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**Gareth Mitchell:** From Europe's leading science university this is the official Podcast of Imperial College, London.

Hello, I'm Gareth Mitchell, a presenter of the BBC's Digital Planet and a lecturer here at Imperial College. Welcome to the first ever edition of our new podcast. Imperial has over 11,000 students and 6,000 staff. We're in the top three UK universities and top ten internationally so we've plenty of world leading science to tell you about every month. And in today's inaugural edition an artistic twist in the quest for artificial intelligence as an Imperial computer scientist attempts to make a machine paint.

A lot of research is all about generating images which look perfectly like the real world. Computer games, when you're running around a simulated London, it looks perfectly like London. Now, the flipside of the coin is to take actual images and turn them into more abstract representations of them.

But how might computer art lead to better engineering? And away from the lab Imperial students take to the road in the College Union's vintage fire engine.

We're riding through central London on the bench seats of Jezebel. This is where the firemen would have traditionally rode to the scene of the fire. And the whole fire crew would have worked as a team.

That's all to come in this edition of the official Podcast of Imperial College London.

### Professor Peter Sever and new drugs to reduce the risk of heart attacks

But first I'm off to part of Imperial College's Medical School. I'm in Paddington and you might just about be able to make out in the background the sound of a train rumbling out of the station because I'm just around the corner from the International Centre for Circulatory Health which has teamed up with centres in Ireland and Scandinavia to investigate a new drug combination for reducing the risk of heart attack. The headline news is that this novel combination can halve the chances of moderate risk patients getting a heart attack. Well, the results of the trial, called ASCOT, have just been published in the European Heart Journal, and the man I'm going to see is the co-principal investigator on the study and is also a co-director of the International Centre for Circulatory Health, Professor Peter Sever.

**Peter Sever:** Historically I think we've been very bad at recognising that most people are at risk of heart disease and stroke, not just because they've got one risk factor but because they've often got two or more. And this was one of the first studies ever designed to look at combined intervention with blood pressure lowering and cholesterol lowering. And quite clearly, overall reducing in this hypertensive population was extremely beneficial. To our surprise there was a much greater benefit of lowering cholesterol if you were assigned the calcium- blocker regimen for your blood pressure than if you were

assigned the beta-blocker.

**GM:** And for people who obviously may not know that much about heart disease and how to cope with it other than using a statin, which are well known as drugs that reduce cholesterol, that would seem to make sense. Reducing cholesterol therefore fewer cardiac events or heart attacks or whatever. And the interesting thing here then is you're looking at adding to that statin one of two classes of drugs, either the beta-blocker or this exciting combination that you're talking about here, a calcium-blocker?

**PS:** Yes, that's right. As far as coronary events are concerned, clearly lowering cholesterol confers benefit, indisputable benefit. We know from many, many of the blood pressure trials that lowering blood pressure, which is a risk factor for coronary events as well, does indeed confer benefit. But what we're seeing here is possibly an additional mechanism being involved between the statin and the calcium-blocker. The figures were about a threefold difference. So if you were on a calcium-blocker and the statin you got about a 53 per cent reduction in coronary events but only a 16 per cent, and non significant, benefit of the statin if you were on the beta-blocker.

**GM:** And I suppose there are two bits of evidence for that, you know, one that may come from the trial depending on how you read the statistics behind the patient data, and I know that's always complicated and often controversial. But also here at Imperial College you've been doing effectively lab experiments that also suggest that this mechanism may be taking place then?

**PS:** Yeah. This is one of life's extraordinary coincidences that in our vascular lab, run by Alan Hughes and his colleagues in my department, we've been looking at the behaviour of human vascular smooth muscle cells which are cultured from tissues that have been removed from patients. And you can show in the in vitro cell culture model that when you add statins to proliferating cells they inhibit growth and replication in such a way as to potentially stabilise the cells in the context of the atherosclerotic plaque.

**GM:** I suppose the big question for patients or potential patients, maybe people who are at moderate risk who I imagine may be slightly overweight, they might be smokers, they may have high blood pressure, the implication for these people may be that they should be given this accommodation involving a calcium-blocker and the traditional statin?

**PS:** Well, yes. I think that is a real likelihood. I mean, one of the other important findings in the trial was that the benefits that we saw with this combination in preventing heart attacks was seen within three months. A highly statistically significant reduction in acute coronary events was seen within three months. And we believe that there is probably some additional, what we call, pleiotropic mechanism that is contributing to this very, very early benefit.

**GM:** Right, so here at Imperial College you have your fingers in many pies, as it were, and thinking very much to the future. You and your collaborators are now planning future studies into looking at reducing heart attacks. So tell me more about that.

