

## Researchers forecast cancer treatments and atomic-scale modelling in 2014

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KEY THEME: INNOVATION UNION

by Ben Deighton



Image of atoms and electrons. © Shutterstock/ Sergey Nivens

**Radical new treatments for cancer could be available in hospitals in 2014, while quantum computing could allow scientists to model chemical reactions at the atomic level for the first time – these are some of the predictions made by researchers in Horizon's poll of major developments this year.**

Horizon asked researchers who have previously featured in the magazine for their forecasts on the scientific developments that could have a major impact in 2014.

The answers ranged from aerial robots that could revolutionise the way warehouses are stocked, to new steel smelters that use less coal, and climate models that will enable scientists to be more confident in forecasts for rising sea-levels due to global warming.

### Quantum simulation



Professor Andris Ambainis, the coordinator of the Quantum Computer Science (QCS) consortium at the University of Latvia, believes that the development of quantum computers could allow researchers to make simulations of chemical reactions at the atomic level. 'Some of the biggest developments may occur in the area of quantum simulation. Quantum simulation uses quantum computers to model physical systems. For example, one could study chemical reactions on the level of individual atoms and electrons by modelling them on a quantum computer. Such modelling is notoriously hard for ordinary computers. Because of that, even quite small quantum computers may produce interesting advances in this area,' he said.

### Vaccine for Malaria or AIDS



Sir Tim Hunt, member of the ERC Scientific Council and 2001 Nobel laureate, said that science discoveries were by definition unexpected, but a vaccine for Malaria or AIDS would change the world in 2014. 'The whole point about discoveries is their unexpectedness - so let's hope for new and surprising developments, rather than more of the same. As for scientific developments, it would be wonderful to see effective vaccines against Aids and Malaria developed; but I am not holding my breath,' he said.

### Steady progress in online security



Dr Stephan Lechner, Director of the Institute for the Protection and Security of the Citizen at the European Commission's in-house scientific service, the Joint Research Centre, hopes that there won't be any major online threats in 2014, and we can make steady progress in developing online security. 'Major changes often originate from fully unexpected events like 9/11, Stuxnet, the Fukushima incident or the Snowden whistle blowing, so they cannot be derived deterministically. Unfortunately, many of the disruptive changes are of a negative nature. I sincerely hope that we will not see any of them in 2014 but will be able to work for a steady progress of online security and science moving to markets,' he said.

### Less coal for steel smelting



Wolfgang Schneider, a project officer at the Research Fund for Coal and Steel, believes that the biggest change to steel production in 2014 might be the introduction of new smelters that use less coal. 'Although most likely not available in full-scale in 2014, the big new thing for steel might be the move from Blast Furnaces to HIsarna type smelters (that use less coal). This would be breakthrough technology requiring less coal, leading to reduced carbon dioxide emissions and because of the flexibility in the process, coal could even be replaced by biomass, gas or hydrogen,' he said.

### Aerial robots



Professor Bruno Siciliano, a specialist in control and robotics at the University of Naples Federico II, Italy, believes that aerial robots could have a major impact on society next year or the year afterwards. 'I think the biggest development in robotics in 2014 could be aerial robots for plant inspection or warehouse servicing tasks ... It is adding the third dimension in a light way and as such it has got a great potential!'

### Using the immune system to fight cancer



Dr Harpreet Singh, the coordinator of GAPVAC and Chief Scientific Officer at Immatic, a biotech spin-off from the University of Tübingen, Germany, believes that treatments that use the immune system could have a major impact on cancer treatment in 2014. 'Some of these therapies show dramatic response rates in early stage trials. With the Food and Drug Administration (FDA) breakthrough designation in place, the time-to-market for such therapies has been additionally shortened. I am pretty sure, we will see FDA approvals of another checkpoint inhibitor targeting PD-1 and cellular gene therapy targeting CD19 (two types of cancer treatment that use the patient's own immune system to fight tumours) already by the end of 2014. But this is just the start. Combination is key and particularly the combination of checkpoint inhibitor and therapeutic cancer vaccines will be a game changer,' he said.

### Better models to monitor polar ice



Professor David Vaughan, the coordinator of the polar ice monitoring project Ice2sea, and Glaciologist at the British Antarctic Survey, believes that better ice sheet monitoring models will allow scientists to be more certain in forecasting how much the sea level will rise due to climate change. 'I think we should see the convergence of ice-sheet models towards a common methodology that will allow us to be more confident in the projections of ice loss and sea level rise. On the larger scale, I would like to see wider acceptance that climate change has a human cause. If we can see wider agreement on that point then perhaps we could truly begin the global discussion on what we should do about it,' he said while conducting research at the Pine Island Glacier, Antarctica.

### Real-time climate data



Prof. Patrizia Ziveri, the coordinator of the MedSeA project at the Universitat Autònoma de Barcelona, considers that real-time data from satellite-tracked drifters collecting multiple parameters including biogeochemical data (e.g. acidity and total carbon dioxide) would have a major impact on our understanding of the role of humans in climate change. 'This data capability at the regional scale, in combination with existing in situ observational techniques, (such as) monitoring, field observations, will allow great strides to be made with understanding the most human-relevant ocean impacts today.'