

Research Topics & Ideas: Biotechnology

About this document

This PDF contains 50 **biotechnology research topics** for dissertations and theses, organized into 10 areas of biotechnology, from agricultural and plant biotechnology to tissue engineering and biomaterials. Each topic is written as a researchable question and linked to a completed dissertation (2022–2026, 23 universities), so you can see how it was studied in practice. Use it to shortlist biotechnology dissertation topics and thesis ideas, then narrow one down to your own population, setting and timeframe.

By [Derek Jansen](#) (MBA) · Reviewed by [Eunice Rautenbach](#) (DTech) · Grad Coach · October 2026

Online version: gradcoach.com/research-topics-biotech/

© 2026 Grad Coach. Free to share and adapt under [CC BY 4.0](#) with credit to Grad Coach and a link to gradcoach.com/research-topics-biotech/. Research questions and thesis titles quoted here remain their authors'; each dissertation keeps its own license.

Contents

Agricultural and plant biotechnology · 5 topics	2
Biosensors and diagnostics · 5 topics	2
Cell and gene therapy · 5 topics	3
Computational and structural biotechnology · 5 topics	3
Gene editing and CRISPR · 5 topics	4
Metabolic engineering and biomanufacturing · 5 topics	4
Microbiome engineering · 5 topics	5
Protein and antibody engineering · 5 topics	5
Synthetic biology and genetic circuits · 5 topics	6
Tissue engineering and biomaterials · 5 topics	6
How to turn a topic into your research question	7

Agricultural and plant biotechnology

1. Which genes have to be switched on before a tough grass can be engineered at all?

See it in a real dissertation: [Develop bioengineering tools for upland switchgrass by overexpressing morphogenic genes](#) · Nuoya Xu · Iowa State University · 2022

2. Can salt tolerance be bred into a tomato without losing the fruit quality?

See it in a real dissertation: [Evaluating Potential of a Genetic Cross Between Salt-sensitive and Salt-tolerant Genotypes to Improve Salinity Tolerance and Fruit Quality of Tomato](#) · Dhuha Salah Mohamed · Purdue University · 2026

3. How much of the microbiome on a leaf is inherited rather than picked up?

See it in a real dissertation: [Diversity and Heritability in Arabidopsis thaliana Leaf Microbiomes](#) · Hannah Whitehurst Hackley · University of Chicago · 2023

4. How does a diatom chloroplast decide which partner signal to respond to?

See it in a real dissertation: [Partner Specificity in the Diatom Chloroplast Three-component Regulatory System](#) · Laura Nicole Hiotaky · Purdue University · 2026

5. What would it take for a germplasm repository to actually serve a working aquaculture industry?

See it in a real dissertation: [Integrating Germplasm Repositories into Oyster Aquaculture Systems at the Pathway, Center, and Network Levels](#) · Sarah Bodenstein · Louisiana State University · 2023

Biosensors and diagnostics

6. Can DNA nanotechnology detect a pathogen without a laboratory around it?

See it in a real dissertation: [Crispr-Cas Enabled Dna Nanotechnology For Advanced Pathogen Detection](#) · Mahera J. Kachwala · University at Albany, State University of New York · 2023

7. Which regulatory proteins make the best sensors for a heavy metal in water?

See it in a real dissertation: [Engineering Whole Cell-Based Biosensors for Heavy Metal Detection Using Metalloregulatory Transcriptional Repressors of the SmtB/ArsR Family](#) · Alison Draeger · University of North Texas · 2022

8. Could an ultrasound scanner read out what an enzyme is doing inside a body?

See it in a real dissertation: [Engineering Ultrasonic Reporters for Imaging Cellular Enzyme Activity](#) · Jee Won Yang · California Institute of Technology · 2026

9. How low a concentration of a biomarker can a cell-free sensor honestly detect?

See it in a real dissertation: [The Design of a MicroRNA Sensor Using an Improved Cell-Free Protein Synthesis System for Low-Limit Biomarker Detection](#) · Caroline E. Copeland · Louisiana State University · 2023

