In our Time Programme 3
Unweaving the Rainbow

Melvyn Bragg : Hello, my guests today are Richard Dawkins, who's book "Unweaving the Rainbow", has just been published, and Ian McKewan, whose novel "Enduring Love" a tale of rationalism, romanticism and religion at odds with one another, has recently been successfully launched in paperback, his new novel is "Amsterdam". Richard Dawkins, "Unweaving the Rainbow", most people would think that comes....it takes off from Wordsworth, but in fact you take off from Keats?

Richard Dawkins : Keats complained that Newton had spoiled all the poetry of the rainbow by unweaving it, by explaining it, and I've just taken this as a sort of symbol for the reluctance that some poetic minds have to embrace science, and I'm really trying to say, "The poetic mind should be embracing science as one of the most poetic things that they could possibly experience, and inspiration for great poetry". So it' s almost a sort of , take Keats by the hand, and say "Come on, look at science again, you'd love it".

Melvyn Bragg : According to Hayden's memo, which you quote, what Keats said was, "he destroyed the poetry of the rainbow", this is Newton, "he destroyed the poetry of the rainbow, by reducing it to a prism". Now you don't think a prism is a reduction at all, do you?

Richard Dawkins : Well in one sense it's reducing, it's taking white light, which is a mixture of all lights and then reducing it to different colours that compose it, but that's not reducing in any kind of demeaning sense, I mean you reduce white light to it's component colours, that's analysis, you're breaking it apart, you're dissecting it , but that's helping to understand, and it's just a symbol for understanding the world and the universe, as a whole, and then of course you come back and synthesize a picture of the world, a world picture which is a beautiful and coherent entity in itself.

Melvyn Bragg : Well, let's just explain the hinge of the book a little more, because you again quote from Keats, from Larmia, where he says, "Do not all charms fly at the touch of **cold** philosophy?", meaning in his case, in his time Natural Science is in a way. "There was an awful rainbow, once in heaven", awful meaning full of awe, "and it is gone", and the book is shot through with quotations from poets, and quotations from scientists and philosophers, and it is an attack on what you call "bad understanding", it is actually, it's an attck on the idea of "awe" being sufficient, isn't it?

Richard Dawkins : Awe is my starting point, with science, I feel intense awe, but as you say, it's not sufficient, it's the starting point to understand. So we begin with awe, and a scientist really yields to no one in the feeling of awe that we have when we contemplate the universe, but then we say, "Now we're working on understanding it, now we want to break it down, now we want to build it back up again, to understand".

Melvyn Bragg : One of the particular passages in your book, and it's full of glittering passages like, "This is when do unweave the rainbow", so we all see the rainbow, and everybody knows rainbows, and when you look at them your heart does leap up, doesn't it, you'll say, "Look there's a rainbow", rush to the window. Now you unweave it, could you unweave it for us now?

Richard Dawkins : The rainbow is a spectrum and Newton did it in a rather more simple way with a prism. He simply let white light from the sun go through a slit into a prism. The prism then bends the light through an angle which is different for each of the component wavelengths that are in the white light, because white light is a mixture of red, green, blue etc. out to violet. They bend through different angles when they go from air into glass, and this separates out the rainbow. So unweaving the rainbow....what Newton did, was to show that white light is a mixture of other lights. What we now know is tha the rainbow is only a tiny, tiny fragment of the whole electromagnetic spectrum, which extends all the way up to radio waves at the long wave end and down do X-rays at the short wave end.

Melvyn Bragg : You develop that in your chapter on barcodes in the stars, don't you?

Richard Dawkins : Yes.

Melvyn Bragg : And so how far does that take us? Can you just develop that a little more?

Richard Dawkins : One way to put it is a way that Edward Wilson has put it, in his book "Concilience", is that humans up until the scientific era were almost blind, because they were limited to seeing in the visible spectrum, which is theis minute little fraction of the whole electromagnetic spectrum. Almost blind, just seeing through this tiny chink, this tiny window, and now we can see using radio waves, we can see to the furthest reaches of the universe, using the whole electromagnetic spectrum. So we've....science has enormously enlarged our vision of this place in which we find ourselves.

