

# Relying on automation – new applications for circular dichroism

Automating circular dichroism measurements with the Chirascan-plus Circular Dichroism Spectrometer and the Tecan Cavro Omni Robot

Applied Photophysics has created a new protein discovery solution, incorporating Tecan's Cavro® Omni Robot to automate sample preparation for its Chirascan™-plus CD Spectrometer. This newly created system combines Tecan's precise and reliable sample handling with measurement reproducibility, opening up a wide range of circular dichroism applications for the first time.



The R&D team at Applied Photophysics. From left to right: Lindsay Cole (Senior Application Scientist), Paul Hatton (Senior Mechanical Engineer), Bernard Costello (Application Scientist), Rene Ayina (Senior Programmer) and Tim Collins (R&D Manager)

For over 40 years, Applied Photophysics, based in Surrey, UK, has designed and supported innovative, high performance spectrometers. The Company's Chirascan family of instruments, which uses next generation circular dichroism (CD) technology, has opened up new areas of interest, including clone selection and biopharmaceutical formulation. Lindsay Cole, Project Leader at Applied Photophysics, explained: "CD is extremely sensitive to the conformation of biological macromolecules in solution, including secondary and tertiary protein structure, allowing us to detect significant changes in the spectrometric properties of proteins. The sensitivity of this technique requires extremely careful sample preparation to avoid reproducibility issues and erroneous results. As a result, throughput is very low when performed manually, with a study of 20 samples taking almost an entire day."

In early 2009, Applied Photophysics collaborated with the biopharmaceutical community to investigate the possibility of automating CD measurements with an OEM robot to revolutionize throughput

and reproducibility. "My project brief was to develop a system enabling unattended running of samples," Lindsay continued. "Although we could have developed a solution in house, it quickly became apparent that the most efficient way of achieving reliable automation was to use an existing system from an OEM supplier. We looked at the various systems on the market, and it was obvious that the Tecan Cavro Omni Robot best suited our needs. There are various 'HPLC-type' autosampling systems on the market, but these would have significantly constrained our instrument design. In comparison, the Omni Robot is a gantry format general-purpose component that can simply be bolted onto our platform, offering the required xyz liquid handling without further modification. This eliminated the need to design and integrate our own fluidics, sample probe and injection port, and gave us useful features, such as the sample level sensing, and the option to add other sample handling and preparation capabilities in the future. Tecan engineers also came to our facility and integrated an Omni Robot with our Chirascan-plus instrument as a proof-of-concept – which worked first time – and so



we were confident that the Tecan solution offered exactly what we needed.”

“Because the Tecan component is a relatively open and malleable liquid handling robot, it was very easy to incorporate it into our system. The Omni Robot is held in a purpose-built enclosure alongside the Chirascan-plus, and we had a basic system set up and working within a month of receiving our first unit. All our efforts could then be focused on designing the critical fluidics and sample chamber to suit an automated set-up, as well as developing experimental sampling and cell cleaning protocols.”

The automated platform uses a single fixed probe and a Cavro XCalibur syringe pump to perform sequential sampling from up to four 96-well plates, without dilution or cross-contamination of samples. Auxiliary components – such as the sample chamber lid, liquid wash pumps and vacuum pump – are controlled by a Cavro Smart I/O Board in the Omni Robot. The system is also able to automatically switch between dispensing water, cleaning solution or solvent via a smart

distribution valve, allowing thorough cleaning and drying of the sample cell between measurements. “Sampling, measurement and cell cleaning take up to ten minutes per sample, and we can run up to 200 samples per day, or 384 samples over a weekend, with just about 30 minutes of plate loading and experimental set-up by a technician. The instrument is temperature controlled to avoid sample degradation during extended runs, and we can also use the Omni Robot to prepare titration plates with variations in pH, salts and ligands, to allow easy investigation of conditions that destabilize the conformation of target macromolecules,” Lindsay added.

“Automation significantly increases the practical throughput of the Chirascan-plus, allowing unattended running with minimal

user intervention. It has reduced labor requirements per measurement by 90 %, with a 10-fold increase in productivity, so in terms of samples per person per hour, it increases productivity about 100 times. This, combined with the reliability and increased reproducibility offered by the Cavro Omni Robot, has greatly increased the appeal of CD as an analytical technique for proteins, particularly for the biopharmaceuticals development market.”

To find out more about Tecan’s Cavro Omni Robot, visit [www.tecan.com/components](http://www.tecan.com/components)

For more information on Applied Photophysics, visit [www.photophysics.com](http://www.photophysics.com)

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Increasing throughput with the Tecan Cavro Omni Robot

