OMB No. 0925-0001 and 0925-0002 (Rev. 09/17 Approved Through 03/31/2020)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Dyson, Anna

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING

| INSTITUTION AND LOCATION | DEGREE(if applicable) | Completion DateMM/YYYY | FIELD OF STUDY |
| --- | --- | --- | --- |
| Université Laval, Quebec, Canada | Baccalaureat | 05/1990 | Architecture/Philosophy |
| Università di Siena, Siena Italy  | Diploma | 01/1990 | Architectural History |
| Yale University, New Haven, CT | MArch | 05/1996 | Architecture |

# Personal Statement

In January 1st, 2018, I was appointed the Hines Professor of Architecture, with a joint appointment in Forestry and Environmental Studies. My research concerns the design and development of novel environmental systems that couple design criteria for systems that process energy, water, and materials in buildings with the health of human beings and their extended ecosystems. My research is focused on the generation of new methods for measuring and visualizing the relationships between built environment systems and the health of humans and other life forms within the ecosystem. I am establishing and directing the **Center for Ecosystems in Architecture** (**CEA**) a unique educational and research consortium dedicated to addressing the global need for sustainable, healthy, energy-efficient built environments. CEA supports Masters and PhD level students as well as professional researchers towards the invention and development of building systems that metabolize energy, water and materials while supporting biodiverse ecosystems. CEA will establish a competitive, integrated test site, titled Built Environment Ecosystems Measurement (BEEM) Laboratory that will provide an open and evolving architecture for researchers to test a range of emerging materials and/or technologies. The focus is towards new built environment systems that are *both* cost-effective *and* supporters of health and biodiversity, rather than the status quo technologies that tend to lead to degradation of both the environment and human health and wellbeing. CEA’s mission is to generate and test future system concepts, while connecting our built environment testing frameworks with collaborative research teams from across the Yale Schools of Architecture, Medicine, Engineering, Forestry & Environmental Studies, Nursing and Public Health. Alongside cutting-edge industry partners, CEA researchers have a track record of developing innovative solutions to environmental challenges, in order to advance the field of building science, and to set a precedent for sustainable, environmentally-responsible architectural design on the national and international level.

The following publications highlight my most relevant qualifications for serving as a Co-Investigator on the current project:

1. Mattalucci, B., Walf, A., Philips, K., Draper, J., **Dyson, A.H.**, (2017). An Experimental Framework based on Interactive Thermal Modules and Real-time Biometric Data Processing for the Personalization of the Built Environment. *International Journal of Architectural Computing (IJAC): Special ACADIA Edited Issue.*
2. Krietemeyer, B., Andow, B. C., & **Dyson, A. H.** (2015). A Computational Design Framework Supporting Human Interaction with Environmentally-Responsive Building Envelopes. *IJAC, 13(1),* 1-24. doi: 10.1260/1478-0771.13.1.
3. Andow, B. C., Krietemeyer, B., Stark, P. R. H., & **Dyson, A. H.** (2013). Performance criteria for dynamic window systems using nanostructured behaviors for energy harvesting and environmental comfort. In J. P. Lynch, C.-B. Yun, & K.-W. Wang (Eds.), Proc. SPIE 8692 Smart Structures/NDE (pp. 86923V-1 - 86923V-11). Bellingham, WA: Proceedings of SPIE.
4. Keena, N., Raugei, M., Aly Etman, M., Ruan, D., & **Dyson, A.** (2018). Clark's Crow: A design plugin to support emergy analysis decision making towards sustainable urban ecologies. *Ecological Modelling, 367*, 42-57.

