

# THE BLOB

**A GENIUS WITHOUT A BRAIN**



A 52' DOCUMENTARY DIRECTED BY **JACQUES MITSCH**

WRITTEN BY **JACQUES MITSCH, AUDREY DUSSUTOUR & LAURENT MIZRAHI**

PRODUCED BY **KARINA SI AHMED & GUILLAUME ALLARY**

IN COPRODUCTION WITH **ARTE FRANCE**

DELIVERY **MAY 2019**

An unlikely appearance, 720 mating types, an infinite life and exceptional skills... Here comes *The Blob!* More commonly known as slime-mold, this extraordinary one-billion-year-old organism challenges our worldview on living matter and is about to revolutionize the concept of intelligence.

Shot on 3 continents, blending science fiction, animation, the beauty of nature, humor and cutting-edge science, the film is a scientific investigation shaped like a thriller, following top international experts from Europe, Japan and the US, through their major discoveries, and offering a mind-blowing experience into the very roots of cognition.

**HAUTEVILLE**  
PRODUCTIONS

**arte**

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SALES

# THE SUBJECT

Known to scientists as slime mold, or *myxomycete*, the blob is a unicellular organism, which is to say that it is made up of a single giant cell. It has been around for billions of years – long before the appearance of animals or plant life, making it one of the most “primitive” life forms on earth. Some look like big yellow sponges, others resemble lichens or coral – their color changes according to the species: white, black, grey, brown, blue, green, pink, red, yellow...

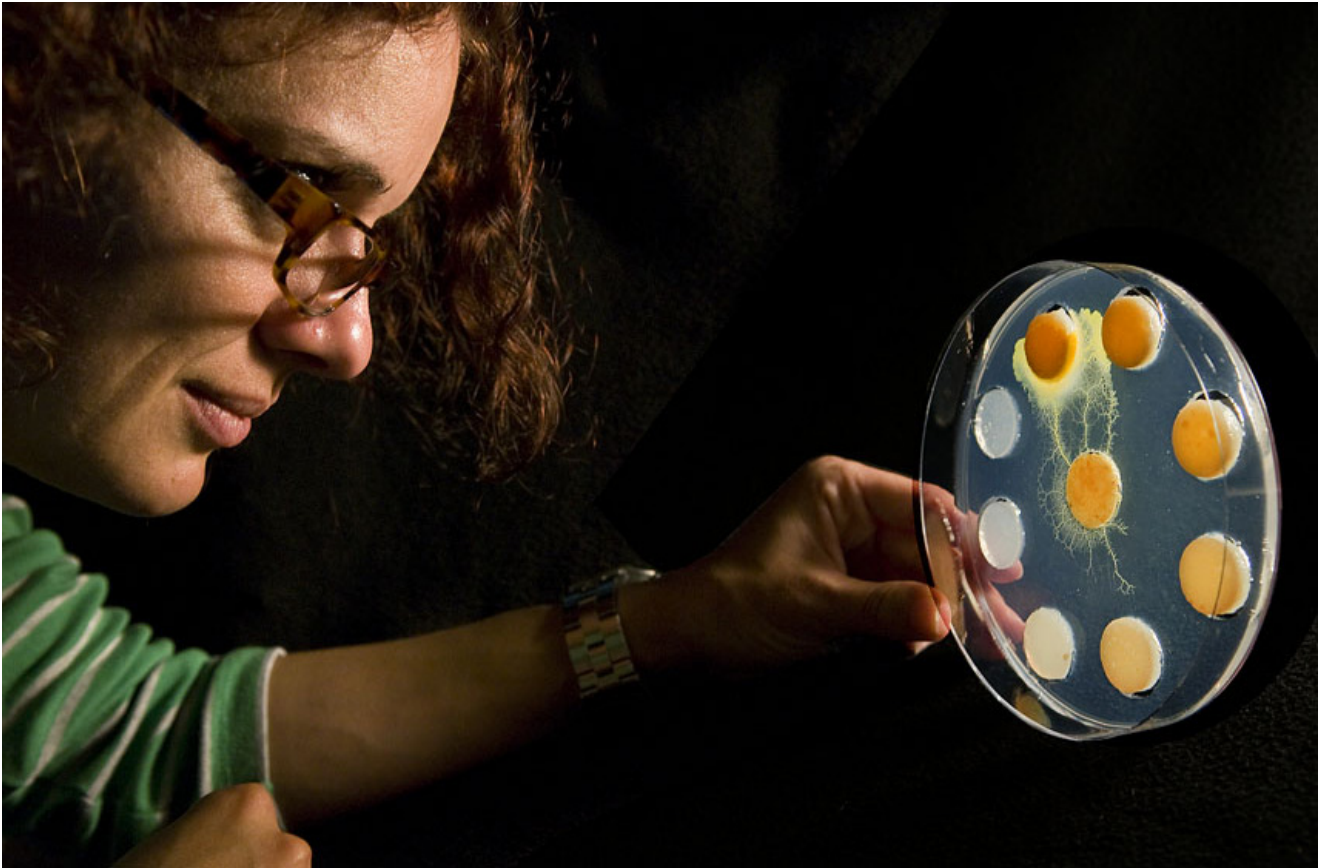
There are blobs across the planet. They usually live in the underwood, a humid environment away from light. But one can also find them in the desert, the tropics, on mountains, temperate or boreal forests, the arctic tundra... Nothing stops the blob, except areas that are over-exploited by man.

