Structure Watch

THE STATES OF A SENSOR

The most common sensory pathways in prokaryotes use His–Asp phosphorelays, which have at least two components — a sensor histidine kinase (HK) and a response regulator. Most HKs are transmembrane proteins and their cytoplasmic regions have autokinase, phosphotransfer and phosphatase activities. Previous structural studies have focused on single cytoplasmic domains of HKs, so our understanding of the various signalling states has been lacking. However, Hendrickson and colleagues now describe the first structure of the complete cytoplasmic region of a sensor HK — a 1.9-Å-resolution crystal structure of the cytoplasmic region of an HK from *Thermotoga maritima* in complex with ADPβN.

The structure highlights new functions for several conserved residues, and provides insights into a state that seems ready for phosphotransfer. The cytoplasmic region contains an N-terminal dimerization and histidine phosphotransfer (DHp) domain and a C-terminal catalytic and ATP-binding (CA) domain, and this work provides the first view of a substantial interface between these domains. The authors propose that regulatory signals received by the external sensor domain are transduced to this interface to control its stability. A destabilized interface, which allows the CA domain to move and *trans*-phosphorylate the DHp domain, might be required for autokinase function, whereas a stabilized interface might be needed for phosphatase function.

REFERENCE Marina, A., Waldburger, C. D. & Hendrickson, W. A. Structure of the entire cytoplasmic portion of a sensor histidine-kinase protein. *EMBO J.* **24**, 4247–4259 (2005)

A MINIMAL COAT CAGE

In intracellular membrane trafficking, coat protein complex II (COPII) mediates cargo export from the endoplasmic reticulum. COPII is composed of Sec23 and Sec24 (Sec23/24), Sec13 and Sec31 (Sec13/31), and the GTPase Sar1. Sec23 is a GTPase-activating protein for Sar1, Sec24 functions in cargo selection, and Sec13/31 has a structural role. Recent work showed that Sec23/24 and Sec13/31 can self-assemble to form COPII-cage-like particles. However, Balch and colleagues now show that Sec13/31 can self-assemble to form minimal cages in the absence of Sec23/24, and they describe a 30-Å-resolution cryo-electron-microscopy structure of these Sec13/31 cages.

The structure shows a novel cuboctahedron shape. In the authors' model, it is formed by 24 Sec13/31 heterotetramers, and they believe that each heterotetramer is arranged in the manner Sec13/31–Sec31/13. This cage structure has the potential to form flexible polyhedrons of increasingly larger geometries that can contain large, oddly shaped cargo. So, although the Sec13/31 cage is different to the cages formed by clathrin, this work shows that the function of Sec13/31 is analogous to that of clathrin. In the authors' model, Sec23/24 (similar to the clathrin adaptor proteins) coordinates the selection of cargo with the self-assembly of Sec13/31 cages (similar to clathrin-cage self-assembly).

REFERENCE Stagg, S. M. *et al.* Structure of the Sec13/31 COPII coat cage. *Nature* **439**, 234–238 (2006)