**PS:** Yes, the big, big study, which goes by the name of Aviator, is a very exciting prospect to see whether using a first-in-class drug: a drug which inhibits the enzyme renin in a moderate risk population of people. They're not patients. They are individuals walking around the street but who we know from various observations on their blood pressure, their weight, their smoking habits and so on are at increased risk of a subsequent cardiovascular event. To see whether we can prevent these events occurring by administering a dose of one of these new classes of drugs, the renin inhibitors. And this study, which will take place predominately in the UK and Ireland but also in North America and Canada and India, will be the first study ever to investigate the potential benefits of therapeutic intervention in a largely South Asian population, who we know are at increased risk of cardiovascular disease.

**GM:** Exciting times indeed. Well, Peter Sever thanks very much indeed.

This is the official Podcast of Imperial College, London with me Gareth Mitchell. Still to come. Drawing on high end computing to put the art into artificial intelligence. But can a machine really create a masterpiece? But before that some quick headlines from around the college.

### Headlines from around the College

It's late nights all-round in the Physics Department at the moment as scientists there make a major contribution to the biggest experiment on Earth. The European Particle Physics Lab, CERN, is gearing up to open its new large Hadron Collider (LHC) just before Christmas this year 2007. Imperial physicists are the principal researchers responsible for the Compact Muon Solenoid (CMS) detector. This giant

piece of kit will capture the subatomic particles given off from the high energy collisions in the LHC in the quest for the Higgs boson, a fundamental particle that's been theorised but so far never found in practice. Tracking it down will validate the standard model; the theory that underlies much of modern physics. So no pressure folks.

And Imperial College researchers say that our Solar System was formed from a much richer combination of minerals than we first thought. Members of the Earth Science and Engineering Department, working with colleagues just round the corner at the Natural History Museum, have been analysing fragments returned from NASA's Stardust spacecraft that intercepted a comet in early 2006. Comets were some of the first bodies to be formed in the Solar System so work out exactly what they're made of and you've got a pretty good idea of what was whizzing around as the planets were taking shape. The Stardust samples under analysis by the Imperial's researchers suggest that Earth and its neighbours were born in much more turbulent times than we first thought.

And you can stay up-to-date with breaking news from the College on our Press Office website at [www.imperial.ac.uk/news](http://www.imperial.ac.uk/news)

### **Say hello to Jezebel, a vintage fire engine at the College maintained by students**

Well, now then, walking around the labs and workshops on our main campus in South Kensington you expect to see plenty of cutting edge technology, some of which is destined to end up in the aircraft, operating theatres or even the homes of the future. So it's a bit of a surprise to encounter this: [Sounds of a horn] It's a vintage fire engine called Jezebel. This 90 year old lady is the mascot of Imperial's Royal College of Science. Yet what exactly does move her guardians, all busy science students with a pretty full lecture schedule to spend their valuable time tinkering with Jez's engine and polishing her chrome? Well, that's just what Science Communication MSc student Alex Johnson wondered so she bravely chose to spend a day with Jezebel and her crew.

**Ashley Brown:** Jezebel came to college in the 1950s. In fact she's 90 years old this year, being built in 1916, and last year celebrated her 50th birthday with the College. She has a massive nine litre engine which develops about the same as a milk float in terms of power these days. She has a working pump. And we go out quite regularly for social visits. Today actually we're off to Kew Bridge Steam Museum which has an enormous steam engine. We're there for a fire appliances day where we're the star attraction.

**Alex Johnson:** Ashley Brown, Secretary of the RCS Motor Club. Not being the sort of person who generally frequents vintage fire engine rallies it was with some foreboding that I showed up at Jez's garage in college early on a drizzly Sunday morning in May. But by the time I was dressed up in a traditional fireman's jacket, holding on for dear life as we bounced through the streets, I began to think that it might not be so bad after all. Hugh Blackwell, one of my fellow fireman, describes the scene.

**Hugh Blackwell:** Well, we're riding through central London on the bench seats of Jezebel. This is where the firemen would have traditionally rode to the scene of the fire and the whole fire crew would have worked as a team. So the driver would stick his arm out or shout which way to go and the people riding on the bench seats, they all stick their arms out in the direction of travel to indicate which way the fire engine is turning.

**AJ:** I discovered that Jez had something of a fan following.

**Cathy Davis:** I'm Cathy Davis and I did a physics degree at Imperial College quite a few years ago. I graduated in 1985. I used to ride on Jez and help polish her so recently I brought my daughter along. So we're having a ride today on Jez and it's brilliant fun.

**AJ:** So what's your name?

Claire.

**AJ:** How old are you?

Ten.

