



Experiment title: Crystallographic Investigations on Structure and Function of Photoactive Proteins	Experiment number: MX-134	
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Report:

Phytochromes are bilin-binding photoreceptors in plants where they modulate a broad spectrum of biological responses, and in various bacteria. Upon absorption of light at two different wavelengths, they are interconverted between two forms, Pr absorbing in the red and Pfr absorbing in the far-red spectral region. The photochemical key event of this process is an isomerisation at a double bond connecting pyrrole rings C and D of the bilin. Phytochromes have the functions to catalyze the assembly of apo-protein and bilin chromophore, to catalyze photo-induced conversion between Pr and Pfr forms, and to trigger signal transduction. In plants, phytochromes are known to modulate numerous physiological responses like e.g. seed germination or shade avoidance [1]. Typical bacterial phytochromes are composed of an N-terminal photosensory chromophore module and a C-terminal protein kinase. Two biliverdin-binding phytochromes, Agp1 [2] and Agp2, were found by genome sequencing of *Agrobacterium tumefaciens*, a tumour-inducing soil bacterium. We are presently focussing on

the photosensory chromophore module Agp1-M15 of Agp1, and have obtained crystals of the holo-protein which has bound its natural chromophore biliverdin [3].

At the microfocus beamline ID13 we collected the first complete diffraction data of two native crystals, one diffracting to a resolution of 7.5 Å and the other one diffracting to 8.5 Å. The data were used to determine the tetragonal space group I422 and the unit cell parameters $a = b = 171 \text{ Å}$ and $c = 81 \text{ Å}$, corresponding to a solvent content of 55% as calculated from $V_m = 2.73 \text{ Å}^3 \text{ Da}^{-1}$ assuming a single polypeptide chain of Agp1-M15 per asymmetric unit [3].

References

- [1] H. Smith, Phytochromes and light signal perception by plants - an emerging synthesis, *Nature* **407**, 586-591 (2000)
- [2] T. Lamparter, N. Michael, F. Mittmann, and B. Esteban, Phytochrome from *Agrobacterium tumefaciens* has unusual spectral properties and reveals an N-terminal chromophore attachment site, *Proc. Natl. Acad. Sci. U. S. A.* **99**, 11628-11633 (2002)
- [3] P. Scheerer, N. Michael, J.H. Park, S. Noack, C. Förster, M.A.S. Hammam, K. Inomata, H.-W. Choe, T. Lamparter, and N. Krauß, Crystallization and preliminary X-ray crystallographic analysis of the N-terminal photosensory module of phytochrome Agp1, a biliverdin-binding photoreceptor from *Agrobacterium tumefaciens*, *J. Struct. Biol.* **153**, 97-102 (2006)