

# Benjamin J. Hackel

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## EDUCATION

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- Massachusetts Institute of Technology** Cambridge, MA  
Ph.D., Chemical Engineering GPA: 5.0 / 5.0 2004 - 2009  
• Minor: Biological Chemistry
- University of Wisconsin** Madison, WI  
B.S., Chemical Engineering GPA: 3.99 / 4.0 1999 - 2003  
• Electives: Biochemistry, Biology, Cell Biology, Bioinstrumentation, Biomaterials

## EXPERIENCE

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- Stanford University** Stanford, CA  
*Postdoctoral Scholar* 2009 – present  
• Advisor: Prof. Sam Gambhir (Radiology)  
• Develop molecular imaging technologies to enable the early detection of cancer
- Massachusetts Institute of Technology** Cambridge, MA  
*Graduate Research Fellow* 2005 - 2009  
• Advisor: Prof. Dane Wittrup (Chemical Engineering and Biological Engineering)  
• Developed a technology platform for the robust engineering of high affinity, stable fibronectin proteins for molecular recognition  
• Engineered heterobivalent epidermal growth factor receptor binders capable of non-agonistic receptor downregulation
- University of Wisconsin** Madison, WI  
*Undergraduate Research Assistant* 2002 – 2004  
• Advisor: Assoc. Prof. Eric Shusta (Chemical and Biological Engineering)  
• Conducted research towards the development of non-invasive targeted neurotherapeutics  
• Developed yeast expression systems to optimize protein production via genetic and cellular engineering
- Lawrence Livermore National Laboratory** Livermore, CA  
Technical Scholar / Researcher Summer 2003  
• Developed chemistry to synthesize  $\alpha$ -thioester peptides for use in native chemical ligation
- Procter & Gamble** Cincinnati, OH  
Product Development Engineer – Intern Summer 2001  
• Designed a chemical formulation to introduce novel properties into a proprietary surfactant

## TEACHING / SERVICE

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- Massachusetts Institute of Technology** Cambridge, MA  
• New England Structural Biology Association Conference Co-organizer  
• Teaching Assistant: Integrated Chemical Engineering  
• Research Mentor: Undergraduate Research Opportunities Program
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|---------------|---------------------------|---|
| Atul Kapila   | Biology, MIT              | <i>Fibronectin Production and Stability</i> |
| Selasie Goka  | Biochemistry, Wellesley   | <i>Fibronectin Crystallization</i>          |
| Minah Shahbaz | Chemical Engineering, MIT | <i>Synthetic Library Design</i>             |
| Danielle Wang | Chemical Engineering, MIT | <i>Synthetic Library Design</i>             |
- University of Wisconsin** Madison, WI  
• Tutor: Chemical Engineering

## PUBLICATIONS / PATENTS

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**Hackel, B.J.**, Neil, J., White, F., and Wittrup, K.D., "Epidermal growth factor receptor downregulation with heterobivalent fibronectin constructs" *in preparation*.

**Hackel, B.J.**, Ackerman, M., Howland, S., and Wittrup, K.D., "Stability and complementarity bias improve the protein functionality landscape" *in preparation*.

**Hackel, B.J.**, and Wittrup, K.D., "The full amino acid repertoire is superior to serine/tyrosine for selection of high affinity immunoglobulin G binders from the fibronectin scaffold" *submitted*.

**Hackel, B.J.**, and Wittrup, K.D., "Engineered proteins including mutant fibronectin domains" *U.S. Patent Application 2009 61/233,82*.

Ackerman, M., Levary, D., Tobon, G., **Hackel, B.J.**, Orcutt, K.D., and Wittrup, K.D., "Highly avid magnetic bead capture: an efficient selection method for *de novo* protein engineering utilizing yeast surface display" *Biotech. Prog.* 2009 25, 774-783.

**Hackel, B.J.**, and Wittrup, K.D., "Yeast surface display in protein engineering and analysis" in *Protein Engineering Handbook* (Lutz, S., and Bornscheuer, U.T., eds) 2008, 621-648. Wiley.

**Hackel, B.J.**, Kapila, A., and Wittrup, K.D., "Picomolar affinity fibronectin domains engineered utilizing loop length diversity, recursive mutagenesis, and loop shuffling" *J. Mol. Biol.* 2008 381, 1236-1252.

Lipovsek, D., Lippow, S.M., **Hackel, B.J.**, Gregson, M.W., Cheng, P., Kapila, A., and Wittrup, K.D., "Evolution of an interloop disulfide bond in high-affinity antibody mimics based on fibronectin type III domain and selected by yeast-surface display: Molecular convergence with single-domain camelid and shark antibodies" *J. Mol. Biol.* 2007 368, 1024-1041.

Chao, G., Lau, W.L., **Hackel, B.J.**, Sazinsky, S.L., Lippow, S.M., and Wittrup, K.D., "Isolating and engineering human antibodies using yeast surface display" *Nature Protocols* 2006 1, 755-768.

**Hackel, B.J.**, Huang, D., Bubolz, J.C., Wang, X.X., and Shusta, E.V., "Production of soluble and active transferrin receptor-targeting single-chain antibody using *Saccharomyces cerevisiae*" *Pharm. Res.* 2006 23, 790-797.

Camarero J.A., **Hackel, B.J.**, DeYoreo, J.J., and Mitchell, A.R., "Fmoc-based synthesis of peptide alpha-thioesters using an aryl hydrazine support" *J. Org. Chem.* 2004 69, 4145-51.

## HONORS

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- National Defense Science and Engineering Graduate Fellowship
- National Science Foundation Graduate Fellowship
- International Conference on Biomolecular Engineering Poster Award
- Hilldale Undergraduate Research Fellow
- Wisconsin Academic Excellence Scholar
- Wisconsin All-State Scholar
- Herbert V. Kohler Award
- Phi Eta Sigma National Scholar
- National Science Foundation REU
- C.S. Brown Chemical Engineering Award
- R. and E. Pott Engineering Award
- M.A. Crosby Chemical Engineering Award

## REFERENCES

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*Available upon request*