

## CHARMMGUI Tutorial 2: Preparing A Membrane Protein System: Histidine Kinase Receptor

Visit the CHARMM-GUI website at <https://charmm-gui.org/>. Login to your account.

Click “Input Generator” in the menu to the left.

Ironically, even though this is a histidine kinase receptor, this structure contains no histidines, so PDB2PQR is not necessary to find protonation states.

In the menu on the left, select “Membrane Builder”.

Under “Protein/Membrane System”, upload the 2ksf.pdb system.

Click “Next Step: Select Model/Chain”.

Select model 1. Click “Next Step: Manipulate PDB”.

Click “Next Step: Generate PDB and Orient Molecule”.

View the 2ksf.pdb molecule in VMD with the axes displayed. (Or you can click “view structure” in CHARMM-GUI.) You can see that this structure is aligned along the y-axis. For MD, membrane proteins are usually aligned along the z-axis.

Back in CHARMM-GUI, we need to align the protein along the z-axis, so we will need to rotation the molecule along the X axis” by 90 degrees.

Select “Rotate Molecule with respect to the X-axis” and enter “90” degrees.

Click “Next Step: Calculate Cross-Sectional Area”.

The next page gives you the option to add a heterogeneous membrane. Since this is mainly for demonstration purposes, we are just going to make a homogeneous DPPC lipid bilayer.

For “Length of X and Y”, enter 40.

Select “PC (phosphatidylcholine) Lipids”. Under DPPC, set 1 for upper leaflet ratio, and 1 for lower leaflet ratio.

Click “Show System Info”.

Click “Next Step: Determine the System Size”.

Make sure ions are included. Add 0.15 M NaCl by clicking the “-” next to KCl, and then selecting “NaCl” and clicking “Add Simple Ion Type”. Click “Calculate Solvent Composition”.

Click “Next Step: Build Components”.

Click “Next Step: Assemble Components”.

Take note of the System size A, B, and C values. Write these down for later.

For Force Field Options, make sure CHARMM36m is selected.

Under Input Generation Options, select “OpenMM”.

Click “Next Step: Generate Equilibrium and Dynamics Inputs”.

Click download.tgz and save it somewhere on your system.