Stanford

Lynette Cegelski

Associate Professor of Chemistry and, by courtesy, of Chemical Engineering

Curriculum Vitae available Online

CONTACT INFORMATION

- **Administrative Contact**

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Bio

BIO

Associate Professor Lynette Cegelski's research is inspired by the challenge and importance of elucidating chemical structure and function in biological systems and the need for new and unconventional approaches to solve outstanding problems in biology and medicine. The Cegelski laboratory has developed a unique set of tools, particularly integrating solid-state NMR spectroscopy with biochemistry and microbiology, to determine atomic- and molecular-level detail in macromolecular assemblies, intact cells, and bacterial biofilms. Coupled with small-molecule screening and inhibitor discovery, they are driving the development of new strategies to address the global challenge of antibiotic resistance and infectious disease.

Lynette Cegelski completed her undergraduate studies in Chemistry at SUNY-Binghamton, New York (B.S. summa cum laude and Phi Beta Kappa 1998), where she participated in research to determine the microtubule-bound conformation of the anti-cancer drug Taxol by REDOR solid-state NMR. This formative experience motivated her move to Washington University to conduct her PhD training in the laboratory of Professor Jacob Schaefer, where she trained as a solid-state NMR spectroscopist (Ph.D. Biophysical Chemistry 2004). She investigated cell-wall and whole-cell systems and examined photosynthesis and photorespiration in intact leaf NMR experiments. She gained expertise in Microbiology and Infectious Disease research as a postdoctoral fellow in Molecular Microbiology at the Washington University School of Medicine, working with Professor Scott Hultgren. There, she introduced the first small-molecule inhibitors of functional amyloid assembly in bacteria. She joined the faculty of the Stanford Chemistry Department in 2008. Her work has garnered early career awards, including the Burroughs Wellcome Career Award at the Scientific Interface, the 2010 NIH Director’s New Innovator Award, and the National Science Foundation CAREER Award.

Current research in the Cegelski Lab examines bacterial cell-wall composition and, beyond the cell surface, how bacteria self-assemble extracellular structures and use these as building blocks to generate biofilm architectures. Parallel efforts involve the dissection of modes of action of newly discovered antimicrobials and anti-virulence compounds. Lab members employ biophysical and biochemical tools, develop new assays and protocols, and design new strategies using solid-state NMR spectroscopy to examine assemblies such as amyloid fibers, bacterial cell walls, and biofilms. Recent discoveries have emerged from work with E. coli, S. aureus, Vibrio cholerae, and Pseudomonas aeruginosa. Translationally, small-molecule screening efforts have identified biofilm inhibitors that are being tested as potential inhibitors of pathogenesis in vivo.

The laboratory recently discovered that E. coli produces a chemically modified form of cellulose that contributes to the integrity of the biofilm extracellular matrix. Its presence evaded detection through decades of research on bacterial cellulose due to the challenges associated with using solution-based methods to interrogate biomass breakdown products. The laboratory is pursuing several avenues related to manipulations and applications of this new cellulosic material.

Additional targets of study include functional amyloid fibers termed curli and the mechanism by which bacteria use curli together with cellulose to construct biofilm architectures. The curli system is notable as a dedicated amyloid-assembly machinery and inhibitors of curli assembly may also hold promise as inhibitors of amyloids associated with human disease.

Collectively, the Cegelski Research Program is positioned at the scientific interface of Chemistry, Biology, and Engineering and is revealing new bacterial structures, new anti-infective targets, and inhibitors of bacterial adhesion and biofilm formation.

ACADEMIC APPOINTMENTS

- Associate Professor, Chemistry
- Associate Professor (By courtesy), Chemical Engineering
- Member, Bio-X
- Faculty Fellow, Stanford ChEM-H
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- NSF CAREER Award, National Science Foundation (2015)
- Hellman Faculty Scholar Award, Hellman Fellows Fund (2012)
- Terman Fellowship, Stanford University (2011)
- NIH Director's New Innovator Award, National Institutes of Health (2010)
- Career Award at the Scientific Interface, Burroughs Wellcome Fund (2008)
- Terman Fellowship, Stanford University (2008)

PROFESSIONAL EDUCATION

- Postdoc, Washington University School of Medicine , Molecular Microbiology (2008)
- PhD, Washington University , Chemistry (2004)
- BS, Binghamton University, SUNY , Chemistry (1998)

