

1. Are Industrial Processes using GE or Synthetic Microbes “Contained”?

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2. Microbes, biofuels, synthetic biology

- Most industrial processes are considered to be “contained” and therefore not required to undergo rigorous assessments.
- Only exception appears to be use of microalgae cultivated in open ponds.
- Many industries already using engineered microbes, cyanobacteria, yeast, fungi to produce biofuels, bioproducts, chemicals, and consumer products.

3. Industrial processes are messy, not “contained”

A friend of Biofuels Digest writes: “I was down in Brazil last month and got an earful from a very high up there on [Amyris]. If their shiny high grade fermenter was not up to snuff they are really in trouble... having worked in nice university labs and clean room pharmaceuticals they did not know what was awaiting them in the down market dirty world of biofuel. You can't make biofuels with anything you've got to keep that clean.”

(www.biofuelsdigest.com, May 2012)

4 GE microbes are transported by truck and shipped long distances (e.g. Amyris shipping GE yeast from California to Brazil).



Any ethanol production yields large amounts of residues. How safe from contamination can those be?



Plastic tubes in photobioreactors need to be regularly flushed and cleaned.

Industrial refineries rely on engineers and other staff with no professional background in biosafety.



5. WHY be concerned?

In the case of biofuel production, microbes are being engineered to break down cellulosic plant material. This is challenging since plants evolved specifically to defend against this. But if microbes can be engineered to do so, and then they are released and survive in nature, we could be in trouble.

6. Microbes are especially risky, unpredictable and hard to assess

- Small size makes them difficult to detect
- Very wide dispersal via air and water possible
- Fast generation times and high mutation rate
- Horizontal gene transfer
- Largely unknown biology/ecology/natural history
- Fundamental to basic life-support systems
- Can cause disease or release toxins
- Once released virtually impossible to trace or reverse

7. WILL THEY SURVIVE IF RELEASED?

Must be “hardy” to withstand conditions of mass cultivation, and hardiness renders them more likely to outcompete other species if they are released

- Efficient at accessing and utilizing nutrients,
- Resistant to pests and predators
- Fast growing
- Capable of withstanding extremes (temp, salinity, chemical concentrations etc)

9. We are at a critical juncture

- Synbio industry is proceeding apace very rapidly and largely unregulated
- Tools of biotechnology outpace our ability to assess, understand or prevent consequences
- We are avoiding serious consideration and societal debate about the moral social and ethical questions, instead treating biotechnology and its regulation as an entirely isolated “scientific” matter.

WHY? WHAT TO DO?

We need independent studies and assessments. Processes continue to be dominated by industry and commercial interests

- **Precautionary Principle:** Agencies should stop deregulating until we know what we are doing, not use the excuse that new tools place them “outside of authority” to regulate!