THE SECRETS OF THE CLOUDS

Programme transcript

THE EDGE title 10.00.20.00	Dissolve to white
<u>Voice over</u> 10.00.25.00. -10.00.34.00 **Something remarkable is happening in the clouds that affect all life on earth - but so far biology cannot explain it.** **The Secrets of the Clouds** 10.00.45.01. **Understanding life has never been easy. Its very complexity is puzzling. Why *is* there such variety?** 10.00.56.00 -10.00.01.12.00. **It took genius to discover the answer.** **In 1859 Charles Darwin realized that no matter how different animals may appear, they are all related to each other.** 10.01. 02.00 -10.01.23.00. **It was a revelation. Darwin saw the invisible link between all creatures, - an infinitely slow process that connects us all - he called it evolution.** 10.01.28.00. **EVOLUTION is a battleground, - the survival of the fittest, - a constant, ruthless struggle for**	*Frightening sounds.* *Insects, etc…birds calls.* *Building tension.* **10.00.26.14.** ***Red howler monkeys: between second and third line.*** ***JUNGLE WILD TRACK*** **<u>10.00.34. -10.00.42.</u>** ***Drum effect*** **10.01.37.** ***Change in music***

resources and reproduction. 10.01.40.00. –10.01.47.00. **But there was something that even Darwin couldn't explain. A problem left for others to solve: Altruism.**	***Meadow.***
Marlene Zuk 10.01.48. –10.01.58. ***'Darwin said that if you could find a case where an organism did something solely for the good of another organism it would annihilate my theory.'***	**10.01.57.** ***Bee buzz***
Voice over 10.01.59.00. **Worker bees seem to deny Darwin's theory. They are like kamikazes: to protect the hive they will sting- even though it costs their own life.** 10.02.10.00 **How can such behavior evolve in a world that is shaped by natural selection?** 10.02.19.00. **This was biology's greatest puzzle and it took another genius to solve the paradox…** 10.02.25.00. **Evolutionary biologist, Bill Hamilton could see a realm that Darwin couldn't even imagine.**	**10.02.58.** ***Louder bee buzz*** **10.02.31.00** ***Meadow wild track comes in***
Hamilton's voice track 10.02.36. ***'Darwin's basic argument seemed to show a very selfish living world and yet this didn't seemed to be that one saw around. There has to be a middle path.'***	***Meadow wild track louder, birds, sheep.*** **Hamilton walks in Wytham wood** **CUT TO CLOUDS, FIELD**

Voice over 10.02.51.00 **In 1964 Bill Hamilton discovered that altruistic behavior can be explained if one looks beyond the individual and takes a gene's-eye-view of nature.** 10.03.03.03. JUST BEFORE ZOOMING TO FLOWER **HE saw that from the point of view of genes, it didn't really matter much if one individual lived or died, because a copy of the same genes lived on in all the other individuals that it was related to.**	**Book cover: Narrow Roads of Geneland** **Dissolve bee to bee** **10.02.52.00.** ***Bee buzz in*** **Bees point of view** **FLOWER ZOOM IN DISSOLVE MITOSIS** **BUSY CELL DIVISION BUSY BEES** **10.03.07.** ***bee buzz***
Richard Dawkins 10.03.17. ***'The essence of Bill Hamilton's theory was that when we think about natural selection we have to think in the gene level, rather than just in the individual level.'***	**10.03.18. –03.26.** *Professor Richard Dawkins evolutionary biologist*
Richard Dawkins voice track 10.03.27. ***'The individual is the machine or vehicle, /which carries the gene about.'***	**Flying insect extreme CU, flying over roofs** **10.03.30.** ***Sound of helicopter*** **Blue sky, insect appears cut to:**
Breathing space 10.03.33. –10.03.42.	**Time lapse of rushing white clouds**
Voice over 10.03.43.00. **Bill Hamilton took Darwinian thinking into a new dimension. One that the rest of the scientific world is ONLY just catching up with.** 10.03.55.00. **But sadly his life was cut short while he was pursuing yet more answers…**	**Montage of science papers** **Walking away in photos dissolving into each other, dissolve to big tree**