**AJ:** What's your favourite thing about Jez?

How fast it goes.

**AJ:** We're just arriving at Kew Bridge Steam Museum. Jez has been attracting quite a lot of attention as we've been going through central London. People taking photos through their car windows. We stopped at a petrol station and someone came to take a photo of us. We're just pulling into the car park where there are lots of other fire engines so we don't feel quite so much like we stand out anymore. So there I was, my very first fire engine rally. Next time I'll remember my umbrella. Still, I have to admit my curiosity was whetted. So I braved the drizzle to find a real hardcore fire engine enthusiast to tell me about what was on display.

**Andrew Scott:** I'm Andrew Scott and I'm a member of the Fire Service Preservation Group. I'm one of the organisers of this little event here. I've brought along my Dennis fire engine. That's a 1939 model light four. We've also got a 1970 Dennis D fire engine. We've also got a police car and a ex-Cornwall Fire Brigade's breakdown lorry and a wartime escape carrying unit here with us today. Unfortunately the weather has deterred one or two people from coming but hopefully we've had a reasonable day.

**AJ:** Next came the highlight of the afternoon, the pumping displays. She may be old but Jez still proved a dab hand at putting out fires. John James, Chairman of the RCS Motor Club, explained how the pumping worked.

**John James:** The first thing to do is connect up the hard suction which is basically a pipe that can withstand pressure of water being drawn up through it and it won't collapse. We have to do this because Jezebel won't have any water on board. We always have to pump from either an open water source like a river or a stream or from a hydrant. So we connect that up and dunk that in the dam and then engage the pump which is basically a second gearbox just underneath the driver's seat. Start the priming pistons to draw the water up through the suction hose and then when the pump is primed you can open the outlet valve to squirt water down the hose.

**AJ:** I didn't quite follow the technicalities but I was impressed by how quickly Jez extinguished the blaze. I asked Ashley Brown if we could rely on Jez and her courageous team in a civil emergency.

**AB:** If we were nearby and someone was in danger I think we would be expected to actually do something. However, we can't be called out and our constitution quite clearly says that in the event of a fire we should run in the other direction.

**AJ:** Shame. Nonetheless, I had more fun than I anticipated at Kew Bridge and I'm proud to be Jez's latest fan. In fact, judging by the attention she received, she inspired a whole new generation of fire engine enthusiasts.

**GM:** Jezebel's newly acquired fans ending that report from Alex Johnson, clearly a fan of the old lady herself now. You can find out more about Jezebel by visiting the Imperial College Union site at [imperialcollegeunion.org](http://imperialcollegeunion.org) and then just type Jez into the search box.

#### **Dr Simon Colton and his painting computer**

And whilst you're at it why not go to this website, the [paintingfool.com](http://paintingfool.com). There you will find the fruits of the labour of Simon Colton in our Department of Computing. Before your very eyes your web browser will draw you a computer generated masterpiece. Paints are brushed on to the canvas in real time as if by an invisible artist. And Simon is interested in whether computers, being the cold logical machines we often think they are, can actually be creative. Well, obviously if you're someone like Turner Prize winner Tommer Abt, or one of the aspiring artists next door to us here in South Kensington at the Royal College of Art, you'll be hoping the answer is no. But fear not, the idea isn't to put human artists out of business, not for now anyway. This is part of a wider research agenda investigating the potential of artificial intelligence. And I've been to Simon Colton's lab for a demo.

**Simon Colton:** This is an area of computing research called Non-photorealistic Rendering. Lots of research is all about generating images which look perfectly like the real world. Computer games, when you're running around a simulated London, it looks perfectly like London. Now, the flipside of the coin is to take actual images and turn them into more abstract representations of them. So this software actually simulates paintbrushes down to the bristle level. I can show you on the computer here.

**GM:** Okay, so you're bringing up another image on the screen. There's a squiggly line forming in front of us but it's about to become a work of art. This is work in progress. So what's going on here?

**SC:** Well, this is a photograph of the Madrid rooftops I took a few years ago. I wanted to show you this

one because it's simulating acrylics. So you can see the variation in the acrylics here. It's not just a block line of blue as we're looking at it. There's ridges and there's different variation in that.

**GM:** It has a real texture to it, doesn't it, this line?

**SC:** Yes. This is fairly straight but you can see there are some areas of white of the canvas showing through where the programme has wobbled a bit.

**GM:** And that in itself is realistic, isn't it? You know, a real artist would be applying the acrylic and maybe just miss a few bits of the canvas and bits of the white canvas show through, as is the case here.

**SC:** That's right. And so part of the simulation process is to make it feel a little bit more human. It's a design not to look like an automated process, which humans have.