The most studied blob is the *Physarum polycephalum*. When fed a regular diet of mushrooms and bacteria, it will typically double in size every day. Measuring from 1 cm<sup>2</sup> à 10 m<sup>2</sup>, it has no mouth, stomach, ears, or eyes. And yet, it sees, smells, eats, digests, reproduces, adapts and moves – up to 4cm per hour. With not two but 720 mating types, it can also regenerate, meaning it's practically immortal. When cut in half, its membranes scar over in a record-breaking two minutes, forming two new, identical blobs.

Not a plant, animal, nor mushroom, it's an organism that shares characteristics with the three major living categories, defying all the laws of biology. It's enough to have the scientific community in a tizzy! But what to make of an organism with no brain or nervous system who can optimize its nutrition, locate itself in space, escape from a labyrinth, create efficient and adaptable networks of veins, learn to overcome initial apprehension, transmit its learning to its kin, anticipate and resolve complex problems... in short, show proof of intelligence? Because this is indeed what a blob is capable of...

New research into this strange genius is overturning scientific certainties about intelligence that were thought to be confirmed. A new, fundamental area of research is opening up before our eyes, a true revolution that is confirming the scientific revolution expressed by Charles Darwin over a century ago: amongst living creatures, intelligence does not belong only to those with a “complex” brain, but also applies to “invertebrates” such as insects and jellyfish, plants, and even organisms made up of just one cell, yet able to develop intelligent behaviors and cognitive skills.





This is what hypnotized **Audrey Dussutour**, an ethologist at National Center for Scientific Research (CNRS), who had committed to a career in studying the behavior and nutrition of ants before chancing upon the *Physarum polycephalum*. Fascinated by this unicellular organism's extraordinary capacities, she found herself devoting a greater and greater amount of her time.

For the past nine years she has been conducting a series of experiments in her lab in Toulouse that have shed light on the feats of this true prodigy of evolution. In fact, she found its nickname, *the blob*, taken from a 1958 film starring Steve McQueen in which an extra-terrestrial jelly invades earth, swallowing all of its inhabitants...

Today the blob is not just on movie screens, but also appears on the schedules of international scientific meetings, proof that unicellular expert is starting to be taken seriously. In fact, Audrey Dussutour's research on the blob and scientific issues it raises are in no way eccentric or anecdotal: they tell us a lot about the living world's unity beyond its diversity, what is "brainless" intelligence, opening new research avenues as exciting as they are dizzying.

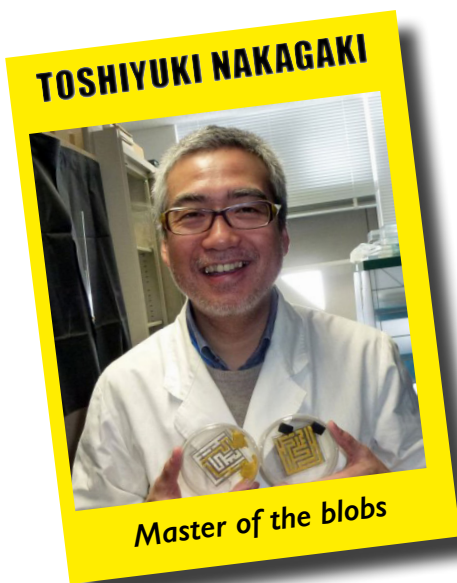
It's well known that pioneering research in a central field leads to material applications. In the blob's case, these are close at hand. For example, in the field of pharmaceutical and biomedical research, some scientists work on the hypothesis that the blob might provide new understanding of the parasite behind malaria (also a unicellular organism) or the development of tumors – whose vascular structure is similar to the blob's. But the progress in primary research on the blob could also lead to innovations in other fields: the optimization of networks, nutrition, software...

