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PRESENTS

THE GREAT CHAMELEON CARNIVAL

Documentary of 43 & 52 Minutes

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NOTE OF INTENT

If you thought you knew everything about this strange reptile, certainly the most astonishing of all, you were wrong. If you take the time to observe chameleons in the wild and truly understand them, you will soon realize that their armed tongue and their independent and peripheral ocular system, although spectacular, are only a small part of their incredible capabilities. Actually, the chameleon's ace in the hole is its evolution and its formidable faculties of adaptation...

In order to take a deep dive into the chameleons' world and to give meaning to their strange way of life, we chose to go to the island of Madagascar, a fascinating land of beauty and diversity, which tells better than any other the incredible history and the hectic lives these extraordinary reptiles live. The island is home to the largest concentration of chameleons in the world, and the greatest diversity: 96 species, almost all endemic, out of 217 recorded. There is an incredible variety of colors, sizes and appearances: helmeted, horned, scrawny or colossal... In particular, the smallest chameleon in the world, discovered a few weeks ago (*Brookesia Nana – 1.2 cm*), but also the largest (*Calumma parsonii – 75 cm*). Two phenomena located at the two extremes of the lineage, which nevertheless share the same region in the North-East of the island and which we will find later in our presentation.

A rather paradoxical reality; because, contrary to appearances, chameleons are not native to Madagascar. They actually appeared towards the end of the Cretaceous period, about 66 million years ago in East Africa, and only arrived in Madagascar in the Miocene period, 40 million years later.

But then, why Madagascar, and especially how did they adapt so well in what seems to have been for them a sort of Garden of Eden where they developed better than anywhere else?

This is where our film begins; an epic that begins 20 million years ago, which will take us from one end of the island of Madagascar to the other to discover these surprising reptiles that are like no other and which, thanks to their incredible performance, have managed to carve out a unique place in evolution...

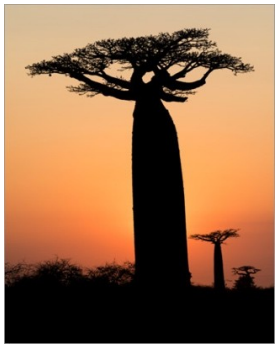
THE GREAT CROSSING

Of course, chameleons did not just fall from the sky one day on this island located 500 km off the coast of Mozambique. Knowing that the claws they walk on definitely make them poor swimmers, how did they manage to get there? Specific weather conditions, the direction of the currents, a few floating islands and old tree stumps enabled them to cross this part of the Indian Ocean and the Mozambique Channel. Scientists speak of auspicious accidents, weather shocks, eggs trapped in trees or individuals hidden in floating islets that ended up washing ashore as far as Madagascar. A fossil found in 2020 confirms this theory, since it is a chameleon that was found 19.5 million years ago in East Africa but which now only exists in Madagascar...

THE CHAMELEONS' GARDEN OF EDEN

"If chameleons were to have a country, it would undoubtedly be Madagascar. "

A veritable garden paradise, now threatened, Madagascar's biogeographical isolation, its variety of climates and reliefs have favored the development of a unique fauna and flora in the world, for the most part endemic: the Baobab, the Fossa, the Red owl, the Ravenala, the Pygmy mouse lemur, the Blue coua, the Tailless tenrec or of course the Aye-Aye, famous for its funny face, to name but a few. Madagascar displays an incredible natural variety that makes it comparable to Australia, Socotra or the Galapagos Islands in terms of the rarity and richness of its biodiversity. This largely explains the spectacular expansion of chameleons on the island.






Because they have had to adapt to the multitude of ecological niches found in Madagascar, chameleons have developed so many distinctive signs and adaptive traits that illustrate this incredible variety of biotopes. We will see, for example, why some land chameleons on this island walk on five legs, why their color palette is much more enchanting than in East Africa, why, in some parts of the island, egg incubation pauses for

several months, why one species has developed strange bone plates on its back, like a dinosaur, or why some species have a horn at the end of their mouth? The answers to these questions lie in the very origins of Madagascar.

BROOKESIA SUPERCILIARIS (Brown leaf chameleon).

