

Research

Research Support

Current:

Start-up funding, Morsani College of Medicine, Dept. Molecular Medicine, University of South Florida

Role of bacterial aggregates in infection (Darch, PI)

01/2019 – Present

Role: Principal Investigator

Cystic Fibrosis Foundation (CFF) research grant (DARCH19G0) (Darch, PI)

Bacterial aggregate formation and tolerance in the CF lung

Estimated start date 11/01/2019; end date: 10/31/2021

\$250,000

Effort: 1.7 Calendar Months

The aim of this proposal is to determine spatial and genetic determinants of aggregate tolerance, specifically to host immune factors.

1R21AI150279-01 (Chen, PI)

09/01/19 – 08/31/21

0.6 calendar months

NIH/NIAID

\$275,000

“Fragment-based Inhibitor discovery targeting *Pseudomonas aeruginosa* LPS synthesis”

The goal of this program is to develop novel inhibitors against LPS synthesis as new antibiotics targeting *P. aeruginosa*.

Role: Co-Investigator

Completed:

CFF Postdoctoral Fellowship DARCH16F0

“Biogeographical determinants of *P. aeruginosa* antibiotic resistance in CF”

04/01/2016 -12/31/2018

Publications

1. Kroeck, K.G., Sacco, M.D., Smith, E.W., Zhang, X., Shoun, D., Akhtar, A., **Darch, S.E.**, Cohen, F., Andrews, L.D., Knox, J.E. and Chen, Y., (2019). Discovery of dual-activity small-molecule ligands of *Pseudomonas aeruginosa* LpxA and LpxD using SPR and X-ray crystallography. *Scientific reports*, 9(1), pp.1-12.
 2. **Darch, S.E.** & Koley, D (2018) Quantifying microbial chatter: scanning electrochemical microscopy as a tool to study interactions in biofilms. *Proc. R. Soc. A* 474: 20180405. <http://dx.doi.org/10.1098/rspa.2018.0405>
 3. **Darch, S.E.**, Fitzpatrick, M., Simoska, O., Barraza, J.P., Stevenson, K.J., Bonnacaze, R.T., Shear, J.B. and M. Whiteley (2018) Spatial determinants of quorum signaling in a *Pseudomonas aeruginosa* infection model. *Proceedings of the National Academy of Sciences USA*. 2018 May 1;115(18):4779-4784
 4. **Darch, S.E.**, Kragh, K.N., Abbott, E.A., Bjarnsholt, T., Bull, J.J. and Whiteley, M., (2017). Phage Inhibit Pathogen Dissemination by Targeting Bacterial Migrants in a Chronic Infection Model. *mBio*, 8(2), pp.e00240-17
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5. **Darch, S. E.**, McNally, A., Harrison, F., Corander, J., Barr, H.L., Paszkiewicz, K., Holden, S., Fogarty, A., Cruz, S.A. and Diggle, S.P. (2015) Recombination is a key driver of genomic and phenotypic diversity in a *Pseudomonas aeruginosa* population during cystic fibrosis infection. *Scientific reports* 5
6. **Darch, S. E.**, West, S. A., Winzer, K. & Diggle, S. P. (2012) Density-dependent fitness benefits in quorum sensing bacterial populations. *Proceedings of the National Academy of Sciences USA*. 109: 8259-8263.
7. Stacy, A., McNally, L., **Darch, S.E.**, Brown, S.P. and Whiteley, M. (2016) The biogeography of polymicrobial infection. *Nature Reviews Microbiology*. 14:93-105.
8. Sønderholm, M., Kragh, K.N., Koren, K., Jakobsen, T.H., **Darch, S.E.**, Alhede, M., Jensen, P.Ø., Whiteley, M., Kühl, M. and Bjarnsholt, T., (2017). *Pseudomonas aeruginosa* Aggregate Formation in an Alginate Bead Model System Exhibits In Vivo-Like Characteristics. *Applied and Environmental Microbiology*, 83(9), pp.e00113-17.
9. **Darch, S. E.**, & Whiteley, M. (2015). Show Me the SNPs. How Bacterial Sex Generates Diversity in the Cystic Fibrosis Lung. *American journal of respiratory and critical care medicine*, 191(7), 725-727.
10. **Darch, S.E.**, Ibberson, C.B. and Whiteley, M., (2017). Evolution of Bacterial “Frenemies”. *mBio*, 8(3), pp.e00675-17.