Melvyn Bragg : Those outside science, and using the word "poet", is as good a metaphor, it's a very good metaphor, so those who feel outside science, sometimes, even when they are very sympathetic to it, like Auden, the poet Auden, who you quote, feel a bit. . . feel a bit rejected by it . I mean, Auden, who was a man of science himself, said, "The true men of action in our time, those that have transformed the world are not politicians but scientists, and fortunately poetry cannot celebrate them, because their deeds are concerned with things, not persons, and I'm therefore speechless. When I find myself in the company of scientists, I feel like a shabby curate who has wandered by mistake into a drawing room full of Dukes". What do you think about that buisiness of being speechless? The poet feeling speechless?

Richard Dawkins : The first thing I would say is that, I've always felt, as a scientist, that I'm wandering into a drawing room full of Dukes when I'm with poets, (laughs) and I think a lot of scientists do that. I don't quite understand that remark of Auden about "poetry must be speechless", about science. I sort of feel that poetry should be anything but speechless about science, and so I'm a little bit baffled about that, and in a way, my whole message is that poets should not be speechless about science.

Melvyn Bragg : Ian McKewan, you....let's take the novel "Enduring Love" now, out in paperback as I said, where you have a scientist as a chief character, and you talk about science a lot, and you use science. Do you share Auden's position, that you feel that you are in a drawing room full of Dukes, rather liek a shabby curate? Or do you feel it's something you can take on and bring in?

Ian McKewan : Well, I think it's something to take on and bring in, especially now. I mean I think Richard's book is particularly interesting because it lies right at the centre of what I would regard as a heroic age of biology, and in this time, scientists, particularly biologists, are talking about things, that I don't think they committed themselves 20 years ago- Consciousness, human nature..... . . moral.....

Melvyn Bragg : Things that novellists looked after!

Ian McKewan : In fact they're on our patch! (laughter) So we have a lot to learn from them, and it's interesting too, that many of our best scientists, science writers, Richard included, are highly literate. In other words, there's a conversation been going on for centuries about human nature, or about the difference between men and women, for example, and scientists are joining this conversation, not only to tell us, but also absorbing, and taking it in. So I think there is a great deal of exchange going on, especially in this area of biology.

Melvyn Bragg : But there is, coming back to Auden, who had the advantage of reading science at Oxford, I mean he was a man who knew his science, particularly geology, and he kept it up in is metaphors about science. When you.... you've made yourself very well acquainted with science indeed over the past few years, and you write about it and so on, do you actually feel that it helps your imagination when you are writing fiction? Is it like Graham Greene going to a different country in the world and coming back with information from that? Or is it like something which stimulates part of your mind that would not otherwise have been stimulated in a more central intellectual way? What's it like?

Ian McKewan : Well, I would come to a central concept in Richard's book about the anaesthetic of familiarity. You know, we live in this extraordinary world, we take it entirely for granted, becuase we've come to consciousness of it slowly through our babyhood. If we were to arrive here, as it were, from across the universe, we would be astonished. Both poets and scientists share at least that as a starting point to de-anaesthetise us from that familiarity. So I take a lot from science directly to the imagination. Something more than just saying, "Wow" or "Isn't it extraordinary".

Melvyn Bragg : Can you give us an example? I mean from "Enduring Love" there are many examples, I've got the block marked up here, it's much better if it comes from you. Can you give me an example where you're using science as a way to describe something, which previously you'd have described in a more....in a none scientific way?

Ian McKewan : Okay, I don't think, for example, I could have described five men hanging on the ropes of a balloon trying to keep it down....

Melvyn Bragg : A hot-air balloon this is going up.....