FURCIFER VOELTZKOWI

FURCIFER PARDALIS (Panther chameleon)

CALUMMA GALLUS (Lance-nosed chameleon)

CALUMMA PARSONII (Parson's chameleon)

Voeltzkow's chameleon

Very early on, 120 million years ago, the island was separated from the African continent and developed a characteristic biodiversity that provided ideal conditions for chameleons when they arrived 100 million years later: tropical forests, arid zones, a coastline and mountains full of insects and invertebrates that had arrived long before them and that constituted a real food reservoir. Another advantage is that when the chameleon arrives, it is the only tree lizard, so it will take over the largest ecological niche on the island without much competition.

Much more than its East African cousins, it will also conquer the ground and adapt to the terrestrial substrate, giving birth to very different species, much smaller, with much shorter legs and a small, stiffer tail on which they lean to move. Most are monochrome, imitating the colors of leaves and wood. Here again, the explanation is simple, there are very few large terrestrial predators in Madagascar. There are no more than 9 species of carnivorous mammals, the most powerful of which is the Fossa, an endemic feliform species of the eupleridae family, which is often mistaken for a feline and looks more like a giant mongoose. The absence of venomous snakes on the island, or large amphibian predators, makes Madagascar a much less dangerous place than East Africa, but this does not mean that they have no predators.

The CHAMELEON'S PREDATORS - SPIDERS,

SNAKES

BIRDS,

CANIBALISM

Tree snakes, birds and large spiders are a constant threat to chameleons which, despite their slowness and apparent vulnerability, have managed to use defensive strategies to survive, that sometimes go against all logic...

THE CHAMELEON'S TRICKS

Looking at a chameleon, one might think that its slowness and immobility make it vulnerable; yet these are two major assets of its defense system. Blending in with their decor of leaves, bark or flowers, thanks to the mimicry they have developed over the course of evolution, the fact that they do not move is the best way for them to remain invisible. They can also stand on their legs and move back and forth to simulate the natural movement of leaves; this jerky immobility is called: "The chameleon dance". This is a way of creating a visual discontinuity that fools potential predators. Contrary to some preconceived ideas, the chameleons' color changes are not just for hiding or camouflage, but rather to express their emotions: anger, fear, or desire as we will see later in this presentation. They have another subterfuge at their disposal, "stick defense": they hide behind a large branch, peeking out with their eyes to inspect the surroundings. When faced with the threat of a predator, their expandable rib cage allows them to inflate to deter predators, which does not always work. Their last resort is to drop off their tree to escape death. This is why they always sleep at the end of branches or leaves to sense predators coming or to drop easily into the void.

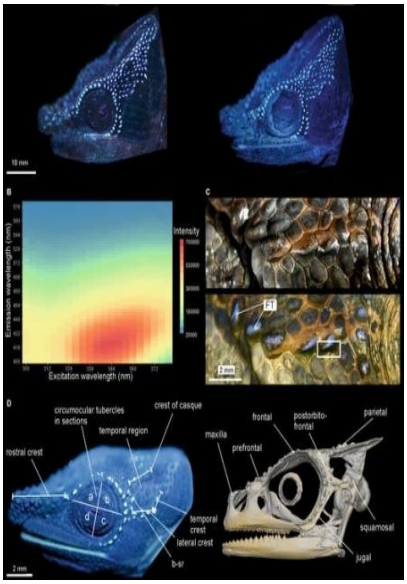
MIMICRY AND INTIMIDATION

DEFENSE AND INTIMIDATION – SWELLING THE CHAMELEON DANCE – CAMOUFLAGE

SLEEPING TECHNIQUE / DEFENSE

Unlike other lizards, they have no external ears, so only vibrations and movement can alert them to danger. To compensate for this low sensory activity, nature has endowed them with the most extraordinary eye system on the planet, which compensates for their weakness of hearing and smell. This is undoubtedly the best way for them to protect themselves from unpleasant surprises. The chameleon's eyes can move independently of each other. This reptile is able to see two distinct images at the same time because the visual information from each eye does not meet in its brain. Only when hunting do they switch back to binocular mode to regain three-dimensional vision.

