meat. And so, I thought, I bet heme is the key catalyst for meat flavor.
81.	18:14	PAT BROWN researching on laptop	**NARRATOR:** At first, Pat was hoping to hand his idea off to someone more qualified to take it on.
82.	18:19	**SUE KLAPHOLZ OC**	**SUE KLAPHOLZ:** The idea was to find someone who might carry out his work or who he could work with to carry out his ideas. And then it got really complicated there with talks with lawyers and contracts and, you know, he didn't want that. He just wanted it to happen. And so, as he often feels that if, if he wants something to

			happen, he has to do it himself. So he started looking into founding a company.
83.	18:40	Photo of PAT BROWN wearing 'Choose Earth' shirt	**NARRATOR:** Pat never returned from his sabbatical. And his departure from Stanford shocked the scientific community.
84.	18:48	**JOE DERISI OC** Photo of Pat holding pipette	**JOE DERISI:** When Pat left his lab he's an incredibly well-established, preeminent scientist at Stanford University's biochemistry department, one of the best in the world. One of the highest levels of scientific achievement one can attain.
85.	19:02	**DAN HOGAN OC** White board with sketches in PAT BROWN office	**DAN HOGAN:** You know, the concept of him leaving all that I think for almost everyone was pretty shocking.
86.	19:11	**MIKE EISEN OC** Photos of PAT BROWN working	**MIKE EISEN:** Of all the people, if you had told me 10 years earlier that Pat was gonna end up starting a company like that, I would've laughed at.
87.	19:18	Photos of PAT BROWN working Photo of PAT BROWN pitching investors	**NARRATOR:** Intent on raising enough cash to put together the kind of research team that could develop his ideas and take on the meat industry, Pat started pitching his vision to venture capitalists in nearby Silicon Valley.
88.	19:32	**RACHEL KONRAD OC** **LOWER THIRD** Rachel Konrad, Former Chief Communications Officer, Impossible Foods Photo of PAT BROWN pitching investors	**RACHEL KONRAD:** I mean, it is almost unheard of that in your late fifties, right? You would walk over to Sandhill Road and you would give a presentation that you just whip outta your MacBook, right? And you get funding, and at 57 years old, you start a company that just does not happen, right?

89.	19:52	**SUE KLAPHOLZ OC** **DAN HOGAN OC** **MARK KRASNOW OC**	**SUE KLAPHOLZ:** Blasting ahead. That was one of Pat's mottos. **DAN HOGAN:** Blast ahead. **MARK KRASNOW:** Blast ahead.
90.	20:00	Vintage film of boys playing British Bulldog **PAT BROWN OC**	**PAT BROWN:** Blast ahead. And it doesn't mean blow things up and so forth. It just means whatever is in your way you go around it, you go through it, you go over it, you just keep blasting ahead. You get knocked down, you blast ahead, you know?
91.	20:20	**PAT BROWN OC**	**PAT BROWN:** I don't know. I just love that expression. It, to me, it just conveys a lot of the joy and determination of being a scientist, yeah.
92.	20:30	Photo of PAT BROWN pitching Impossible Burger	**NARRATOR:** As a complete outsider, Pat was able to approach the food industry from a different angle.
93.	20:36	**MARK KRASNOW OC**	**MARK KRASNOW:** This was another revolution that Pat was kind of planning out, which was the food technology revolution.
94.	20:44	Archival Footage PAT BROWN on Bloomberg discussing Impossible	**NARRATOR:** And nothing grabs Silicon Valley investors' attention like the words technology revolution.
95.	20:51	**RACHEL KONRAD OC**	**RACHEL KONRAD:** Pat learned that really fast. Obviously, under Pat Brown, Impossible Foods raised more than $2 billion.
96.	20:58	Pat Brown at EAT Forum 2019	**PAT BROWN:** *The critical thing to investors is, this is a, at the time, one and a half trillion dollar global market that's being served by a prehistoric technology that hasn't*

