**Target audience**
Students studying AS Chemistry who are interested in modern materials, nanotechnology, polymers, macromolecules, molecular biology and biochemistry

**Key concepts**
Nanotechnology, polymerisation, modularity, proteins, bis-amino acids, bis-peptides, masks

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**The Activity**
Cells make **proteins** for example silk fibroin. Wallace Carothers invented **nylon** in 1935 in an attempt to make artificial silk. Christian Schafmeister and his colleagues have more than 14 different bis-amino acids, their molecular Lego®, that they use to make **bis-peptides**. Compare these three types of materials and the processes by which they are made. How close are we to producing artificial proteins?

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**Background knowledge**
To tackle this activity it would be useful to know about:

- Monomers, polymers and polymerisation
- Amino acids as the building blocks of proteins
- Functional groups – amine groups and carboxyl groups

**Resources**
You will need to learn about making bis-peptides and we recommend the Scientific American article Molecular Lego in the February 2007 issue. You can buy and download it from the Scientific American digital archive² for $7.95. Finding out about nylon is easy and you may already have a favourite resource about protein synthesis in cells: if you don’t, try this overview³ of the process and this webpage⁴ to give basic details about the reaction. Do not underestimate how useful it is to discuss your ideas with other students and with your teachers, or with someone else interested in Chemistry.

**Outcomes**
This activity has many possible outcomes, for example a report, essay, display or presentation. You should also think about your audience because that may influence the decisions you make. Is it students, teachers or both? Are they scientific or a mixed audience? You should discuss with your teacher which approach you would find most rewarding.

**Helpful hints**
- If you are finding the Molecular Lego article hard going, read the information boxes first
- For the process making each material, what are the reactants?
- What chemical reactions are involved?
- How are these reactions controlled?
- How easy is it to control what products are made?
- How varied and useful are the products?

**Going further**
Find out about nanomachines and the processes by which they are made.