Breathing space 10.04.05.	**CLOUDS & TREE TOPS**
ABC Radio Piece 10.04.07. -10.04.25. ***'Today we pay tribute to a man who /showed that nature can be kind or altruistic as well, his name is or was W.D.H because he has just died in the Congo in his quest for more cooperative tendencies in the wild. He has been called the greatest evolutionary biologist after Darwin...'***	**10.04.11. -04.20.** *ABC Radio Australia* *May 2000.* **10.04.14.** ***RADIO TUNING IN, sound of travel*** **CUT** **Pan from road to cemetery, Luisa passing by…** **Grave shot.**
Voice over 10.04.28.00. **The scientific world has lost one of its most original thinkers.**	**Luisa, marble** **10.04.34.** ***Thunder wild track…***
Luisa Bozzi 10.04.36. ***'He was a person that had an incredible sense of freedom. He had a freedom in his mind.'*** *Tim Lenton:* 10.04.45. ***'BH was an extraordinarily thoughtful person with a deep love of nature...'*** *James Lovelock:* 10.04.54. ***'He was a very brave man, as his death shows. He would go into the wildest, most dangerous places to further his science.*** *Ed Hooper:* 10.05.06. ***'I think what we can learn from Bill is the value of open and honest and uninhibited scientific***	***Thunder, rain…all the way long.*** **10.04.38. -04.44.** *Dr Maria Luisa Bozzi* *science journalist* **EDINBURGH HILLS IN GOLDEN GLOW. Tim looks up.** ***Wind.*** **10.04.48. -04.54.** *Dr Tim Lenton* *Earth system scientist* ***Wild track fades out*** **10.04.54. -05.06.** *James Lovelock* *originator of Gaia theory* **10.05.06. -10.05.17.** *Ed Hooper* *science author*

inquiry.' *10.05.17.-05.37 Marlene walking* *Marlene Zuk* 10.05.19. ***'Most of us have – you know -3 to 5 ideas in their life and the chance of one of them being brilliant is pretty much nil. Bill had a 100 of ideas and 10 of them were good. Which is extraordinary.'*** *Peter Henderson:* 10.05.37. ***'He really was genuinely a little bit a like Isaac Newton. /Newton saw the apple falls, - he saw gravity occurring. And he asked the question why?*** *A* ***typical example of Bill was seeing the beautiful autumn colors*** (***of leaves /and not taking it granted as most of us do: 'Yes, it is very pretty, I take a photograph!' He was actually saying that there is an evolutionary reason behind this. I can actually ask the question 'why'?***	***Meadow wild track with birds*** **10.05.23. –05.37.** *Professor Marlene Zuk* *evolutionary biologist* **10.05.37. –10.05.40.** *Professor Peter Henderson* *theoretical biologist* **10.05.41.** ***RAIN DROP SOUND, splash*** 10.05.49. Darwin's garden **Autumn, -lonely bench at Kew** ***MUSIC FADE in***
Voice over 10.06.08.00. **Hamilton was born in 1936 and grew up in the countryside fascinated by nature and its patterns**…	***English countryside wild track*** **Picture of Bill as a baby with Mary and parents.** **Photo with Mother on field. Rainbow over fields. Ants.**

