Presented in IMAX®, "Voyage of Time: The IMAX Experience" is a one-of-a-kind celebration of life and the grand history of the cosmos, transporting audiences into a vast yet up-close-and-personal journey that spans the eons from the Big Bang to the dinosaur age to our present human world … and beyond. A labor of love from one of American cinema's most acclaimed and visually exciting filmmakers, Terrence Malick ("The Thin Red Line," "The Tree of Life"), "Voyage of Time: The IMAX Experience" represents the filmmaker's first foray into documentary storytelling.

The film's panorama of awe-inspiring images will take you into the heart of monumental events never witnessed – from the birth of the stars and galaxies to the explosion of diverse life-forms on planet earth, including humankind – in immersive new ways that only IMAX can deliver.

This is a cosmic experience – a hymn to the glories of nature, life and scientific discovery – in which all the elements come together to form Malick's most original film to date.

"Voyage of Time" will be released in two unique formats: "Voyage of Time: Life's Journey," the 90-minute experience narrated by Cate Blanchett, which takes the audience on a poetic journey full of open questions, and "Voyage of Time: The IMAX Experience," a 45-minute, IMAX adventure for audiences of all ages, narrated by Brad Pitt.

IMAX Entertainment presents in association with IMAX Documentary Films Capital and Knights of Columbus.

Exclusive IMAX showings of "Voyage of Time: The IMAX Experience" begin Oct. 7.

www.imax.com/VOT

On Creating a Sensual Cinema of Science

The most beautiful thing we can experience is the mysterious. It is the source of all true art and science. He to whom the emotion is a stranger, who can no longer pause to wonder and stand wrapped in awe, is as good as dead – his eyes are closed.

– Albert Einstein

Cinema in the 21st Century moves nimbly between dramas of raw intimacy, investigative documentaries and soaring blockbuster spectacles. Terrence Malick's new film, "Voyage of Time: The IMAX Experience," attempts something outside any of these categories.

It is the thrillingly ambitious exploration of a bold idea: to use the power of the movies to merge our scientific knowledge of the universe with the indescribable mysteries and passion of art into a sensual trip that, for each person, becomes a uniquely personal discovery.

The film sets the roaming eye of the director free from the familiar boundaries of time, into the vast span of literal eons, to explore nearly 14 billion years of our universe -- and to ask the questions … rarely spoken, contemplated in private moments … that nevertheless permeate our lives:

Where did our world and its interplay of spectacular forms come from?

What does our deep past reveal about all of us and our own lives?

How did we change, adapt and survive to become who we are today?

This is a true movie-going adventure, an act of making the long-unseen seen – and also felt. For the last several decades Malick has been probing the unobvious means to give audiences this one-of-a-kind journey.

Throughout much of his life, long prior to beginning production on this film, Malick was immersing himself in studies astronomical, biological and philosophical, compiling notes and talking to professors, researchers and innovators in fast-moving fields ranging from physics to anthropology. The preparation led up to a film that had to carve out a new form from the intersections of science and art.

The story of the universe is the oldest story ever told – one that humans have been trying to fathom since Paleolithic times. But it is a narrative that, the more complex it grows, can stymy the near-focus of many storytelling tools. How can drifting stardust, tides of lava, meteor storms, dividing cells, rising forests, the permutations of species and the very patterns of life generating, struggling, evolving and thriving … speak to us, even inspire us, in the here and now?

To explore the potential, Malick and a team of close-knit creative collaborators began to experiment at the boundaries of both practical special effects and state-of-the-art visual effects. From microphotography to supercomputer-generated visualizations, the inquiry became: can we reproduce for the screen the most immense cosmological events and the most bizarre life-forms that no one ever witnessed – and do it in ways that people can relate to them, and consider their beauty, meaning and consequences from their own individual perspectives?

To set the tone, Malick handed producers Sarah Green and Nick Gonda the Einstein quote that heads these notes and the Feynman quote below:

> *Is no one inspired by our present picture of the universe? Our poets do not write about it; our artists do not try to portray this remarkable thing. The value of science remains unsung by singers: you are reduced to hearing not a song or poem, but an evening lecture about it. This is not yet a scientific age.*
>
> – Richard Feynman

"Those two sentiments really speak to Terry's sense of duty as an artist to endeavor to share nature's story in a way that doesn't numb the mind, but awakens within it a true sense of euphoria and awe," explains Gonda.

The goal was to forge a fresh and mesmerizing life story of earth, one that might capture not only the massive chronology but, equally so, the expressive magic at the core of a continual cosmic unfolding we can't easily observe, yet participate in every minute of our lives. Audiences would not be set adrift in a detached universe, but given a visceral field in which to sightsee and discover how each of us is embedded in the intricate braid of time that underlies our own every-day, personal dramas.

Thus it is that "Voyage of Time" reflects not just the creation of our world – but also its wildly swinging moods: its fierceness, strangeness and glories, its cataclysm and resilience. It is the history of life blended with the terrain of our inner lives – as the tiniest, most primitive cells mirror our own insistent drives to touch, grow, build and adapt, over and over, to ceaseless change.

***From* 'Cheese Mites' *to* 'Voyage of Time'**

For more than a century of filmmaking, science and motion pictures have been twined. From the earliest days of movie cameras, the potential of film to document – and at times to

simulate – stark reality was of tremendous scientific interest. By the early 20th Century, for the first time, science experiments once confined to witnesses in private laboratories could be captured for all to see, and even scrutinize, the results. The camera's ability to magnify and manipulate time only added to its vitality as a scientific tool. The invisible world around us was suddenly becoming imaginable, knowable, by one and all.

In 1903, a landmark film unironically entitled "Cheese Mites," created by British cinema pioneer Charles Urban and zoologist Francis Martin Duncan, provided the world's first moving images of the never-before-seen microbial world – inside a piece of Stilton cheese. At the time, it drew thunderous applause from highly entertained London dancehall audiences who had never experienced anything like it. This was followed by unlikely hit shorts from naturalist F. Percy Smith, including "The Balancing Bluebottle" and "The Acrobatic Fly."

The nature film gained mass popularity in the 1920s with Charles Urban's "Secrets of Nature" – a series of 144 under-15-minute films created by amateur science enthusiasts on subjects ranging literally from the birds and the bees to marine life. This creative explosion of films utilized such then-novel visualization ideas as stop-motion photography, micro-cinematography and animation.

In circular fashion, science was, at the same time, becoming an early theme of fictional cinema – perhaps because both thrived on a love of experimentation and unexpected discovery, as well as curiosity about humanity's direction. From George Melies' 1902 "Le Voyage Dans La Lune," cinema inspired artists to envision the unfathomed cosmos beyond our planet, with effects-driven journeys to Earth's Moon and Mars. By the late 1920s the mad scientist was born in films such as Rene Clair's "Paris Qui Dort" and Fritz Lang's "Metropolis", launching a meme that persists.

