SYNTHETIC BIOLOGY & THE DUAL-USE DILEMMA

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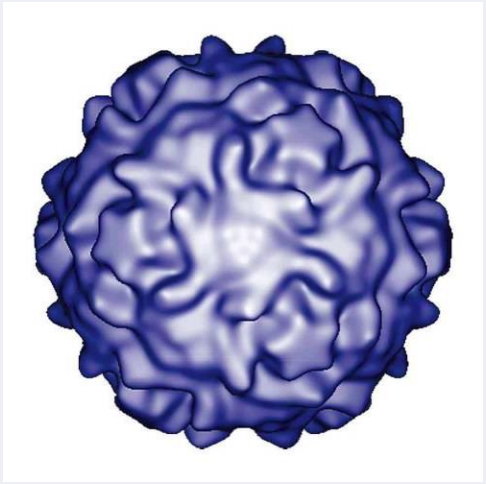
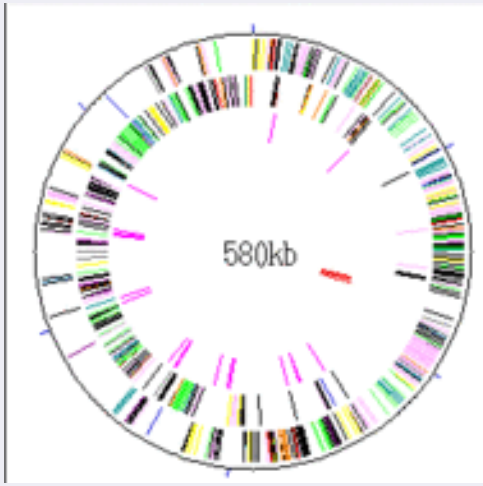


Cello *et al.* 2002

de novo synthesis of poliovirus

Venter proposal

minimal bacterial chassis



competing definitions

	DERIVATION FROM EXISTING ORGANISM	DE NOVO SYNTHESIS
EXISTING ORGANISM		broad
NOVEL ORGANISM		narrow definition

synthetic biology = *de novo* synthesis of biological organisms/components using rational design principles

benefits

medical applications (diagnostics and therapeutics)

environmental applications (biofuels, biosensors, bioremediation)

industrial applications

three ethical concerns

designing new forms of life is playing God

synthetic biology will undermine the life-machine distinction

synthetic biology is likely to be misused

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my claims

the first concern is misplaced

the second concern is not urgent

the third concern is more problematic...

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the first concern – playing God

two interpretations

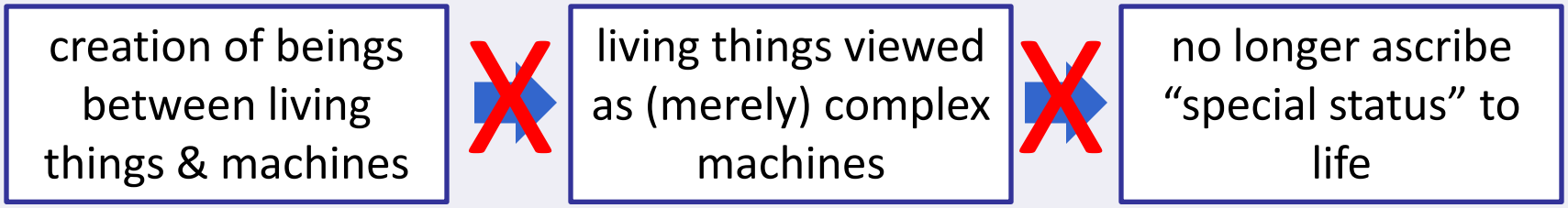
- religious – doing what should be left to a higher being
- secular – failing to recognise human limitations