			improved in millennia and is demonstrably one of the least efficient technologies on Earth.
97.	21:13	JOE DERISI OC	**JOE DERISI:** He's applying his skills where he can on a problem he thinks is incredibly significant. Making proteins by growing cows. I mean, it's kind of an insane old technology that basically doesn't even work very well.
98.	21:27	**Graphic: Inefficiency of using animals for calories**	**NARRATOR:** An average cow will need to consume 25 pounds of feed to produce one pound of edible beef.
99.	21:36	**Graphic: Agricultural Land Use**	**NARRATION:** Studies show 75% of the agricultural land on Earth is committed to raising livestock and using new food technology to get all our calories and protein from plants, would free up land the size of North America and Brazil combined.
100.	21:55	Black and white archival of people eating hamburgers	**NARRATOR:** With funding pouring in, Pat decided to put heme to the test on America's most iconic meat product.
101.	22:04	**PAT BROWN OC**	**PAT BROWN:** Why a burger? Something very close to half of all beef produced in the US is sold as ground beef.
102.	22:12	**PAT BROWN OC**	**PAT BROWN:** It was important just for, for business purposes, um, but also for kind of, uh, you know, uh, sending a shot across the bow of the animal-based food industry in a way.
103.	22:23	Archival Film from the 1970's - Barbeque **JOSEPH DERISI OC**	**ARCHIVAL NARRATOR:** *Juicy broiled hamburgers with just the right touch of charcoal flavor from the fire have become an American institution.* **JOSEPH DERISI:**

			I recall Pat explaining to me that people like their hamburgers.
104.	22:35	Industrial film from 1970s of barbecuing	**ARCHIVAL NARRATOR:** *Just the elegant aroma of that ground beef picking up added flavor from the fire is enough to give everybody the firm idea that it's time to eat.*
105.	22:44	Family eating dinner Guy leaning over counter to grab tray with burger on it Cooked patties in a pile off the assembly line **JOSEPH DERISI OC**	**JOSEPH DERISI:** And so if you really wanna affect that part of the food economy, you have to provide a product that's just as good, just as delicious, cooks the same way, smells the same way, but doesn't have the climate impact that growing protein from a cow does.
106.	23:01	**SUE KLAPHOLZ OC**	**SUE KLAPHOLZ:** It has to handle like meat. When you pick it up, it should feel like, like raw, raw beef.
107.	23:07	**HAROLD MCGEE OC** Burgers on the grill	**HAROLD MCGEE:** And then you put it in the pan and you start to cook it and it had to change colors just the way a beef burger does. And develop all those wonderful aromas.
108.	23:18	JOE DERISI OC	**JOE DERISI:** That challenge is huge, but it's also all biochemistry.
109.	23:23	Heme animation	**NARRATOR:** While meat is loaded with heme, the same molecule is also present in plants.
110.	23:31	Plants on newspaper Photo Ariel and colleague	**NARRATOR:** Now the question became: Which plants would provide enough heme to begin his experiment? Pat started doing research on legumes, like soybeans.
111.	23:42	**DAN HOGAN OC** Soy root nodules	**DAN HOGAN:** I do remember one time where I came into his office, I remember his shoes up on the desk, sort of like leaning back in his chair, reading some papers: What are you reading? He's like, Oh, I'm reading about soy root nodules. Okay, why? (laughs)

