Appendix 3: Rubric used to evaluate mutation question on baseline and end of semester surveys

Survey Question	*** 0 = simply did not know**	**1 = demonstrated some understanding but missing many key concepts**	**2 = demonstrated good understanding but still missing a few key concepts**	**3 = demonstrated sophisticated understanding of almost all concepts**
Please answer the following question as best as you can, using concise and clear language. *It is possible for a mutation in a single amino acid sidechain (also known as a residue or R-group) to make a protein non-functional.* ***How*** *this might be possible? (You can use the back of this form to finish your answer if needed.)*	No idea or answer was entirely wrong.	Recognize that proteins are made of different amino acids but don't indicate that amino acids determine protein structure and therefore function.	Realize that the sidechain type is important for the protein's function, but don't make direct connection between structure and function.	A protein's function (e.g., binding a substrate or metal ion) depends upon its structure. A protein's structure in turn is determined by the way its individual sidechains interact with each other.