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Biochemistry and Molecular Biology

Research Interests

A eukaryotic cell is not simply a bag of enzymes. Proteins are compartmentalized and must be directed to specific locations to carry out their functions. How proteins are targeted to these locations is an interesting and complicated process. We use a combination of biochemical and cell and molecular biological approaches to study protein targeting. The enzyme tRNA nucleotidyltransferase, responsible for the addition of the specific cytidine-cytidine-adenosine sequence to the 3-termini of tRNAs, is of particular interest to us as this enzyme functions in multiple locations (cytosol, nucleus, mitochondrion, chloroplast) in eukaryotic cells. Using yeast and plants as model systems, we are studying how this protein is distributed to multiple locations and how this distribution is regulated. To identify the targeting information contained within these proteins we are using a combination of techniques including site-directed mutagenesis, gene fusions and fluorescence and confocal microscopy. We also are using a combination of biochemical and biophysical approaches (including site-directed and random mutagenesis, enzyme assays, circular dichroism and fluorescence spectroscopy) to study the enzymatic mechanism of tRNA nucleotidyltransferase. This reaction is particularly interesting as unlike most DNA and RNA polymerases this enzyme adds a specific nucleotide sequence in the absence of a nucleic acid template.

Selected Publications

Schmidt von Braun, S, Sabetti, A, Hanic-Joyce, PJ, Gu, J, Schleiff, E and Joyce, PBM (2007) Dual targeting of the tRNA nucleotidyltransferase in plants – not just the signal. J. Exp. Bot. 58: 4083-4093.

Shan, X, Russell, TA, Paul, SM, Kushner, DB, Joyce, PBM (2007) Characterization of a temperature-sensitive mutation that impairs the function of yeast tRNA nucleotidyltransferase. Yeast (accepted).

Hanic-Joyce, PJ, Joyce, PBM (2002) Characterization of a gene encoding tRNA nucleotidyltransferase from Candida glabrata. Yeast 19:1399-1411.

Jain, RK, Chang, WT, Chitta, G, Joyce, PBM, Gorr, S-U (2002) In vitro aggregation of the regulated secretory protein chromogranin A. Biochem. J. 368: 1-5.

Jain, RK, Joyce, PBM, Molinete, M, Halban, PA, Gorr, S-U (2001) Oligomerization of the green fluorescent protein in the secretory pathway of endocrine cells. Biochem. J. 2001 360: 645-649.

Gorr, S-U, Jain, RK, Kuehn, U, Joyce, PBM, Cowley, DJ (2001) Comparative sorting of neuroendocrine secretory proteins: a search for common ground in a mosaic of sorting models and mechanisms. Mol. Cell. Endocrin. 172: 1-6.

Molinette, M, Lilla, V, Jain, R, Joyce, PBM, Gorr, S-U, Ravazzola, M, Halban, PA (2000) Trafficking of non-regulated secretory proteins in insulin secreting cells. Diabetologia 43: 1157-1164.