Since then, science on film has spanned many forms – from the classic, Mid Century high-school filmstrip, to epic television documentaries such as David Attenborough's 11-episode "Planet Earth" that became shared events, to the advent of the larger-than-life *The* IMAX *Experience*®, to Jacques Perrin's and Jacques Cluzaud's immersive feature films "Winged Migration" and "Oceans" all the way to Werner Herzog's contemplative "Encounters at the End of the World."

"Voyage of Time" takes another step towards bringing audiences into the experiential core of what science understands of our world, our history, our existence. It began with consultations with a team of leading-edge physicists, biologists and natural historians to set the film's flowing timeline – and evolved into a full-on experimental laboratory of cinematic play.

A Story for Everyone

"Voyage of Time" could not have been created without the input of scientists from multiple areas of inquiry. The film's lead scientific adviser is Dr. Andrew Knoll, the Fisher Professor of Natural History at Harvard University, a NASA consultant and author (Life on a Young Planet: The First Three Billion Years of Evolution on Earth; and Biology: How Life Works) whose work focuses on the early evolution of life, earth's environmental history – and most importantly the rich interconnections between the two. His vast knowledge of these areas – and willingness to contemplate the unknown – made Knoll a perfect match for Malick's vision.

For Knoll, what Malick has achieved is no less than a revolutionary sea-change in how cinema approaches science – and how audiences might experience its revelations and riddles.

"I once joked with Terry that if I were to make this film myself it would not even resemble his," muses Knoll. "It would probably look something like what you'd see on a PBS 'Nova' episode –covering the typical bases of what we know, how we know it and when it happened -- but that's not Terry's mission. His film asks something else entirely: how do we, as the products of this long evolutionary process, *think* about that process? And he explores that question through the most wonderfully evocative images I've ever seen, and probably ever will see. It is easily the most different and distinctive telling of the story of life's story that exists."

Knoll continues: "What's great about this film is that it has nothing in common with the natural history film as you know it – the film where there's a middle-aged naturalist in Bermuda shorts walking around the savannah telling us about anthills. This is on a completely different plane and Terry just does away with all prior conventions. There is not only room for this approach but I think there has really been a need for a great filmmaker to step back and say the story of life is the most amazing story you can tell – and it's a story that rightfully belongs to all of us. If you just open your mind to this film, and let not only the beauty but the depth of the ideas sink in, I think it will be impossible not to be moved by it. At a time when many of us are more cut off from nature than ever, it ties the audience member in his or her seat to this great journey of the universe."

Knoll's part of Malick's journey began when he got a call more than two decades ago, completely out of the blue, from Malick. "The man on the other end said his name was Terry Malick and he asked if we could have lunch to discuss a natural history film. It was only half way through lunch that it suddenly dawned on me, 'Hey, this is the guy who made 'Badlands','" recalls Knoll. "And since then, it's just been great fun and a wonderful opportunity to get to know Terry."

A fan of Malick's filmmaking already, Knoll was unsurprised to find in the filmmaker a questing, restless mind. For a long time they did nothing more than talk in depth about the early history of earth – about what was known about each geologic period, era and epoch and what knowledge was still being sought. They carefully excavated numerous theoretical ideas – both accepted and maverick – Malick had encountered on biological evolution and its potential driving forces. Knoll saw that Malick was not simply interested in a cursory understanding of life sciences to spur his creativity; his interest extended to how the laws of nature might be linked to the most fundamental questions of life, death and humanity's place in the cosmos.

Then, as production was getting under way, Malick asked Knoll to come aboard as the film's primary science advisor. At that point, Knoll started working with Malick to assure that a scientifically accurate timeline of life's evolution underpins the film's imagery.

"My job was simply to make sure that Terry got the science right," says Knoll. "What you see on the screen is all Terry's creative genius, but he would send me treatments and I'd comment on them very specifically, and we talked over a lot of ideas. There are things we don't know about the early earth and there are many things we know very well. I'm not aware of anything in the final movies that are out-of-sequence or stray far from the moorings of what scientists understand at this point. There are some uncertainties of timing that are debated – did the first cells evolve 4 billion years ago or 3.5 billion years ago? But in the context of the film those questions don't really matter because the film takes you into the *process* of life evolving."

Another area where open questions remain is exactly what those first forms of life – whenever, precisely, they first appeared on the planet so astoundingly – looked like. "I think the film creates a vision that has scientific plausibility though we can't say it has absolute historical accuracy," says Knoll. "The organisms we see today that are most similar to early life forms are bacteria so we are able to look at what we know about the genetics, function and morphology of living bacteria and then essentially strip that down to the simplest possible thing that would function."

Knoll was particularly impressed by how Malick's film traverses deep swaths of time – the yardstick of geologists, yet one that can disorient human minds and derail the natural compression of storytelling. Geologists, Knoll notes, are able to do a kind of "mental gymnastics" to grasp talking about, say, a million years as a brief blip, but human brains aren't well-suited to contemplating that kind of epic scale. "Getting that sense of time and vastness under your fingernails is hard," comments Knoll.

The aesthetic beauty of the film only lends the science behind it more power, says Knoll, who believes there can be a dynamic give-and-take between the romance of art and the

rigorousness of scientific pursuit. He notes that a discussion with Malick about the processes of death in animals versus bacteria inspired a lecture he is giving this fall that includes the topic of death as viewed by a paleontologist.

"I hope I've been of some benefit to Terry, but I have also benefitted tremendously from our conversations," Knoll points out. "The wonder of Terry's film is that not only will it inspire a 10 year-old girl to think about new things, it also inspired a 60 year-old scientist to think in new ways."

Knoll says science has been mistakenly cast as the enemy of mystery and awe – but the contrary is more the case. "Every scientist I know thinks the universe, life and all the phenomena of nature are mysterious in the best possible way. Knowledge doesn't lessen your sense of beauty and mystery; it enhances it. Our job as scientists is to reach into that mystery and try to build understanding. And that is also what Terry does, in his own way, with this movie."

For Knoll, the film also marks a waypoint in Malick's own filmmaking evolution. "In some ways, I think Terry has been building to this film his whole career – and now it seems he has reached that place to which he has always been heading. I've seen most of his films, but without question I like 'Voyage of Time' best of all. This is a film you will be thinking about a long time after the lights come up."

Theoretical physicist Lee Smolin of the Perimeter Institute, another of the film's consultants, was equally moved by the film. In a letter to the filmmakers, he wrote: "As a scientist, I saw nothing that seemed wrong; the simulations of the early universe and of star and planet formations are consistent with my understandings. It is beautiful and inspiring … The interweaving of contemporary scenes with the history of the universe seems very appropriate. It raises the question of what we value, and how we decide what we value, against the history of life and our universe."

History of the Voyage

Terrence Malick might not, at first glance, have seemed the filmmaker destined to re-envision scientific storytelling on the motion picture screen. After all, he has been called the most purely emotional and soulful filmmaker of these times, our lyric poet of cinema, exploring the cipher of being in the modern world. Starting with his debut feature, "Badlands," Malick has been renowned for using every visceral component of the natural landscape – sounds, patterns, shapes and rhythms -- as a sensory palette for potent stories that prod and provoke with big metaphysical questions.