10. Can a coacervate be designed to release its RNA only under the right conditions?

See it in a real dissertation: [Redox-Responsive Polyamine-RNA Coacervates: Design, Characterization, and Applications in RNA Sensing and Delivery](#) · Chloe Forenzo · Clemson University · 2026

Cell and gene therapy

11. What stops a CAR-T cell from persisting, and can a regulatory element fix it?

See it in a real dissertation: [Genetic Engineering of Notch1 Regulatory Elements to Improve CD19 CAR T-cell Proliferation and Persistence](#) · Merle Kincaid Phillips · Harvard University · 2026

12. Does adding a coreceptor make an engineered T cell better at finding its target?

See it in a real dissertation: [Expression of a Chimeric Coreceptor Enhances the Antitumor Immunity of CD22-Targeted CAR-T Cells](#) · Nicholas Asby · University of Chicago · 2024

13. How many gene edits can a therapeutic cell carry before it stops being manufacturable?

See it in a real dissertation: [Design and characterization of multiplex gene-edited CAR-T cells resistant to orthogonal immunosuppressive pathways within the solid tumor microenvironment](#) · Ryan Murray · Northeastern University · 2024

14. Which loading strategy gets a gene therapy vector into a vesicle that will deliver it?

See it in a real dissertation: [Enhancing EV-AAV incorporation: insights into natural loading and active loading strategies for improved gene therapy vector delivery](#) · Ioulia Vorobieva · University of Oxford · 2025

15. Does a cyclic peptide carry nucleic acid into a cell better than a linear one?

See it in a real dissertation: [Investigating Hybrid Cyclic/Linear and Linear Peptides as Vehicles for Nucleic Acid Delivery](#) · Abdulelah Alhazza · Chapman University · 2022

Computational and structural biotechnology

16. Can causal discovery pick out a biological mechanism from observational data at scale?

See it in a real dissertation: [Causal Discovery at Scale for Biological Mechanism Inference](#) · Ashka Shah · University of Chicago · 2026

17. What does the shape of high-dimensional biological data tell you that a cluster does not?

See it in a real dissertation: [Topological data analysis for high-dimensional data in biology](#) · Katherine Benjamin · University of Oxford · 2026

18. How much of genome inference can be automated before judgment has to intervene?

See it in a real dissertation: [Mostly Automated Rapid Genome Inference Environment](#) · Sajal Bhattarai · Purdue University · 2026

19. Which catalytic step in an enzyme mechanism can simulation actually settle?

See it in a real dissertation: [Multilevel Computational Investigation into the Catalytic Mechanisms of Matrix Metalloproteinase-1 and Fat Mass and Obesity-associated Enzyme](#) · Ann Varghese · Michigan Technological University · 2023

20. What does modeling reveal about how a bacterium organizes itself under stress?

See it in a real dissertation: [Modeling Intercellular and Intracellular Organization and Dynamics Of the Bacteria Escherichia coli : From Population Dynamics in the Gut Microbiome, to Condensate Formation in Starved Cells](#) · Alberto Alonso · Rochester Institute of Technology · 2026

Gene editing and CRISPR

21. How does a bacterium decide which piece of an infection to remember?

See it in a real dissertation: [Generation of Memory of Infection During the CRISPR-Cas9 Immune Response](#) · Robert Heler · Rockefeller University · 2025

22. Can a wild ancestor of a crop be edited to show what domestication actually changed?

See it in a real dissertation: [Towards understanding maize domestication: Genetic transformation and genomic editing of teosinte \(Zea mays ssp. parviglumis\)](#) · Jacob D. Zobrist · Iowa State University · 2023

23. Which inherited heart conditions could precision editing realistically correct?

See it in a real dissertation: [Unraveling the Genetic Code: Harnessing Precision Editing for Improper Cargo Sorting and Membrane Trafficking Within Inherited Cardiovascular Diseases](#) · Smith, Chelsea L · Harvard University · 2025