340° INDEPENDENT PERIPHERAL VISION



Their unique field of vision, which radiates out to a circumference of almost 340°, allows them to see danger coming from anywhere. It is also one of the most developed chromatic visions on earth, equivalent to that of birds and superior to ours, since we only have 3 receptors and they have 4, the fourth being the one thanks to which they perceive the ultra-violet spectrum.

This phenomenal vision is in fact a clear sign of adaptation, which stimulates and justifies most of the chameleon's surprising behavior, starting with hunting. We have seen how chameleons manage to defend themselves, despite their vulnerability, and we will now see how they hunt for food, and in this area, they are not lacking in assets either. While chameleons can swim, they cannot run or jump. They therefore needed one of those ingenious workarounds that nature often gifts to compensate for these weaknesses. Although they move slowly, chameleons have one of the two fastest tongue strokes in the animal kingdom, another technological achievement that matches perfectly with the ingenuity of their eye system. The ballistic projection of a chameleon's tongue is equivalent to an acceleration from zero to 90 km/h in one hundredth of a second – i.e., a speed of over 250 km/h. These tests were carried out by researchers at Brown University (Rhode Island, north-east) and published in "Scientific Reports". And to complete this treasure trove of biophysics, we must add its jaw, one of the most powerful in nature, which is 10 times greater than that of a T-Rex – in proportion to its size of course! This explains why fights between males are often deadly and why they are capable of literally crushing the mouths of some of their predators when they have the opportunity. The combination of vision, tongue and jaw, found in chameleons, is one of the most formidable predatory combinations found in nature. This lethal weapon can handle a prey weighing more than a third of the chameleon's weight. It can also reach a length of more than twice the size of the animal. In order to make these incredible characteristics more understandable, Kiisa Nishikawa, a biomechanics researcher at the University of Arizona, explains on the website of the journal "Science": "It's like a human eating 10 kilos of hamburgers and only using their tongue to carry them to their mouth."

THE HUNT

THE TONGUE-CATAPULT

SEE – COMMUNICATE – SEDUCE

As formidable as it is, the chameleon's catapult tongue only has one use, to hunt, feed and drink. On the other hand, chameleons mostly rely on their eyes in life – and as we will see, in Madagascar even more so than elsewhere. For a long time, it was thought that, like the octopus or the crab spider, the chameleon's homochromia allowed it to change colors suddenly to escape its predator or to surprise its prey, but this is not the case. Their natural mimicry and the weapons they have at their disposal are sufficient for this. The chameleon's spectacular color changes are in fact a formidable communication tool. It is a behavioral homochromia, through which they can express stress, anger, seduction or even illness. Madagascar is the ideal place to observe these chromatic variations because it is here that we come across the most colorful chameleons on the planet, such as the panther chameleon, for example, no doubt due to the rich flora on the island.

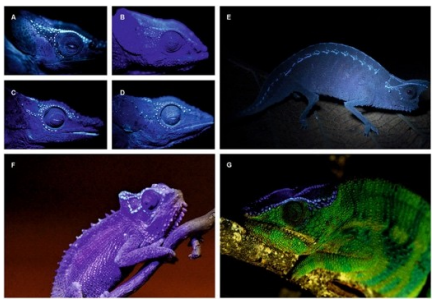
NATURAL MIMICRY

STRESS - ILLNESS SUNBATHING

SEDUCTION

FLUORESCENCE

U.V VISION



From dark black to scarlet and fluorescence, its range of colors is one of the widest in the animal kingdom and plays an essential role in the reproduction phases. Sensitive to ultraviolet light. Thanks to their 4th receptor, females, for example, can enjoy the hues and shades that correspond to UV frequencies, colors that birds cannot distinguish well, which guarantees better mating conditions. In contrast, males use more saturated colors to impress their opponents and deter them from fighting.

TUMULTUOUS MATING

It is undoubtedly during this seduction phase that these fluctuations in effects and colors are most impressive, especially as this merry-go-round is often accompanied by a show of strength in which the males puff themselves up and firmly display their attributes to impress the female and her potential suitors. A show that is not always enough to convince the female. Natural selection forces the males to fight. The fighting ritual is divided into three stages: intimidation, combat and killing. Here again, the messages are visual. Their adjustable ribcage can inflate by three times the volume of the head and neck, which can be enough to confuse their competitors.

