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CARDIFF UNIVERSITY
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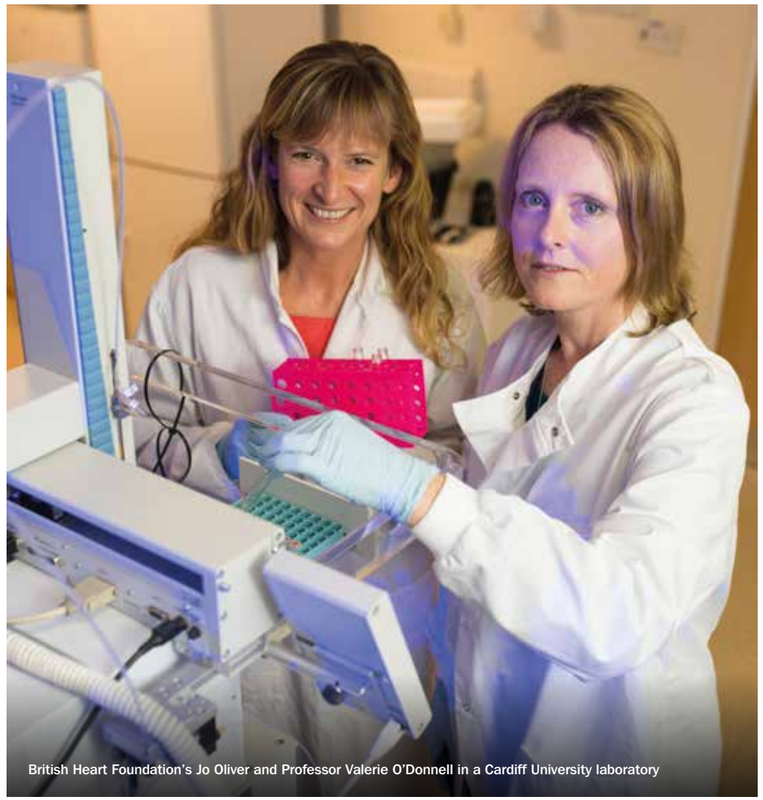
# CHALLENGE CARDIFF

**British Heart Foundation's Jo Oliver talks to Professor Valerie O'Donnell**

# Getting to the fat of the matter

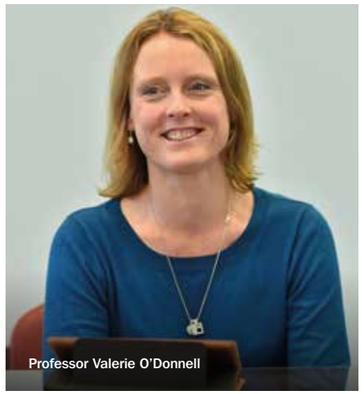
**Judas**
The Archbishop of Wales talks poetry with Professor Damian Walford Davies

**Ecohomes – the solution to the housing crisis?**
Steve Morgan OBE challenges Ester Coma Bassas on affordable low carbon housing



British Heart Foundation's Jo Oliver and Professor Valerie O'Donnell in a Cardiff University laboratory

Jo Oliver



Professor Valerie O'Donnell

Aspirin prevents platelets from making this lipid which is why it is given to people at risk of heart attack. Aspirin is one of the most widely used drugs in the world and it works by preventing lipids from being made.

Of course, the problem is that aspirin can lead to increased bleeding because if you have no thromboxane it makes it harder for your blood to clot when it really needs to. People generally think about lipids and heart disease in the context of high cholesterol or high triglycerides, but it's so much more complicated than this.

**JO:** If BHF supporters asked why we're funding your research, what can you tell us about the advances you've made and the difference it's made so far?

**VO:** Our research is very much at the basic science end, so it takes many years to lead to potential benefits for patients. Understanding what these lipids do is only the beginning. We have to understand the biology of our vascular system before we can hope to develop new treatments for disease.