Audrey Dussutour will be the driving force of our documentary: her account in her book *Everything you Always Wanted to Know About the Blob* (Edition des Equateurs, 2017) put us "in the head of a scientist," a unique viewpoint into the heart of fundamental research. Her passion for discussing the blob, her central role in the most important research on this organism along with international scientists with whom she is very close and her desire to make every aspect of these unique discoveries accessible to all make of her an ideal guide.

This film follows a scientific process and it is structured around the key experiments that allowed Audrey Dussutour and top international experts to further their understanding of the blob and its exceptional abilities.

**Pr. Toshiyuki Nakagaki** from **Hokkaido University in Japan**, whose pioneer experiments on slime molds have twice earned him IgNobel awards, “honoring achievements that first make people laugh, and then make them think.” **Pr. Michael Levin**, of Tufts University in **Boston**, who became renowned for his work on planarians, these aquatic worms with a surprising capacity for regeneration, and is currently working on cognition at cellular level – and how cellular networks process information. **Dr. Frantisek Baluska**, a researcher in vegetal physiology at Germany’s University of Bonn and a member of the International Laboratory of Plant Neurobiology in **Florence**, Italy, who works on cognition amongst plants. **Hans-Günther Döbereiner**, Professor of Physics at the Institute of Biophysics of the University of **Bremen**, Germany, specialized on network theory, who uses the blob as a model organism to understand the dynamics of the vast networks in relation with medical research (vascularization of tumor cells for instance) as well as optimization of networks... **Andrew Adamatzky**, professor of computer science at **Bristol’s** University of the West of England, who sees the blob as a nature-born computer acting like a processor – that is to respond to external signals, to treat them, and complete logical operations – and uses blobs as a sort of “brain” for the robots he built. And **Myriam de Haan**, who works as a researcher at the Botanic Garden Meise, in Belgium, and will guide us to visit the largest collection of Myxomycetes in Europe.

These present so many pedagogical and very visual opportunities to dive into the heart of the mystery of living matter, and even to the very roots of the concept of intelligence.



# THE FILM'S MAJOR CHAPTERS

## IN SEARCH OF THE BLOB

In a forest, where the camera reveals this strange organism tucked into a tree trunk as well as in a lab, we discover the *Physarum polycephalum* main characteristics. A single cell, but hundreds of cores. A mesh of veins that allows for the distribution of nutrients, but also movement. ... And a secret weapon: when the environment's conditions are bad (dryness, lack of food), the blob can go into dormancy, transforming itself into a thin, dried crust – sclerotia. It can remain like that for years, until it once again encounters water and food and returns to its original form. And any trace of decay will have disappeared from the organism. So, we can consider it immortal.

## A GENIUS OF NUTRITION

The blob is voracious. That's a godsend for Audrey Dussutour, as a nutrition specialist. But the blob is never blinded by its gluttony; on the contrary, it keeps close watch on its diet. A first experiment shows that the blob is able to choose the source of nutrition presenting the optimal balance between sugar and protein (one third/two thirds). Better yet, it's able to create the ideal diet for its growth from two imperfect sources; it adapts and optimizes its nutrition based on its environment! That's the first observation that astonished Audrey and aroused her curiosity. How far could the blob take this capacity to create strategies?

## AN ACE OF NETWORKS OPTIMIZATION

We will travel to Japan to meet the man that Audrey considers "the master of blobs": the biophysicist Toshiyuki Nakagaki, whose research has focused on the blob's capacity for movement. He has proven that the blob was able to find the shortest path to get out of a labyrinth. He even set up an experiment where 36 bits of food are laid out in a pattern corresponding to cities in the Tokyo area, and a slime mold at the spot corresponding to Tokyo. The blob develops its network of nerves across the map, linking cities more efficiently than the existing rail system – the paths the blob creates are both shorter and less redundant. *Physarum* is also capable of locating itself thanks to the mucus that it leaves behind as it goes and which serves as a spatial memory – a form of cognition that highly intrigues scientists.

## A STUDENT ABLE TO LEARN; A PROFESSOR ABLE TO PASS ON ITS KNOWLEDGE

A form of "brainless intelligence" has already been proven amongst plants, able to process complex information, react to stimuli and to make the optimal choices towards survival. But what about these even more "primitive" organisms that are blobs? Audrey has discovered that blobs are able to learn to overcome an aversion for a substance that it abhors (salt, or caffeine) when it realizes that the substance is inoffensive. Even more incredible, the blob can fuse with fellow blobs and pass on what it has learnt.