Ian McKewan : This balloon is going up, they're being lifted off the ground, they have to make a quick decision, if they all hang on together, they can get this balloon down, if one of them breaks ranks, then suddenly there is no point in being altruistic and hanging on. The language of that, altruism versus selfishness, the game theory of that is drawn directly from a discussion that's been going on amongst evolutionists and biologists, and economists also drawing from it for some years. So it adds to my sense of what could be done with this, I mean it generates more drama, for me, because there is a way of describing it, a really interesting way.

Melvyn Bragg : Do you, both of you, I mean do you think that thinking about science, and Menoir I think has written extremely well about this, thinking about science is different in a way than thinking about fiction. You thinking, Richard about genes, from the selfish gene onwards, and you thinking about Ian, sort of how to create books, is it a different..... energies being employed, a different area's being tapped? Have you..... because this book is full of quotations from poets, so you've obviously got a lot of affection and knowledge of them Richard? What do you think?

Richard Dawkins :Well, I suppose there's got to be a certain difference, in that a scientific proposition is then tested, and scientific language is rather more public, so different scientists in different parts of the world tackling the same problem ought to get the same answer, because they ought to have access to the same results. But so much of science is imagination, so much of deciding what to test, what experiments to do, is a piece of sheer creative imagination. People like....

Melvyn Bragg : Can you give us an example?

Richard Dawkins : Well, Einstein, I suppose. I mean Einstein's great gift was huge imagination, a wonderful way of letting his mind soar away from the mundane, and..... . .

Melvyn Bragg : Thought experiments?

Richard Dawkins : Yes. Thought experiments, and of course, once Einstein had exerted his genius in this way, eventually experimental physicists and observational physicists could come along and verify his predictions. But the imaginative step, I suppose, is very much what poets should be able to empathise with.

Melvyn Bragg : What's your take on this, Ian?

Ian McKewan : It's a very interesting example, actually, Einstein, Steven Weinberg in his book on physics was talking about how the **elegance** of Einstein's theories probably were instrumental in it's gaining very wide acceptance very quickly.

Melvyn Bragg : Penrose says that actually, doesn't he? Yes, that the elegance was that which attracted him....

Ian McKewan : Well actually the experimental data, and there are endless trips out to observe eclipses of the sun to see if star light was being bent, as the theory should predict. But they were only accurate to within about 10% which actually was not enough, and it was not till the radio astronomy in the 50's that there was proper hard evidence, as it were, and yet the theories were in the text books by the late 20's. It had a kind of beauty, you know, that beauty and truth that Keats wrote so famously of, clearly helped it, in being established in the minds of other scientists.

Melvyn Bragg : You say, Richard, you say in a chapter on the selfish cooperator, you say, "Science is poetic", you

say, "and ought to be poetic, as much to learn from poets, and should press good poetic imagary and metaphor into its inspirational service". What does it have to learn from poets?

Richard Dawkins : I've always used metaphor and not just to get points across to other people, but actually to think for myself. So something like the selfish cooperator which you've just mentioned, the genetic book of the dead, which is I think, the next chapter after that. Now that's....I ought to glorify it by saying it's good poetry, but it's poetry in the sense that it's an imaginitive metaphor which is designed to make one think, and what that one means is that all living creatures carry around in themselves, in their genes, a detailed description of the worlds in which their ancestors lived.

Melvyn Bragg : I want to come to good and bad poetry in a minute, because you attack bad poetic science, but before we....I wouldn't like to just flip over what Ian referred to, the....what you call "the anaesthetic of familiarity", which Ian saw as something which novelists and poets engage or try to waken us up to familiarity. Can you give us some examples? You give some wonderful examples in the book, the squid, the chameleon, the basking shark and so on. Do you think....can you just give us one or two examples of what you see as the familiarity to which we are anaesthetised, and why that is something we should look at with a sense of wonder, and we don't?