24. Has gene editing made a bioterror event easier, and what would slow that down?

See it in a real dissertation: [Gene Editing and the Accessibility of Bioterrorism: Rethinking Global Biosecurity in the Post-Covid-19 Era](#) · Nicholas Morales · Missouri State University · 2026

25. When is it better to evolve a biological system than to engineer it directly?

See it in a real dissertation: [A Tale of Two Strategies: Evolving and Engineering Biology Across Scales](#) · Zhou, Jie · California Institute of Technology · 2026

Metabolic engineering and biomanufacturing

26. How far can a precursor be pushed in E. coli before the cell fights back?

See it in a real dissertation: [Scale Up of a Novel Method to Maximize Malonyl-CoA in Escherichia Coli](#) · Clifford LeBlanc · Louisiana State University · 2022

27. Which organism should you engineer when the feedstock is a waste gas?

See it in a real dissertation: [Metabolic engineering of Cupriavidus necator H16 for sustainable biomanufacturing](#) · Simona Della Valle · University of Oxford · 2023

28. How do you control a bioprocess you can only measure indirectly and late?

See it in a real dissertation: [State Estimation, Covariance Estimation, and Economic Optimization of Semi-Batch Bioprocesses](#) · Ronald Alexander · West Virginia University · 2023

29. Can a probiotic yeast be turned into a delivery vehicle for a biologic?

See it in a real dissertation: [Engineering Saccharomyces boulardii for Enhanced Protein Surface Display and Biologics Delivery](#) · Luping Xu · Purdue University · 2026

30. Could engineered biology recover a rare element more cleanly than mining does?

See it in a real dissertation: [Design and Construction of Synthetic Biology Tools for Sustainable Lanthanide Extraction](#) · Jones, Ethan Mackenzie · Harvard University · 2024

Microbiome engineering

31. Can a gut bacterium be engineered to deliver a therapy where it already lives?

See it in a real dissertation: [Engineering Bacteroidales and Their Phages Towards Biomedical Interventions in the Gut Microbiome](#) · Jay Fuerte-Stone · University of Chicago · 2026

32. Which phage would you choose to edit a microbiome without removing it first?

See it in a real dissertation: [Bacteriophage Vectors for in situ Microbiome Engineering](#) · Peter Voorhees · University of North Carolina at Chapel Hill · 2024

33. How long does an engineered yeast have to stay in the gut to be worth taking?

See it in a real dissertation: [Engineering Probiotic Yeast to Enhance Gut Residence Time for Inflammatory Bowel Disease Therapy](#) · Alaina Parker · University of North Carolina at Chapel Hill · 2026

34. What natural products are hiding in bacteria nobody has managed to culture?

See it in a real dissertation: [The Application of Functional Metagenomics to Natural Products Research](#) · Jeffrey W. Craig · Rockefeller University · 2025

35. How do bacteria handle dissolved carbon, and what could that be engineered to do?

See it in a real dissertation: [Dissolved Inorganic Carbon Metabolism in Bacteria](#) · Jana Wieschollek · University of South Florida · 2025

Protein and antibody engineering

36. What can a synthetic antibody do inside a cell that a natural one cannot?

See it in a real dissertation: [Application of Synthetic Antibodies to Biology: The Engineering of Antibody-Based Tools and Therapeutics](#) · Tomasz Ślęzak · University of Chicago · 2023

37. Could one binder scaffold be reconfigured to steer several different cell fates?

See it in a real dissertation: [Tuning cell fate with a toolbox of DoubleCatcher bispecific binder scaffolds](#) · Claudia Louise Driscoll · University of Oxford · 2024

38. How large can a designed transmembrane barrel get before it stops folding?

See it in a real dissertation: [Rational engineering of the longest transmembrane \$\beta\$ barrel](#) · H He · University of Oxford · 2025

