Examples of proteins

Rubisco, insulin, immunoglobulins, rhodopsin, collagen and spider silk as examples of the range of protein functions.

Six proteins which illustrate some of the functions of proteins are described in table 4.

Rubisco This name is an abbreviation for ribulose bisphosphate carboxylase, which is arguably the most important enzyme in the world. The shape and chemical properties of its active site allow it to catalyse the reaction that fixes carbon dioxide from the atmosphere, which provides the source of carbon from which all carbon compounds needed by living organisms can be produced. It is present at high concentrations in leaves and so is probably the most abundant of all proteins on Earth.	**Insulin** This hormone is produced as a signal to many cells in the body to absorb glucose and help reduce the glucose concentration of the blood. These cells have a receptor for insulin in their cell membrane to which the hormone binds reversibly. The shape and chemical properties of the insulin molecule correspond precisely to the binding site on the receptor, so insulin binds to it, but not other molecules. Insulin is secreted by β cells in the pancreas and is transported by the blood.
Immunoglobulin These proteins are also known as antibodies. They have sites at the tips of their two arms that bind to antigens on bacteria or other pathogens. The other parts of the immunoglobulin cause a response, such as acting as a marker to phagocytes that can engulf the pathogen. The binding sites are hypervariable. The body can produce a huge range of immunoglobulins, each with a different type of binding site. This is the basis of specific immunity to disease.	**Rhodopsin** Vision depends on pigments that absorb light. One of these pigments is rhodopsin, a membrane protein of rod cells of the retina. Rhodopsin consists of a light sensitive retinal molecule, not made of amino acids, surrounded by an opsin polypeptide. When the retinal molecule absorbs a single photon of light, it changes shape. This causes a change to the opsin, which leads to the rod cell sending a nerve impulse to the brain. Even very low light intensities can be detected.
Collagen There are a number of different forms of collagen but all are rope-like proteins made of three polypeptides wound together. About a quarter of all protein in the human body is collagen – it is more abundant than any other protein. It forms a mesh of fibres in skin and in blood vessel walls that resists tearing. Bundles of parallel collagen molecules give ligaments and blood vessel walls their immense strength. It forms part of the structure of teeth and bones, helping to prevent cracks and fractures.	**Spider silk** Different types of silk with different functions are produced by spiders. Dragline silk is stronger than steel and tougher than Kevlar™. It is used to make the spokes of spiders' webs and the lifelines on which spiders suspend themselves. When first made it contains regions where the polypeptide forms parallel arrays. Other regions seem like a disordered tangle, but when the silk is stretched they gradually extend, making the silk extensible and very resistant to breaking.