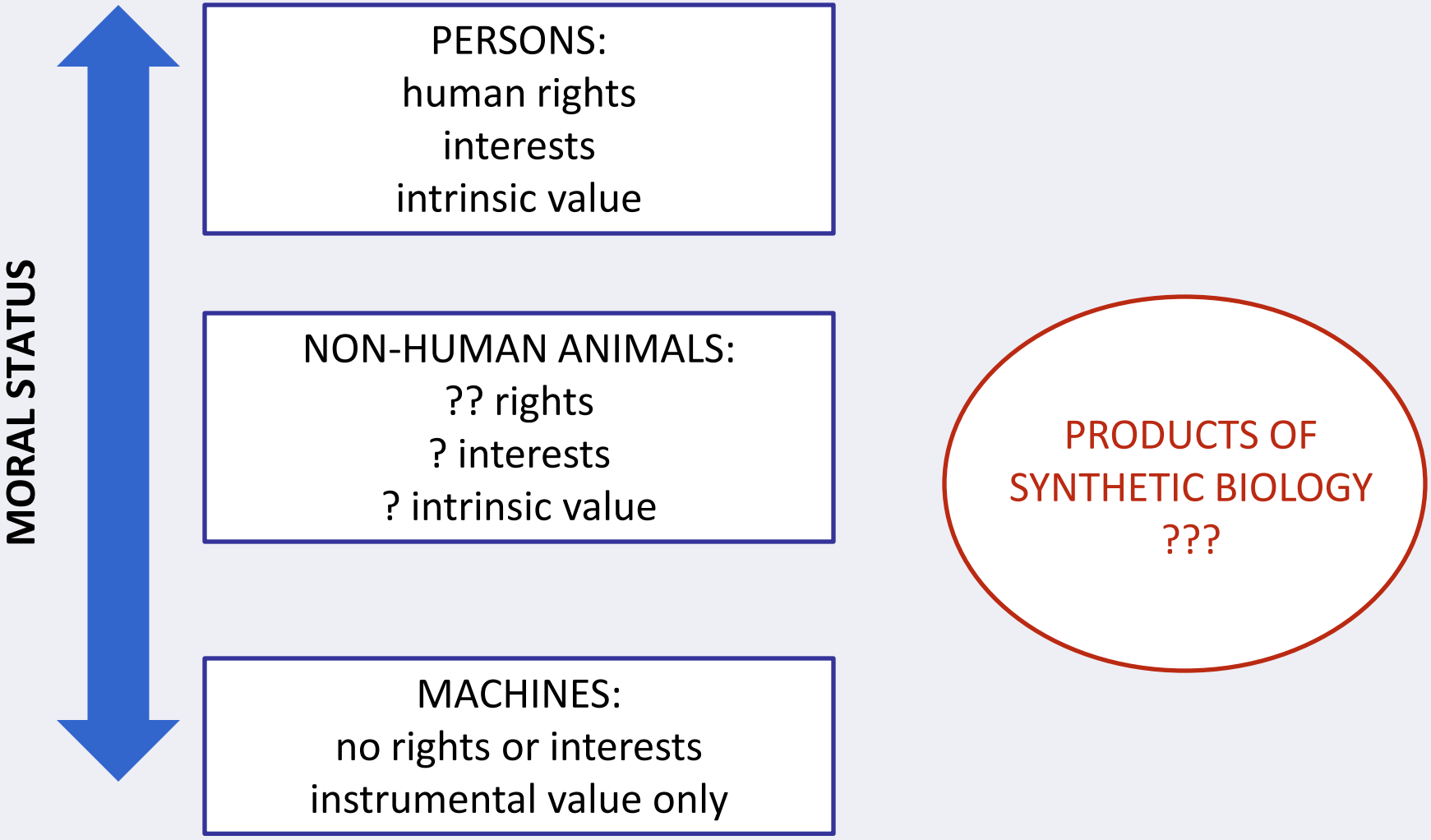
but we already create life, including novel life forms

we already ‘play God’ – synthetic biology might allow us to do so more effectively

the second concern – undermining the life-machine distinction

Cho, Magnus, Caplan & McGee (1999):