# Positions and Honors

**Positions and Employment**

1998-2004 Assistant Professor, School of Architecture, Rensselaer Polytechnic Institute (RPI), Troy, NY

2004-10 Associate Professor, School of Architecture, RPI

2011-2017 Professor, School of Architecture, RPI

2007-2017 Founding Director, Center for Architecture Science and Ecology (CASE), New York, NY

2018- Hines Professor of Architecture, Yale University, New Haven CT

 Professor of Forestry & Environmental Studies, Yale University, New Haven CT

# Honors:

**Architecture and Engineering Awards for Academic Program Innovation:**

2015 Innovator Award from Architectural Record, 2nd Annual Women in Architecture Awards

#### 2012 United States Green Building Council (USGBC) Award of Excellence for Pedagogy – Architectural Sciences/Built Ecologies Graduate Program, CASE (Founder & Director)

#### 2012 Association for Computer Aided Design in Architecture (ACADIA), Award for Innovative Academic Program: Built Ecologies Graduate Program (Program Founder & Director)

**Selected Design Awards for Architectural Systems Innovations and Installations:**

2009 International Holcim Award for Sustainable Construction: CASE, 1st Prize, North America

2009 Architect R+D Award, Active Phytoremediation System: Biomechanical Hybrid

2009 – 2011 Buckminster Fuller Challenge Finalist

 2010 American Institute of Architects (AIA): Enclosures, Integrate: Innovate, 1st Prize

 2010 AIA: Enclosures, Integrate: Innovate, Honorable Mention for Climate Camouflage

 2010 The Chicago Athenaeum: Museum of Architecture and Design: Good Green Design Program Award, Center for Architecture Science and Ecology

 2010 The Chicago Athenaeum: Design Award, Active Modular Phytoremediation System

 2010 Urban Green Expo Dynamic Next Generation Façade Systems: Heliotrace and HeliOptix

2011 SPARK International Design Award - Active Modular Phytoremediation System(AMPS)

 2011 SPARK Award Concept Design - Solar Enclosure for Water Reuse (SEWR)

 2011 Architect R+D Award - Solar Enclosure for Water Reuse (SEWR)

 2012 Smart Geometry: Material Intensities – Bioresponsive Building Envelopes

 2012 Smart Geometry: Material Intensities – *Form Follows Flow*

2015 Building Health Care Innovation and Design: Hospital Build and Infrastructure - Best

Sustainable Hospital Project, SKMC (with SOM)

2016 PS 62 - Award of Excellence: Architectural Engineering Integration, American Society of Civil Engineers; Architectural Engineering Institute (AEI) (with SOM)

2016 Smart Geometry (SG): Hybrid Domains – Atmospheric Delight

2017 The Kathleen Grimm School for Leadership and Sustainability, Staten Island, NY (PS 62) –

World Changing Ideas Award, Fast Company, Finalist. (with Skidmore, Owings and Merrill

(SOM) LLP)

# Other Experiences and Professional Memberships

**Selected Relevant Architectural Projects:**

* Co-Founder of Center for Architecture Science and Ecology (CASE) with Skidmore Owings and Merrill LLP
* 6 technology companies founded by CASE PhD grads from CASE Intellectual Property.
* Directed multiple building-integrated demonstrations with A&E Partners.
* Project Architect on multiple novel buildings systems designs including: Fashion Institute of Technology (FIT) Student Union Building, New York, NY (SHoP Architects); Sheikh Khalifa Medical City (SKMC) Hospital Complex, Abu Dhabi (SOM); Public Service Answering Center, PSAC II (SOM), Bronx, NY; PS 62, Staten Island, NY – The First Zero Energy School in the North Eastern United States (SOM).
* Directed Energy Analyses for multiple building projects, including: Master Plan of Cornell Tech, NY, NY Campus, (SOM); Botswana Technology Innovation Hub, (SHoP Architects); SKMC, (SOM).

**C. Contributions to Science**

My area of research interest involves the development of new methods for measuring and developing intelligent environmental controls within buildings and building infrastructure, using novel materials, devices and integrated systems across a number of factors. With an extended team of academic and industry collaborators, I am currently leading the development of an Ecosystem-of-systems approach to real time data acquisition and visualization that couples environmental data and models to human biometrics data acquisition, across a far greater range of variable and indicators than has been previously possible within the built environment. In my new position at Yale, I will lead the installation of the Built Environment and Ecosystems Measurements (BEEM) Lab, which will host the execution of this area of research.