It isn't simply a case that eating too much fat causes heart disease. It's more about the lipids we make in our bodies and how they respond to infection, exercise, smoking, our genes and our lifestyle choices.

At this stage, we are working out what the new lipids we have discovered are doing during development of heart disease. On the other hand, some of our recent work being done with haematologists is aiming to develop new drugs that could promote blood clotting because too much bleeding is a major problem in trauma injury, surgery and inherited bleeding disorders.

Other lipids we have worked on with colleagues in the US are in clinical trials now for inflammatory disorders but still are a way off from becoming actual drugs available for patients. But this is the ultimate aim.

**JO:** You're now the co-director of the Systems Immunity Research Institute. How will the new research strategy of the Institute benefit your research area?

**VO:** The new approach we have taken in the Institute is around applying mathematics and computer sciences approaches to our research - something we increasingly need to do - because these days we generate a huge amount of data and it is a huge challenge to analyse and understand it. The new Institute is allowing us to showcase the work at Cardiff, and put us on the global stage of immunity research.

For my own research it's been amazing. We have joint projects with researchers in the School of Computer Sciences and Informatics who are helping to write software and automate our processes so we can handle the large amounts of data our mass spectrometers are generating. This is allowing us to discover more new lipids and is making it easier and quicker to work out which lipids are worth researching in more detailed studies. It's also allowing us to compare lipids in people with various genetic mutations associated with cardiovascular disease and dementia.

**JO:** What would you like to achieve in the next five years, with regards to your research?

**VO:** We have an awful lot to do, including discovering more lipids, working out what they do and then translating them into new ways to diagnose or treat cardiovascular disease and other similar inflammatory disorders. We believe that a single cell type contains about 5,500 unique lipids of which about half are totally new. It's more than enough to keep us busy for many years to come. We work as an interdisciplinary team, including chemists, computer scientists, cell biologists and clinicians. It's down to the hard work of the entire group that we are managing to get this work done at all.