MALE DIMORPHISM - SEDUCTION – COURTSHIP DISPLAY -

FEMALE FURCIFER PARDALIS REJECTION – BRIGHT ORANGE

MALE COMBAT

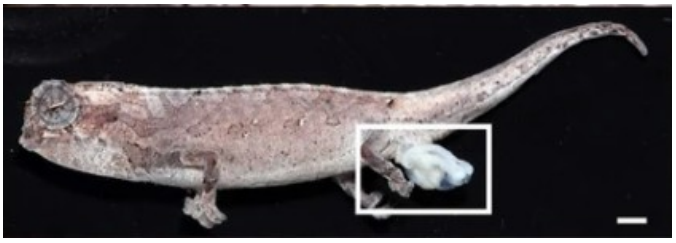
Chameleon fights can be extremely violent. The first attack consists of ejecting its competitor and when the latter resists, the confrontation can go as far as death. The power of its jaw allows it to crush its opponent's head. Despite this, the female can display dark colors and stripes to decline the advances of the winner. She may also display other colors to warn that she is pregnant.

As with all reptiles, the partners copulate. The male's sex is ostentatious, like that of snakes, and can be very long. The male can take his time and the act can last up to 15 minutes. Sometimes, the female bites and rejects her partner abruptly for no apparent reason. If she is willing, her cloaca opens for copulation to take place.

COPULATION

MALE COPULATORY ORGAN.

FEMALE CLOACA



The stages of this animal's reproductive process are among the longest in nature, with incubation lasting from 4 to 13 months, depending on the species. In most cases, even tree-dwelling females descend to the ground and dig a deep enough hole to lay their eggs, then abandon them. Thanks to the good atmospheric conditions, only oviparous chameleons are found on the island, unlike in East Africa, where all three modes of reproduction exist, oviparity, ovoviviparity and viviparity. That being said, Madagascar is home to a unique species capable of slowing or pausing the incubation of its eggs. This astonishing phenomenon is called "diapause", which allows the chameleon to counteract too great a climatic variation, cold or hot, which is dangerous for the eggs. The baby chameleons hatch on their own and come to the surface as autonomous individuals, able to hunt within minutes of hatching. This is a real feat, given the anatomical and biological complexity of the chameleon, especially its tongue and eyes. It also means there are no real chameleon family units, quite a common trait among reptiles.

FEMALE BURROW EGG-LAYING

BABY CHAMELEONS – SOLITARY HATCHING

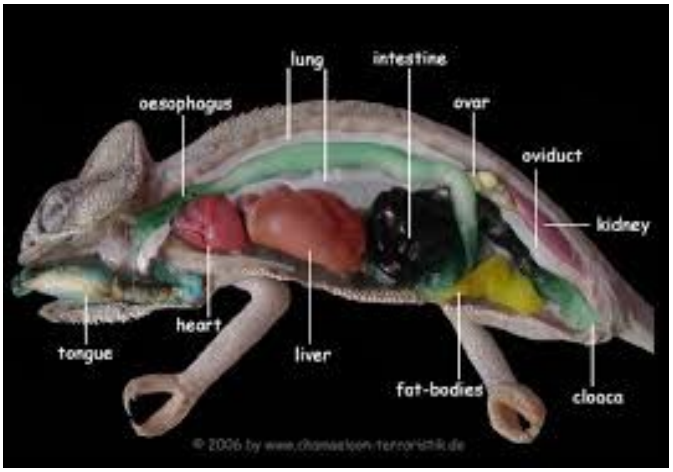
PHENOMENA...

This gives us the opportunity, at this point in our film, to address the subject of organic miniaturization. We will see in this film that Madagascar holds many records in this area: the smallest primate, the smallest frog and the smallest chameleon on the planet. This chameleon is one of four new species described in recent months on the island. "*Brookesia nana*" is in fact the cousin of "*Brookesia micra*", which already held the record for miniaturization among chameleons since 2012, with a length of barely three centimeters. Discovered by the German naturalists Frank Glau Jörn Köhler and Mark Scherz, the male of this tiny species is only 1.2 cm long. Once out of the egg, it measures no more than 3 to 4 millimeters. It also displays an unexpected trait: its sex can reach 20% of its size. This tiny reptile is pushing the miniaturization of life among vertebrates even further. Imagine fitting lungs, liver, heart, stomach, intestines and all the organs found in vertebrates, whatever they may be, into such a microscopic volume... Many scientists are working on this miracle of nature in the hope of finding solutions to some of our organic cloning protocols.