Richard Dawkins : We spend most of our lives surrounded by other human beings, and we interact with them in very ordinary ways, and we like or we dislike them, we argue with them, we quarrel with them, we love them, whatever it might be. We forget that those other human beings that we're interacting with are gigantic metropolises, of not just cells, but of bacteria within cells, because each one of our cells is a small town of symbiotic bacteria that perhaps two or three thousand million years ago were once free-living, and then about a thousand million years ago, a little bit longer ago, came together in cells. So every one of your cells, every one of the cells of your friends, of the prime minister, everyone, is a town of bacteria, and you yourself are a gignatic city, a megalopolis, of cells, each one of which is a town of bacteria.
If when you look at somebody, you realise that, then immediately your seeing....you've stripped away the anaesthetic of familiarity, you're seeing something which is true, and always has been true, but which you didn't realise, and I think your life is enriched for realising that.

Ian McKewan : Yes another very good example, I think, from Richards book, he takes us through the means by which the brain constructs vision, I mean the richness that we see, one's tempted to feel it's just falling on a screen of the retina and the brain is just simply, you know, reporting, as it were, what's there, when in fact....

Melvyn Bragg : Direct from the front line yeah. . .

Ian McKewan : ....it's erm. . . I think your analogies with virtual reality are very instructive actually. You give us an example of those sort of hollowed out faces , that you might buy at a party shop. When you look at it from the. . . from the wrong side, the hollow side, the desire of the brain to make a face or "Face! Face! Face!", as you put it, does create the sense of projecting an image towards the eye. We tried this out, and it was actually very exciting.

Richard Dawkins : Yes, yeah.

Ian McKewan : It really does take you straight to that extraordinary thing that we take for granted, our rich visual world's constructed, you know, without our knowing.

Melvyn Bragg : And this book is saying to poets, or everyone who is not a scientist, "look scientists can increase your sense of awe, can increase your sense of wonder, can change your sense of perception, right in the whole of life". It's also. . . and it's a great defender of science, and an embracer of poetry, but it's also an attack on various persons and movements which are against this politically correct culture, as with Kennewick man , or X-files, or some of Stephen J. Gould's theories , because.... particularly because, as you say, he writes so well, and is persausive. Can you give us a line on what sort of "bad poetry" you're attacking and why you're attacking it?

Richard Dawkins : Yes well you've been through in that, it's not just bad poetry, it's also pseudo-science , which is another matter, and I take it that's not what we want to talk about now. But bad poetry, because some scientific writers are so skilled with words and with language and with images and with poetic images with metaphor, it is possible to be seduced, and the main example, I suppose that I use in the chapter on bad poetry, is the idea of the

Cambrian explosion. The idea that about 520 million years ago, it's almost as though life just suddenly arrived, or multicellular life, the main phyla of life, the molluscs and the arthropods and the vertebrates and things just suddenly sprang into existence from nothing.

Now this has been graphically and poetically written about, and it's an idea that grabs you, it's a very imaginative, very exciting idea that in this brief period between 530 million and 520 million years ago, life suddenly sprang on the scene and tried all kinds of experiments and was flexing its muscles and was feeling its oats, and all these sorts of ideas, for which I think there's really rather little evidence, and I suspect that actually evolution back in the Cambrian era, back 520 million years ago was probably pretty much the same as it is now, the same kind of process of Darwinian selection was going on, and we have been seduced and misled by powerful bad poetry.

Melvyn Bragg : Why do you think it's bad though? What disturbs you about that seduction?

Richard Dawkins : That particular seduction, I think what's bad about it is that it gives people the idea that it's possible for something as complicated as the mollusc body plan, or the vertebrate body plan, to arrive overnight, what you have to remember, is that evolution is a slow and gradual process, and that once upon a time molluscs and vertebrates, molluscs and humans indeed, had a common ancestor, and then a short time after that, the mollusc ancestor and the vertebrate ancestor were different species in the same genus, they were very closely related. Shortly after that they were different genera in the same family etc. Now that had to be a gradual divergence. Nobody would deny that if they actually think about it.