Bill Hamilton 10.06.16. ***'There were several factors in my childhood that me more than others to think about this. One was that I was part of a very large family and realizing even as a child that I thought very differently about my family members than I did about anybody else.'*** 10.06.38. ***'Also I think my mother kept honey bees and understanding the organization of these incredible communities, primarily seeing again that there is something very special there about these close relatives which enables these incredible act of altruism to occur.'***	***English countryside wild track*** **Mary looking at family photos.** **Photo of children in a row** **10.06.14. -10.06.23.** *Voice of W. D. Hamilton* **Oaklea garden** **Honey bees in garden**
Voice over 10.07.03.00. **By coincidence Hamilton grew up in the same corner of Britain as Darwin, just a few miles from his house.** 10.07.14.00. **Hamilton's sister, Dr. Mary Bliss still lives at Oaklea, the home of an inspired childhood.**	***English countryside wild track*** **Oaklea.**
Mary Bliss voice track 10.07.22. ***'One of my main images is Bill sitting at the dining room table with his setting boards and pins, setting out the catches of the day.***	***English countryside wild track*** **Mary walking in woods** **Collecting bugs on field.**
Just setting them out very very meticulously, so he could then add into his collection.'	***English countryside wild track*** **Mary through shed window – smiles** **Collecting bugs under bark** **Butterflies on pins, pan on collection.**
Voice over	***English countryside wild***

10.07.42.00. **This early fascination would lead Hamilton on a life long quest to understand what he observed in nature.** 10.07.53.00. –10.08.04.00. **On a childhood excursion Hamilton visited Down House, the home where Darwin wrote his famous theory of natural selection.** 10.08.06.00 **From here it was clear which path Hamilton would follow.** **He would devote his life to exploring evolutionary biology…** **And rather than seeking answers from a desk, Hamilton like Darwin would always search for clues in the real world believing nature itself would show the way.**	***track*** ***English countryside wild track*** **Montage of Down House** **Pathways and gardens at Down House** **10.08.13.** ***Pine forest wild track*** **Scottish landscape.**
Stephen Keynes 10.08.29. ***'They were observing things when they walked around the countryside here and Bill was fascinated by this bit of country just as Darwin was himself, so they had great similarities in their approach. Self-questioning endlessly.'***	**10.08.30. –08.39.** *Stephen Keynes* *Great grandson of Charles Darwin* **Details of the garden.**
Voice over 10.08.47.00. **But as devoted as he was to Darwin, even as a student Hamilton recognized there were problems with classic evolutionary theory.** **He searched for a way to explain the paradox of social insects like worker bees: Once born, they devote their entire lives to the hive. They have a remarkable adaptation, - a super effective sting with one catch.** 10.09.19.00.	**Wasp** **10.08.54.** ***Annoyingly loud buzz***

The sting is barbed, - once used it cannot be withdrawn: - in effect it is a suicide machine. **How can a weapon designed to protect others, which causes its owners death, make evolutionary sense?**	**Barbs on sting:** **Photo, zoom down** **10.09.19.** ***sound effect*** **Dead bee**
Richard Dawkins 10.09.35. ***'Darwin himself was worried about bees and other social insects. How it was that the adaptations shown by worker bees and worker ants, which are, after all sterile could get passed on through the generations'.***	**10.09.35. –09.55.** *Professor Richard Dawkins* *evolutionary biologist*
Voice over 10.09.56.00. **Hamilton was the first to realize that the explanation lies in the unique genetic make up of insect communities.**	**Bee hive**
Richard Dawkins 10.10.06. ***'Sterile workers who are female are extra specially closely related to their youngest sisters who are going to be reproductive young queens. So when a worker ant or bee looks at a young queen who is her sister, that young queen is almost an identical twin to her.'***	
Voice over 10.10.29.00. **For the workers it makes more genetic sense to devote their lives to the young queens than to reproduce themselves.** 10.10.38.00. **They can give up their own future because it is already contained within someone else.**	**Bumblebees** **Bumblebee eating eggs** **Bees in increasing numbers**

