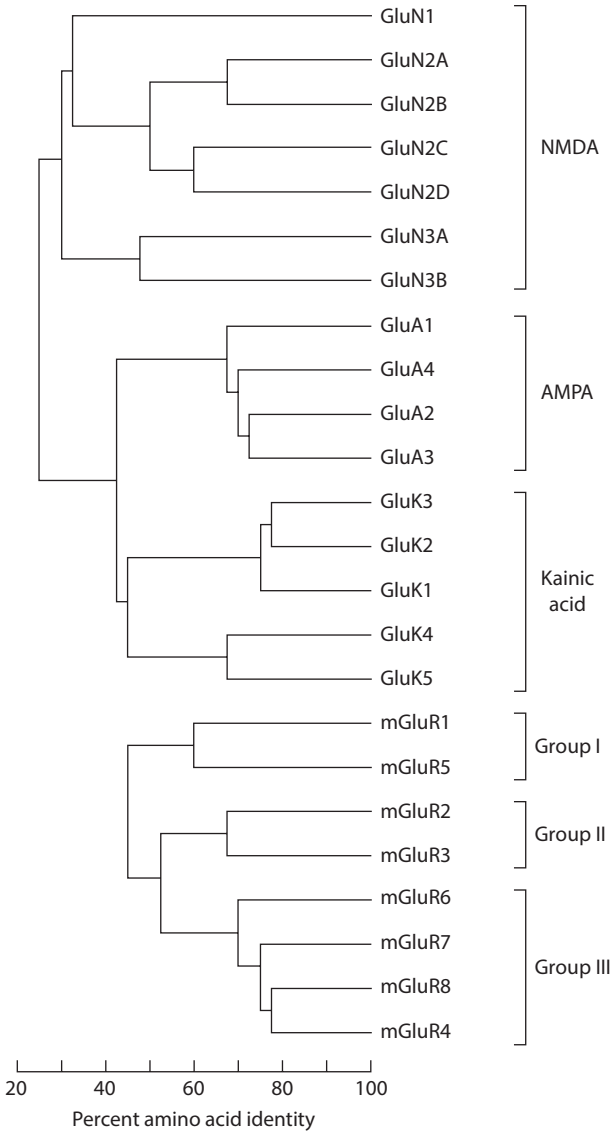


**FIGURE 12.1** Phylogenetic tree showing the amino acid sequence identity between cloned mammalian glutamate receptors. The subgroups according to receptor pharmacology have been noted. The NMDA, AMPA, and kainic acid receptors belong to the superfamily of ligand-gated ion channels whereas the metabotropic glutamate receptors (mGluR1–8) belong to the superfamily of G protein-coupled receptors.

The same signaling molecule can act on both G protein-coupled receptors and ligand-gated ion channels (Figure 12.1). One of the reasons for the heterogeneity is that it allows cells to be regulated in subtle ways. For example, whereas the fast synaptic action potential is initiated by glutamate receptors of the ligand-gated ion channel family, these receptors are themselves regulated by slower and longer acting glutamate receptors from the G protein-coupled receptor family. The action on these two receptor families is shared by a number of other neurotransmitters such as GABA (Chapter 15), acetylcholine (Chapter 16), and serotonin (Chapter 18).