Oral presentations

European Cystic Fibrosis Society Annual Meeting (2012)

‘Microbial Diversity in the Cystic Fibrosis Lung - Assessing the Limitations of Current Diagnostic Microbiology and Antibiotic Susceptibility Profiling’ S.E. Darch, S.A. Cruz, S. Holden, D. Forrester, A. Smyth, A. Fogarty and S.P. Diggle

Molecular Microbiology and Infection symposium (University of Birmingham) (2013)

An SGM associated symposium, abstract selected for a 25-minute presentation. **Title as above**

Department of Molecular Biosciences (MBS) at The University of Texas at Austin annual retreat. Selected for 15-minute oral presentation (2016)

‘Determining the spatial parameters of *P. aeruginosa* cell-cell signaling in Cystic Fibrosis using micro-3D-printing’

16th International Conference on *Pseudomonas* (Liverpool, UK) (2017)

‘Defining the calling distance of quorum signals using micro-3D printed *P. aeruginosa* communities’ S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, R.T. Bonnecaze, J.B. Shear and M. Whiteley

4th International conference on model hosts (Rhodes, Greece) (2017)

Defining the calling distance of quorum signals using micro-3D printed *P. aeruginosa* communities’ S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, R.T. Bonnecaze, J.B. Shear and M. Whiteley

6th ASM conference on cell-cell communication in bacteria (Athens, USA) (2017)

Defining the calling distance of quorum signals using micro-3D printed *P. aeruginosa* communities’ S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, R.T. Bonnecaze, J.B. Shear and M. Whiteley

School of Biological Sciences 2018 Graduate Student and Postdoc Symposium
Georgia Institute of Technology (April 2018)

Spatial determinants of quorum signaling in a *Pseudomonas aeruginosa* infection model

S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, K. J. Stevenson, R.T. Bonnecaze, J.B. Shear and M. Whiteley

Invited seminar University of Georgia, Athens (May 2018)

Social interactions in the Cystic Fibrosis Lung

ASM Microbe (June 2018)

Spatial determinants of quorum signaling in a *Pseudomonas aeruginosa* infection model

S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, K. J. Stevenson, R.T. Bonnecaze, J.B. Shear and M. Whiteley

ASM Biofilms (October 2018)

'Exploring antimicrobial tolerance and social dynamics of bacterial aggregates in the CF lung'

S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, K. J. Stevenson, R.T. Bonnecaze, J.B. Shear and M. Whiteley

North American Cystic Fibrosis Conference (NACFC) (October 2018)

'Exploring antimicrobial tolerance and social dynamics of bacterial aggregates in the CF lung'

S.E. Darch, M. Fitzpatrick, O. Simoska, J. Barraza, K. J. Stevenson, R.T. Bonnecaze, J.B. Shear and M. Whiteley

Infectious Disease Symposium, The University of South Florida (January 2019)

'Exploring antimicrobial tolerance and social dynamics of bacterial aggregates in the CF lung'

Department of Molecular Medicine Scientific Retreat, The University of South Florida (March 2019)

'Exploring the social lives of microbes in the CF lung'

63rd Wind River conference on prokaryotic biology (June 2019)

'Exploring spatial dynamics of antibiotic tolerance in the cystic fibrosis lung'

Department of Cell Biology, Microbiology and Molecular Biology (CMMB), University of South Florida (August 2019)

'Exploring social dynamics of bacterial aggregates in the CF lung'

South Eastern Branch of the American Society of Microbiology (February 2020)

'Exploring spatial dynamics of antibiotic tolerance in the cystic fibrosis lung'

Scientific Conference involvement

American society of microbiology (ASM) ASM Microbe 2020, Chicago IL
Chair and moderator of "Biofilms at the cutting edge" (June 2020)

Teaching/Mentoring

USF courses taught

2019- Present GMS6103 Foundations in Medical Microbiology and Immunology. *Pseudomonas aeruginosa* and biofilms. ESKAPE pathogens.

Graduate Student Mentees

January 2020- Present Alexa Gannon, Ph.D student

MS Student Mentees

August 2019- Present Breanna Eidson, MS student

Thesis/ Dissertation Committee participation

2019 – present Michael Sacco, PhD candidate – Chen Lab (Dr. Yu Chen), Dept. Molecular Medicine, University of South Florida

2019 Brittney Gimza, PhD candidate – Shaw Lab (Dr. Lindsey Shaw), CMMB, University of South Florida (Chair)

2020 Robert Brzozowski, PhD candidate – Eswara Lab (Dr. Prahathees Eswara), CMMB, University of South Florida (Chair)

External thesis review participation

2019 Ibrahim Balghith Awadh, PhD candidate. The iThree institute University of Technology Sydney. “Identification and characterisation of genes involved in *Pseudomonas aeruginosa* L-form biogenesis”

Service

Professional Service

Ad Hoc journal reviews

2018 – present Journal of medical microbiology, PLOS Pathogens, mBio, ISMEJ, Scientific Reports, Royal Society Open Science, Pathogens and Disease, JOVE

Professional organization membership

2014- present American Society of Microbiology, member

2018- present American Society of Microbiology South Eastern Branch, member

2020- present American Society of Microbiology Florida Branch, member

Professional organization committee service

2019- February 2020 American Society of Microbiology South Eastern Branch, Policy Committee Member

March 2020 - present American Society of Microbiology South Eastern Branch, Executive Secretary

June 2020 Moderator of scientific session at ASM Microbe 2020 – abstract selection committee for “Biofilms at the cutting edge”

Department Service

2019- present Departmental representative for the department of molecular medicine at MCOM faculty meeting

2019 – present Graduate student recruitment – MCOM Department of Molecular Medicine

March 2020 Recruitment committee for Research associate position (24324), Dr Xingmin Sun's laboratory, USF.