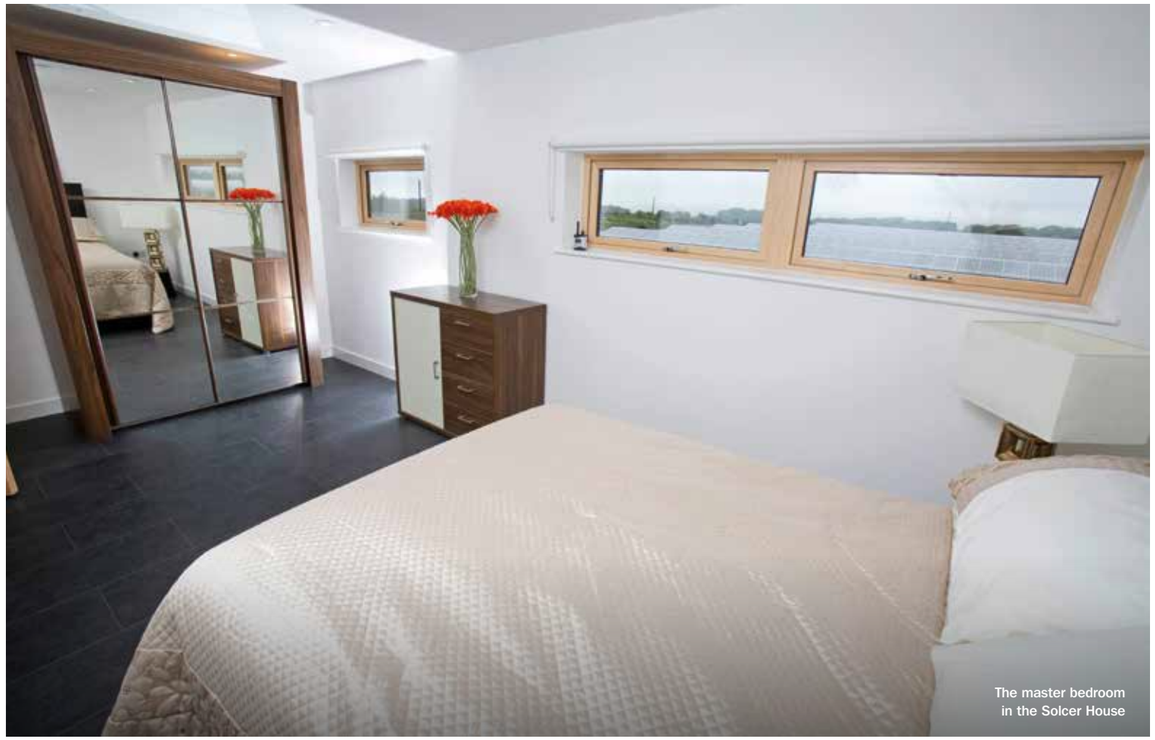




# Homes for the future

"Solcer House demonstrated that zero carbon targets could be met in an innovative and affordable way."

Photography of the Solcer House courtesy of BASF



The master bedroom in the Solcer House

Roof panels

For every 1 kWh of energy the Solcer House takes from the national gird, it is able to generate and transfer 1.75 kWh of energy back into it.

Steve Morgan OBE

Ester Coma Bassas outside

Solcer House taken from rear aspect

To the dismay of many in the construction, property and renewable energy industries, the Chancellor George Osborne has scrapped plans to make all new UK homes carbon neutral by 2016.

Shortly after his announcement, a team led by Cardiff University's Welsh School of Architecture unveiled the UK's first carbon positive house, capable of exporting more electricity to the national grid than it uses.

Built in just 16 weeks at a cost well within the social housing budget, the three-bedroom 'Solcer House' demonstrated that zero carbon targets could be met in an innovative and affordable way, creating long-term benefits for both the economy and the environment.

As one of the UK's most successful house builders, Steve Morgan OBE, chairman and founder of Redrow plc,appreciates the vital role that innovation plays in providing affordable homes.

Steve is interested in the challenges associated with designing and building a carbon positive house, and curious as to how it can be rolled out more widely across the country.

He spoke to Ester Coma Bassas, the project architect of the Solcer House, to find out more.

**SM:** Where did the idea of building a carbon positive house come from?

**ECB:** The idea to build the house came about through the University's involvement with the Low Carbon Research Institute (LCRI) – a body that was set up in Wales in 2008 to link academic research with industry and government, specifically in the development of low-carbon technologies.

The Welsh School of Architecture has been involved in a programme looking at the built environment, and how carbon dioxide emissions can be reduced through the development of individual building components and buildings themselves.

Up until recently, it was UK government policy to make all new homes carbon neutral by 2016, so it was a natural progression for us to bring together all of the latest technologies and demonstrate to builders that this target could be met at an affordable price.

**SM:** As you say, shortly before the house was unveiled, the UK government scrapped plans to make all new homes carbon neutral from 2016, stating that this couldn't be achieved cost-effectively. Has your project proved otherwise?

**ECB:** There are a number of ways of getting to this zero carbon target. Some feel that you can't achieve zero carbon housing with on-site energy generation alone and, therefore, at certain times of the year – specifically in the winter months – energy will need to be drawn in from the national grid.

Mass house builders in particular have been resisting the move to zero carbon housing, saying that the target is difficult to reach, costly to implement and brings risks in applying relatively unfamiliar technologies.

What we have shown is that over a whole year, it is quite feasible for a zero carbon building to achieve energy positive performance. For every 1kWh of energy the Solcer House takes from the national gird, it is able to generate and transfer 1.75kWh of energy back into it.

We're still analysing the final cost of replicating the house, but we believe that a single house could be built at a cost of around £1,000 per square metre. If you were to build a number of these houses at the same time, the cost could be reduced by around 10 to 15%. The costs would then be well within the standard housing benchmark, which is currently £800 to £1,000 per square metre.