And yet, as early as his second film, "Days of Heaven," Malick included time-lapse shots of seeds sprouting – a science-based vision of life in the act of regenerating itself. And just as scientists work in a realm beyond words, so too has Malick increasingly stripped his visions down to the most unadulterated explorations of what it means to exist. From the lush-then-fiery Pacific war of "The Thin Red Line" to the primal beauty of early America in "The New World," Malick's settings have again and again mirrored through the deep realities of nature the unfixed essence of our human lives.

More recently, Malick stitched footage of the formation of the universe and the earth into his Academy Award®-nominated (and Cannes Film Festival Palme D'Or winning) feature "Tree of Life," merging it with the story of a Texas family's personal evolutions.

The trajectory can be traced from the start, but there can be little doubt that "Voyage of Time" marks a departure for Malick. It is his first film that unfolds entirely without human dialogue and a film in which the boundary between external and internal is more porous than it has ever been.

Producer Sarah Green, who has worked with Malick since "The New World," notes that this film has been on Malick's mind since he began making films. "In the time I was getting to know Terry, before we started in on our first picture together, he talked often about this idea. He had been researching and planning, and occasionally shooting, for years, and keeping up with the latest scientific discoveries in real time. It was a challenge to try to keep pace, but great fun," Green says. "It's my theory that this film was made now because technology, both in the area of scientific data and supercomputer renderings thereof, and in the visual effects world, has caught up with Terry's mind. He was finally able to create what he'd envisioned."

Says producer Nicolas Gonda: "Terry has always treated nature as one of the most fascinating characters in any story but now, with 'Voyage of Time,' he is solely focused on that character and its incomparable story."

Gonda postulates that the genesis of the film may go back to even before Malick was a filmmaker. "I remember Terry bringing in meticulously notated books that spanned from those he read in elementary school to university and beyond," recalls Gonda. "And I think the full genesis probably dates back to Terry's formative years as a child, when he, like many of us, stared at the night sky and began asking the questions he does in his films about humankind's place in the universe.

"That awe clearly led to years of inquiry and that inquiry evolved into inspiration," Gonda continues. "For as long as I've known Terry it's been clear this is a film he was destined to create and he would be restless until it was realized. It's inspiring to see that tenacity in an artist,

and I think that was the primary catalyst to making this possible since his passion became contagious."

In those pre-production years, much of what occurred was a long prelude, full of probing and absorbing concepts. Recalls Green: "There was always a new study, a new theory, a new discovery that Terry would find to further his creative ideas. In the early days, he would give me 'hit lists' of cutting-edge scientists from whom he felt he could learn, and I would reach out to them. Almost to a person, they responded favorably, and were excited to see their work meshed with that of an artist of Terry's caliber. It was clear from the discussions that Terry could hold his own with them all, so they knew they would be well represented."

For long-time documentary producer Sophokles Tasioulis, who joins Malick's team for the first time, the film holds a special place in Malick's *oeuvre* – at once something new and connected in a chain to all of it. "I believe Terry has been compelled all his career by this question of man in nature. 'Voyage' is different from all his other films, on the one hand, since the story does not focus on the human side," says Tasioulis. "But on the other hand, it is clearly an organic progression from his previous films, which have increasingly moved towards a new kind of narrative language. While 'Voyage' always had a special place for Terry, I strongly believe he needed to do his other films before he could complete 'Voyage.'"

Tasioulis notes that Malick's insatiable curiosity is at the heart of the film's energy. "Terry is one of the most knowledgeable people you'll ever meet – his profound knowledge of history, the latest scientific discoveries and sociological trends can be very intimidating. He is preoccupied both with science but also with the things which we cannot explain. Terry is very curious and he will always challenge you to think further and deeper. He'll ask questions most people don't dare ask."

That questioning enters the film perhaps most starkly in the form of its resonant narration – which is performed by Academy Award® winner Cate Blanchett for "Voyage of Time: Life's Journey" and by Oscar®-nominated Brad Pitt in "Voyage of Time: The IMAX Experience." The two narrations differ – Blanchett's narration is the more searching and poignant, an urgent inquiry from a child of earth to the mother of all, while Pitt's is the more awestruck and explanatory – but both evoke a kaleidoscope of impressions and emotions.

Says science advisor, Dr. Andrew Knoll: "It's not the typical narration that simply gives you the facts. Instead, the narration asks you: 'isn't this wonderful and how do we even think about it?' I really like that because we already have documentaries that give you that fact-based narration and what we need is someone to say: 'Isn't this all so amazing and awe-inspiring?' The strength of the narration is that it invites you to interpret the words as you wish. But the

narration is really just an adjunct I think to the incredible and undeniable power of the visual imagery."

Dan Glass and Skunkworks

As the film's development got under way, there was increasing momentum on solving the looming questions of just how to visualize scientific phenomena no has ever seen and few have contemplated. *How to give the elusive and formless palpable substance? How to evoke the immaterial and elemental? How to ground the intemporal in the here and now?*

To help him explore the possibilities, producer Grant Hill introduced Terrence Malick to the film's visual effects supervisor, Dan Glass, who is perhaps best known for such imaginative comic-book fantasies as "The Matrix" sequels and "Batman Begins." Working with Malick on "Voyage of Time" took Glass into uncharted territory. He understood Malick was attempting to visually reproduce the many transformations of the universe, in all their natural rhythms of growth and decay, not just as accurately as possible but also with a stirring veneration and love for our world.

It was a project that spurred Glass into reading he never imagined – about such mind-blowing realities as the primordial *Population III* stars that are said to have brought the earliest sparkles of light to the universe; and the *tiktaalik* fish that wandered out from the sea to walk on land, altering the planet forever.

The process was life-changing for Glass. "I've always had a fascination with the beginnings of life and everything in the universe, but this has really furthered that and compelled me to look at the world in a new way. Every day is exciting now as I get up and start looking at things closer than I ever have. You realize that your life is only a very small part of a bigger story, and yet you also see how all of these incredible occurrences, these chance events, have led up to who we are right now. That's an amazingly empowering idea. And it's a story that isn't over – it will go on and on."

To dive into total visual unknowns, Glass and Malick created what they dubbed "Skunkworks" – inspired by the term used in the industrial and tech worlds to connote a group devoted to radical innovation in R&D. The film's Skunkworks began as an Austin, Texas-based laboratory focused intently on wide-ranging photographic experimentation.

"These were literally chemical experiments we were doing," explains Glass, "to see how various liquids, dyes, gasses and fluids might behave as we filmed them at high-speed. We used

everything from gels and glass to smoke machines and fluid tanks to create a whole range of effects."

Glass continues: "It was a lot of fun to do and very much in tune with how Terry's mind works. The process allowed him to bring his intuition and react to things in real time."

An inspiration throughout was the work of 19th Century painter Albert Bierstadt, whose sweeping landscapes of the American West were romanticized yet so intensely detailed that people who had never seen the locales were magically transported. "We wanted that richness Bierstadt had," Glass describes. "So we would layer and layer and layer in subtleties – be it tiny debris in the cosmos or floating particulates at the microbial level -- in a process that Terry called 'Bierstadting.'"