THE BROOKESIA NANA …

THE BROOKESIA MICRA

ANATOMY OF THE CHAMELEON BROOKESIA MICRA – TO SCALE



BUT MADAGASCAR ALSO HOLDS ANOTHER RECORD; ALONG WITH THE SMALLEST, IT ALSO HAS THE LARGEST CHAMELEON IN THE WORLD: THE (*CALUMMA PARSONII*), WHICH CAN REACH UP TO 75 CM IN LENGTH. IT LIVES IN THE NORTH-EAST OF THE ISLAND. They share the same biotope, yet one lives on the ground and the other in the trees – they never cross paths.

Yet another extravagance unique to Madagascar, which makes this pilgrimage to the land of chameleons truly original and which gave us the opportunity to see chameleons from a different angle.

CALUMMA PARSONII – 75 CM LONG.

CONSERVATION

Although the discovery of four new species by Malagasy scientists a few months ago confirms the extraordinary diversity that can be observed in Madagascar, the survival of these reptiles is increasingly threatened in this country. After being weakened by poaching for Western countries, where chameleons have become one of the most popular pets since the 1980s, deforestation is now the most immediate danger for chameleons. One threat follows another.

Today, the illegal trade has been replaced by breeding operations in Europe, Asia and the United States. While some species do not tolerate captivity, others, among the most attractive, are easily bred. From more than 10,000 individuals exported per year between 1980 and 2000, we have dropped to less than 1,000 individuals per year today, from official sources of course. This would have been good news if the chameleons were not under enormous pressure from logging companies and a total lack of environmental policy. Nearly 150,000 hectares of forest are ravaged every year; in 2017, more than 500,000 hectares were lost to fire and logging, the equivalent of 50 times the size of Paris. The island of Madagascar is among the 5 biggest deforesters on the planet and the situation is getting worse with each passing year. We will see, with the “Calumma Tarzan”, which chameleon species are the most threatened and the solutions proposed by local associations but also by CITES (Convention on International Trade of Endangered Species) and IUCN International Union for Conservation of Nature) to preserve them.

We will also see the short and medium term environmental policy that the Malagasy government wishes to put in place (reforestation, control of wild felling, technical means to fight fire, etc.) and if it actually means what it says, knowing that the poverty rate is very high and that the exploitation of certain natural resources is a question of survival in many states of the island.

Our wish is of course to end this journey in the land of chameleons on a positive note. We hope that the information gathered from local NGOs, the CITES office in Antananarivo, as well as the data communicated by TRAFFIC (Wildlife Trade Monitoring Network), the IUCN (International Union for Conservation of Nature) and the AFD (French Development Agency) will allow us to present, if not to evoke, the different solutions thought of by the Malagasy government and international institutions to preserve the forests and the exceptional biodiversity of the island, as efficiently as possible.

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THE GREAT CHAMELEON CARNIVAL

DIRECTOR'S NOTE

TREATMENT

The first aim of this film is to shed new light on these unique reptiles, on their anatomy, which remains a masterpiece of adaptation, very different from other reptiles, on their private life, which is as violent as it is quirky, and on certain little-known behaviors and performances, rarely filmed in the wild.

Far from wanting to make a rather contemplative "Catalog" documentary that would be limited to presenting beautiful images of the multiplicity of chameleons that can be found in Madagascar and the different phenomena that live there: the tiny ones, the giants, the more colorful ones, the helmeted ones, the red noses or even the skinny ones, the list is long... We preferred a more behavioral approach that gives us the opportunity to tell about their story, their evolution and the fantastic capacities of adaptation that helped them to survive, through the presentation of each species that we are going to meet. Each phase of the presentation that we have described in the beginning of this document (anatomy, predation, defense, locomotion, sexuality, reproduction, etc.) will give us the opportunity to observe and film the species or group most representative of these different behaviors. The Furcifer pardalis or "panther chameleon" is the most colorful chameleon on the planet. They make a great case study for the chameleons' famous homochromy. The Brookesias, which include the smallest chameleon in the world, the Nana, but also the Pygmy, the Horned, the Minima, etc., all of which live on the ground, among leaves and roots, are great to talk about natural mimicry, of which they are the champions, and of course about organic miniaturization, since none of them exceed 5 cm in size... The Calumma parsonii to tell the story of the tribulations of sexuality but also to present the giant – the most quarrelsome and dangerous of the island, whose mouth is undoubtedly