The proof of such cognitive abilities in a simple cell is a real revolution and shakes the international scientific community. How does it store this information? How does it share it? At what stage of its thousands of years of existence did it develop this form of intelligence? These are the questions that Audrey and her colleagues will address in June 2018 during the conference organized at the Konrad Lorenz Institute, in Vienna. Devoted to these "primitive" beings that had long been ignored by cognitive sciences (unicellular organisms, plants, "simple" animals such as marine sponges...), the conference will allow us to better understand the evolution of cognition amongst living beings. It's a new field of fundamental research that is opening up, and with it the chance for wonderful discoveries. The blob has adapted over hundreds of millions of years, facing changing sets of environmental conditions. It has so much to teach us! The blob's great story is only beginning.

# TREATMENT – By Jacques Mitsch

## THE BLOB, THIS HERO

In the beginning, the blob is a fantastic, malicious being – a bit kitsch and straight out of some science-fiction universe, and this B-movie from the late 50s starring Steve McQueen. But behind this extravagance, this brainless genius has turned out to be a very serious research subject who may lead to major scientific discoveries. And it has a major asset that separates it from other unicellular organisms: it's not microscopic... it's even very visible and immediately recognizable. Its spongy and colored appearance is unsettling, intriguing, amusing, while the beauty of its very detailed pseudopods proves surprising and captivating. Its hunger, capacity for movement and of exploring its environment, all on the border between plant and animal life, are the source of endless curiosity and even affection. The blob is facetious, unpredictable, surprising; he draws attention, raises questions, (re)awakens a desire to learn. All in all, he brings together all the qualities of a documentary film's central character: surprising both in form and substance, leading us to discover an unknown world, of fundamental and applied research, and bringing us to the heart of living matter and a universal, vertiginous questioning.