PATENTS

- Lynette Cegelski, Ji Youn Lim. "United States Patent 9,271,493 Methods for Microbial Biofilm Destruction", Leland Stanford Junior University, Apr 11, 2016

LINKS

- The Cegelski Lab: http://cegelski.stanford.edu
- Bio-X Profile: https://biox.stanford.edu/about/people/affiliated-faculty/lynette-cegelski-assistant-professor-chemistry

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our research program integrates chemistry, biology, and physics to investigate the assembly and function of macromolecular and whole-cell systems. The genomics and proteomics revolutions have been enormously successful in generating crucial "parts lists" for biological systems. Yet, for many fascinating systems, formidable

challenges exist in building complete descriptions of how the parts function and assemble into macromolecular complexes and whole-cell factories. We are inspired by the need for new and unconventional approaches to solve these outstanding problems and to drive the discovery of new therapeutics for human disease.

Our approach is different from the more conventional protein-structure determinations of structural biology. We employ biophysical and biochemical tools, and are designing new strategies using solid-state NMR spectroscopy to examine assemblies such as amyloid fibers, bacterial cell walls, whole cells, and biofilms. We would like to understand at a molecular and atomic level how bacteria self-assemble extracellular structures, including functional amyloid fibers termed curli, and how bacteria use such building blocks to construct organized biofilm architectures. We also employ a chemical genetics approach to recruit small molecules as tools to interrupt and interrogate the temporal and spatial events during assembly processes and to develop new strategies to prevent and treat infectious diseases. Overall, our approach is multi-pronged and provides training opportunities for students interested in research at the chemistry-biology interface.

Teaching

COURSES

2019-20

- Chemical Principles II: CHEM 31B (Win)

2018-19

- Biochemistry I: CHEM 181, CHEMENG 181, CHEMENG 281 (Aut)
- Chemical Principles II: CHEM 31B (Win)

2017-18

- Biochemistry I: CHEM 181, CHEMENG 181, CHEMENG 281 (Aut)
- Biological Chemistry Laboratory: CHEM 184 (Spr)

2016-17

- Biochemistry I: CHEM 181, CHEMENG 181, CHEMENG 281 (Aut)
- Biological Chemistry Laboratory: CHEM 184 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Corleone Delaveris, Haotian Du, Melissa Gray, Jen Hope, Ioannis Kipouros, Katie Liu, Alex Stahl, Joe Thomaz

Postdoctoral Faculty Sponsor

Jasna Brcic, Roi Rutenberg

Doctoral Dissertation Advisor (AC)

Madeline Chosy, Niki Goularte, Roxanne Jacobs, Jamie Jeffries, Till Kallem, Josh Visser, Sabrina Werby

Undergraduate Major Advisor

Kyle Enriquez

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (Phd Program)

Publications

PUBLICATIONS

- **Peptidoglycan and Teichoic Acid Levels and Alterations in Staphylococcus aureus by Cell-Wall and Whole-Cell Nuclear Magnetic Resonance** *BIOCHEMISTRY*
  Romaniuk, J. H., Cegelski, L.
  2018; 57 (26): 3966–75

- **Phosphoethanolamine cellulose: A naturally produced chemically modified cellulose** *SCIENCE*
  Thongsomboon, W., Serra, D. O., Possling, A., Hadjineophytou, C., Hengge, R., Cegelski, L.
  2018; 359 (6373): 334–38

- **Bacterial cell wall composition and the influence of antibiotics by cell-wall and whole-cell NMR.** *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*
  Romaniuk, J. A., Cegelski, L.
  2015; 370 (1679)

- **Cell-Based High-Throughput Screening Identifies Rifapentine as an Inhibitor of Amyloid and Biofilm Formation in Escherichia coli** *ACS INFECTIOUS DISEASES*
  Maher, M. C., Lim, J. Y., Gunawan, C., Cegelski, L.
  2015; 1 (10): 460-468

- **Bottom-up and top-down solid-state NMR approaches for bacterial biofilm matrix composition.** *Journal of magnetic resonance*
  Cegelski, L.
  2015; 253: 91-97