39. Can a statistical model predict which mutations will improve a protein?

See it in a real dissertation: [Statistical models of protein mutational effects, directed evolution, and clinical chemistry](#) · Alpay, Berk A · Harvard University · 2024

40. How do motor proteins share a load when several of them pull on one cargo?

See it in a real dissertation: [Characterization and cooperative dynamics of kinesin motor proteins in intracellular transport](#) · Vahid Alizadeh · Temple University · 2026

Synthetic biology and genetic circuits

41. Could cells be made to keep a written record of the signals they received?

See it in a real dissertation: [Synthetic Biology Approaches for Recording Diffusible Cell-Cell Communications](#) · Katerina Maria Cheronis · University of Chicago · 2026

42. How closely can an RNA circuit hold gene expression to a designed setpoint?

See it in a real dissertation: [Model-guided Design of RNA-based Synthetic Circuits for the Dynamic Regulation of Gene Expression](#) · Jordan Ryan · Louisiana State University · 2022

43. Which steps of the central dogma can be put under synthetic control, and which resist?

See it in a real dissertation: [Synthetic Control of the Biological Central Dogma](#) · Bryan Michael Gerber · California Institute of Technology · 2026

44. Can a plant be given a logic gate that responds only when two signals arrive together?

See it in a real dissertation: [Developing a Generalizable Two-Input Genetic AND Logic Gate in Arabidopsis thaliana for Multi-Signal Processing](#) · Charles E. Anderson · University of North Texas · 2022

45. What becomes possible in synthetic biology once DNA can be ligated to itself reliably?

See it in a real dissertation: [Intramolecular Ligation of DNA as a Tool in Synthetic Biology](#) · Strawn, Isabell K. · University of Colorado Boulder · 2023

Tissue engineering and biomaterials

46. How much of a human tissue can be assembled to a written program?

See it in a real dissertation: [Programmable Assembly of Genetically Engineered Human Tissues](#) · Lu, Jingcheng · Harvard University · 2024

47. What pore structure does a scaffold need before cells will move into it?

See it in a real dissertation: [Designing Microporous Annealed Particle \(MAP\) Scaffolds with Stable, Functional Porosity for Cell Integration in Challenging Clinical Applications](#) · Clare Flanagan · University of Virginia · 2026

48. Is a printed tissue better built from spheres than from a continuous bio-ink?

See it in a real dissertation: [Digital Assembly of Spherical Bio-Ink Particles](#) · Jinchang Zhu · University of Virginia · 2026

49. Which fiber geometry tells a stem cell what to become?

See it in a real dissertation: [Stem Cell Regulation Using Nanofibrous Membranes with Defined Structure and Pore Size](#) · Laurence Blake · University of North Texas · 2022

50. Could a metallic glass be made biocompatible enough for an implant?

See it in a real dissertation: [Design, manufacture and validation of biocompatible Bulk Metallic Glasses \(BMGs\) for bioengineering applications](#) · Shangmou Yang · Loughborough University · 2026

How to turn a topic into your research question

A topic is a starting point, not something you can research yet. These four steps take you from a topic on this list to a focused question you can actually answer.

- 1. Shortlist three, not one.** Pick three topics from this list that genuinely interest you and fit the access you have to people and data.

Recommended reading: [How to find and choose a dissertation topic](#)

- 2. Read the dissertation behind each one.** Its literature review and its "recommendations for future research" section show you what is already known and what is still open.

Recommended reading: [How to find a research gap](#)

- 3. Narrow it to your setting.** Name one population, one setting and one thing you will measure or explore. That turns a broad topic into a question you can finish.

Recommended reading: [How to write a research question](#)

- 4. Line up your aims, objectives and questions.** Your committee will check that they agree.

Recommended reading: [Research aims, objectives and questions](#)

Work through these once and you will have a focused question rather than a broad topic, which is what the rest of your proposal is built on.