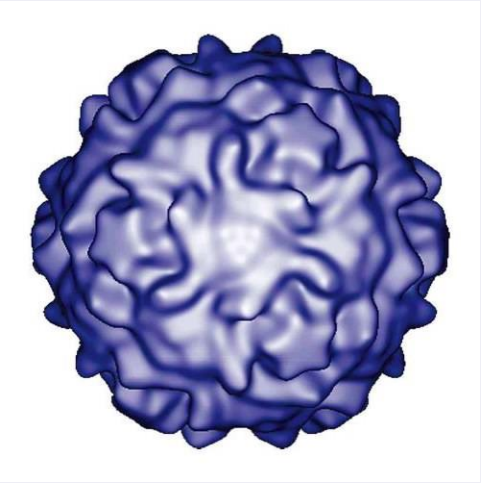
first concern **second concern** third concern

a reformulation of the second concern

synthetic beings assigned incorrect moral status

mistreatment – e.g. synthetic beings wrongly used as if they were mere machines

the third concern – possible misuse



Cello *et al.* 2002

de novo synthesis of poliovirus

Tumpey *et al.* 2005

reconstruction of 1918 Spanish influenza virus

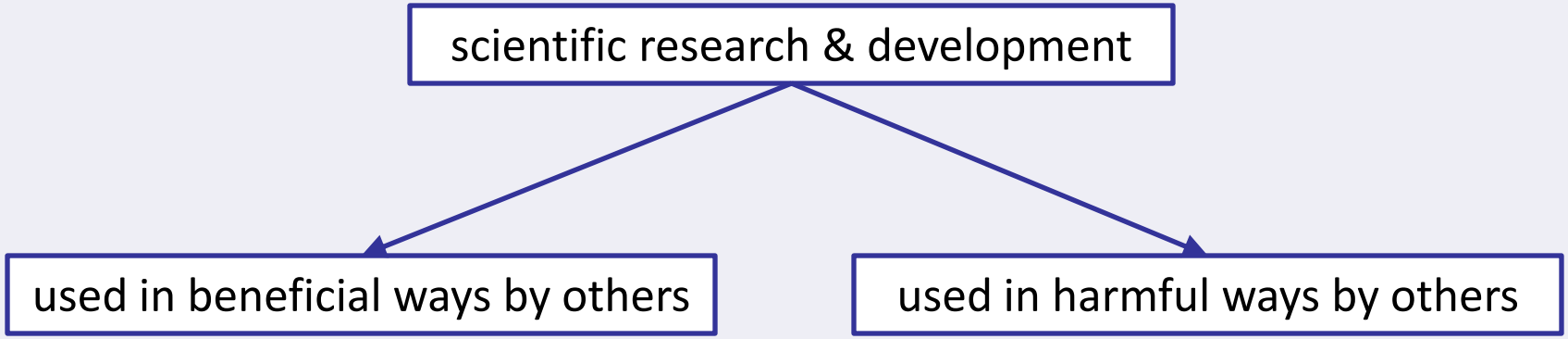
varieties of misuse

bioterrorism

state sponsored biological warfare

‘garage biology’ or ‘biohacking’