Richard Dawkins 10.10.45. ***'That is the essence of H's theory…Genes working through one individual are looking after copies of themselves in other individuals.'***	
Breathing space 10.10.54.	**FLOW OF ANTS**
Marlene Zuk 10.10.59. ***'He recognized that there is a sort of continuity among organisms that It isn't just each individual acting by her or himself but it's that everybody is acting in relation to how much their genes are represented in other organisms. And it was really a tremendous insight.***	
Voice over 10.11.20.00. –10.11.24.00. **But how can animals calculate how much of their genes are in others?**	***Lionesses***
Richard Dawkins 10.11.24. ***'Every time you catch a ball, every time play tennis and you manage to return the ball your brain and your muscles and your nerves are behaving as if they were solving very complicated differential equations. You are not aware of that. You probably don't even know what a differential equation is, when you catch a ball, but you can still catch the ball. And in exactly the same way a bird or an insect or a lion behaves as if it had made these complicated calculations.'***	**10.11.50.** ***waves*** **Eagle catching fish**

Voice over 10.12.00.00. – 10.12.08.00. **Genes are driving behavior, searching for copies of themselves in others.** **According to Hamilton, even in humans.**	**10.12.02.** ***Traffic*** **Bees and traffic** **People and traffic**
George Fieldman 10.12.08. ***'Hamilton's Rule was neatly described by J.S. Haldane, who said that he would lay down his life for two brothers or 8 cousins. So two brothers because one has on average they have half of their genes in common with one brother or one sister. So two brothers are the equivalent of oneself.'*** 10.12.30. ***The essence of the idea is that altruism has genetic and biological basis and that is the way how it carries on and exists in everything you see around you.'***	**10.12.08. –12.28.** *Dr George Fieldman* *Evolutionary psychologist* **10.12.28.** ***Increase traffic sound***
Space 10.12.43.	**10.12.42.** ***Increase traffic sound*** **Buses passing**
George Fieldman 10.12.44. –10.13.15. ***'The vehicle for this and this is the fascinating thing to me. The vehicle – how altruism takes place – is by the emotion of love. I think of my 3 children whom I love and I have my affection for them. And that is the means by which resources, care and protection are channeled into those with whom we have about half of their genes in common at the maximum.'***	
Breathing space 10.13.15.	**Meandering vehicles** ***Increase traffic sound***

Voice over 10.13.26.00. **Hamilton was only a young postgraduate in London when he began writing his ideas.** **It was a very lonely time for him.**	**Senate House longshot with clouds time lapse** **Senate House library inside shots**
Christine A. Hamilton 10.13.37. ***'It was a very lonely period for him. He felt really quite isolated. He, very few people seemed to understand the significance of what he was working on.'***	**10.13.37. –13.41.** *Christine A. Hamilton* **Pan form lake to pink house.**
John Hajnal 10.13.51. ***'He was worried that his work would not be recognized, might not even published. But he was convinced that it was very important.'***	**10.13.58. - 14.07.** *Professor John Hajnal* *Hamilton's supervisor, LSE* **10.14.07** ***Fanfares***
Voice over 10.14.14.00. –10.14.5.00. **It took decades for his ideas to be universally recognized. In 1993 he was awarded the Kyoto Prize – after the Nobel, the most prestigious accolade in science.**	**10.10.14.07. –14.18.** Kyoto Prize
Peter Henderson 10.14.26. ***'One of the most fond moments which actually characterized him in some sense in his rather modest quiet way was that one night after we have been working floating meadow and we both have got a glass with ice, a large amount of whisky in it. When a wasp came to the light and then stung me, and I have got stung by a second one. So I put my drink down and I was digging in my shirt, fighting for the wasp when,***	**Photo of floating meadow** **Photo in Amazon**

