Case study: Developing new medicines more cheaply

The global challenge

The development and manufacture of medicines can be really expensive. This is especially true for an emerging class of medicines, (biopharmaceuticals) that are made using living organisms and tend to comprise larger, more complex molecules than medicines made through combining and reacting chemical raw materials. Biopharmaceuticals are being developed for conditions with no existing treatments, such as Ebola, or for which existing treatments are inadequate, such as cancer.

In the UK, the NHS already spends a large portion of its budget on medicines. In other countries without national health services there is a large cost to individuals: either to those who become ill or to those who pay insurance premiums. In some cases people cannot afford to get the treatment they need.

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Approaches to manufacturing new medicines

Historic production methods for many biopharmaceuticals involved extraction from animal tissues. Now they are typically produced by inserting human, animal or plant genes into bacteria, yeast or animal tissue cultures (animal cells kept alive and functioning outside of the organism which they originally came from). These engineered organisms or tissue cultures are then kept alive in a contained environment.

A plant genetic technologies example

Tobacco plants have been genetically modified (GM) to produce some of these biopharmaceuticals. These include 'recombinant human proteins', which can be used to treat conditions such as diabetes and growth disorders, or antibodies, which can be used in treatments for HIV and Ebola. Tobacco plants can either be permanently or temporarily engineered to produce biopharmaceuticals.

Before they can be used by people, plant derived pharmaceuticals have to be extracted and purified, although there are proposals to modify food plants to enable 'edible vaccines'.

UK facts & figures

- Almost half of all UK adults take prescription drugs on a weekly basis
- The NHS spent 14% of its total budget on medicines in 2015/16: £17 billion from a total of £116 billion
- GM plants are not currently used to produce materials for medicines in the UK, or Europe, but in 2011 the UK's Medicines and Healthcare products Regulatory Agency (MHRA) approved a clinical trial involving antibodies against HIV derived from tobacco grown in greenhouses in Germany.

Arguments made in favour of using GM plants to develop new medicines

- Reduced cost of producing biopharmaceuticals and increase the scale of production
- Produce new classes of medicines that can treat previously untreatable diseases or have fewer side effects than existing treatments
- Produce vaccines that can be swallowed rather than injected.

Arguments made against using GM plants to develop new medicines

- Where GM plants are grown outdoors, engineered genes may be transferred from GM plants to related plant species, especially if food crops like maize or rice are used to produce biopharmaceuticals
- With current technology, the extent to which individual GM plants produce a biopharmaceutical cannot be controlled, so getting the right dosage could only be achieved with post-harvest testing
- Unlike microorganism or animal tissue cultures, standardised protocols for purifying plant-derived pharmaceuticals have not yet been developed, and a different protocol would be required for each plant type
- Animals eating these plants unknowingly would experience the effects of the drug in question.