the most impressive and demonstrative. This family of chameleons inspired most of the chameleon representations found in famous cartoons – Pascal from Disney's Tangled, Rango, the chameleon cowboy from Nickelodeon or Randall in Pixar's Monsters, Inc. ...
We will come across many other chameleons throughout our journey, each species being an opportunity for us to present the many anatomical or biological details or specific behaviors that will punctuate our film.

The conclusion of the film will deal with the conservation programs planned to save the most endangered chameleon species, such as the Calumma brevicorne and the Panther Chameleon, which, like almost all chameleons in the world, suffer from the destruction of their natural habitat.

THE INVESTIGATION...

From one biotope to another, in some of the most splendid landscapes of Madagascar, we are going to meet chameleons of different families and answer the many questions we have about these strange reptiles. Why and how did they manage to move from East Africa, where they originate, to Madagascar? How did they develop to such an extent, that is to say nearly 50% of known species? How can such a wide variety of shapes, colors, sizes, anatomical and biological characteristics be explained in such a limited biotope? We will also try to understand how these reptiles are so different from others and how their adaptation during evolution can explain such anatomical singularities, such exceptional behaviors and equally unique performances. Finally, as bio-mimicry increasingly takes over all areas of scientific research, in a multitude of fields, we will see what chameleons have already given us and what they can still teach us that could be useful in the future.

TONE AND STYLE...

The rather theatrical tone that we want to give to the film is intended to reflect the contradictory feelings that the chameleon inspires. Situated halfway between the fear that its strange anatomy and dinosaur-like mouth can arouse, and the humor that its unusual and disconcerting behavior can generate, Malagasy folk tales do not lack imagination when it comes to talking about chameleons. For some, its hesitant walk is a lesson in wisdom and reflection; in the north of the island, the chameleon is considered to be "mystical and repulsive, endowed with the power to bring bad luck to those who mock it".
The object of tales, proverbs or myths, they occupy a special place of real importance within Malagasy culture. One thing is certain however, they leave no one indifferent and we want the camera to capture the myriad of feelings they elicit in our imagination... The caricature of Randall in Pixar's Monsters Inc. or of little Pascal in Disney's Tangled is worlds apart from the open and swollen mouth of a Furcifer chameleon ready to fight. Sometimes dramatic, sometimes humorous, sometimes poetic, we wish to offer a rather theatrical show of images and action, as well as a lesson in things and nature, in the heart of one of the most beautiful islands in the world.

N.B
This gallery of portraits which will surprise by the disparity of the shapes, the colors, the sizes and its incredible postures and expressions has for main objective TO ILLUSTRATE AND ARGUMENT OUR PROPOSAL WHICH REMAINS ABOVE ALL ETHOLOGICAL and behavioral.

TECHNIQUE & LOGISTICS

In order to obtain a high-quality film, the most aesthetic and the most captivating possible, the images will be shot in 6K and in fixed optics.

Regarding the capture of certain chameleon behaviors in action, such as hunting, color changes, independent vision and other spectacular actions, we will have a high resolution imaging setup, high speed cameras and directional microphones, as well as high and low frequency sound sensors. For a quality shooting, accessories such as the Slider, the drone and the stabilizer will guarantee us stable, elegant and dynamic images out in nature as well as indoors. An adapted logistic will be necessary to face all eventualities, if we do not manage to film certain behaviors in nature. Our contacts in Madagascar are committed to reconstitute a natural setting by creating a large aviary and a terrarium with a crate in which the chameleons will be handled with care by the Malagasy herpetologists of the University of Antananarivo with whom we will work. This installation will also allow us to be able to make very aesthetic shots, backlit on a variable nature background. This installation will also allow us to film, before the arrival of the team and after its departure, images of exceptional character that we could not shoot during our stay...

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