and I have grabbed that wasp and 'Damn, I've got it!' And Bill said: 'Oh! It is a so-and-so actually I know the name of this. In fact it is actually named after me.' ***And the look of shyness on his face, as he admitted that it was a hamiltonian, an actual species was named after him. A strange sort of sense of modesty, an embarrassment almost.'***	**Zoom into photo of Hamilton**
Voice over 10.15.23.00. **Now at last acknowledged as a world leading evolutionary scientist, Hamilton was not about to stop…**	
Marlene Zuk 10.15.30. ***'He was not somebody that just sort of rested on. 'OK, I had this one idea. I had that when I was 32 and when I am 72 or 82 or 92 I am still going to be talking about this one idea and reflecting on you know how wonderful it was and everything else. He was just thinking about things all the time.'***	
Voice over 10.15.49.00. **In the mid 90s he began exploring an idea about life that was so novel, that even evolution itself may not explain it.** 10.16.01.00. **Ironically it started with an argument he had with another maverick British scientist, James Lovelock.**	
James Lovelock 10.16.08. ***'I first met Bill Hamilton here in Oxford…he was a great opponent of my ideas and he entirely disagreed***	**10.16.11. –16.17.** *James Lovelock* *originator of Gaia theory*

with everything I said.'	
Bill Hamilton 10.16.17. ***'We were unable to resolve our differences about Gaia whether it was a real phenomena or not. And eventually we agreed to differ.'***	**10.16.17. -16.29.** *Professor W. D. Hamilton evolutionary biologist* **10.16.28.** ***Thunder, lightening.***
James Lovelock 10.16.31. ***'We spent a very pleasant evening together arguing and finishing up saying: 'Oh well, perhaps that is your view of it, and this is my view of it.'***	***Rain sound continuously*** **Lovelock closes window, rain on leaves**
Voice over 10.16.48.00 -10.16.03.00. **James Lovelock's Gaia hypothesis argues that planet Earth is self-regulating…that *collectively* life is able to control the environment according to its own best interest… life and the planet are a single system.**	**Earth from space dissolves to clouds.** **Dissolve to pan over land**
Bill Hamilton 10.17.03. ***'The more influence life has on the Universe the better is as far as I am concerned. So it would be nice to think of the world as a one living organism in some sense. However I have a great difficulty with the idea of how such a coordinated organism could arise.'***	**10.17.23.** ***Earth passing by effect***
James Lovelock 10.17.24. ***'He took it as a challenge. He didn't just say that it couldn't happen at all. He just said we don't know yet how it happens.'***	

Voice over 10.17.35.00. –10.17.51.00. **As always, Hamilton looked for a real example in nature - not theory. Some direct evidence that showed Gaia at work.** 10.17.47.00. **Lovelock suggested he investigate the role marine algae play in climate control.**	**10.17.31.** ***Cloud formation sound effect (from CU of cumulus time lapse)*** **Hamilton pictures dissolve** **10.17.40.** ***Water splashing*** **Ocean, algae floating in the ocean. White caps sea-spray.** **Seascape with clouds…**
James Lovelock 10.17.52. **'Without the algae the Earth would be 10 Celsius warmer than it is now….'**	**10.17.57.** **waves**
Voice over 10.17.47.00. **In the mid 80's Lovelock established that marine algae are helping clouds to form over the sea…** 10.18.11.00. **He saw this as evidence of GAIA. He argued the microscopic marine algae were working as a thermostat, regulating the temperature of planet Earth.**	**10.18.03.** ***Cloud formation sound effect (from CU of cumulus time lapse)*** **10.18.07.** ***wind*** **Ocean, algae floating in the ocean. White caps, sea-spray. Algae dissolves into clouds.** **Seascape with clouds…**
Lovelock 10.18.24. ***'The marine algae produce a gas which oxidizes in the atmosphere, to form the tiny water soluble droplets, around which water can condenses and form the clouds we see in the sky. Without these droplets rain would just fall a cloudless sky and the Sun could come through to warm the Earth.'***	**10.18.40. –8.48.** *James Lovelock* *originator of Gaia theory* **10.18.47.** ***Sea wild track***
Voice over 10.18.50.00.	