112.	23:58	**Impossible Foods graphic animation showing root nodules and leghemoglobin**	**PAT BROWN:** What I remembered was that they have a very high concentration of a protein called leghemoglobin. And I think I remembered it because I always thought the name was really funny.
113.	24:07	Foghorn Leghorn cartoon	**PAT BROWN:** There was this old-school cartoon character called Foghorn Leghorn. And every time I hear a leghemoglobin, I kind of (laughs) do a double take.
114.	24:19	**SUE KLAPHOLZ OC** Root nodules	**SUE KLAPHOLZ:** He has a great memory for things he's learned, and he's very good at putting things together. He knew that root nodules were gonna be a good source of heme.
115.	24:31	**PAT BROWN OC** Jerry-rigged street sweeper images footage of early Impossible Foods experiment	**PAT BROWN:** Two or three months after Impossible Food started, we were in southern Minnesota in soybean country, with a friendly farmer,-harvesting soybean root nodules.
116.	24:42	**ARIEL KLAPHOLZ-BROWN OC** **LOWER THIRD** Ariel Klapholz-Brown Pat's Daughter Early Impossible Foods Employee Still of broom and street sweeper experiment	**ARIEL KLAPHOLZ-BROWN:** Nodules are like little balls along the roots and they're pretty delicate, so there's not already something in place in the farming industry to take them off of the roots and keep them intact, but also get rid of the, the waste.
117.	24:57	Stills and footage of early Impossible Foods broom and street sweeper experiment	**ARIEL KLAPHOLZ-BROWN:** And that, they ended up using a street sweeper for. They basically rigged it so that you could put plants and roots down a chute and then it would go through these rolling bristles and sort of brush off the nodules, but not bring the root with it. So, you had a lot of dirt and a lot of nodules and [laughs] slowly collected enough to, um, take home and purify.

118.	25:23	Archive people testing burgers	**NARRATOR:** Taste tests in the lab confirmed Pat's hunch. Adding heme to plant-based materials gave them a meat-like taste.
119.	25:32	**Archival cartoon of butcher and guy in bow tie at conveyor belt table smelling meat**	**HAROLD MCGEE:** It took Pat thinking from the ground up. And asking very basic questions about what meat is and how its flavors developed to realize that heme was actually crucial in the generation of the aromas that we love in beef and meats in general.
120.	25:52	**Harold McGee OC**	**HAROLD MCGEE:** So right off the bat, he'd come up with something that the meat industry had never realized about what makes their product delicious.
121.	26:00	Photo of Pat's Lab Archive of Root Nodules	**NARRATOR:** But how to make enough heme? Street sweepers and soy nodules weren't going to do it.
122.	26:06	**PAT BROWN OC**	**PAT BROWN:** We need to figure out how, how we can make it at a very massive scale and cheaply.
123.	26:13	Root nodules Heme in test tube and petri dish Archive Workers in Impossible Lab	**NARRATOR:** Eventually, the team came up with a plan to insert the soy DNA into yeast cells. The yeast could then be fermented to produce the massive amounts of heme needed to keep up with demand. Genetically modified organisms are a commonly used tool in the US food industry, including in the production of most cheeses.
124.	26:33	CBS news profile of Impossible Foods	**NARRATOR:** Getting the taste right was one huge hurdle. But there were many other challenges confronting the burger-making teams, and they all had to be faced simultaneously.
125.	26:44	**ARIEL KLAPHOLZ-BROWN OC** Petri dishes and Impossible Foods employees in lab	**ARIEL KLAPHOLZ-BROWN:** We were kind of reverse engineering the burger. So, we thought of it in its different components, the soft connective tissue, the lean tissue, the flavor, the

			juice, basically, um, the adipose tissue - fat. And then thought about how to best recreate each of those tissues, combine them, and then hopefully we'd have something that was like a ground beef.
126.	27:09	Impossible Foods Animation **SUE KLAPHOLZ OC** A/B tests of Impossible Burger	**SUE KLAPHOLZ:** So many aspects needed to be right. So, you could imagine maybe, uh, somebody puts together a prototype of beef that looks just like beef. Or you try to make it into a patty and it just disintegrates when you cook it. So those are some of the earlier issues.
127.	27:27	**RACHEL KONRAD OC** Heme being mixed with material in a bowl in a lab	**RACHEL KONRAD:** When I first joined in 2016, we had a product that, let's be very, very clear, it was really subpar. It was this gluten-based wheat burger, right?
128.	27:39	**RACHEL KONRAD OC** Heme being mixed with material in a bowl in a lab	**RACHEL KONRAD:** It would fall apart effectively, um, under almost any cooking circumstance.
129.	27:44	**PAT BROWN OC** Small patties on a big sheet, Impossible ground meat in a bowl	**PAT BROWN:** You know, in the first month we made patties just to get a sense of: How far are we from anything close to what we want to make? Well, really far, okay?
130.	27:54	**RACHEL KONRAD OC** Patty being measured, weighed on a scale	**RACHEL KONRAD:** The product wasn't nearly the, the sort of consistency - didn’t have the chew down that true meat lovers, loved. So, the team iterated and iterated.
131.	28:09	Photo of ARIEL in lab wearing T-shirt with cow on it **ARIEL KLAPHOLZ-BROWN OC**	**ARIEL KLAPHOLZ-BROWN:** I was, I think optimistically skeptical (laugh), because it really took a, a long time for it to turn into something viable. Um, but it seemed like an amazing idea. So, I think everyone was just putting a lot of faith behind the idea. That attitude is kind of what kept us propelling forward.

