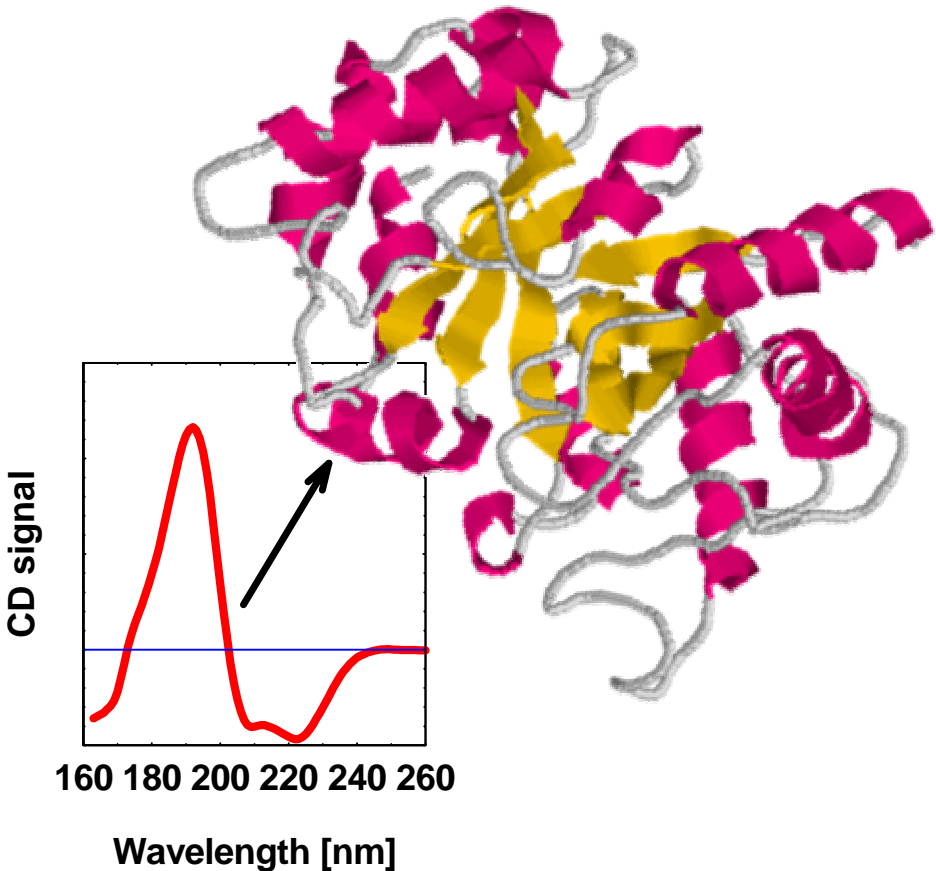


Synchrotron Radiation Circular Dichroism (SRCD)

ISA, University of Aarhus



At the Institute for Storage Ring Facilities at Aarhus University (ISA) we offer access to a SRCD facility. The facility is open for researchers with an interest in molecular structures of e.g. proteins, peptides, drugs and other macromolecules.

What is CD:

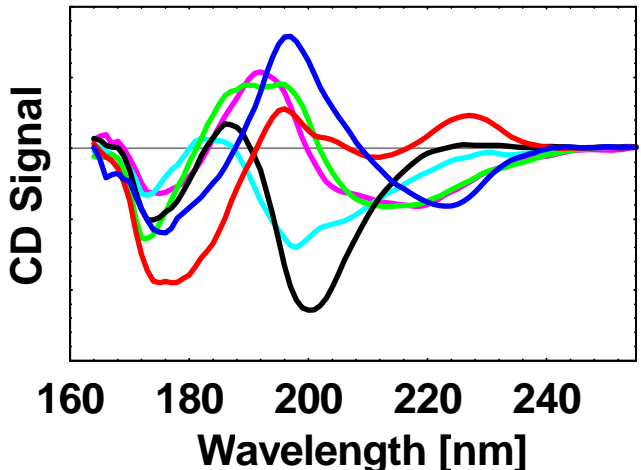
Circular dichroism is the difference in absorption between left and right hand polarized light. Chiral molecules do in general give rise to a dichroic signal. In particular, the secondary structures of peptides and proteins give rise to characteristic far UV CD spectra. A number of additional transitions in the VUV region are detectable by SRCD. To a first approximation, a CD spectrum can be considered to arise from the weighted summed components of secondary structure that comprise a protein. Many linear and non-linear methods currently exist for calculating protein secondary structure contents from CD spectra using the far UV data.