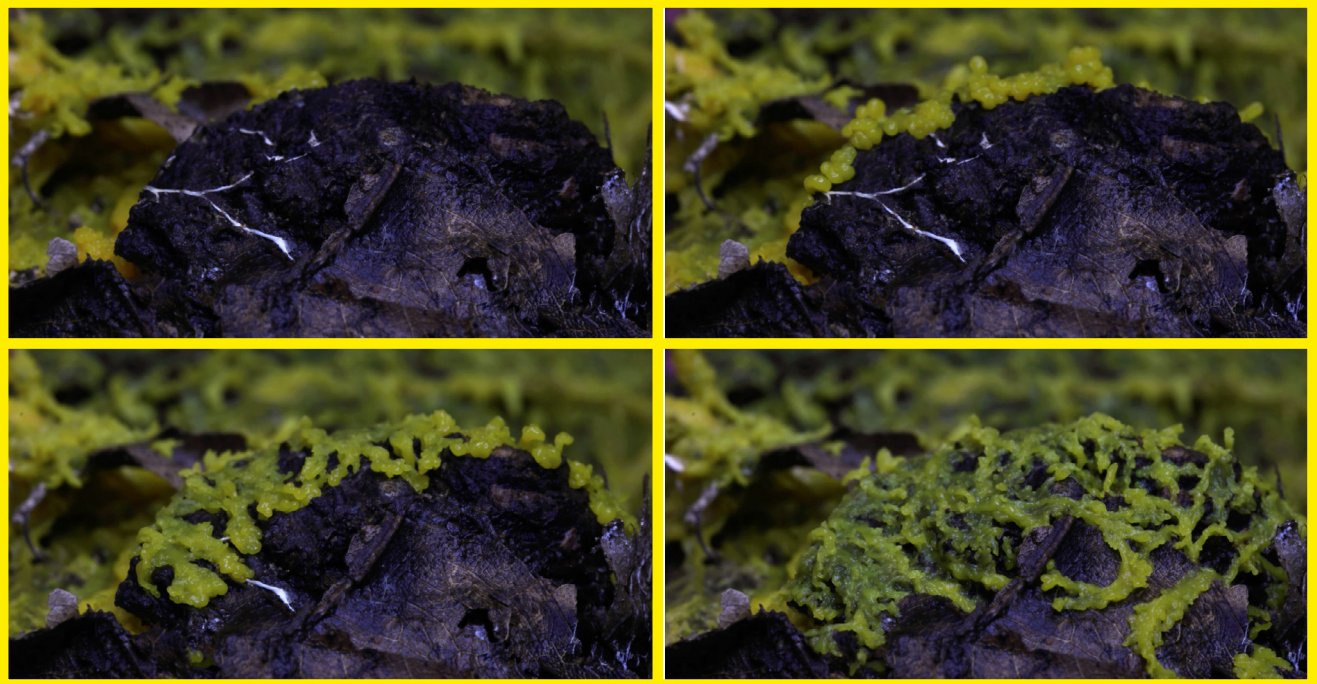


## THE FILM, AN INVESTIGATION AND REFLECTION ON LIVING MATTER

The film will be structured like a scientific investigation. Obviously, the scientific logic thoroughly dictates the narration's main stages. But as with my previous science-based films – especially these two on animal and plant cognition: *In the Mind of Plants*, (ARTE France, 2009), and *Animal Doctors*, (ARTE France, 2013) – I wish to endow the film with its own dramaturgy. This time, I'd like to draw inspiration from the film that gave the blob its nickname, placing the codes of fantastic thriller in the service of knowledge. Starting like a police investigation, I will keep on maintaining a strange and outstanding atmosphere: labs will become places full of mysteries, scientific instruments could be those of Crime-Scene investigators, and all the experiments that come one after another help us progress in this inquiry...



The research and experiments that we will bring to life are part of a true revolution in the way we see the world around us. My direction must shine a light on these cracks, tip over our certainties. I wish to bring the viewer to comprehension and reflection through use of juxtaposition, unexpected metaphors and surprising humor; emotions and poetry. In this optic, I'll film outdoors as much as possible, in the blob's natural environment, as well as that of its friends (ants, plants, aquatic worms...). As to the scientists' contributions, I will film them in action, filmed and grant them their status as full characters, not just limited to interviews with fixed ideas. I'll take the time to reveal their personalities, their way of being or their ironies. My aim is that they not only add to the content, but also the film's shape.



Regarding my "hero", I want to film the blob as a character, as it's never been filmed before. I will therefore conceive a "studio-blob", like a movie set. With its controlled temperature and lighting, this room will be the setting of all sorts of experiments as surprising as they will be playful; it will also allow us to recreate natural settings from the inside, like a full-size vivarium filmed in macro, putting our characters into action and playing on their size as Saul Bass did in his film Phase IV. Most of the shots involving the blob will be filmed in time-lapse. These particularly poetic images will be complemented by animations that will clarify the mechanisms of the experiments and elaborate on all that is at stake.



**WATCH**  **THE TRAILER**

<https://vimeo.com/255368151> // Password: blob

# THE AUTHORS

## **JACQUES MITSCH — DIRECTOR**

After studying biology and cinema (ESAV Toulouse) he has directed numerous documentaries since 1986 for Canal +, France Télévisions and notably ARTE.

Selective Filmography: (with some hyperlinks to watch full films)

**SOUNDS OF NATURE** (3x52' – GÉDÉON PROGRAMMES / ARTE G.E.I.E/ PLANÈTE +) – 2018

**ANIMAL DOCTORS** (52' – K PRODUCTION / ARTE France) – 2014

**THE BONE RUSH** (52' – LA COMPAGNIE DES TAXI BROUSSE / ARTE France) – 2012

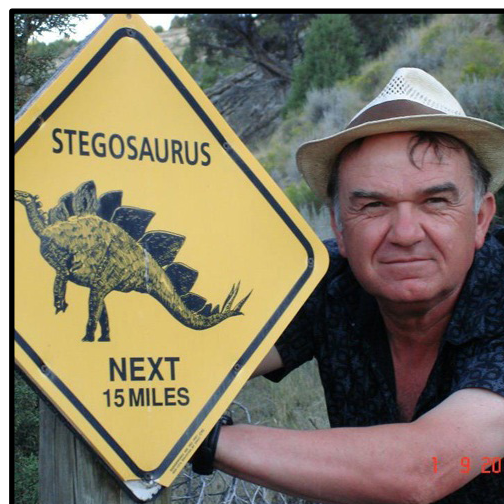
**A NATURAL HISTORY OF LAUGHTER** (52' – ALTOMEDIA / K PRODUCTION / DOCLAB / ARTE France) – 2011 – In association with Rai Uno.