132.	28:32	**RACHEL KONRAD OC** Archival Footage of Patties on a grill Archival Footage Impossible Lab	**RACHEL KONRAD:** So by the fall of 2018, the scientists approached me and they were like. Hey, we, we want you to try this, product, unlike the 1.0 Wheat Burger, the 2.0 burger was made with soy, which has much better consistency. And so the moment I tasted that, I was like, whoa, this is a huge opportunity. And it was this mega hit right from the beginning,
	29:02	CBS Sunday Morning Clip	**NARRATOR:** *This is the Impossible Burger.* **WOMAN IN STADIUM:** *It doesn't taste like plant.* **NARRATOR:** *So it tastests like the real thing?* **WOMAN IN STADIUM:** *It does. I'm spooked.*
133.	29:11	Lower Third: The Glenn Beck Program	**STU BURGUIRE:** *Burger A is the Impossible Burger* **GLENN BECK:** *That is insane!* **STU BURGUIRE:** *Isn't that insane?* **PAT GRAY:** *That's amazing!* **STU BURGUIRE:** *I'm shocked that both of you went with the wrong one.* **GLENN BECK:** *That is amazing!* **GLENN BECK:** *We are anti-fake food. We are anti-vegan stuff. We both hate vegetables. And for that to fool, and I'm a rancher!*

134.	29:34	**RACHEL KONRAD OC** Archival Photo of Impossible Whopper	**RACHEL KONRAD:** OMG it was so much fun. Especially the launch of Burger King.
135.	29:39	**Clip 1083 CNN report on Impossible Whopper** **Lower Third:** **Audio Courtesy of CNN** Archival Photo of Impossible Whopper	**CNN anchor:** *This is not an April Fools' joke. Burger King announced Monday it would launch the Impossible Whopper, made with plant based patties from Impossible Foods, this week.*
136.	29:49	**PAT BROWN OC**	**PAT BROWN:** Launching into Burger King was a huge deal for us.
	29:53	Archival News Headlines TWP and CNN	**RACHEL KONRAD:** It really put plant-based meat on the map. It put Impossible Foods on the map.
137.	29:59		**PAT BROWN:** I feel like: we've proven this is gonna work.
138.	30:03	Archive CBS report Impossible Lab Shots of Impossible Burger Impossible Burgers being packaged	**NARRATOR:** It had taken more than seven years of trial and error, but Pat's Impossible Lab had created a nutritious plant-based burger with zero cholesterol that third party research estimates uses 96% less land, 87% less fresh water, and generates 89% fewer greenhouse gas emissions than burgers made from cows.
139.	30:28	Impossible Burgers being packaged Impossible Products **DAN HOGAN OC** Impossible Foods Lab archive footage	**DAN HOGAN:** When Burger 2.0 came out and people could get it in their hands and cook with it, I think that was an inflection point for the whole food system and we'll look back and see that this is really what set everything in motion. When I tasted that, well, I, you know, I think I maybe one of the few times I've cried after eating something, you know, 'cause you know, seven years in the making.

