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Golgi complex remodeling during animal development

Despite the Golgi complex's central role in cellular logistics, its contribution to animal embryogenesis remains largely unexplored. Studies in mammalian stem cells seem to indicate that the Golgi is essential for the transition from pluripotency to differentiation, but a comprehensive census of the molecular machinery driving these functional changes is currently lacking.
This proposal aims to bridge this gap by analysing the remodelling of the Golgi proteome during the critical initial stages of animal development. Using the sea urchin embryo as a high-synchrony experimental model, the project pursues two primary objectives. First, novel, rationally designed Golgi-specific affinity reagents will be developed and validated. Bypassing the limitations of traditional subcellular fractionation and the need for species-specific antibodies or genetic engineering these binders will enable rapid, one-step isolation of high-purity Golgi membranes from embryonic homogenates. Second, these tools will be deployed to purify the Golgi complex across five distinct pre-gastrulation stages, from late segmentation to the mesenchyme blastula. Using mass spectrometry, we will map the change in the protein complement of the Golgi complex as this organelle transitions from dispersed elements to a centralized ribbon-like configuration. This proteomic census will reveal how the Golgi's structural and enzymatic machinery is developmentally remodelled to support cell-fate determination and morphogenesis.
The successful implementation of this project will not only provide a high-resolution map of organelle dynamics during development but will also establish a novel tool for studying alterations of Golgi composition (proteins, lipids, glycans) between different physiological states and, potentially, across diverse species.