So algae are producing a gas that form clouds and cool the planet. But no one could explain why. Hamilton was intrigued.	
James Lovelock 10.19.02. ***'He thought that here there might be a link between the views of evolutionary biologists of how such thing could have evolved and what we were finding in the way of regulation.'***	
Voice over 10.19.16.00. **Here was life not just adapting to the environment, but actively *changing* it for no apparent reason… something that natural selection could not explain.**	
Bill Hamilton 10.19.27. ***'An evolutionist immediately asks: Why the hell should these algae in the sea be producing clouds which h are going to benefit the land and benefit everybody else, in fact benefit other organisms much more than it benefit themselves?'***	**Microscopic algae**
Voice over 10.19.42.00. **Hooked on the problem, Hamilton started to work together with Lovelock's colleague, Tim Lenton to find an answer.** 10.19.48.00. **They noticed that algae seemed to produce gas in the greatest quantities around the gigantic algae blooms that form in the oceans.** 10.19.58.00. **Hamilton theorized that algae may be using the gas to escape from the crowded conditions at the end of a**	**Algae blooms** **Satellite pictures of bloom** **10.19.47.** ***Sea wild track*** **10.19.53.** ***Spacey***

bloom when nutrition's run out.	
Tim Lenton 10.20.08. ***'I think, he made a connection with an earlier piece of work that he has done, which showed that the dispersal of organisms is a usually favored by natural selection.'***	**10.20.14.** ***Birds***
Bill Hamilton 10.20.21. ***'I found numerous examples of insects for example that would go through a number of generations of wingless insects and than as the bark begin to dry out they would start to produce winged forms. I would say this is very closely parallel to what we are talking about. When things are good than you just save on any unnecessary appendages you go as fast as you can but once things begin to look tough then you produce wings and try and fly away.'***	
Voice over 10.20.52.00. **For algae, trapped in a crowded bloom the only way out is up. But algae don't have wings. How could they find a way of escaping through the air? Hamilton had an answer…**	
Bill Hamilton 10.21.05. ***'We already know of what are called bubble processes. The minute bubbles from a breaking white top rise through the seas and burst thus causing the white top…algae attach themselves to the surface of the bubble. They rise with the bubble and as the bubble bursts on the sea surface there is a kind of tiny fountain that springs out of the bottom of the bursting bubble and they are thrown into the air at***	

least to a few centimeters.'	
Voice over 10.21.40.00. **When the water vapor around the algae gas condenses into cloud droplets enormous heat is released, sucking the air up from below. Any airborne algae could be getting a ride.**	
Tim Lenton 10.21.52. ***'If these plankton are injected to the air, the winds across the ocean will transport them and will drop them to a different part of the ocean and that would benefit them, that could pay back evolutionarily.'***	**10.21.53. –22.05.** *Tim Lenton* **10.22.04.** ***Sea wild track***
Voice over 10.22.05.00. –10.22.22.00. **Algae use bursting bubbles to get airborne, and the gas they produce helps lift them to high altitudes… Hamilton and Lenton compiled their thoughts in a paper suggesting why algae might be flying in clouds of their own making.** 10.22.23.00. –10.22.35.00. **But it was just an interesting hypothesis — evidence would need to be found in the real world.** **In 1998 Hamilton funded biologist William Marshall to try and find algae in the air above the Atlantic ocean.**	**Seascape, crushing waves.** ***Marshall puts the samplers in culture room.*** **Pan on green bottles.**
William Marshall 10.22.36. ***'A day like today, it is very windy we have lots of white caps, any organisms are in the water column are going to be injected into the air column. And we are hoping to catch that today.'***	