# Novel Systems for the Delivery of Building Environmental Controls

With leading Architecture and Engineering (A&E) Partners, I have developed novel methods to leverage the Built Environment Process (BEP) to demonstrate and test novel systems for the simultaneous delivery of clean air, energy, water and materials to built environments, coupled with extensive consideration of human factors for health and wellbeing. In particular, the research takes an ecosystemic approach in order to uncover the interrelationships between environmental controls for energy, water, air and material lifecycle systems, towards the discovery of novel approaches.

1. Letchford, C.W., Lander, D.C., Case, P., **Dyson**, **A.H.**, Amitay, M., (2016). Bio-mimicry inspired tall buildings: The response of cactus-like buildings to wind action at Reynolds Number of 104, *Journal of Wind Engineering and Industrial Aerodynamics*, Volume 150, March 2016, 22-30.
2. Thomas, A. V. & Andow, B. C., Suresh, S., Eksik, O., Yin, J., **Dyson, A. H.**, & Koratkar, N. (2015). Controlled Crumpling of Graphene Oxide Films for Tunable Optical Transmittance. Advanced Materials, 27(21), 3256-3265. doi: 10.1002/adma.20140582.
3. Menicovich, D., Lander, D., Vollen, J.O., Amitay, M., Letchford, C., & **Dyson, A.H.** (2014). Improving Aerodynamic Performance of Tall Buildings Using Fluid-based Aerodynamic Modification. Journal of Wind Engineering & Industrial Aerodynamics,133: 263-273**.**
4. Krietemeyer, E. A., Smith, S. I., **Dyson, A.H.** (2011). Dynamic window daylighting systems: Electropolymeric technology for solar responsive building envelopes. In Y. Bar-Cohen & F. Carpi (Eds.), Proc. SPIE 7976 Electroactive Polymer Actuators and Devices (EAPAD) (pp. 79763A-1 - 79763A-15). Bellingham, WA: Proceedings of SPIE.
5. **Development of Immersive Environments for Coupling Experimental Measurements with Data Visualization and Analysis of Complex Environments**

With this area, I am collaborating with an extended interdisciplinary team to develop a comprehensive visual analytics environment that can interactively display a much broader range of environmental and human factors simultaneously. It was initially developed towards a platform for decision-making in the design and maintenance of built environment systems through the use of interactive, queriable data visualization interfaces that are layered with semantic annotations. However, with BMGF funding, the team and area of inquiry has substantially expanded our scope to incorporate and service human health analytics in multiple ways. (see video under bullet point #2 below) Semantic data involves adding descriptions, semantic overlays and metadata, providing an interactive path back to the provenance and ‘fitness’ of the original data towards the characterization of certain data qualities such as completeness, sensitivity, consistency, accuracy and bias. Development of visual analytics environments (dashboards) for the acquisition and display of heterogeneous data types and analyses across multiple scientific categories (environmental, socio-demographic, biometric, etc) and scales, from metadata to microdata.

1. **Dyson, A. H.** (2002).Recombinant Assemblies. Versioning: Evolutionary Techniques in Architecture. Architectural Design,Sharples, Holden, Pasquarelli, Ed. Wiley-Academy, Vol.72 No.5.
2. **Dyson, A.,** Keena, N., Aly Etman, M., McCusker, J. et al. (2017). The Data Journey (DJ) Environment for Healthy Birth Growth and Development. Retrieved from <https://vimeo.com/245830941>
3. Keena, N., Aly Etman, M., Diniz, N., Rempel, A., & **Dyson, A.** (2016). Towards a visualization framework to evaluate the emergy of built ecologies. *Proceedings from Emergy Synthesis 9: Theory and Applications of the Emergy Methodology* (pp. 127-142). Gainesville, FL: Center for Environmental Policy, University of Florida.
4. Keena, N., & **Dyson, A.** (2017). Qualifying the quantitative in the construction of built ecologies. In D. Benjamin (Ed.), *Embodied energy and design* (pp. 196-205). New York: Columbia University GSAPP Lars Müller.
5. **Ecological Systems Thinking to Facilitate Design and Decision Making for Built Environment Systems and Infrastructure**

This area involves modeling of energy, material and information flows associated with the built environment process. Our approach couples the human health and ecosystem health in developing analytical criteria for the design of our built and urban ecologies.