- **Spectral Snapshots of Bacterial Cell-Wall Composition and the Influence of Antibiotics by Whole-Cell NMR** *BIOPHYSICAL JOURNAL*
  Nygaard, R., Romaniuk, J. A., Rice, D. M., Cegelski, L.
  2015; 108 (6): 1380-1389

- **Congo Red Interactions with Curli-Producing E. coli and Native Curli Amyloid Fibers.** *PloS one*
  Reichhardt, C., Jacobson, A. N., Maher, M. C., Uang, J., McCrate, O. A., Eckart, M., Cegelski, L.
  2015; 10 (10)

- **Sum of the parts: composition and architecture of the bacterial extracellular matrix.** *Journal of molecular biology*
  McCrate, O. A., Zhou, X., Reichhardt, C., Cegelski, L.
  2013; 425 (22): 4286-4294

- **Curcumin as an amyloid-indicator dye in E. coli.** *Chemical communications*
  McCrate, O. A., Zhou, X., Cegelski, L.
  2013; 49 (39): 4193-4195

- **REDOR NMR for Drug Discovery** *Bioorganic and Medicinal Chemistry Letters*
  Cegelski, L.
  2013

- **Dimethyl Sulfoxide and Ethanol Elicit Increased Amyloid Biogenesis and Amyloid-Integrated Biofilm Formation in Escherichia coli** *APPLIED AND ENVIRONMENTAL MICROBIOLOGY*
  Lim, J. Y., May, J. M., Cegelski, L.
  2012; 78 (9): 3369-3378

- **Evaluation of Phosphoethanolamine Cellulose Production among Bacterial Communities using Congo Red Fluorescence.** *Journal of bacteriology*
  Thongsomboon, W., Werby, S. H., Cegelski, L.
  2020

- **Mechanical and microstructural insights of Vibrio cholerae and Escherichia coli dual-species biofilm at the air-liquid interface.** *Colloids and surfaces. B, Biointerfaces*
  Abriat, C., Enriquez, K., Virgilio, N., Cegelski, L., Fuller, G. G., Daigle, F., Heuzey, M.
  2020; 188: 110786

- **Design and Implementation of a Six-Session CURE Module Using Biofilms to Explore the Chemistry-Biology Interface** *JOURNAL OF CHEMICAL EDUCATION*
  Werby, S., Cegelski, L.
  2019; 96 (9): 2050–54
- **Benzoladderene Mechanophores: Synthesis, Polymerization, and Mechanochemical Transformation** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Yang, J., Horst, M., Romaniuk, J. H., Jin, Z., Cegelski, L., Xia, Y.
  2019; 141 (16): 6479–83
- **Benzoladderene Mechanophores: Synthesis, Polymerization, and Mechanochemical Transformation.** *Journal of the American Chemical Society*
  Yang, J., Horst, M., Romaniuk, J. A., Jin, Z., Cegelski, L., Xia, Y.
  2019
- **Integration of electron microscopy and solid-state NMR analysis for new views and compositional parameters of Aspergillus fumigatus biofilms** *MEDICAL MYCOLOGY*
  Reichhardt, C., Joubert, L., Clemons, K. V., Stevens, D. A., Cegelski, L.
  2019; 57: S239–S244
- **Integration of electron microscopy and solid-state NMR analysis for new views and compositional parameters of Aspergillus fumigatus biofilms.** *Medical mycology*
  Reichhardt, C., Joubert, L., Clemons, K. V., Stevens, D. A., Cegelski, L.
  2019; 57 (Supplement_2): S239–S244
- **Spectral comparisons of mammalian cells and intact organelles by solid-state NMR** *JOURNAL OF STRUCTURAL BIOLOGY*
  Werby, S. H., Cegelski, L.
  2019; 206 (1): 49–54
- **Respiratory Heterogeneity Shapes Biofilm Formation and Host Colonization in Uropathogenic Escherichia coli** *MBIO*
  Beebout, C. J., Eberly, A. R., Werby, S. H., Reasoner, S. A., Brannon, J. R., De, S., Fitzgerald, M. J., Huggins, M. M., Clayton, D. B., Cegelski, L., Hadjifrangiskou, M.
  2019; 10 (2)
- **Carbon compositional analysis of hydrogel contact lenses by solid-state NMR spectroscopy.** *Solid state nuclear magnetic resonance*
  Rabiah, N. I., Romaniuk, J. A., Fuller, G. G., Scales, C. W., Cegelski, L.
  2019; 102: 47–52
- **Vancomycin-Arginine Conjugate Inhibits Growth of Carbapenem-Resistant E. coli and Targets Cell-Wall Synthesis.** *ACS chemical biology*
  Antonoplis, A., Zang, X., Wegner, T., Wender, P. A., Cegelski, L.
  2019
- **Unraveling Escherichia coli's Cloak: Identification of Phosphoethanolamine Cellulose, Its Functions, and Applications.** *Microbiology insights*
  Jeffries, J., Fuller, G. G., Cegelski, L.
  2019; 12: 1178636119865234
- **Respiratory Heterogeneity Shapes Biofilm Formation and Host Colonization in Uropathogenic Escherichia coli.** *mBio*
  Beebout, C. J., Eberly, A. R., Werby, S. H., Reasoner, S. A., Brannon, J. R., De, S., Fitzgerald, M. J., Huggins, M. M., Clayton, D. B., Cegelski, L., Hadjifrangiskou, M.
  2019; 10 (2)
- **Functional Specialization in Vibrio cholerae Diguanylate Cyclases: Distinct Modes of Motility Suppression and c-di-GMP Production.** *mBio*
  Zamorano-Sánchez, D., Xian, W., Lee, C. K., Salinas, M., Thongsomboon, W., Cegelski, L., Wong, G. C., Yildiz, F. H.
  2019; 10 (2)
- **Synthesis and Mechanochemical Activation of Ladderene-Norbornene Block Copolymers.** *Journal of the American Chemical Society*
  Su, J. K., Feist, J. D., Yang, J., Mercer, J. A., Romaniuk, J. A., Chen, Z., Cegelski, L., Burns, N. Z., Xia, Y.
  2018; 140 (39): 12388–91
- **Phosphoethanolamine cellulose enhances curli-mediated adhesion of uropathogenic Escherichia coli to bladder epithelial cells.** *Proceedings of the National Academy of Sciences of the United States of America*
  Hollenbeck, E. C., Antonoplis, A., Chai, C., Thongsomboon, W., Fuller, G. G., Cegelski, L.