Melvyn Bragg : But is. . . do you take no account whatsoever? Do you give no credit whatsoever to Fred Hoyle's admittedly rather discredited idea that some movements forward have been caused by objects from other parts of space landing on the Earth, as we know something did 65 million years ago. It's supposed top have wiped out the dinosaurs, landing on Earth and then something coming from that. Could that not have been a cause of a rapid developement of bodies not there before?

Richard Dawkins : Well when things land from outer space, as they did 65 million years ago, that, if that theory is true, wiped out the dinosaurs, and left the world clean and free, for a new adaptive radiation, which was the mammals. Now that probably did happen, and it's an exciting if a rather gloomy, in some ways, view of life, that every now and again catastrophes happen, and most of life is wiped out , and then there's a new flowering. But the Fred Hoyle idea which is that the projectile from outer space, not only wipes things out for a fresh start, but actually brings some sort of genetic information, which is then used, that I think, well it is science fiction. Fred Hoyle happens to be a brilliant science fiction writer, and I love his science fiction! But there is no evidence for it and there is no need for it either, because the existing or parsimonius theory will do very nicely to explain what did happen.

Melvyn Bragg : I'd like to come back to the body of the book, and turn to Ian McKewan. Ian you called yourself a natural sceptic, you've said, I'm quoting, "We've pushed God into His last redoubts, down among the quarks and bosons or out there in some remote black hole, there's no need for Him, here on Earth".

Ian McKewan : Well, no need for Him here on Earth to explain the biosphere, that's what I meant.

Melvyn Bragg : Oh I haven't got to explain the biosphere on that one? (laughs)

Ian McKewan : We don't actually need Him as a....I mean I would assume that it's a resonable method...a working method for a scientist to say, "Well God may or may not exist, but let's see how far we can get in our explanations without Him". So yes, I don't....I mean I think the biosphere is explained, and Richard no doubt can tell us, without reference to God, and we've come quite along way, in the last. . . especially in the last 50 years.

Melvyn Bragg : I think it's worth raising this though, because there's great agreement, a lot of people, quite enough people want to know why they "Why?" question exists, why do we ask "Why?" ? Now I've heard Richard Dawkins speak extremely eloquently on this, and let us just talk about this for a minute or two. I think it is worth addressing why we keep asking where we came from, in terms of not accepting that it is something explicable, but the reason is something that is rather mysterious or there's a guiding intelligence or a creative intelligence, and so on. Do you think that that"why?" question is completely relevant?

Ian McKewan : No, I think it's inate, I think it's just so caught up with human nature..... I have no illusions about

science. I don't think that if we just have another 1000 years of science it's going to eradicate either our belief in spooky coincidences at one end of the scale or profound religious experience at the other, I mean I think this is, you know, how we largely are.

Melvyn Bragg : So if we largely are like that, and you yourself have taken more and more to taking on science, one has to ask , "where does that come from?", where does "why?" come from?

Ian McKewan : You see I think science can't offer us the things religion can, the consolations of immortal life, moments of ecstatic transcendance, which I think even jumping out of your bath and shouting "Eureka!" which doesn' happen to us all, but even that can't grant us. I don't think we'll ever be doing without it, I mean I think that personally I can, but I mean I'm talking for most of us or lots of us, it'll always be there, and that sense that there is a mystery beyond which we cannot penetrate, I think is spread right across cultures .

Melvyn Bragg : Of course you could argue that if Archimedes did jump out of his bath and say "Eureka!", it was because he'd discovered a principle of science!(laughs)

Ian McKewan : Yes, whether he had that kind of total moment of transcendance that religious ecstasy is meant to bring, I don't know.

Melvyn Bragg : Now you've said a great deal about this, but I think it is worth discussing, particularly in the context of this book, where you are unweaving the rainbow, where people like to say, "gosh that's something" in inverted commas or not in inverted commas, "God given". Do you think the "why?" question is something that need not be asked? And do you think, if I can just push it one stage further, the soul is something that cannot be discussed with any sense of arriving at a decent conclusion?

Richard Dawkins : Yes I think that just because a question can be asked there is no reason why it deserves an answer. There are many questions in that category.