Why SRCD:

“Synchrotron radiation circular dichroism (SRCD) spectroscopy is an emerging technique which offers significant improvements to the well-established method of conventional circular dichroism (cCD) spectroscopy. It takes advantage of the high light flux available from synchrotron sources over a wide range of wavelengths (energies), which results in higher signal-to-noise ratios and enables the collection of lower wavelength data than possible using xenon arc lamps that are typically the illumination source in cCDs.”

—B. A. Wallace *et. al.* *Faraday Discuss.* 2004, 126, 237–243

Figure: SRCD spectra of beta-sheet-rich proteins as the first components of a reference database for the identification of fold motifs and supersecondary structures. The SRCD spectra shown extend well into the VUV wavelength range otherwise not obtainable by conventional CD (adapted from B. A. Wallace *et. al.* *Faraday Discuss.* 2004, 126, 237–243).



A few examples of SRCD research performed at ISA.

- *Autosomal dominant congenital cerulean cataract is caused by a mutation of a single amino acid in human γ D-crystallin, the protein which provides both refractive power and transparency in the eye. With SRCD it was possible to show that the mutation causes a small but real conformational change in the crystalline protein, otherwise not detectable by conventional CD. (Ref: B. A. Wallace et. al. Faraday Discuss., 2004, 126, 237–243)*



- *Spider silk is made and spun in a complex process that tightly controls the conversion from soluble protein to insoluble fiber. SRCD provided a quick and versatile method for examining the secondary structure of silk solutions. The study suggested that there was a strong drive in spidroin proteins toward the beta sheet rich state and that the spider succeeded to keep the system ready at all time to undergo the conversion from liquid to solid. Time, storage temperature, and methanol effects suggest that hydrophobicity is a dominant force in the behavior of silk protein. (Refs: C. Dicko et. al. BIOMACROMOLECULES 2004, 5, 704-710 and BIOMACROMOLECULES 2004, 5, 758-767)*



- *The initiation of protein biosynthesis in living cells is an important and rate limiting step, and is promoted by protein initiation factors (IF). SRCD was used to describe the structure of an N-terminal fragment (designated Domain I) of IF2 from Escherichia coli. It was found that Domain I of IF2 is very sensitive to changes in temperature, and that the N-terminal of IF2 consists of α -helical structure and that it may interact with different RNA species. Furthermore, the IF2 N-terminal is connected to the rest of the protein by a flexible linker (Refs: B.S. Laursen, et. al. J. Biol. Chem., 2003, 278, 16320-8 and Protein Science, 2004, 13, 230-239).*

Further reading about SRCD:

- *Synchrotron radiation circular-dichroism spectroscopy as a tool for investigating protein structures.* B.A. Wallace, *J. Synchrotron Rad.* (2000). 7, 289–295
- *Synchrotron radiation circular dichroism spectroscopy of proteins: secondary structure, fold recognition and structural genomics;* BA Wallace and Robert W Janes, *Curr. Opin. Chemical Biology* 2001, 5, 567-571.

Access:

Access to the SRCD facility is offered free of charge to researchers after approval by a user selection panel. However, short experiments or tests will be accommodated on shorter notice. We are considering changing the SRCD facility, to provide access on short notice all year round.

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