1. Keena, N., Raugei, M., & **Dyson, A.** (2018). The benefit of integrating emergy synthesis and LCA towards more comprehensive analysis of advanced building systems.*In Proceedings of the 10th biennial emergy conference*. Gainesville, FL: Center for Environmental Policy, University of Florida. (In press).
2. Aly Etman, M., Keena, N., & **Dyson, A.** (2017). A New Parametric Framework: Developing Design Options in Real Time. *Edinburgh: 33rd International Conference on Passive and Low Energy Architecture. Design to Thrive.*
3. Keena, N., Aly Etman, M., Rempel, A., & **Dyson, A.** (2016). Designing built ecologies: Investigating the potential of emergy analysis to inform the decision making process within architectural systems design. In P. L. Roche, & M. Schiler (Ed.), *Proceedings from 32nd International Conference on Passive and Low Energy Architecture. Cities, Buildings, People: Towards Regenerative Environments* (pp. 1775-1782). Los Angeles, CA: PLEA.
4. Aly Etman, M., Keena, N., Diniz, N., Rempel, A., & **Dyson, A.** (2016). New parametric framework motivating environmentally conscious design. In P. L. Roche, & M. Schiler (Ed.), *Proceedings from 32nd International Conference on Passive and Low Energy Architecture. Cities, Buildings, People: Towards Regenerative Environments* (pp. 640-645). Los Angeles, CA: PLEA.

# D. Research Support

# Ongoing Research Support

**Bill and Melinda Gates Foundation Grant (OPP1131555) Dyson (PI) 02/2016-12/2018**

***Healthy Birth, Growth and Development Knowledge Integration: Semantic and Data Analytics***

The goal of this project is to design and develop the concept and framework for a novel web based interactive visual analytics environment for HBGDki data called the Data Journey (DJ) that allows interdisciplinary teams of scientists, data scientists, and domain experts to visualize and compare existing datasets as well as upload new datasets for knowledge integration and discovery.

**Role: PI**

New York State Energy Research and Development Authority (NYSERDA)  **Dyson (PI) 2012-2018**

***Electroactive Dynamic Daylighting System***

**Role: PI**

**Completed Research Support**

NYSERDA / Center for Architecture Dyson (PI) 2011-2016

Science and Ecology (CASE)

Role: PI

United States Department of Energy (DOE) Dyson (PI) 2011-2015

Intelligent Facades for High Performance Green Buildings (09EE0002285).

Role: PI

National Science Foundation (NSF) Dyson/ Letchford (PIs) 2012-15

Reducing Vibration and Wind Loads in Tall Buildings Using Fluidic-based Aerodynamic Modification

Role: Co-PI

NYC-DDC Dyson (PI) 2014-2017

Fresh Air Building Systems (FABS) Installation and testing in the Public Safety Answering Center II (PSAC II), Bronx NY.

Role: PI

New York State Energy Research and Development Authority (NYSERDA) Dyson (PI) 2014-2017

Electroactive Dynamic Daylighting System.

Role: PI

NEXUS-NY Dyson (PI) 2015

Building Integrated Intelligent Desiccation System.

Role: PI

San Francisco Foundation Dyson (PI) 2015-2016

Building and Energy Systems Research

Role: PI

NEXUS-NY Clean Energy Seed Accelerator Dyson (PI) 2016

Building-Integrated Thermoelectric System.

Role: PI

New York State Division of Science, Technology and Innovation (NYSTAR) Dyson (PI) 2006-17

Cost share through Center for Future Energy Systems (CFES) - Integrated Building Systems.

Role: PI

Bill and Melinda Gates Foundation (BMGF) Dyson (PI) 2016-2017

Data Journey: Interactive Visualization and Data Analytics for Healthy Birth, Growth and Development Knowledge Integration.

Role: PI

New York City Department of Design and Construction (NYC-DDC) Dyson/ Draper (PIs) 2016-2017

Amplified Modular Phytoremediation System (AMPS) Demonstration within the Center for Biotechnology and Interdisciplinary Studies (CBIS)

Role: Co-PI