The Skunkworks lab was designed from the start to invite a variety of guests – scientists and artists alike – who contributed insights. "From the earliest days, I remember Terry saying that he wanted the feeling that every shot in the film was drawn by a different artist's hand. That idea was very exciting. So we set out early on to actually bring in a lot of hand-picked artists and artisans to contribute a lot of different, original ideas," Glass explains.

"The result," says Glass, "is that the whole piece is full of variations, which also helps to communicate the tapestry of life. I feel so privileged to have worked with the many wonderful artists and thinkers brought onto the picture. It required very unique personalities, people who could translate abstract ideas into stunning images."

The Visual Challenges

Glass had no formal script to follow as he worked with Malick. Instead, he had to try to wrangle the entire timeline of life on earth – with its epic events spaced millions and billions of years apart – into a manageable process. Yet he also knew Malick wanted the very opposite of a coolly linear undertaking.

"The idea was to use that factual timeline, but more so to be inspired by the wonder of it all," explains Glass. "As a filmmaker, Terry retains a childlike enthusiasm for life in the world and the most miraculous things around us and that is the central feeling of this film. The task for those of us working with him was to try to condense all this information into a way that retains that fascination."

Four areas of challenge loomed in particular:

- Creating the astrophysical imagery before the solar system we know existed, and then conceiving and visualizing the futurescape of our universe referencing the latest theories about our cosmic destiny
- Representing the protoplanetary disk that formed and condensed to become our solar system and the planets it contains
- Imaging the first unicellular forms of life in all their majesty and motion, which would learn to replicate and form increasingly complex organisms
- Reconceiving animals that no longer roam the earth, convincingly blending them with analog equivalents where they exist today

Each carried its own immense tangle of complications. The opening of the film was a special case. "The early astrophysical period is by nature the most abstract and also our vision of it is necessarily based on a lot of theory," Glass notes.

It did not easily lend itself to imagery at all. "Right after the Big Bang, there was essentially no light and the universe was just a conglomeration of mass at different densities, if you will. Well, that is quite hard to show photographically," laughs Glass.

To even hope to get it right, he relied on guidance from the film's scientific advisors. "We were lucky to have so many well-respected scientists not only contributing knowledge, but also showing us their own visuals," notes Glass. "So we tried to take those more diagrammatic and schematic representations that scientists use in their research and turn them into something beautiful."

No object was off-limits in the quest to create the cosmic interplay. At one point, the team shot lit road flares dropping into boiling water. "Other times it would be something as simple as marmalade suspended in glycerin that could be layered to create something that felt real and tangible," Glass muses. "We also built our own 'flow tables' that we filled with poured milk and dyes and paints, to mimic galaxies. And we used water tanks, because just a few drops of dye in a water tank can feel like vast nebulae or strange microscopic environments."

Astonishing photography from the Hubble Space Telescope, NASA's interplanetary space probes and the Solar Dynamic Observatory – a satellite observing the sun – also added to the array of visual information on which the team relied.

Though no photographic visuals exist of black holes, the film suggests their influential presence by using adapted supercomputer simulations and more obscure approaches. Glass and Malick used ferrofluids that become strongly magnetized in the presence of a magnetic field to explore unusual effects. "When we played with the ferrofluids, we were able to create amazing

shapes by controlling the current around them," says Glass. "You get very bizarre yet organic effects suggestive of some of the theoretical ideas surrounding black holes."

For the proto-planetary disk that ultimately formed into our solar system and the planet earth, Malick "wanted to make sure it was grounded in reality," says Glass. "We worked with painted glass orbs that we could photograph in hard backlight, which could feel like a planet if you shot it at the right frame rate and scale. And we used salt granules laid out on a disk that was turning very slowly to resemble asteroid belts, shot in layers to retain very deep focus."

The images of the single-cell cyanobacterial life-forms that begat more complex cells with their organelles and labyrinthine inner machinery came to vivid life through reference to laboratory footage and electron-microscopy. "We are familiar with amoebae as flat objects on a microscope slide, but they're really stunningly 3-dimensional when viewed with an electron-microscope. Unfortunately the current process only works on inanimate or dead cells so we digitally applied activity from the flatter, moving references to CG imagery derived from the electron microscope imagery," Glass explains.

Long-gone dinosaurs were created with the help of renowned paleontologist Jack Horner, Regents Professor of Paleontology at Montana State University and Curator of Paleontology at the Museum of the Rockies, who gave the team invaluable insight into the likely appearance of early dinosaurs right down to the texture of their skin.

While it was thrilling to digitally craft a menagerie of extinct creatures, Glass says he was wary of the uncanny valley, where computer-animated creations stand out for their eerily inorganic perfection. "In some cases, we were able to find living creatures that could stand in for older variants, but in many cases they don't exist and we had little to go on but the fossil record," says Glass. "Those were a challenge because no matter how convincingly detailed an image you can create in a computer, people just know it's not real. What we tried to do was represent these creatures as if photographed for a documentary, not always able to compose or chance upon the perfect natural light. That way, they feel a little bit more like wildlife."

Though current understanding of astrophysics, geology and biology was the film's fundament, the process became increasingly instinctual as Malick and Glass watched rough-cut after rough-cut, tinkering all the way. It was a bit like watching a conductor take an orchestra through the swells and subtleties of a grand symphony. "Terry would choose to linger on some images longer just to give you a chance to take in everything. He was constantly thinking about how everything played in context, and not purely as individual shots," explains Glass.

Glass knew that the organic was as important to Malick as the scientifically authentic. "I remember an early conversation, maybe 10 years ago, in which Terry said he didn't want to

smooth things out during the digital intermediate process," offers Glass. "He wanted the film to feel more like a patchwork quilt, representing the tremendous variety of life. Terry would prefer to be more austere in approaching a shot than to over-explain what the shot was. The intention was to really let the viewer join the ride, and have a personal experience. The imagery conveys the energy at the root of life, but without trying to be too strongly specific."

After ten years of total immersion in the project, Glass sees it as signaling a different way to approach effects. "For a long time, visual effects were more technically than creatively driven, and they had to be because the state of computing power at that time was such that you had to be incredibly specific early on in order for the renders to be designed. We're at a stage now, and have been for a few years, where that has inverted – and we are more able to let the technology work to our creative ends. So that fascinates me," Glass says.

"And with this film, I think we were able to explore the ideal balance of the digital with the organically and creatively designed," he concludes.

The Elements of Beauty

While effects are key to "Voyage of Time," equally vital is natural photography – utilized to re-envision a planetary past no camera lens could ever see. Even as Dan Glass was working in the visual laboratory, Terrence Malick was receiving a non-stop flow of fresh images from the film's global cinematography team, who roamed land and sea in search of primal evocations of earth in its various stages. Overseeing the process was lauded cinematographer Paul Atkins, who has been documenting the world's cultures and wildlife for decades (and was 2nd Unit Cinematographer on the Oscar®-winning "The Revenant"), as well the film's line producer Greg Eliason.