2018

- **Spectral Comparisons of Mammalian Cells and Intact Organelles by Solid-State NMR.** *Journal of structural biology*
  Werby, S. H., Cegelski, L.
  2018

- **REDOR NMR Reveals Multiple Conformers for a Protein Kinase C Ligand in a Membrane Environment** *ACS CENTRAL SCIENCE*
  Yang, H., Staveness, D., Ryckbosch, S. M., Axtman, A. D., Loy, B. A., Barnes, A. B., Pande, V. S., Schaefer, J., Wender, P. A., Cegelski, L.
  2018; 4 (1): 89–96

- **The Congo red derivative FSB binds to curli amyloid fibers and specifically stains curliated E. coli.** *PloS one*
  Reichhardt, C., Cegelski, L.
  2018; 13 (8): e0203226

- **A dual function antibiotic-transporter conjugate exhibits superior activity in sterilizing MRSA biofilms and killing persister cells.** *Journal of the American Chemical Society*
  Antonoplis, A., Zang, X., Huttner, M. A., Chong, K., Lee, Y. B., Co, J. Y., Amieva, M., Kline, K., Wender, P. A., Cegelski, L.
  2018

- **Whole-Cell Detection of C-P Bonds in Bacteria** *BIOCHEMISTRY*
  Bartlett, C., Bansal, S., Burnett, A., Suits, M. D., Schaefer, J., Cegelski, L., Horsman, G. P., Weadge, J. T.
  2017; 56 (44): 5870–73

- **Disentangling Nanonets: Human a-Defensin 6 Targets Candida albicans Virulence.** *Biochemistry*
  Cegelski, L.
  2017; 56 (8): 1027-1028

- **Visualization of Aspergillus fumigatus biofilms with Scanning Electron Microscopy and Variable Pressure-Scanning Electron Microscopy: A comparison of processing techniques** *JOURNAL OF MICROBIOLOGICAL METHODS*
  Joubert, L., Ferreira, J. A., Stevens, D. A., Nazik, H., Cegelski, L.
  2017; 132: 46-55

