



### ▶ A Christian Response

Eliminating human suffering, protecting the environment, promoting general well-being and advancing scientific knowledge using reason and human ingenuity are goals in harmony with Christian teaching. If used correctly, synthetic biology could help revolutionise medicine, provide manufacturing solutions and solve some energy and environmental problems. If appropriate legislation and effective controls were implemented to eliminate or avoid potential risks there would be few compelling reasons to stop or ban synthetic biology. The Christian world could welcome this scientific innovation. God has endowed human nature with mental and intellectual capacities. It is our responsibility to use the divine gifts for the benefit of humanity and of nature as a whole.

### ▶ Questions

- Is humankind playing God when creating artificial life? Does this put us on a par with God, or change our views of God?
- Can we apply engineering approaches to biological life? Is life nothing more than a series of chemical reactions?
- We know that the accidental or deliberate release of alien species (such as rabbits in Australia) can lead to unforeseen problems. Should this be a consideration in approaching synthetic biology?

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# Synthetic Biology





'You alone are the LORD. You made the heavens, even the highest heavens, and all their starry host, the earth and all that is on it, the seas and all that is in them. You give life to everything.' Nehemiah 9:6

## Synthetic Biology

### What is Synthetic Biology?

Synthetic biology is concerned with artificial or unnatural living organisms or life. Although we tend to think in terms of human or sentient life, in synthetic biology, life is considered in biochemical terms and is mostly concerned with some of the simplest forms of known life, such as bacteria and viruses. All life forms are composed of molecules (e.g. proteins, DNA, lipids), which are in themselves non-living. These molecules are referred to in synthetic biology as 'bioparts'. The biochemical definition of life is that of bioparts assembled within a physical container (i.e. the bacterial cell wall) which are able to continually regenerate, replicate and evolve. Synthetic biology brings together the disciplines of biology and engineering and is essentially about the redesigning and reassembly of biological systems. The biologist wants to understand living systems better, and the engineer wants to create new things. The biologist identifies the individual bioparts of the living organism and the engineer then standardises the bioparts. The analogy which is sometimes used is that of car manufacture, where the different bioparts are then fitted onto a common 'chassis', usually a bacterium such as *E. coli*, where they perform the desired function. An example of an organisation doing this is the BioBricks foundation.

### Why undertake Synthetic Biology?

Synthetic biology (SB) research can have direct application in areas such as health, energy, the environment and agriculture. For example, synthetic biology techniques have been used in some parts of the production of the anti-malarial drug Artemisinin. Similarly, SB has been used in the adaptation of advanced biosensors for detection of the hospital superbug MRSA (Methicillin resistant *Staphylococcus aureus*). A similar biosensor can help detect arsenic in drinking water – a major problem in Bangladesh. Another example of synthetic biology based biomaterials is a synthetic version of spider silk; because of its strength and light weight it can be used in a wide range of applications



### Why is the Church interested in Synthetic Biology?

Synthetic biology involves a fundamental tinkering with nature, which raises questions such as: what is the right relationship between humanity and nature? Does God give us authority to unpick and reconstruct nature in the fundamental way which is at the core of synthetic biology? How far is far enough, and to what extent should our God-given ability to be creative be hemmed in by moral and ethical considerations? It is clear that the ability to generate synthetic organisms does not put man on a creative par with God, but we should be careful about seeking to 'play god' in these endeavours. Humanity's relationship with the rest of creation must not be confused with a wrongful domination and exploitation. Creation should not be perceived as sacred; rather, it needs to be viewed as a gift to be cherished.

### Potential Social and Ethical issues

**Biosafety.** Artificially synthesised organisms which can reproduce and mutate could have unpredictable and potentially damaging effects when released into the environment either intentionally or accidentally. Although researchers are trying to come up with 'safety locks' which could prevent an environmental hazard, it is very difficult to predict the effect of these organisms on nature once they leave the protected environment of a science laboratory or test site. In addition, the build-up of novel biological elements in the food-chain is unpredictable and may have unexpected effects.

**Bio-weapons.** The recreation of extant viruses, like the Spanish Flu virus or the polio virus or the creation of new biological weapons is possible. Terrorists could obtain the necessary materials from a DNA synthesis company for a fee. In addition, there might be a greater risk of 'state bio-warfare' as part of a weapons programme.

**International justice.** Patenting synthetic biology developments could lead to an increased dependence of poor people and countries on rich countries and companies. For example, the previously mentioned anti-malarial drug Artemisinin was originally derived from a plant native to China. The manufacture of such medicinal and other commercially important chemicals through synthetic biology might deprive a poorer country of a potential source of income.

**Unregulated developments.** The manipulation of DNA and other biological materials by hobbyists (as opposed to trained and supervised professionals) already appears to exist as a significant phenomenon. The availability of key reagents and components has opened up the possibility of a 'garage industry' in synthetic biology – by definition, operating outwith normal regulated research networks such as university and research facilities. This increases possibilities of accidental or malicious release of engineered organisms.