Atkins notes that realizing Malick's overall vision for the outdoor photography was a process of learning-on-the-fly. "I realized 'Voyage of Time' was not to be a natural history documentary in the traditional sense, but a new form, requiring our team of wildlife cinematographers to learn and adapt to a different photographic style," he explains. "We explored a style that was developed by Terry and his long-time DP, Emmanuel 'Chivo' Lubezki. We threw away the telephoto lens, the standard tool for filming subjects at a safe distance, as Terry prefers everything be shot in deep focus with wide-angle lenses. The challenges in this approach became painfully obvious on our first shoot – in Hawaii on Kilauea volcano. As we moved the IMAX® camera precariously close to molten lava to get a shot with a 40mm lens (wide-angle in the 15/70 format), the soles of our boots literally melted."

Those challenges were amplified as the team headed underwater to bring audiences sea creatures that harken back to some of the first complex life forms. "We were constantly searching for animals or behavior that were different, mysterious, or evocative in some way. This was quite a task when we were filming underwater with the huge IMAX cameras," Atkins points out. "A full load of 65mm film only allows for three minutes of shooting, after which you must surface, swim back to the boat, lift the 300 lb. rig out of the water, and re-load it. By the time you're back in water, your subject has long gone."

Throughout, Atkins worked in synch with Dan Glass's digitized menagerie of extinct creatures. The cinematographer explains: "Visualizing ancient creatures that no longer exist required CGI and Dan's incomparable talents with visual effects. But while the creatures themselves were created digitally, Terry wanted the images to feel organic, to be placed in a real, natural environment. Some of our most technically specific shoots involved working with Dan and his effects team to film 'background plates' for his digital dinosaurs in the Araucaria forests and Atacama desert of Chile, and among the redwoods of California – landscapes relatively unchanged for millions of years. In other cases we searched for living creatures or images that resembled prehistoric species such as a horseshoe crab or the eye of a monitor lizard or the chambered nautilus, which is a deep-sea cephalopod considered to be a living fossil."

Images then married the most majestic of sounds as the film grew closer to completion. Sound designer Joel Dougherty wove natural and speculative sounds into the film's universe. Music supervisor Lauren Mikus then worked closely with Malick to choose a variety of instrumental pieces that evoke the swirling, swelling, creative energy of life at both ends of the magnitude scale. The music ranges from Bach's *Mass in B Minor* – the composer's last completed work and perhaps his most profoundly unified – to Mahler's grand and turbulent choral masterpiece, *Symphony No. 2* aka "*Resurrection"*; from the 20th Century minimalist composer Arvo Part to jazz pianist Keith Jarrett.

"Like every ingredient in Terry's films, the music decisions were made as a result of an extraordinary process of experimentation with the goal of discovering a kinship between image, sound and even silence," explains Gonda.

Gonda and Green note that early viewers of the finished film took away completely different meanings and inspirations that sparked conversations about life, purpose, humanity and the role humanity has taken on as the keeper of the planet. They could not have had a greater fulfillment of their hopes for this multi-decade labor of love. This is what makes "Voyage of Time" so distinctive in filmmaking history: it is a science film that is all about the felt experience.

Says Gonda: "What I've always loved about Terry's films is that you can have an entire auditorium see the same images and listen to the same sounds, yet each individual walks away with a different impression. This film takes that idea to its highest level. No two people can possibly see it the same way, though it is grounded in real science. … Perhaps the true essence of the film only arrives when you suspend any preconceived notions of how you *should* experience it and you simply allow the film to unfold as a song would, where you don't pay attention to the particular instruments, but to the harmonic whole."

He concludes: "My producing partner, Sarah Green, encourages audiences to react to a Terry Malick film with their heart before their minds. That, I think, is the best advice for anyone about to go into the adventure of 'Voyage of Time.'"

ABOUT THE NARRATOR

BRAD PITT (Narrator/Producer), one of today's strongest and most versatile film actors, is also a successful film producer with his company Plan B Entertainment. In the past few years, Pitt won an Academy Award® as a producer of "12 Years a Slave," directed by Steve McQueen (the film also won Oscars® for screenwriter John Ridley and supporting actress Lupita Nyong'o), led a five-man tank crew in David Ayer's World War II epic "Fury," starred in and produced "By the Sea" opposite his wife Angelina Jolie, who also wrote and directed the film, played a supporting role in "The Big Short," and the lead in "War Machine," a provocative satirical comedy from David Michôd for Netflix, both of which he also produced with his Plan B shingle. Most recently, Pitt wrapped principal photography on Robert Zemeckis' "Allied" opposite Marion Cotillard.

In 2013, Pitt starred and produced one of the year's top ten grossing movies, "World War Z" for Paramount. Following Z, Pitt played a supporting role in Cormac McCarthy's "The Counselor" directed by Ridley Scott as well as Andrew Dominik's "Cogan's Trade." This is the second time Pitt has starred and produced a Dominik film, the first being "The Assassination of Jesse James by the Coward Robert Ford," for which he was named Best Actor at the Venice Film Festival. In 2011, Pitt gave two of his most complex and nuanced performances in Bennett Miller's "Moneyball" and Terrence Malick's "Tree of Life," films he also produced. Pitt won the New York Film Critics Circle Award and the National Society of Film Critics Award for both roles. Additionally, Pitt was nominated for a Screen Actors Guild, Golden Globe® Award, British

Academy of Film and Television Arts ("BAFTA") Award, and an Academy Award® for his work in "Moneyball." The movie also received an Academy Award® Best Picture nomination. "Tree of Life" won the Palme d'Or at the Cannes Film Festival and received an Academy Award® nomination for Best Picture as well.

In previous years, Pitt was an Academy Award® nominee for his performance in David Fincher's "The Curious Case of Benjamin Button" and Terry Gilliam's "Twelve Monkeys," for which he won a Golden Globe Award. He was also a Golden Globe Award nominee for his performances in Edward Zwick's "Legends of the Fall" and Alejandro González Iñárritu's "Babel."

In 2009, Pitt starred in Quentin Tarantino's "Inglorious Basterds" as Lt. Aldo Raine; and appeared in Joel and Ethan Coen's comedy thriller "Burn After Reading." Opposite George Clooney, his "Burn After Reading" co-star, he also appeared in Steven Soderbergh's hits "Ocean's Eleven," "Ocean's Twelve" and "Ocean's Thirteen."

It was Pitt's role in Ridley Scott's Academy Award®-winning "Thelma and Louise" that first brought him national attention. He soon went on to star in Robert Redford's Academy Award®-winning "A River Runs Through It," Dominic Sena's "Kalifornia" and Tony Scott's "True Romance." Pitt also received critical acclaim for his performances in the two David Fincher films: "Se7en" and "Fight Club." His other films include Doug Liman's "Mr. and Mrs. Smith," which was one of 2005's biggest hits and Guy Ritchie's "Snatch."