Voice over 10.22.50.00. **The air samples were cultured in the laboratory. Would they reveal algae? And would they have the ability to colonize new environments?**	**Taking boat back.**
Chad Marshall 10.23.03. ***'You can see that these are collections that we made 8 or 9 weeks ago. This shows quite clearly that we have got algae that we've collected and observed under the microscope on the strips. And this tells us that the algae are viable and that they can grow. They are potential colonizers for new areas in the sea'.***	**Chad in culture room with samples.**
Voice over 10.23.27.00. –10.23.35.00. **It was a promising start. Now Hamilton planned to investigate high above the oceans, to see if algae were being dispersed by clouds.**	**Microscope room with Hamilton.** **CU of green chloroplasts in the algae.**
William Hamilton 10.23.35. ***'I believe that we are going to find that a lot of these things really do fly really long distances and if so we need to look for them up in the clouds.'***	
Voice over 10.23.50.00. –10.24.10.00. **Hamilton had found a reason for the algae to form their clouds that made evolutionary sense: dispersal. But he knew it raised a deeper, more complex question. Algae through clouds are regulating the earth's temperature…but what**	

process was setting the thermostat? There was nothing in natural selection to answer that.	
William Hamilton 10.24.10. ***'What Lovelock originally described and we confirmed by evolutionary mechanism is a thermostat, no doubt about that. But who is setting the thermostat to switch off at a particular point? What is it achieving in such a way that life would benefit? This is what is missing at the moment.'***	
Voice over 10.24.38.00. **It's a profound question that points to life operating in a new way we can't yet explain.** 10.24.49.00. **But sadly, it will be others who must seek the answer. Bill Hamilton only lived long enough to pose this fascinating problem.**	
Marlene Zuk 10.25.09. ***'He was at the peak of his career, still generating a lot of ideas, he was extremely fecund is his mind.'***	
Voice over 10.25.22.00. **Hamilton was fearless - both in life and in science. He was prepared to pursue ideas that upset the scientific establishment.** **As an evolutionist he was concerned that sudden changes brought about by modern medicine could interfere with the flow of evolution with devastating consequences.** **And that is what took him on his**	

last journey, into the Congo, on a search for the origin of AIDS. **He was investigating claims that a polio vaccine cultured in monkey tissues may have allowed the virus to cross species.**	
Ed Hooper 10.25.58. ***'He was looking for the possible presence of SIV, the simian immuno-deficiency virus, that is, the chimpanzee SIV is known to be the direct ancestor of of HIV1 the virus that caused the AIDS pandemic.'***	**10.25.57. –26.12.** *Ed Hooper* *Science author*
Luisa Bozzi 10.26.16. ***I was very much against this two mission because the country was in a civil war, because there was a risk of getting sick. But he felt that it was his duty to go there.'***	**10.26.21. –10.26.26.** *Dr Maria Luisa Bozzi* *Hamilton's companion*
Peter Henderson 10.26.30. ***'He just believed that the truth is frightfully important and therefore he had to get the very essence and the truth of the origin of AIDS. He balanced the risks of his personal life versus the importance of science.'***	
Voice over 10.26.45.00. **Bill Hamilton died on the 7th of March 2000 from complications following a bout of cerebral malaria. The man is gone, but his ideas will influence science for years to come.'**	

Tim Lenton 10.27.02. ***'For those that had the privilege to work with him there is a rich legacy of work to be done, questions to pursue further.'***	
Luisa Bozzi 10.27.16. ***'He was prepared to die even that he was so enthusiastic, so young in his mind so young in his heart, So, he loved life very much.'***	
Luisa's voice track 10.27.39. ***'Brought by the wind higher up into the troposphere, all of you will form the clouds, and wandering across the oceans, you will fall down and fly up, again and again. Till, eventually, a drop of rain will join you to the water of the flooded forest of the Amazon.***	
THE END 10.28.05.-38.35.	**Credits** **10.28.01. –28.25.**

THE SECRET OF THE CLOUDS

Credit list

Voice over
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VET

Archive
ABC Radio Australia
BBC Worldwide
Film Images
Inamori Foundation
Mostra
NASA
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The British Library W.D. Hamilton Archive
VPRO

