We will summarize recent progress in predicting the 3D Structure and Function of G Protein Coupled Receptors (GPCRs). These receptors play a critical role in cell communications and in sensing the outside world (vision, smell, taste, and pain). There are no experimental 3D structures available for human GPCRs despite their importance to pharma. Indeed, considering every form of life there an experimental structure for only a single GPCR: bovine rhodopsin. Consequently we validate our predicted structures by using them to predict the binding site and binding energies for endogenous ligands and for other agonists and antagonists, with the emphasis on how binding changes upon mutations of residues in the predicted binding sites We find that these results are in excellent agreement with available binding and mutation experiments. We will discuss results for some of the following systems:

- Adrenergic receptors (β1, β2, α1a)
- Serotonin receptors (5HT2a,b,c)
- Dopamine receptors (D1, D5)
- Histamine receptors (H2)
- Muscarinic acetylcholine receptors (M1, M2)
- Mrg receptors (C11, A1)
- Chemokine Receptors (CCR1, CCR5)
- Vasopressin receptors (V1a, V1b, V2)
- somatostatin STR2, Urotensin II Receptor
- Purinergic, adenosine receptors (P2Y1)
- Lipid receptors (LPA, S1P, LPC, G2a, TDAG8, OGR1),
- Olfactory receptors. Taste receptors

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