- **Mechanochemical unzipping of insulating polyladderene to semiconducting polyacetylene.** *Science (New York, N.Y.)*
  Chen, Z., Mercer, J. A., Zhu, X., Romaniuk, J. A., Pfattner, R., Cegelski, L., Martinez, T. J., Burns, N. Z., Xia, Y.
  2017; 357 (6350): 475–79

- **Whole Ribosome NMR: Dipolar Couplings and Contributions to Whole Cells.** *The journal of physical chemistry. B*
  Nygaard, R., Romaniuk, J. A., Rice, D. M., Cegelski, L.
  2017; 121 (40): 9331–35

- **Pseudomonas phage inhibition of Candida albicans.** *Microbiology (Reading, England)*
  Nazik, H., Joubert, L. M., Secor, P. R., Sweere, J. M., Bollyky, P. L., Sass, G., Cegelski, L., Stevens, D. A.
  2017

- **Influence of the amyloid dye Congo red on curli, cellulose, and the extracellular matrix in E. coli during growth and matrix purification.** *Analytical and bioanalytical chemistry*
  Reichhardt, C., McCrate, O. A., Zhou, X., Lee, J., Thongsomboon, W., Cegelski, L.
  2016; 408 (27): 7709-7717

- **Fungal biofilm composition and opportunities in drug discovery.** *Future medicinal chemistry*
  Reichhardt, C., Stevens, D. A., Cegelski, L.
  2016; 8 (12): 1455-1468

- **Mechanical Behavior of a Bacillus subtilis Pellicle** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Hollenbeck, E. C., Douarche, C., Allain, J., Roger, P., Regeard, C., Cegelski, L., Fuller, G. G., Raspaud, E.
  2016; 120 (26): 6080-6088

- **Influence of the amyloid dye Congo red on curli, cellulose, and the extracellular matrix in E. coli during growth and matrix purification** *Influence of the amyloid dye Congo red on curli, cellulose, and the extracellular matrix in E. coli during growth and matrix purification*
  Reichhardt, C., McCrate, O. A., Zhou, X., Lee, J., Thongsonboom, W., Cegelski, L.
  2016; 408 (27): 7709-7717

- **Analysis of the Aspergillus fumigatus Biofilm Extracellular Matrix by Solid-State Nuclear Magnetic Resonance Spectroscopy.** *Eukaryotic cell*
  Reichhardt, C., Ferreira, J. A., Joubert, L., Clemons, K. V., Stevens, D. A., Cegelski, L.
  2015; 14 (11): 1064-1072
- **Frequency-selective REDOR and spin-diffusion relays in uniformly labeled whole cells** *SOLID STATE NUCLEAR MAGNETIC RESONANCE*
  Rice, D. M., Romaniuk, J. A., Cegelski, L.
  2015; 72: 132-139
- **Bacterial cell wall composition and the influence of antibiotics by cell-wall and whole-cell NMR.** *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*
  Romaniuk, J. A., Cegelski, L.
  2015; 370 (1679)
- **C-di-GMP Regulates Motile to Sessile Transition by Modulating MshA Pili Biogenesis and Near-Surface Motility Behavior in Vibrio cholerae.** *PLoS pathogens*
  Jones, C. J., Utada, A., Davis, K. R., Thongsomboon, W., Zamorano Sanchez, D., Banakar, V., Cegelski, L., Wong, G. C., Yildiz, F. H.
  2015; 11 (10)
- **Toward a Biorelevant Structure of Protein Kinase C Bound Modulators: Design, Synthesis, and Evaluation of Labeled Bryostatin Analogues for Analysis with Rotational Echo Double Resonance NMR Spectroscopy** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Loy, B. A., Lesser, A. B., Staveness, D., Billingsley, K. L., Cegelski, L., Wender, P. A.
  2015; 137 (10): 3678-3685
- **Characterization of the Vibrio cholerae extracellular matrix: a top-down solid-state NMR approach.** *Biochimica et biophysica acta*
  Reichhardt, C., Fong, J. C., Yildiz, F., Cegelski, L.
  2015; 1848 (1): 378-383
- **Cell-Based High-Throughput Screening Identifies Rifapentine as an Inhibitor of Amyloid and Biofilm Formation in Escherichia coli.** *ACS infectious diseases*
  Maher, M. C., Lim, J. Y., Gunawan, C., Cegelski, L.
  2015; 1 (10): 460–68
- **NMR spectroscopy for atomistic views of biomembranes and cell surfaces.** *Biochimica et biophysica acta*
  Cegelski, L., Weliky, D. P.
  2015; 1848 (1 Pt B): 201–2
- **Characterization of the Vibrio cholerae extracellular matrix: A top-down solid-state NMR approach.** *Biochimica et biophysica acta*
  Reichhardt, C., Fong, J. C., Yildiz, F., Cegelski, L.
  2015; 1848 (1): 378-383
- **Molecular determinants of mechanical properties of V. cholerae biofilms at the air-liquid interface.** *Biophysical journal*
  Hollenbeck, E. C., Fong, J. C., Lim, J. Y., Yildiz, F. H., Fuller, G. G., Cegelski, L.
  2014; 107 (10): 2245-2252
- **Putative Hydrogen Bond to Tyrosine M208 in Photosynthetic Reaction Centers from Rhodobacter capsulatus Significantly Slows Primary Charge Separation** *JOURNAL OF PHYSICAL CHEMISTRY B*
  Saggu, M., Carter, B., Zhou, X., Faries, K., Cegelski, L., Holten, D., Boxer, S. G., Kirmaier, C.
  2014; 118 (24): 6721-6732
- **Solid-state NMR for bacterial biofilms** *MOLECULAR PHYSICS*
  Reichhardt, C., Cegelski, L.
  2014; 112 (7): 887-894
- **Community behavior and amyloid-associated phenotypes among a panel of uropathogenic E. coli.** *Biochemical and biophysical research communications*
  Lim, J. Y., Pinkner, J. S., Cegelski, L.
  2014; 443 (2): 345-350
- **Solid-State NMR for Bacterial Biofilms.** *Molecular physics*
  Reichhardt, C., Cegelski, L.
  2014; 112 (7): 887–94