Pitt's Plan B Entertainment has been responsible for producing numerous award-winning and commercially successful films including "The Departed," "The Assassination of Jesse James by the Coward Robert Ford," "The Tree of Life," "World War Z," "12 Years a Slave," "The Normal Heart," "Selma" and "The Big Short." The company's forthcoming slate includes David Michod's "War Machine" for Netflix; James Gray's "The Lost City of Z," based on David Grann's best-selling book starring Charlie Hunnam; "World War Z 2"; as well as development with a number of marquee filmmakers and writers in both film and television.

ABOUT THE FILMMAKERS

TERRENCE MALICK (Writer/Director) was born in Ottawa, Illinois, and grew up in Texas and Oklahoma. He worked for *Newsweek*, *Life*, and the *New Yorker*, and taught philosophy at MIT before attending the American Film Institute**.** He is the writer/director of "Badlands," "Days of Heaven," "The Thin Red Line," "The New World," "The Tree of Life," "To the

Wonder," "Knight of Cups" and the upcoming untitled project starring Ryan Gosling, Michael Fassbender and Rooney Mara.

GRANT HILL (Producer) is currently producing the Netflix sci-fi drama series "Sense8," written and directed by the Wachowskis. He also produced the epic drama "Cloud Atlas," directed by Lana Wachowski, Tom Tykwer and Andy Wachowski, and released in 2012. The same year, he earned a Best Picture Academy Award® nomination for writer/director Terrence Malick's drama "The Tree of Life." It was his second Best Picture Oscar® nomination, following his collaboration with Malick on "The Thin Red Line."

Hill's previous producing credits include James McTeigue's "Ninja Assassin," and the Wachowskis' "Jupiter Ascending," "Speed Racer" and "V For Vendetta."

He also served as co-producer on James Cameron's multiple Oscar®-winning film "Titanic" and as an executive producer on "The Matrix Revolutions" and "The Matrix Reloaded."

DEDE GARDNER (Producer) is an Academy Award®-winning producer and president of Brad Pitt's production company, Plan B Entertainment. Her recent list of producing accomplishments include Adam McKay's "The Big Short"; Ava DuVernay's "Selma"; Steve McQueen's Academy Award®-winning "12 Years a Slave"; Marc Forster's "World War Z"; Andrew Dominik's "Killing Them Softly"; and Terrence Malick's Palme d'Or-winning and Academy Award®-nominated "The Tree Of Life." Currently, among several company projects, she is in production on Bong Joon-Ho's "Okja," and is in post-production on David Michôd's "War Machine," James Gray's "The Lost City Of Z" and Zal Batmanglij and Brit Marling's Netflix original series "The OA."

NICOLAS GONDA (Producer) began his film career at Focus Features, working on the publicity, marketing, and worldwide distribution of a number of Academy Award®-winning films such as "The Pianist" and "Eternal Sunshine of the Spotless Mind." In 2005, he joined the production of Terrence Malick's "The New World," where he served as the Music Supervisor and oversaw elements of the film's post-production. He went on to work with Malick as co-producer of "The Tree of Life," winner of the Palme d'Or at the 2011 Cannes Film Festival, and producer of "To the Wonder."

He currently has several projects in various stages of production. He is continuing his work with Malick on the upcoming untitled feature set in the Austin music scene whose cast includes Ryan Gosling, Natalie Portman, Cate Blanchett, Michael Fassbender and Rooney Mara.

In 2012, Gonda co-founded Tugg, Inc., a web-platform that enables audiences to choose the films that play in their local theatres. Launched at the 2012 South by Southwest Festival, Tugg empowers audiences nationwide to screen films from its extensive library of studio and independent titles. Tugg has partnered with mainstream and independent exhibitors, boasting a theatrical footprint of over 85% of movie theatres in the United States.

Gonda is also a managing partner of Ironwood Entertainment, a development, production and financing company focused on premium independent content for a global audience. Recent titles include Rodrigo Garcia's "Last Days in the Desert," starring Ewan McGregor, and "Things People Do," starring Wes Bentley and Jason Isaacs.

Gonda was recently named one of Indiewire's inaugural "Influencers," Variety's "10 Producers to Watch" and Details Magazine's "Digital Mavericks" for his work in the independent film industry. He also serves on the Board of the Austin Film Society.

Born in Los Angeles, he graduated New York University's Gallatin School of Individualized Study.

SARAH GREEN (Producer) recently produced Terrence Malick's "Knight of Cups" and the forthcoming untitled project from Terrence Malick, starring Ryan Gosling, Cate Blanchett, Michael Fassbender, Rooney Mara and Natalie Portman.

Green also produced Jeff Nichols' "Loving," with Joel Edgerton, Ruth Negga and Michael Shannon, which premiered in competition at the 2016 Cannes Film Festival and will be released by Focus Features in November 2016. She previously produced Nichols' "Midnight Special," with Michael Shannon, Joel Edgerton, Kirsten Dunst, Adam Driver and Sam Shepard, released in March 2016 by Warner Bros.

Green produced Malick's Best Picture Academy Award®-nominated "The Tree of Life" starring Brad Pitt, Jessica Chastain and Sean Penn, which also won the Palme d'Or at the Cannes Film Festival, as well as "To the Wonder" starring Ben Affleck, Olga Kurylenko, Rachel McAdams and Javier Bardem. Green produced Malick's epic adventure "The New World," starring Colin Farrell and Christian Bale, which was nominated for an Academy Award® for cinematography.

Green produced Nichols' "Mud," with Matthew McConaughey and Reese Witherspoon. "Mud" premiered as an official selection at Sundance and selected for main competition at Cannes. "Mud" was the highest-grossing independent release during the summer of 2013. She was Executive Producer on Nichols' "Take Shelter," which premiered at the Sundance Film

Festival and won the Grand Prize in Critics Week, the FIPRESCI award and the SACD award for best feature, all at the Cannes Film Festival.

Green produced the Academy Award®-winning "Frida," directed by Julie Taymor and starring Salma Hayek and Alfred Molina, and "Dirty Dancing: Havana Nights" starring Diego Luna. She also produced "Girlfight" and "State and Main"; "Girlfight" won the Prix de la Jeunesse at the Cannes Film Festival, shared the Grand Jury Prize and won Best Director for Karyn Kusama at the Sundance Film Festival, as well as multiple awards for then-newcomer Michelle Rodriguez. "State and Main" won multiple cast awards for an ensemble that included Philip Seymour Hoffman, Sarah Jessica Parker, Alec Baldwin and Julia Stiles, as well as four screenplay nominations for writer/director David Mamet.

Previously, Green produced Mamet's "The Winslow Boy," "The Spanish Prisoner," "American Buffalo" (directed by Michael Corrente) and "Oleanna." She produced three films for writer/director John Sayles: "The Secret of Roan Inish," nominated for three Independent Spirit Awards; "Passion Fish," nominated for two Academy Awards®, two Golden Globes and two Independent Spirit Awards (winning one); and "City of Hope," which won the Grand Prix at the Tokyo Film Festival and the Critics' Award at the Edinburgh International Film Festival. She also produced the Emmy® Award winning American Playhouse production of "Andre's Mother," which was named Best Television Movie of 1990 by the National Board of Review.

