

## From changing nature to changing the body **A1**



Since time immemorial, human beings have been altering the world around us, often radically. Advances in many fields of science could eventually offer humans the possibility to make radical changes in the human body.

Human enhancement

## What is human enhancement? **A2**



By human enhancement, we mean ways to make functional changes to human characteristics, abilities, emotions and capacities, beyond what we regard today as normal.

Human enhancement

## Medical techniques used for enhancement **A3**



Sophisticated scientific tools developed for medicine could, some say, also be used to enhance 'normal' human performance and capacities, beyond medical goals.

Human enhancement

## Surely this isn't new? **A4**



In one sense, yes, some people already use cosmetic surgery or 'recreational' drugs. And what about coffee? But the sort of changes we're discussing could be much more far reaching.

Human enhancement

## Old and new enhancement **A5**



In one sense, we have always been enhancing the human condition through agriculture, nutrition, energy, engineering, mobility, education and so on. But the new idea is to enhance our bodies themselves.

Human enhancement

## Transhumanism **A6**



A movement has emerged, known as transhumanism, which believes that human enhancements are not only desirable, but essential to achieve a human future beyond our current biological limitations.

Human enhancement

## Enhancements when ... **A7**



Most of what are discussed as potential enhancements are ideas whose realisation is in the future, some relatively close, but mostly far off, and some probably never.

Human enhancement

## Science answerable to society **A8**



Borderlines can be fuzzy between basic scientific research and ethically controversial applications. EC reports stress the need to submit enhancement research to wider European social scrutiny.

Human enhancement

## UK research study

# A9



The UK learned societies (for medicine, science, engineering and humanities) are making a joint study of human enhancement from 2010. Public views will be welcome.

Human enhancement

## Growth hormone – medicine or enhancement?

# A10



Many would say that giving growth hormone to help unusually short children reach a more normal height is medical, but to enable a child of normal height to grow significantly higher would be enhancement.

Human enhancement

## Drugs for sports performance

# A11



Chemical enhancements are used controversially to enhance performance in some sports – for example, erythropoietin to increase red blood cell levels and anabolic steroids for muscles.

Human enhancement

## Chemical enhancements

# A12



Chemicals can alter cognitive performance to some extent, but feasibility, efficacy, addiction, side-effects or cultural values have limited their widespread use.

Human enhancement

## Drugs for energy?

# A13



Selective serotonin uptake inhibitors, e.g. Prozac, may have less adverse effects than other anti-depressants. Some claim they could make healthy people more energized.

Human enhancement

## Doing without sleep

# A14



Modafinil has been used to enable people, for example soldiers in active service, to do without sleep for several days without suffering sleep deficit.

Human enhancement

## Brain electrical stimulation

# A15



Electrical stimulation of the brain is used to treat Parkinson's disease symptoms. Some speculate that it could also be used to choose our mood or to control over-eating, if a way could be found without implanting electrodes.

Human enhancement

## Linking chips and nerve cells

# A16



Scientists have connected silicon computer chips under special experimental conditions to certain nerve cells controlling sight or limb movement. But it's very limited so far.

Human enhancement

## Can we connect brains and computers? **A17**



A full, two-way integration of all 20 billion neurons in our brain with a computer is extremely remote, not only in scale, but even in the concept.

Human enhancement

## Adapting cochlear Implants **A18**



Cochlear implants have recreated a degree of lost hearing, but retinal implants are harder. In principle, such interventions could be adapted to create new human capacities.

Human enhancement

## Smart homes? **A19**



Some scientists envisage one day having brain chips which can interact with sensors in our home or workplace, to control our environment directly as we go about our daily lives.

Human enhancement

## How good are the experiments? **A20**



Some scientists say the reported 'successes' in connecting computer chips to nerve cells may just reflect how smart our brain is at processing the results of relatively primitive experiments.

Human enhancement

## Genetic enhancement doubts **A21**



It is considered much less likely to be able to engineer the complex array of genes which influence human characteristics and behaviour than to enhance us using chemicals or information technology.

Human enhancement

## Extending lifespan? **A22**



Some speculate that the normal human lifespan could be increased to 200 years, perhaps longer. But this presupposes that scientists could arrest a whole range of ageing processes, which few experts currently consider realistic.

Human enhancement

## What's the state of play? **A23**



Enhancements are a mixture of some small real developments and a great deal of speculation, motivated by the desires and values of a few who are pressing for all this to happen.

Human enhancement

## Technology is in our hands **A24**



Enhancement technologies are not an inevitable course that humanity is embarked on, like an unstoppable juggernaut.

Human enhancement

## What we need to decide

# A25



The question facing us is to decide what course to take, faced with these possibilities, what to explore and what to decide not to pursue.

Human enhancement

## External or internal to the body – 1

# A26



Enhancements are often envisaged as making internal modifications to the body, as distinct from external tools which we can use but then put down again.

Human enhancement

## External and internal to the body – 2

# A27



A computer is an external tool. Our brains normally interact with it via the keyboard, screen, loudspeaker, etc. An implanted brain chip would link our brain directly to a computer, or other device.

Human enhancement

## Transient or permanent effects

# A28



Chemical enhancements are transient. You'd need regular or continuous doses to keep the effect going. Implants and modifications in the body would be permanent and difficult to reverse.

Human enhancement

## Permanent genetic change

# A29



If we could ever make changes to genes in our reproductive cells, the effect would be permanent and passed on to every following generation.

Human enhancement

## Upgrading what we do now?

# A30



More modest ideas of enhancement envisage just 'upgrading' our existing features by small changes – e.g. doing with less sleep to finish a piece of work; greater endurance in a sport.

Human enhancement

## Radical enhancements?

# A31



Some envisage going radically beyond our biological limits, like having new sensory capacities, or 'incorporating' functions from other species (imagine rock climbing with gecko-like sticky hands), or even from computers?

Human enhancement

## Medical or enhancement? – 1

# A32



Many people make a distinction between medical interventions because someone is ill, and human enhancements with no relation to any medical condition or the prevention of future illness.

Human enhancement

## Medical or enhancement?

# A33

– 2



The European Convention on Human Rights and Biomedicine makes a legal distinction in allowing sex selection to avoid a gender linked genetic disease but not just for personal preference.

Human enhancement

## Suffering and risk

# A34



Alleviating human suffering is a strong ethical motivation for medicine but not for an enhancement. Risks taken to save a dying person may be unacceptable for enhancing a healthy one.

Human enhancement

## Limitless possibilities

# A35



Transhumanism rejects any distinction between enhancement and the medical aim of restoring 'normal function'. The limitless possibilities of enhancement do away with today's ideas of what's normal for humans.

Human enhancement

## Medical or enhancement?

# A36

– grey areas



Is surgical treatment of the physical features of Down's syndrome medical or cosmetic? Electrode stimulation for Parkinson's disease can also alter a patient's mood.

Human enhancement