Bacterial mechanosensitive channels are believed to sense changes in membrane bilayer tension. The channels protect cells against extremely high cell turgor by forming transient (1-150 ms open dwell time) pores that are sufficiently large in diameter (~16-40 Å) to be essentially non-selective. The rapid release of solutes effected by these channels lowers the transmembrane osmotic gradient and thus diminishes the driving force for water entry. The structural integrity of the cell is thus maintained despite transient turgor pressures greatly in excess of 10 atm. Considerable progress has been made in identifying the structural genes and determining multiple structures for the two major channels found in most bacteria, MscL and MscS. These proteins differ in their structures and in the mechanistic details of the generation of the large open pore that is their function. Many aspects of the channel have been thoroughly investigated using predominantly genetic strategies and this has led to models for the structural changes during gating. In contrast, the key mechanism of tension sensing remains poorly defined. In this presentation the structure of the MscS channel will be reviewed and the current understanding of tension sensing will be presented. For the MscS family of channels there is considerable diversity in the membrane domains that interact with the lipid bilayer. The challenges posed by the diversity of structures of MscS channels will be discussed.