BRAD PITT (Producer) (reference bio above).

Academy Award® nominated filmmaker **BILL POHLAD (Producer)** has been producing quality films for over two decades. As founder and CEO of River Road Entertainment, his ability to seek out compelling material and bring it to light has established his reputation as a filmmaker unafraid to take creative risks.

Having started out as a writer/director in the late Eighties, Pohlad has spent most of the last fifteen years producing. His credits include the Academy Award® winning Best Picture "12 Years A Slave," which also won the Golden Globe® for Best Motion Picture – Drama, two BAFTA Awards, five Film Independent Spirit Awards and a total of three Academy Awards®. Another of Pohlad's producorial efforts, "The Tree Of Life" was nominated for three Academy Awards® including Best Picture. The feature also won the Palme d'Or at the 2011 Cannes International Film Festival and shared the prize for Best Feature at the 2011 Gotham Independent Film Awards. In 2007, Pohlad produced Sean Penn's award-winning adaptation of "Into The Wild," based on the best-selling book by Jon Krakauer. The film garnered two Academy Award®

nominations as well as nods from The Directors Guild, The Writers Guild, and SAG, among others. In addition, Pohlad produced Jean Marc Vallée's "Wild" starring Reese Witherspoon and Laura Dern, which received two Academy Award® nominations and one Golden Globe nomination.

Pohlad has also served as executive producer on numerous films including Ang Lee's Academy Award® winning epic, "Brokeback Mountain," and numerous feature documentaries including Robert Kenner's Academy Award® nominated documentary, "Food, Inc.". Most recently, Pohlad executive produced Juan Antonio Bayona's "A Monster Calls," which will be released by Focus Features on October 14, 2016.

In 2014, more than twenty years after directing his first feature, Pohlad returned to directing with "Love & Mercy," an unconventional portrait of Brian Wilson, the mercurial singer, songwriter and leader of The Beach Boys. The film, which stars John Cusack, Paul Dano, Elizabeth Banks and Paul Giamatti, premiered at the 2014 Toronto International Film Festival and was released to great acclaim, receiving two Golden Globe nominations and topping numerous critics' lists for 2015.

SOPHOKLES TASIOULIS (Producer) is an international film producer based in Berlin, Germany. He studied aerospace engineering at Berlin's Technical University (TU Berlin) as well as Media Design and Media Art at the BILDO Academy Berlin. After completing his studies, he worked for various broadcasters and film production companies (including Arte, BBC, CanalPlus, ZDF) and founded THESA Film und Fernsehproduktion in 1991. In 1998 he founded Hope & Glory Film Productions. Since 2002 he has been in charge of developing, financing and producing projects with German and international co-production partners at Greenlight's Production Department. In the year 2005 he established his own production company, Sophisticated Films, which he continues to use as his main production platform into present day. In 2011 he was recruited to a subsidiary of the Red Bull Media House, Terra Mater Factual Studios where he served as the Head of Cinema, until joining the Red Bull Media House (RBMH) as its Global Head of Cinema in 2012. At RBMH Sophokles oversaw the global cinema business of Red Bull, being responsible for development and production as well as international distribution of all the Red Bull Media House titles.

From the start of 2014, Tasioulis refocused his entire activities exclusively to his own production company becoming one of the main producers on "Voyage of Time," securing international partners such as IMAX and Wild Bunch.

In his career he produced and co-produced a number of noted documentaries, including "Cheerleader Stories" (2001), "Deep Blue" (2004) and "Earth" (2007), as well as features as "Shoes Of America" (2000), "The Great Match" (2006) and the animation feature "Quest for a Heart" (2007) and "Among Wolves" (2010).

His projects have been released by many major distributors such as Disney, Miramax, Lionsgate, Gaumont, GAGA, Studio Canal and many others around the world. Tasioulis has produced 2 of the top ten grossing theatrical documentaries of all times and is an international expert for big, event type theatrical documentaries. Presently he is in development on an international feature film and a wildlife themed theatrical documentary.

From Antarctica to the tropical Pacific, **PAUL ATKINS (Cinematographer)** has filmed the world's wildlife and cultures for National Geographic, for the BBC including many of their most successful series from "Trials Of Life" to "Planet Earth," and for the IMAX screen. His internationally acclaimed directing and cinematography have earned him numerous Emmys, BAFTA Awards and a Telluride Film Festival Tribute. With his wife and filmmaking partner, Grace Atkins, Paul has produced documentaries that challenge our preconceptions of the natural world. Notable among these films is "Great White Shark," which inspired the best-selling book, The Devil's Teeth.

In recent years, Paul has turned his cinematic attention to fictional storytelling and feature films including indie productions such as "Chief" (Sundance 08), and "The Land Has Eyes" (Sundance 04 and Fiji's submission for Best Foreign Film to the Academy Awards). On a 42 day epic voyage around Cape Horn, Paul shot the ocean storm footage for Peter Weir on "Master and Commander" which won the 2004 Academy Award® for Cinematography. In 2008, Paul was Second Unit Director of Photography on Terrence Malick's "The Tree of Life."

In a career spanning more than 20 years in the industry, **DAN GLASS (Visual Effects Supervisor)** has built an extensive list of credits as a visual effects supervisor and director. "Voyage of Time" is the culmination of a ten year working relationship with Terrence Malick that began with the Palme D'Or winner "The Tree of Life."

Glass has also worked with other esteemed directors such as Christopher Nolan, Paul Thomas Anderson, Quentin Tarantino and The Wachowskis and picked up numerous accolades including a BAFTA nomination and two Visual Effects Society ("VES") awards.

Glass directs the Seoul-based story and oversees the visual effects for the Netflix original series "Sense8," written and conceived by the Wachowskis and J Michael Straczynski.

An executive for Deluxe Entertainment since 2010, Glass currently serves as the Chief Creative Officer for the Deluxe Creative Artists Group, overseeing their global network of visual effects studios and talent. Glass served as Senior VFX Supervisor on Terrence Malick's Palme D'Or Winner "The Tree of Life." He has a long list of film credits as Lead or Senior VFX Supervisor that includes "Batman Begins," "Speed Racer" and "V for Vendetta," as well as both "Matrix" sequels.

After completing a degree in architecture at University College London, Glass began his career at the Computer Film Company in London, where he literally learned from the ground up, starting first as a runner and projectionist, and then working as a CG artist, programmer and compositor.

Throughout his career, Glass has established relationships with esteemed directors across multiple disciplines and picked up numerous awards. Currently based in Los Angeles, Glass is executive vice president and general manager of Method Studios, who aim to establish the most creative, efficient and technically advanced visual effects group in the world.

