

Category	Wild type	Missense	Frameshift by insertion
DNA	5' AAA-GCT-ACC-TAT-CGG-TTA 3' 3' TTT-CGA-TGG-ATA-GCC-AAT 5'	5' AAT-GCT-ACC-TAT-CGG-TTA 3' 3' TTA-CGA-TGG-ATA-GCC-AAT 5'	5' AAA-GCT-ACC-ATA-TCG-GTT 3' 3' TTT-CGA-TGG-TAT-AGC-CAA 5'
mRNA	5' UUU-CGA-UGG-AUA-GCC-AAU 3'	5' UUA-CGA-UGG-AUA-GCC-AAU 3'	5' UUU-CGA-UGG-TAU-AGC-CAA 3'
Protein	N PHE-ARG-TRP-ILE-ALA-ASN C / Amino Carboxyl	N LEU-ARG-TRP-ILE-ALA-ASN C / Amino Carboxyl	N PHE-ARG-TRP-TYR-SER-GLY C / Amino Carboxyl

FIGURE 12.2. Indels and frameshifts. In column 2, a region of DNA corresponding to a protein is shown, as is the mRNA and the protein encoded in that region (see Figs. 2.23 and 2.26 for the genetic code and amino acid abbreviations). In column 3, a missense mutation and the resulting change in the protein sequence are shown (with differences to wild type shown in red). In column 4, a frameshift mutation (an addition of an A-T base pair) and the resulting changes in the protein sequence are shown.

12.2, based on Lodish H., *Molecular Cell Biology*, Fig. 8.4, © W.H. Freeman