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Ed Twomey is an Associate Professor in the Department of Biophysics and Biophysical Chemistry and the Department of Neuroscience at the Johns Hopkins University School of Medicine. Prior to joining Johns Hopkins, he received his PhD from Columbia University under the supervision of Alexander Sobolevsky and Joachim Frank, followed by post-doctoral training at Harvard Medical School with Tom Rapoport. His research focuses on how neurons communicate with each other at structures called synapses. Using advanced methods such as cryo-electron microscopy and electrophysiology, the work examines how chemical signals are converted into electrical signals and how disruptions in these processes contribute to brain disorders and aging. His research also studies how the blood–brain barrier forms and functions to develop better and safer ways to deliver drugs to the brain. Ed's recognition for his work includes being named to the Forbes 30 under 30, a Searle Scholar, a National Academy of Sciences Kavli Fellow, a One Mind Bristol Myers Squibb Rising Star, and has recently been awarded the Lee Hood Prize in Biomedical Sciences.

From glutamate to dopamine - decoding the orphan delta-type ionotropic glutamate receptors

Neuronal excitation is the cornerstone of neurotransmission. Typically, this is carried out by ionotropic glutamate receptors (iGluRs), which bind the neurotransmitter glutamate, and in turn open their cationic channels to depolarize post-synaptic neurons. While this is how most iGluRs work, the delta-type iGluRs (GluDs) have long been mysterious. Since their discovery in the 1990s, GluDs have been considered orphan receptors. While GluDs are classified into the iGluR family based on structural homology, they do not bind glutamate, nor seem to have canonical ligand-gated ion channel activity at first glance - leading to their classification as orphan receptors. Thus, their molecular function has long presented a mystery - despite being fundamental for synapse regulation and in disease development such as schizophrenia and cerebellar ataxia. Here, we present our work to decipher the molecular underpinnings and logic of GluD function - using cryo-electron microscopy, biochemistry, and electrophysiology - to journey from their classification as iGluRs to the first ionotropic dopamine receptors.