David JR Conroy

Position

PhD researcher (3rd year)

PhD

Bio- and chemo-sensors for groundwater radionuclides

Research area

Bionanotechnology; biosensors and functionalized nanoparticles

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Supervisor's supporting comments

As a graduate nanotechnologist, MSc bionanotechnologist David is one of the new breed of young scientists who only progress if they are prepared to develop a wide skill base and engage in a multiplicity of new techniques and approaches cutting right across the full range of scientific

disciplines. David has shown himself to be a creative and lateral thinker who is totally committed to finding (and training in) the techniques he needs to accomplish his aim, which is translational research aimed at producing real world analytical devices that lean heavily on the new opportunities offered by bionanotechnology. The uranyl sensor he developed (now published work) really does show the way to remote environmental monitoring of pollutants. In fact, this makes possible an environmental surveillance approach that has hitherto been impossible except with huge expense and infrastructure. His work is likely to change current practice in a big way and he would be a very worthy recipient of a young investigator award.

Nominated by: Paul Millner, Professor of Bionanotechnology, IMSB/FBS Garstang Building, University of Leeds, Leeds, LS2 9JT, UK; Tel.: +44 113 343 3149;
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Q What drove you to choose a career in bioanalysis?

My undergraduate course in nanotechnology here at Leeds University was a multidisciplinary mix of biochemistry, chemistry, physics, electronics and materials. As a result I wanted a research project that was both cutting edge, novel and interdisciplinary allowing me the potential to create a functional biotechnological device with potential for large-scale development rather than research for the sake of research.

Q Describe the main highlights of your bioanalytical research, & its importance to the bioanalytical community both now & in the future

A biosensor is the integration of biological recognition elements with electronic components to create a signal transduction mechanism, for example; current, optical or impedametric to create a superior sensing device. Applications are vast, from toxicology, cancer and medical diagnostics to pharmaceuticals and cosmetics.

In my own work I use bionanotechnology to integrate organic or synthetic components including proteins, antibodies or calixarenes onto functionalized surfaces. In this way, highly functionalized and responsive surfaces are coupled to real-time analysis methods with the hopes of creating a bio-/chemo-sensor that

has a higher specificity or selectivity to what is currently commercially or practically available for field-active devices. My PhD project primarily for environmental and defense technologies is to detect groundwater contamination from UK nuclear legacy sites that has escaped into the environment. Within 18 months of starting my PhD I have managed to create a completely new, novel functioning prototype for groundwater uranium by tethering purified surface layer proteins from bacteria evolved in radioactive contaminated waste sites. With the current problems in Japan and large-scale groundwater radioactive contamination it is unfortunate that my project was not started a few years ago and is not closer to commercialization. However this shows the significant need for such devices.

Q Where do you see your career in bioanalysis taking you?

As bionanotechnology is an emerging field I plan to use my unique skills to establish truly interdisciplinary research laboratories for the integration of a wide range of science and engineering to focus on practical problems. For my future work I see myself potentially looking for a postdoctoral position in either China (if my language skills improve to a conversational level) or in the USA, as these are currently the two leading countries in terms of original research

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with significant funding in nanotechnology. In the next month I am visiting China on a nanomedicine conference to instigate inter-university research, student exchange between laboratories, and to look at potential postdoctoral routes and take the first steps towards achieving my ideal career. Ideally, this will include a combined laboratory of medics, scientists and engineers focusing on areas such as drug delivery, medical diagnostics, functionalizing nanoparticles and biosensing.

Q How do you envisage the field of bioanalysis evolving in the future?

I see the field moving away from the traditional branches of science such as biology, biochemistry, chemistry and the likes. While these will still exist in their own right, more and more disciplines are overlapping; genetics and bioinformatics, and biotechnology and material engineering are current examples. Without the broadening and merging of research minds from structured and traditional ways of thinking, research will stagnate and limit the potential possible. As an example; medics would be consulted to identify the symptoms and markers of illnesses, genetic disorders or disease such as cancer. Biochemists and geneticists would then identify potential disease biomarkers and the antibodies against them. Nanotechnologists will create functionalized

nanoparticles in parallel with biotechnologists so the devices are biocompatible. Material scientists will test drug loading, release and delivery of the nanoparticles that have been conjugated with the produced antibodies. In this way, a nanoparticle designed for a specific illness, loaded with an appropriate drug, is functionalized with a desired receptor molecule to be delivered via the patient's bloodstream. Problems will be approached from different perspectives with the same goal, from problem identification and theory to product design and application, leading to testing, scaling and finally production.

Financial & competing interests disclosure

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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Representative publication

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If you wish to nominate a Young Investigator, please contact the Editor for more details.

Ryan De Vooght-Johnson,
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