National Science Foundation
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SUSTAINABLE SMART CITIES RESEARCH CENTER
Knowledge that will change your world

NSF INTERNATIONAL RESEARCH EXPERIENCE FOR STUDENTS (IRES)

Summer 2015, 2016 and 2017

SUSTAINABLE GREEN BUILDING DESIGN AND CONSTRUCTION

PROGRAM BACKGROUND

- Many of the world's most pressing science and engineering challenges are trans-national in nature and many of the leading scientific and engineering resources are located outside the United States. In order to remain at the forefront of science, technology, engineering, and mathematics (STEM), the United States **needs to nurture a globally-engaged STEM workforce capable of performing research in an international environment**

- Through this NSF-IRES program, our institution was awarded a 3-year-grant to develop an international research experience focused on the theme of **Sustainable Green Building Design and Construction**. This theme was selected for several reasons:
  - There is a growing emphasis on energy efficiency and the protection of natural resources in the building industry;
  - In many developing countries, such as Egypt, there is an acute need for affordable yet resource-efficient housing;
  - Our university and the international partners have collaborated on research in this area in the past and have jointly held two International Workshops directly related to this theme.

- The **main international host** for each of the three summers (2015,2016 and 2017) has been the **Housing and Building National Research Center in Cairo (HBRC).** HBRC is an independent government research center performing a leading role in enhancing the performance of the building , housing and urban development sector in both the local and regional context.

- **Other international Hosts:**
  - **Summer 2015:** The host in The Netherlands was composed of several environmental related companies.
  - **Summer 2016:** During the students stay in the UK the host was our partner institution Staffordshire University
  - **Summer 2017:** In Germany, OTH Institute-Weiden was the main host together with Europoles

SUMMER 2015 – *THE NETHERLANDS AND EGYPT*

Eight undergraduate and graduate students participated in this first IRES program. This program spanned four weeks, with the first two weeks spent in the Netherlands and the following two weeks in Egypt, providing the students with an unique learning opportunity.

Spending the first two weeks of the program in the Netherlands, a country that has some of the most sustainable and smart cities in the world, provided the students with a much broader view of what sustainability and sustainable construction means in a mature environment. The two weeks spent in Egypt under the supervision of HBRC, exposed the students to sustainability efforts in a developing country, where goals and priorities can be very different.

Students in the program were involved in collaborative research projects with direct mentoring by faculty from the U.S. and Egypt, as well as experts on sustainability from the Netherlands. The following research projects were undertaken by the students:

- **Green Wall Applications: Toshka, Egypt**
- **Building Envelope Systems around the World**
- **Strength Performance of Recycled Aggregate Concrete with Class C Fly Ash**
- **Green Building Codes in Egypt**

SUMMER 2016 – *EGYPT AND THE UNITED KINGDOM*

During the 2016 offering, **eight undergraduate and graduate students** participated. This second program included two weeks in Egypt and two weeks in the United Kingdom. This time the students had research mentors in both Egypt and the UK and were able to work on their projects with direct mentoring from both countries. During the students stay in the **UK they were hosted by our partner institution Staffordshire University.**

The program in Egypt was similar to the 2015 program, combining education experiences with opportunities to work with mentors on their research projects. During the two weeks in the UK, the students attended lectures and had open discussions with research faculty on a variety of topics related to the program theme. The students also toured research labs and sites where the host institution tests innovative technologies and building systems.

During the second program offering in 2016, the students worked in teams of two on the following research projects:

- **Sustainable Affordable Housing Design**
- **Assessment of the Green Building Code Design and Construction Provisions**
- **Renewable Energy Sources and Applications**
- **Green Construction Practices and Technologies**

SUMMER 2017 – *EGYPT AND GERMANY*

Eight undergraduate and graduate students participated during the 2017 offering. This third offering included two weeks in Egypt and two weeks in Germany.

The program in Egypt combined education experiences with opportunities to work with mentors on their research projects. After two weeks in Egypt, the students traveled to Germany where they were hosted **by our partner institution OTH institute in Weiden together with Europoles**. During the two weeks in Germany the students attended several lectures from experts in sustainability, visited different sites, attended practical experiences at the laboratories and had the opportunity to visit diverse towns in the south of Germany (Nuremberg, Neumarkt, Regensburg among others).

During the last offering in 2017, the students worked in teams of two on the following research projects:

- **Development of Green Utility Poles for Electric Distribution**
- **Innovative Energy Solutions for Residential Buildings**
- **Green Building Materials**
- **Advances in Renewable Energy Technologies**

PROGRAM OBJECTIVES

1) Provide the students with **a hands-on international education experience** in the emerging area of sustainable green building design and construction;
2) Engage the students in **meaningful research** under the guidance of U.S. and international mentors;
3) Allow students to **create a network of international contacts** in order to promote future collaborations;
4) **Expose U.S. students to foreign cultures**, improve their communication skills, boost their confidence, and provide them with the tools necessary to adapt to and succeed in a global environment;
5) **Promote diversity** by engaging students from underrepresented groups to pursue careers in science, technology, and engineering.

DISSEMINATION OF RESULTS

We have disseminated program results through a variety of media, including:

- Conference publications
- Conference presentations
- Our School of Engineering website
- Our program website
- A final presentation event hosted by the Department of Civil, Construction and Environmental Engineering where all the students had the opportunity to talk about their experience as well as to present their research findings
- A promotional video

CONCLUSIONS

Overall, the international research experience for students has been a success for UAB as well as for our overseas partners. The students have **gained valuable research experience in the area sustainable green building design and construction at the same time that they have acquired a global perspective, by being exposed to engineering innovations and practices in different countries and cultures, and created a network of international contacts** in order to promote future collaborations.