**IN THE MIND OF PLANTS** (52' – K PRODUCTION / GEDEON PROGRAMMES / ARTE France) – 2009. In association with The Science Channel / Al Jazeera / Radio e televisao de Portugal / DRTV / RTBF / SBS / Canal + Polska / TFO / Odisea / ERR / Kultura TV. Also broadcasted on Discovery Science / SVT / RTP

**BACK TO NEOLITHIC** (3x52' & 90' – LA COMPAGNIE DES TAXIS BROUSSE / FRANCE 3 / FRANCE 5) – 2002

**CRYPTOPIZZLE** (60' – K PRODUCTION / ARTE France) – 2001

With the participation of RTSI / TV5 Monde. Also broadcasted on NHK / Discovery (Canada)





## AUDREY DUSSUTOUR — AUTHOR



Audrey Dussutour, 40 years-old, has been a researcher at the University of Toulouse III's Animal Cognition Research Center (CNRS) since 2009. She holds a PhD in Animal Behaviour (Université Paul Sabatier / Université libre de Bruxelles), and held two post-doctoral positions in Canada (Concordia University) and Australia (University of Sydney).

Her work on problem solving amongs social insects (collective intelligence) and unicellular beings (primitive intelligence) have won awards for best research paper from the *The Journal of Experimental Biology*. She also won the award for young researcher from SFECA (the French Society for the Study of Animal Behavior) and the Wetrems Award from Belgium's Royal Academy of Sciences.

Since the publication of her work on the *Physarum Polycephalum* in several prestigious international journals (*Nature*, *Proceedings of the Royal Society London* etc.), Audrey has been called upon to give lectures on the origins of cognition across the world, including Kyoto (Japan), Cairns (Australia), Oxford (UK), Trieste (Italy), Helsinki (Finland). She also collaborates with scientists at universities internationally, such as Tuft University (Boston, USA), Sapporo (Japan), Regensburg University (Germany), Uppsala (Sweden), Georgia Tech (Atlanta, USA) ...

Beyond her research, Audrey has always been keen to share her discoveries with the general public through workshops, school discussions, and also in the media in France (France Inter, RTL, ARTE, France 5...) and internationally, where she regularly participates in radio (CBC – *Quirks & Quarks*, Radio Canada, RTS) and television programs (NTR/VPRO...). Her work has also been the subject of many articles internationally (*Wired*, *Newsweek*, *LA Times*, *Washington Post*, *The Atlantic*...).

# HAUTEVILLE PRODUCTIONS

**Hauteville Productions** is an independent documentary production company, born of a desire to make sense of the world, favoring an auteur's approach. It was recently founded by:

- **Karina Si Ahmed**, executive and creative producer of over 20 documentaries and news magazines. She was previously head of documentaries at Flach Film Production from 2011 to 2017, producing films of international scope that were acquired by networks and broadcasters across the world.

- The publisher **Guillaume Allary** ("The Arab of the Future" by Riad Sattouf, "Three Friends in Search of Wisdom" by Christophe André, Alexandre Jollien & Matthieu Ricard), who was previously a director and producer of documentaries, with Roche Productions among others.

## Selective filmography:

### • 2018 / 2019 – HAUTEVILLE PRODUCTIONS

*What Ever Happened to Rosemary Kennedy?* by Patrick Jeudy – 52' – France 5

*John Ford, The Man who Invented America*, by Jean-Christophe Klotz – 52' – ARTE France

*Cat Stevens, The Bridgebuilder* by Simon Backès – 52' – ARTE France

### • 2011 / 2017 – FLACH FILM PRODUCTION

*Secrets of the World's Richest Woman* by Gérard Miller – 90'/2x52' – France 3 – 2017

With the participation of: Planète + – RTS – RTBF – TV5MONDE

*Hillary Clinton, A Woman on the Edge* by William Karel – 68'/52' – France 3 – 2016

With the participation of: RTS – RTBF – Blue Ant Tv – AMC network iberia/ odisea – DR – ERR – ICI RDI – TV4 Sweeden – TVPoland - LTV- Al Arabiya - NRK.

*Teenage Occupations* by Claude Ventura – 85' – France 3 – 2014

Selected at FIPA 2014, Public Prize at Etoiles de La Scam (Paris), Best Director Prize at Northern Character Film Festival

*Sad People Factory* by Michèle Dominici – 90' – ARTE France – 2013

With the participation of: YLE, Al-Arabiya

*Barack Obama, Great Expectations* by William Karel – 2x52' – France 2 – 2012

With the participation of: TV5MONDE – RTS – RTL-TVI – VPRO – SBS – RSI – RTP – LTV – Al Arabiya – NRK.



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