**GM:** And it is intriguing. You know, you do get the sense of an invisible artist, if you like, in an almost haphazard way applying this acrylic to the canvas.

**SC:** Let me show you another one. So I'll show you an image now of the painting, Vermeer's Girl with a Pearl Earring.

**GM:** That's a very famous Vermeer painting.

**SC:** Very famous painting, and I used it as a test case for simulating these different natural media like charcoals and pencils and so on. But I'm now more interested in simulating something a little bit more abstract with this image. So as we'll see in a second. You can already see that the paints are more vivid. The way to think of it is they're less mixed. So if you mix four or five different paints but you don't actually mix it to completion you'll get strands of paint which haven't been mixed. And you'll see those strands in this simulation. The strokes at the bottom are really kind of colourful. They don't allow the actual colour because I've told the Painting Fool to be a little bit more wild here. And I've told it not to fill in all of the gaps so it's actually drawing lines across each region now rather than trying to fill the region. The reason for this is that it's going to give the Girl with a Pearl Earring a slightly modern twist. And when it runs to completion, when the Painting Fool finishes, which is in, I think, about two minutes for this one, it will be heavily disguised and heavily artistic. That's what I'd like to think.

**GM:** As you were saying all that the Girl with a Pearl Earring is now nearing completion, or the computer's version of it. It's interesting then that this has taken a few minutes because with computers generally you can just programme them to do things very quickly. Do you really need to have all this, if you like, showmanship of seeing each individual stroke coming along? Couldn't you just kind of cut all that out and just get it to crank the algorithm through and produce this in a fraction of a second?

**SC:** Yes and no. But I think the fact that people have to sit through watching this paint is actually quite mesmerising. I'm afraid to say I've sat in front of the computer screen for a long hour or two in the last few weeks just watching it paint because you're never quite sure what it's going to produce. And this adds to your feeling of a valued artefact being produced, a valued painting being produced, rather than if it was lightening fast, which maybe I could have achieved if I was a bit better programmer. And the other thing about this is when people go to the Painting Fool, if people go to the Painting Fool website, what you're seeing now is different to any other painting which has ever been produced. It's slightly different in this case. So the variation of the squiggles you're seeing on screen have never been produced before because there's randomness in there being produced on screen every time you go to this website.

**GM:** Okay, so you're trying to recreate the way that human beings paint but, Simon, why? I mean, we've got plenty of humans who paint. There are plenty of aspiring young artists and established masters who can do this anyway. Why get a computer to do it? Why not leave computers to do things like organise payrolls and the things that computers usually do?

**SC:** Well, I worked for a company which wrote organising payroll software and I can tell you that it wasn't very interesting. Okay, the bigger picture is artificial intelligence. One thing that computers are lacking in the general case is an ability to be creative. And this is what we're looking at in the area of computational creativity. What does it take to get past this next hurdle in the artificial intelligence story of computers being creative? So that they don't just help in simulating airflow in an aeroplane simulation where you're building a new wing they actually help you design the wing. They make aesthetic choices. They invent. They innovate. In general computers are not used in that way but they

have a huge potential. There's no reason to say that they can't be creative. And in this particular case, yes, there are already artists out there who can produce wonderful pieces of art, and there's absolutely no reason why human artists are going to stop painting because computers can now paint. There's no reason to think that they would stop. And why should they?

**GM:** And in the meantime this piece of work, *Girl with a Pearl Earring*, after Vermeer but by the Painting Fool appears to be complete, Simon.

**SC:** Yes. I should ask you this question. Can you tell that it is the *Girl with a Pearl Earring*?

**GM:** Yes. Brilliant. And just in a few words, are you pleased with this one?

**SC:** She has got very longing, very mournful eyes in the original and there's still an essence of that in this. Even though it's done in a very wacky, crazy way you can still get across some of the sensibilities. So, yes, I'm quite pleased with this one.

**GM:** Simon Colton there in the Department of Computing. As a reminder you can see more of his work, or that of his machine to be more precise, at [thepaintingfool.com](http://thepaintingfool.com). And that brings this particular masterpiece to an end. We'll have more from Imperial College, London in our next edition in March, including the Imperial researchers who say that Mars is the place to look for evidence of how life began on Earth. In the meantime you can find out more about the goings on at Imperial on our website at [imperial.ac.uk](http://imperial.ac.uk). The signature tune is called Layla and is composed by Ozgur Buldum. Hear more of his music at [ozgurbuldum.com](http://ozgurbuldum.com). This podcast is a co-production of the Imperial Press Office and the Science Communication Group. I'm Gareth Mitchell and from all of us here on our main campus in South Kensington, thanks for listening and goodbye.

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