140.	30:53	PAT BROWN walking on The Carbon Ranch	**DAN HOGAN:** And what he had done and what he had given up to do this. And, also the implications, how big a positive impact this could have.
141.	31:06	**Close ups of people eating Impossible burgers** **RACHEL KONRAD OC**	**RACHEL KONRAD:** It doesn't require people to buy a new car or anything like that. Every single human being gets three chances a day to do the right thing by way of the environment and to not eat beef, right? That's why it's so powerful.
142.	31:19	Pat and Mike in ATV	**PAT BROWN:** Once something changes in my life it's almost immediately in the rear view mirror. If you ask me where my head is at, you know, are you living in the moment or are you living in the past? Or something like that, I'm always thinking about the future.
143.	31:36	**MARK KRASNOW OC** Pat working on The Carbon Ranch	**MARK KRASNOW:** So I, I just love it, you know, that his first step beyond, his Impossible Foods kind of corporate role (laugh). His first step beyond that is to take over (laugh) a, an, an animal farming ranch. (laugh). That's the first thing. What?
144.	31:54	**Drone shot of farm**	**NARRATOR:** Pat's strategy for saving the planet has always had two fronts: overcoming our dependence on animal meat and rewilding rural landscapes.
145.	32:06	**Drone shot of farm**	**NARRATOR:** This thousand-acre cattle ranch in western Arkansas was purchased by the non-profit Impossible Foundation. For Pat and fellow scientist Mike Eisen, it's an expirement to turn back the clock on decades of ecological damage.
146.	32:22	**PAT BROWN OC** Drone footage of ranch	**PAT BROWN:** When you look around here, as it as it exists right now, uh, it's pretty, and it feels like, in a way, wow, we're out in nature. You know? In reality, this isn't

			nature at all, okay? This is a very unnatural landscape because in order to create it, the land had to be cleared. It was almost entirely forested, this area of Arkansas.
147.	32:54	**PAT BROWN OC**	**PAT BROWN:** You're so used to thinking of, you know, uh, a cattle farm as sort of part of nature. And it's, it's, it's the destruction of nature.
148.	33:03	**DON ANDERSON OC** **Lower Third** Don Anderson Wildlife Biologist	**DON ANDERSON:** I got a phone call from, from Pat and Mike, expressing their interest on planting trees and, you know, getting a call from someone from California to do some work in Arkansas. That kind of got my interest going.
149.	33:15	DON ANDERSON WITH PAT BROWN AND MIKE EISEN looking at trees on Carbon Ranch	**PAT BROWN:** I love this. The fact that it's such a long list of trees. **DON ANDERSON:** It is a very long list. Yes. Diversity. **PAT BROWN:** I know. **DON ANDERSON:** That's excellent diversity. **PAT BROWN:** Exciting. **DON ANDERSON:** It is.
150.	33:24	**DON ANDERSON OC**	**DON ANDERSON:** I haven't met a lot of professors from California universities, so getting a totally different thought process and, and look at the land and how it's used for me has been, been very interesting.
151.	33:35	DON ANDERSON WITH PAT BROWN AND MIKE EISEN looking at tree map	**MIKE EISEN:**

			So this is higher density and these are slightly lower density. This is all gonna end up being hardwood.
152.	33:41	**DON ANDERSON OC**	**DON ANDERSON:** I'm not aware of a project exactly like this in, in the Southeast, so we're, we're glad to be a part of it.
153.	33:50	**MIKE EISEN OC**	**MIKE EISEN:** This is an experiment for us to show people how they can use their land in, in a new way and our product here is, is carbon and our product is biodiversity.
154.	34:01	**PAT BROWN OC** Archival Photos of Carbon Capture Machine	**PAT BROWN:** You know, people talk about, uh, fancy technology for carbon capture, like incredibly expensive machines that require a ton of energy to run that suck carbon outta the atmosphere and squirrel it away. This is by far the best, most proven technology on earth for capturing carbon, pulling carbon out of the atmosphere.
155.	34:31	Pat Brown looking at seedlings	**PAT BROWN:** The underlying technology, you could say photosynthesis, um, has been perfected over more than 3 billion years. It's been optimized. Okay.
156.	34:45	Mike taking photos Pat and Mike checking camera traps and footage of animals	**NARRATOR:** Before the tree planting begins, Pat and Mike are documenting as much of the existing ecology as they can. 15 camera traps and 22 microphones are capturing the sounds and images of the animals living along the edges of the pastureland.
157.	35:04	Pat Brown looking at camera trap footage	**PAT BROWN:** I'm seeing a, uh, bobcat that, um, we see quite a few of around here walking through the dry creek. Great Blue Heron.
158.	35:14	Camera Trap footage	**NARRATOR:**