- **REDOR NMR for drug discovery** *BIOORGANIC & MEDICINAL CHEMISTRY LETTERS*
  Cegelski, L.
  2013; 23 (21): 5767-5775
- **Disruption of Escherichia coli Amyloid-Integrated Biofilm Formation at the Air-Liquid Interface by a Polysorbate Surfactant** *LANGMUIR*
  Wu, C., Lim, J. Y., Fuller, G. G., Cegelski, L.
  2013; 29 (3): 920-926
- **Sum of the Parts: Composition and Architecture of the Bacterial Extracellular Matrix** *Journal of Molecular Biology*
  McCrate, O. A., Zhou, X., Reichhardt, C., Cegelski, L.
  2013
- **Nutrient-Dependent Structural Changes in S. aureus Peptidoglycan Revealed by Solid-State NMR Spectroscopy** *BIOCHEMISTRY*
  Zhou, X., Cegelski, L.
  2012; 51 (41): 8143-8153
- **Quantitative Analysis of Amyloid-Integrated Biofilms Formed by Uropathogenic Escherichia coli at the Air-Liquid Interface** *BIOPHYSICAL JOURNAL*
  Wu, C., Lim, J. Y., Fuller, G. G., Cegelski, L.
  2012; 103 (3): 464-471
- **Plant Cell-Wall Cross-Links by REDOR NMR Spectroscopy** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Cegelski, L., O'Connor, R. D., Stueber, D., Singh, M., Poliks, B., Schaefer, J.
  2010; 132 (45): 16052-16057
- **REDOR Applications in Biology: An Overview** *Encyclopedia of NMR*
  Toke, O., Cegelski, L.
  John Wiley & Sons, Ltd.2010
- **Small-molecule inhibitors target Escherichia coli amyloid biogenesis and biofilm formation** *NATURE CHEMICAL BIOLOGY*
  Cegelski, L., Pinkner, J. S., Hammer, N. D., Cusumano, C. K., Hung, C. S., Chorell, E., Aberg, V., Walker, J. N., Seed, P. C., Almqvist, F., Chapman, M. R., Hultgren, S. J.
  2009; 5 (12): 913-919
- **Microbial Adhesion** *Encyclopedia of Microbiology*
  Cegelski, L., Smith, C. L., Hultgren, S. J.
  Academic Press.2009; 3: 1–10