**SM:** What makes this project unique?

**ECB:** The house is unique in that it's not only energy positive over the entire year – exporting more energy to the grid than it takes away – but is also built using low-carbon materials from the local supply chain. For example, the cement used in the foundations was a special low-carbon variety developed by a local company in Bridgend, whilst the extremely efficient insulating panels were provided by a company in Llandovery.

Furthermore, the off-the-shelf technologies that are used to generate, store and transfer electricity are integrated together to form one complete flexible system rather than several different 'bolt-ons'. Nothing like this has been done before in the UK, and it really does position Wales as a trailblazer of low-carbon technology.

**SM:** What were some of the biggest challenges you faced when designing and building the house?

**ECB:** The biggest challenge was applying what we call the systems approach. To make the Solcer House as efficient and easy to use as possible, we had to ensure that each of the technologies could essentially 'talk' to each other.

In the past, technology has often been 'bolted' onto buildings, which can make things over-complicated and unintelligible for the building user. A smart house should be simple to use.

In the Solcer House, the energy-generating solar panels were intrinsically linked to the energy-storing batteries, which were further linked to the heating, lighting, ventilation and small power systems. Furthermore, the technologies were integrated into the architecture of the house itself, so the solar panels became the actual roof of the house and the solar thermal air collector was the façade.

As an architect, this was challenging as I had to think like an engineer throughout the whole design process.

**SM:** How did you go about sourcing the low-carbon materials and technologies to build the house, and how did you manage to keep costs to a minimum?

**ECB:** One of our main aims when designing and building the house was to not only show that zero carbon targets could be met, but also to showcase the technologies that are currently being developed in Wales. Through our involvement with the LCRI, we were able to source most of the building components, as far as reasonably practical, from Welsh manufacturers and installers.

This was an enormous learning experience for everyone, as it was the first time that some of the local contractors had installed their components. Many of them are now applying this experience to other buildings.

This did, however, have implications for me as an architect, because if you want to make the most of local suppliers you have to look at what technologies are out there first and adapt the design accordingly.

**SM:** If the aesthetics of the house are unacceptable, how can this be improved without compromising the carbon positive principles.

**ECB:** Beauty, or aestheticism, is a subjective value to me. Looking at the Solcer House it is quite obvious that we did not follow a traditional approach in which the architect uses a conventional design methodology focused mainly on the aesthetics and on building's space and form. Instead, we have proposed a 'performance-driven' architectural design, that takes a holistic approach towards energy and thermal performances of buildings, while ensuring that the use and aesthetic of the design are not dismissed.

I believe that in the 21st century, with so many world-wide issues such as fuel poverty and global warming, the housing sector must have a much bigger responsibility. We want to convert UK households into power stations, and to me that is the real beauty.

**SM:** Now that you've successfully built a prototype, how will you go about encouraging house-builders like myself to take up this concept?

**ECB:** Our key task now is to ensure that all the technologies we've put in place are continually monitored to assess how the house is using and generating energy. The house is currently home to a local business, which helps us monitor the continual use of energy.

When we finished building the house earlier this year, we held a launch event at the site which was attended by a range of stakeholders as well as the national media. This generated an extraordinary amount of exposure and subsequently led to a number of organisations and officials visiting the house to see how it could be replicated more widely. These stakeholders have included SMEs, councils, Welsh Government, building owners, landlords, national housing developers and, remarkably, the Vice Premier of China during her visit to the University.

We are continuing to engage with each of these stakeholders, informing them of how the house is performing and the projects that we have lined up for the future.

It is our vision to see this type of house built not only in Wales and the UK, but also all around the world.

**SM:** What are the next steps of the project?

**ECB:** We are now looking at how we can replicate this concept at scale, extending our work to larger housing projects and other building types.

Our next move at a building level will be to design and construct a row of interconnected carbon positive houses, with each house acting as an individual power station with the potential to share energy with other houses..

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