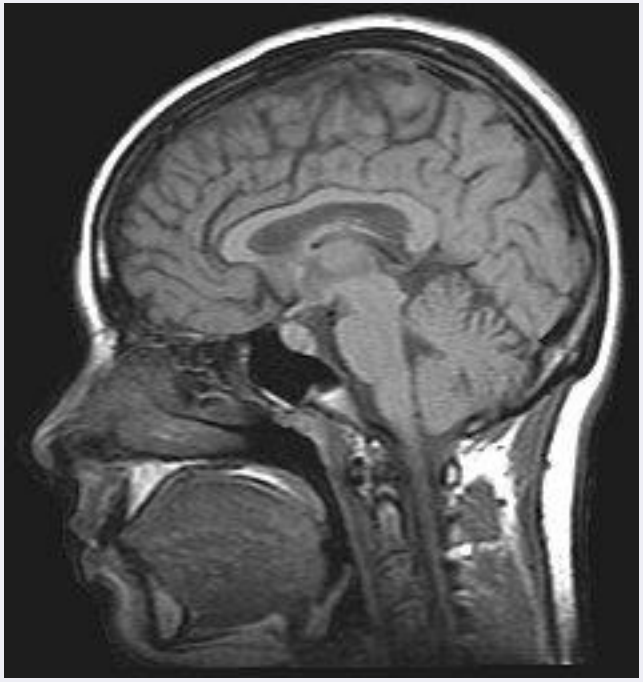
the dual-use dilemma



Leó Szilárd
Hungarian nuclear physicist
1898-1964

Mark Oliphant
Australian physicist
1901-2000

the dual-use dilemma – contemporary examples



neuroimaging and invasion of privacy

behavioural neuroscience and behaviour manipulation

laser uranium enrichment and nuclear proliferation

escaping the dilemma

find a way to prevent misuse

claim: science should proceed regardless of how it's likely to be used

preventing misuse.... at the level of scientific practice

funding decisions

biosafety regulations

codes of conduct

awareness-raising and education

preventing misuse.... at the level of information dissemination

external censorship of scientific publications

self-censorship by scientists, peer-reviewers and journal editors

preventing misuse.... at the level of technology applications

international arms control agreements

export controls

monitoring sale of certain equipment e.g. DNA synthesisers

infectious disease surveillance and response

anti-terrorism measures

the problem...

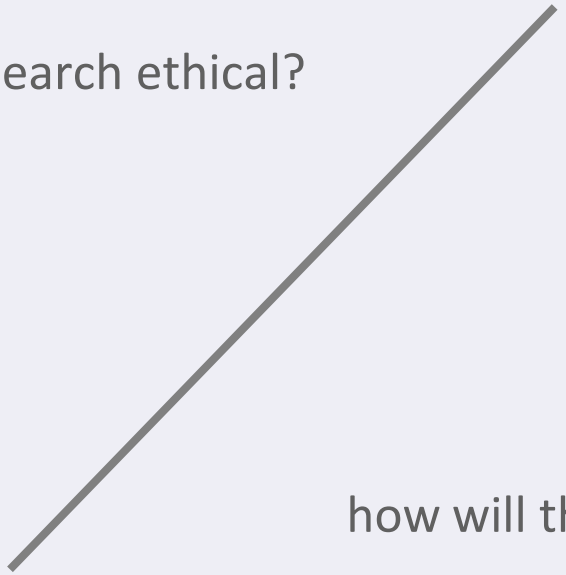
almost all of these measures would impede scientific progress and thus delay or prevent some good uses of science

science policy has to balance the risk of misuse against the benefits of science

so there are still likely to be cases in which dual-use dilemmas arise

the scientist's prerogative – a second way of dissolving the dilemma?

is the research ethical?



how will the research be used?

argument one – the intrinsic value of knowledge

the claim

scientific inquiry is justified by the intrinsic value of the knowledge it produces

but...

knowledge isn't the only thing that's important...

argument two – the gunmaker's defence

the claim

a scientist is not responsible for
harmful uses of her research

but...

often we should take steps to prevent a harm, even if we wouldn't be responsible for it

argument three – “it’s futile”

the claim

individual scientists can’t significantly affect the rate of scientific progress

but...

a small delay might enable better regulation

and...

small initial changes may have large knock-on effects

argument four – uncertainty

the claim

we can't predict the future, so we shouldn't expect scientists to try

but...

maybe we can predict what areas of science will be used more for harm than for good – we haven't even tried

my claims

difficult to find any good argument for the scientist's prerogative

preventive strategies will never be perfect

so, dual-use dilemmas cannot always be escaped – in some cases, a genuine ethical quandary remains: scientists will have to make difficult decisions about whether to proceed with or disseminate their work

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returning to synthetic biology...

the playing God objection is misplaced

concerns about undermining the life-machine distinction are not urgent

but concerns about misuse are more pressing... perhaps there is, or will be, a dual-use dilemma here