

CLAIMS

What is claimed is:

1. A method comprising:
 - providing a minimal medium to a bioreactor;
 - inoculating the minimal medium in the bioreactor with an inoculum including chemoautotrophic and/or photoautotrophic cells; and
 - cultivating, chemoautotrophically, the inoculum to grow a biomass in the bioreactor by providing a gaseous input into the bioreactor until a cell density of the biomass in the medium meets a threshold, whereby the minimal medium is enriched during the cultivation to become an enriched medium.
2. The method of claim 1 wherein the chemoautotrophic cells or photoautotrophic cells produce a growth factor, a hormone, an antibiotic, amino acid, peptide, protein, vitamin, colorant, carotenoid, fatty acid, or oil.
3. The method of claim 1 or 2 wherein the inoculum also includes heterotrophic cells.
4. The method of claim 3 wherein the inoculum includes photoautotrophic cells and the cultivating is performed in the absence of light within the bioreactor.
5. The method of claim 1-3 or 4 wherein cultivating the inoculum includes adding a beneficial molecule to the enriched medium.
6. The method of claim 5 wherein the beneficial molecule comprises glucose.

7. The method of claim 1-5 or 6 wherein cultivating the inoculum includes adjusting the pH of the enriched medium.
8. The method of claim 1-6 or 7 wherein the inoculum includes chemoautotrophic cells and the gaseous input comprises CH₄ and O₂.
9. The method of claim 8 wherein the chemoautotrophic cells include cells of *Methylococcus capsulatus*.
10. The method of claim 1-6 or 7 wherein the gaseous input comprises CO.
11. The method of claim 1-6 or 7 wherein the gaseous input comprises CO₂ and H₂S.
12. The method of claim 1-6 or 7 wherein the gaseous input comprises CO₂, H₂ and O₂.
13. The method of claim 1-11 or 12, wherein the inoculum includes cells of *Cupriavidus necator*, cells of *Rhodobacter capsulatus*, or cells of both.
14. The method of claim 1-11 or 12 wherein the inoculum includes cells of a carboxydolith.
15. The method of claim 1-11 or 12, wherein the inoculum includes cells of *Rhodococcus opacus*.

16. The method of claim 1-14 or 15 further comprising preparing the inoculum before inoculating the minimal medium therewith.
17. The method of claim 1-15 or 16 further comprising preparing the minimal medium.
18. The method of claim 1-16 or 17 further comprising sterilizing the minimal medium and the bioreactor before inoculating the minimal medium with the inoculum.
19. The method of claim 1-17 or 18 further comprising destroying cells in the enriched medium so as to release their contents into the enriched medium.
20. The method of claim 19 wherein destroying cells includes lysing the cells.
21. The method of claim 1-19 or 20 wherein the enriched medium includes one or more of a growth factor, a hormone, an antibiotic, an amino acid, a peptide, a protein, a vitamin, a colorant, a carotenoid, a fatty acid, or an oil.
22. The method of claim 1-20 or 21 further comprising separating the insoluble biomass from the enriched medium.
23. The method of claim 22 wherein the enriched medium, after separation, includes at least 1 gram of D-glucose per liter.
24. The method of claim 22 or 23 further comprising, after separation, one or more of adding mineral salts to the enriched medium, adjusting the pH of the enriched medium,

filtering the enriched medium, providing an enzymatic treatment to the enriched medium, performing a chromatographic separation upon the enriched medium, or performing a selective precipitation from the enriched medium.

25. The method of claim 22, 23 or 24 wherein separating the biomass from the enriched medium includes centrifugation, filtration, or gravity-based separation.
26. The method of claim 22-24 or 25 further comprising removing ammonium ions from the enriched medium.
27. The method of claim 22-25 or 26 further comprising cultivating cells of a heterotroph in the enriched medium separated from the biomass, thereby depleting the enriched medium.
28. The method of claim 27 wherein the heterotroph includes a yeast, fungus, algae, archaeon, bacterium, or mammal.
29. The method of claim 27 wherein the heterotroph cells are derived from a cell line of a multicellular aquatic organism.
30. The method of claim 1-28 or 29 wherein the minimal medium comprises a gel.
31. The method of claim 1-29 or 30 wherein the minimal medium is added to the bioreactor together with a growth support for the cells.

32. An enriched medium produced by any of the methods of claims 1-31.