Melvyn Bragg : But then so where does the question come from Richard?

Richard Dawkins : Well I think it comes. . . I think one can give a Darwinian answer to that, and say that our brains were made by natural selection to understand just enough to help us to survive, and just as we were talking earlier about the rainbow being just a tiny narrow fragment of spectrum, and we didn't know about all the rest of the spectrum, we can see that the whole way that our brain is made by natural selection is limited in this kind of way, and the "why?" question, particularly giving it a kind of personified human answer, everything must have a purpose, what's a mountain for? What are floods for? What are earthquakes for? We are conditioned by natural selection to ask that question because the world in which our ancestors grew up, was very largely a social world in which things happened because people engineered them, things happened because other members of the tribe, or members of other tribes caused them to happen. So when there's a natural catastrophe , like an earthquake or a drought or a flood, it's natural to say "Who's to blame? Why did it happen? Who did it? " , and I believe that all of our looking at the universe, the whole of the scientific enterprise is in a sense "limited" by the fact that our brains were never designed to understand, we don't understand Quantum Theory , because our brains were designed by natural selection only to understand the movement of large objects on the African plains.

Melvyn Bragg : But what about you, Ian? Where does that leave your. . . you mentioned transcendance just a few minutes ago, where does that leave your transcendance?

Ian McKewan : If I want my moment of transcendance I go on a long work and go to the top of a mountain, I mean I think actually contemplating the beauty of the physical world is a source of great joy and..... .

Melvyn Bragg : Which presumably could be..... sorry.....

Ian McKewan : . . . as Wilson says in his book "Concilience", "once you've grasped that the universe is not about you, it does set you free in the most extraordinary way", and once you grasp the horrible possibility, horrible for some, that you only have this tiny crack in time of consciousness, against all eternity, this 80 years if you're lucky, then perhaps the burden on you is to make everything you can of it, of that privilege of consciousness that you've

got.
So I think there are ways of putting it all back together, and to make of your life, to make it rich and possibly even transcendant, without an all -seeing purpose-giving God.

Melvyn Bragg : Yes and there's a whole part of Richard Dawkin's book which we haven't got on to, attacking Gaia and showing that this presumed organic rainforest or planet is not working for each other, but is working separately, just working to exist, and to keep existing, and yet there's something that comes at the....is there something that comes at the end of that? Can that be just an accident then?

Richard Dawkins : Do you mean the idea that world itself is working for..... ?

Melvyn Bragg : Well you er. . . we're slightly running out of time. . . but still....you take the idea of Gaia....of the planet being a single organ, the Gaia notion, and you say (sharp intake of breath)" yes but when you look at the rainforest it isn't Ilkley Moor bar tat, everything isn't just working neatly, with each other all the time, they're working for themselves and this is the overspill". The overspill means that other things exist because of, but there isn't a sense of a gene saying, "oh I'll do a bit extra to help the tree".

Richard Dawkins : If you look deeply at the way that Darwinism works, then the illusion of the rainforest working for the good of the rainforest can arise, but it is an illusion. What's really going on is that each individual, indeed each gene within each individual is working for its own good. But he best way to survive is to survive in the context of the other ones who are also trying to survive, and the end result of that, the rainforest or indeed the whole world looks a lot like a system that's been set up for the good of that system. But it's an illusion.

Ian McKewan : But it is a kind of metaphor isn't it? I mean because all those organisms actually....part of their environment are other organisms, so the process of natural selection is in part, driven by the existence of other organisms, which you are .....

Richard Dawkins : That's a good metaphor, but it becomes a bad metaphor when the whole is seen to be working for the good of the whole.

Melvyn Bragg : I'm afraid we have to come to a close, and I haven't even got to the brain, which I still think it's extraordinary the rapid developement, but perhaps another time, thanks Richard Dawkins, his book is "Unweaving the Rainbow", just been published, and Ian McKewan author of "Enduring Love" and "Amsterdam", and thankyou for listening.