Special thanks to
The British Library
Senate House
Natural History Museum Oxford

The colleauges and family
of William D. Hamilton
Dr. Mary Bliss
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MUSIC TITLE	MASTER TIMECODES IN	OUT	LENGTH	USAGE	COMPOSER	PUBLISHER	LYRICIST	COPYRIGHT PROPRIETOR	PERFORMANCE RIGHTS SOCIETY
Red Howler Monkeys (Amazon Rainforest)	10.00.20.	10.00.39	0.19.	Wildlife recordings	Collected by Richard Ranft	British Library National Sound Archive CD Rainforest Requiem band 6	-	BL National Sound Archive	
Title music	10.00.40.	10.01.36.	0.29	T	Deborah Molison	-	-	Gabriel Films Ltd.	
Flamingoes	10.01.37.	10.01.49.	0.09	T	Deborah Molison	-	-	Gabriel Films Ltd.	
Bees	10.01.58.	10.02.10.	0.12	VI	Deborah Molison	-	-	Gabriel Films Ltd.	
Hamilton	10.02.13.	10.02.39.	0.26.	VI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Bees	10.02.46.	10.03.16	0.30.	BI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	

Title music	10.03.35	10.03.40 .	0.05.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Palearctic Grassland	10.03.42 .	10.04.02 .	0.20.	Wildlife recordings	Collected by Richard Ranft	British Library National Sound Archive W Palearctic GrasslandR2 C2	-	BL National Sound Archive	
Childhood	10.06.05	10.06.24 .	0.19.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Childhood	10.06.32 .	10.06.45 .	0.13.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Oaklea	10.07.01	10.07.17 .	0.16.	BI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Childhood	10.07.20	10.07.50 .	0.30.	BI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.08.47 .	10.08.59 .	0.12.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Bees	10.09.00	10.09.35 .	0.35.	BI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Algae theme	10.10.54 .	10.11.08 .	0.14.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.13.18 .	10.13.25 .	0.07.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Neotropical Rainforest	10. 4.37.	10.14.47 .	0.10.	Wildlife recordings	Collected by Richard Ranft	British Library National Sound Archive W1CDR0000525/ 01	-	BL National Sound Archive	
Algae theme	10.15.46 .	10.16.10 .	0.24.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
GAIA 1	10.16.40 .	10.17.03 .	0.23.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.17.32	10.17.45	0.13.	T	Deborah	Gabriel Films Ltd.	-	Gabriel Films Ltd.	

	.	.			Molison				
Algae theme	10.17.51 .	10.17.54 .	0.03.	BI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
GAIA 2	10.17.58 .	10.18.16 .	0.18.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Algae theme	10.18.19 .	10.18.32 .	0.13.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Algae theme	10.19.15 .	10.19.30 .	0.15.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Algae theme	10.20.03 .	10.20.10 .	0.07.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Algae theme	10.20.50 .	10.21.06 .	0.16.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.22.09 .	10.22.19 .	0.10.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.23.24 .	10.23.37 .	0.13	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.23.45 .	10.24.11 .	0.26.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.24.35 .	10.25.46 .	0.11.	BI	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Algae theme	10.24.47 .	10.25.01	0.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Hamilton	10.25.00	10.25.34 .	0.34.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Title music	10.25.40 .	10.25.50 .	0.10.	T	Deborah Molison	Gabriel Films Ltd.	-	Gabriel Films Ltd.	
Neotropical Rainforest	10.25.51 .	10.25.58 .	0.07.	Wildlife recordings	Collected by Richard Ranft	British Library National Sound Archive W1CDR0000525/ 02	-	BL National Sound Archive	
Hamilton	10.27.10	10.28.23	1.13.	T	Deborah	Gabriel Films Ltd.	-	Gabriel Films Ltd.	

		.			Molison				
Neotropical Rainforest	10.27.12 .	10.28.10 .	0.58.	Wildlife recordings	Collected by Richard Ranft	British Library National Sound Archive W1CDR0000525/ 02	-	BL National Sound Archive	