			These recordings will provide baseline data to measure how things change as the forest returns.
159.	35:21	Camera Trap footage	**PAT BROWN:** We know that, um, the loss of that habitat is the biggest driver of population declines in terrestrial animal species. We're hoping that as the ecosystem recovers the numbers and diversity of wild animals here will increase. And, uh, we'll find out.
160.	35:50	PAT BROWN planting trees on the Carbon Ranch	**PAT BROWN:** This is the start. This is kind of an epic moment for this project where, basically a forest with, you know, more than 300,000 trees, is gonna grow up over the next several years. So, it'll be amazing to just watch how it all plays out. Just watch it grow up. See the biodiversity. And, what we hope to learn is what's the best way to do this, because amazingly it's really not well known at all.
161.	36:18	**Drone footage of Carbon Ranch**	**NARRATION:** One of the biggest unknowns is: in a world without cows, what happens to the people who currently raise livestock for a living - and who are a powerful part of the international economy?
162.	36:30	**PAT BROWN OC**	**PAT BROWN:** These farmers, if you're telling them to stop raising cows, they wanna know, okay, how can I be sure I'm gonna make money and make money on a reasonable timescale. And I've always felt like, okay, this is part of the problem that we, we have to solve.
163.	36:35	PAT BROWN using drone **PAT BROWN OC**	**PAT BROWN:** So, as part of this experiment, one of the things we wanna do is to develop a playbook for the farmers and ranchers. Not just how to manage the land, but how to connect to the carbon markets. This is the lidar.

164.	36:58	PAT BROWN using drone Drone footage of Carbon Ranch	**NARRATOR:** Carbon markets already exist, but in an imperfect form. Pat and Mike are anticipating a time when the market improves and carbon is seen as a resource companies and governments will pay to conserve. Using LiDAR equipped drones, they're calculating how much carbon the ranch is currently holding.
165.	37:21	Drone footage of Carbon Ranch	**PAT BROWN:** It's something we're gonna be tracking as -a way of measuring how much carbon's being captured on, on the land. I think that it could turn out that part of what makes the industry go away isn't just the competition from plant-based meat, but it's the competition from a better way to make a living.
166.	37:41	**DON ANDERSON OC**	**DON ANDERSON:** If the carbon market was to continue evolving and, and maybe the prices, uh, increased, it could have a huge impact on the, on the amount of acres that are planted in trees, uh, throughout the country.
167.	38:00	Montague of photos and footage throughout film PAT and MIKE montague around Carbon Ranch	**MIKE EISEN:** The motivation for Impossible Foods from the very beginning was to enable a different use of all of this land. It wasn't about burgers per se, it was about the, the need to use the land we currently use to, to raise cattle to help address climate and biodiversity.
168.	38:21	**MIKE EISEN OC**	**MIKE EISEN:** A hundred years ago the challenge was feeding people. Now the challenge is, um, saving the planet from the brink of destruction.
169.	38:29	**PAT BROWN OC** PAT BROWN running on Carbon Ranch	**PAT BROWN:** It's not just we need to eventually solve this problem. We need to, we need to solve it as fast as possible. And I do have this kind of like hardcore science optimism that pretty much any scientific problem can be solved. You just keep blasting ahead.

170.	38:50	**CREDITS**	