KEITH FRAASE (Editor) studied film at the University of Texas at Austin. After graduation, he worked as a freelancer, editing commercials and internet spots as well as working for local CBS news affiliate KEYE Austin. He has also served in the position of director, cinematographer, and producer on a number of short films. His first foray into feature narratives was as an Assistant Editor on the Burnt Orange film "Elvis and Annabelle," starring Max Minghella and Blake Lively. From this, he made several connections that eventually led him to work with Terrence Malick on "The Tree of Life." Since then, Keith has remained on Malick's post-production team as an editor on "To the Wonder," "Knight Of Cups" and the upcoming untitled Terrence Malick Film set against the Austin music scene.

REHMAN ALI (Editor) studied film at the University of Texas at Austin. He has written and directed several short films, including "The Alones" and "All I Do," as well as worked extensively on Television projects, including the Jerry Bruckheimer produced, "Marshal Law Texas," which aired on TNT. Since focusing full-time on feature narrative films, Rehman has worked with acclaimed director Terrence Malick, playing an integral creative role in the films "Knight of Cups," "Weightless" and "Voyage of Time."

SCIENTIFIC ADVISORS
TO 'VOYAGE OF TIME: THE IMAX EXPERIENCE'

Chief Science Advisor:

Dr. Andrew Knoll, Department of Organismic and Evolutionary Biology, Harvard University

Science Advisors:

Dr. Robert Berwick, Computational Linguistics, MIT
Dr. Jack Horner, Curator of Paleontology, Museum of the Rockies
Dr. Joel Primack, Physics Department, UC Santa Cruz
Dr. Martin Rees, Department of Cosmology and Astrophysics, Cambridge University
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Dr. Christopher C. Hayward, Moore Prize Postdoctoral Scholar in Theoretical Astrophysics, Caltech
Dr. Andrew J. S. Hamilton, JILA and Dept. of Astrophysical & Planetary Sciences, University of Colorado

A VERY BRIEF TIMELINE OF THE UNIVERSE AND EARTH

The most important thing we have discovered about the universe is that it has a history. The actors are three kinds of stuff. Ordinary matter is built from protons, neutrons and electrons and is the stuff we are made of. Shadowing it is a mysterious dark matter, which shows itself only through the gravitational pull of its mass. It gives off or reflects no light and, beyond that, we know little about it. Then there is an even more mysterious dark energy, whose only role seems to be to accelerate the universe's expansion.

The inception. The universe started roughly 14 billion years ago, exploding into a state of extraordinarily high density and temperature. Whether this was the beginning of time or a transition from an earlier era is presently unknown. At its start the universe is almost perfectly regular and symmetric; the story that follows is one of structure and complexity emerging as the universe expands and cools.

The very early universe. The universe initially expands very rapidly. The symmetry is interrupted by a pattern of very slightly warmer and cooler spots, apparently randomly distributed. This pattern reflects regions with more and less dark matter.

The early universe. The universe cools as it expands, and ordinary matter appears. A tiny asymmetry between matter and antimatter is amplified till the universe is all matter. Later we pass the era of nucleosynthesis when helium and a few other light elements are synthesized; most remains hydrogen.

Decoupling. The temperature of the universe falls to a value where atoms are stable and so it transitions from a plasma to ordinary gas. Light is liberated, making the cosmic background radiation, which keeps the original imprinting of cold and hot spots. This original light fills the universe, and cools as the universe expands. It is presently detectable as microwave radiation, arriving at Earth from all directions of the sky.

The dark era: The denser regions of dark matter fall together under their gravitational attraction, forming the seeds of galaxies. Ordinary matter is pulled by gravity into these seeds, cooling and coalescing to form the first stars. The stars make light by burning hydrogen into helium, and then helium into the heavier elements, by nuclear fusion.

The era of the stars: The heavier elements, such as carbon and oxygen, form within stars, and are liberated when the heavier stars explode in supernovas. These catalyze a galactic ecology within which matter is transmuted from stars to clouds of gas and dust and back to stars again. Disks of gas and dust coalesce around stars and out of them planets form. Some of these have the good fortune to find themselves orbiting long-lived stars, in the "habitable zone" where conditions are right for water to be a liquid and life to initiate. One of these is Earth.

Precambrian: The new born, molten earth cools, forming a rocky crust and fluid oceans; mineral-rich volcanic vents spark chemical reactions; bacterial life-forms emerge and multiply; photosynthesis becomes the driving fuel of life; multi-celled animals grow on the seabed; 88% of earth's existence to date passes.

Cambrian: Life explodes; primitive nervous systems emerge with the first vertebrates; algae diversifies; jawless fish debut; oceanic oxygen levels soar.

Ordovician: Marine life -- sponge-like organisms, squid-like mollusks and coral animals -- flourishes; primitive plants sprout on once-barren land; ancestors of spiders and scorpions move to off-shore lagoons.

Silurian: Massive tropical reefs form in the oceans; fish develop jaws; plants sprout vascular systems and spread, bringing more aquatic animals and insects onto land.

Devonian: "The age of the fishes"; varieties of fish proliferate; early forests shoot forth with 30-meter tall trees; seeded plants spread life to new regions; the first amphibians, air-breathing fish with limb-like fins, leave the water for life on land.

Carboniferous: Lowland swamp forests create extensive carbon-rich coal deposits; oxygen levels on earth hit their peak; insects become airborne; wetland reptiles appear and burgeon.

Permian: Supercontinental land mass Pangaea forms; reptiles grow larger and larger; the worst extinction event in earth's history wipes out masses of species, and yet, life persists.

Triassic: New creatures arise in the wake of change; the first flying reptiles take to the skies; dinosaurs and shrew-like, egg-laying mammals appear.

Jurassic: Diverse dinosaurs of all sizes roam the earth as Pangaea breaks up, forming inland seas; the earliest forms of birds evolve; rodents share the land with giant dinosaurs.

Cretaceous: Continents on the move remodel the earth; dinosaurs including Triceratops and T-Rex dominate; flowering plants dot the planet; another major extinction event shakes life on earth.

Paleocene: Dinosaurs disappear as mammals fill the void and continents drift into their familiar positions; subtropical weather conditions spur grasslands and herds of grazing mammals; the panoply of mammals comes to include primates, horses, cats and dogs.

Neocene: Continents collide; climate dries and cools; mammals and birds take on their modern forms; Asian and African apes diverge; in Africa, early hominids drop out of the trees and start walking upright.

Quaternary: "The age of humans"; hominids evolve bigger and bigger brains and spread across the earth, making a significant impact on nearly all of it; human civilizations form as the Stone Age gives way to the Bronze Age, Iron Age and Industrial Age of technological existence.

The sun dies billions of years in the future, expanding as it cools to become a red giant which engulfs Earth. For a time, new stars continue to form from the ashes of dead stars.

The era of dark energy. As the universe continues to expand, matter, both ordinary and dark, dilutes, but dark energy apparently doesn't, so it may be increasingly dominant. The long term fate of the universe is not known, given that we remain ignorant of exactly what the dark matter and dark energy are. The universe may expand forever or it may pull together and collapse, in parts or altogether, only to be reborn when collapsing regions explode into new big bangs.