

SEA<sup>2</sup>M<sup>3</sup>

THE CENTER FOR SUSTAINABLE ENGINEERING, ART &  
ARCHITECTURE - MATERIALS, MANUFACTURING AND  
MINIMALISM

iridescent



**41 Cooper Square, New York, NY 10003-7102    Tel: +1 212 353 4332**

## **Engineers as Teachers: Cooper Union – Fall 2010**

### *Introduction*

*Iridescent* (<http://iridescentlearning.org>) is the brainchild of Ms. Tara Chklovski. Started in 2006 in Los Angeles, the mission of *Iridescent* is to bring STEM (Science, Technology, Engineering and Mathematics) to children and their parents in underserved sections of our society. Inclusion of the parents as an integral component of the audience for ‘Family Science Courses’ ensures that the family becomes engaged in the learning and enlightenment processes so providing the nascent scientist/engineer with the support of his or her parent(s).

However, engaging a *family* in a conceptual topic – about which they may know nothing – presents a significant and unique challenge. The obvious hurdles presented to children in underserved communities in inner-city schools may be compounded by their limited ability with the English language and their limited background education – both potentially astride poverty, unemployment and poor housing.

*Iridescent* believes that direct engagement of the parents during the introduction of their children to STEM will ensure that continuing interest on the part of the child is nurtured by the parents in a home environment – the linkage preferably continued as a family activity. Support within the school environment continues through a partnership that *Iridescent* forms with the school in which the ‘Engineers as Teachers’ students become mentors and teachers for those interested in STEM.

This combination provides a unique and powerful framework within which to engage interested children and provide continual support for them and their families as they progress through the K-12 education sequence and leave for college. For the initial rollout in New York City, the grades targeted are 3-6, the span increasing by two each year until grades K-12 are covered – at which point the high school students themselves become the ‘Engineers as Teachers’ for kindergarten and first grade and so on.

*How did The Cooper Union get Involved?*

We are extremely fortunate that a Cooper Union alumnus at USC (Dr. Bhaskar Krishnamachari) suggested to Ms. Chklovski that she visit The Cooper Union last summer with a view to possible collaboration in Iridescent's expansion into New York City. Ms. Chklovski had no difficulty in persuading us that The Cooper Union should be involved – part of our mission is that we include the local community in our activities. It is an honor for us to be invited to join this wonderful initiative.

Soon thereafter Ms. Erika Allison contacted The Cooper Union about piloting a Family Science Course program at the Young Women's Leadership School in Harlem. Ms. Jessica Friscia and Ms. Madeline Foster stepped up to the plate and presented a sequence of three classes in March this year with the underlying theme of Sustainable Shelter.

*Fall 2010*

Prior to the pilot in Harlem, The Cooper Union agreed to run the 'Engineers as Teachers' class for the first time in the fall 2010 semester as an Independent Study course. A number of scenarios were anticipated within which undergraduate students from NYU-Poly and Columbia joined the official New York City rollout this fall: for a variety of reasons, Cooper Union is first to the post.

As you may imagine, this has many ramifications. First and foremost, it places a significant responsibility upon us to 'get it right' since we are accountable for the 'official' rollout of the *Iridescent* program in New York City. To ensure that the program becomes well grounded, self-sustaining and sought-after by the targeted schools, Ms. Jennifer Hsu and Ms. Erika Allison have been employed full-time to liaise with, and recruit at the interested schools; to attract as many families as possible into the program; and to generally facilitate everything you as the teacher intend to do. Secondly, being the only game in town means that we are extremely fortunate in having singular access to Iridescent's New York team and Ms. Chklovski when she comes to visit.

*Credibility*

To help you understand the high regard that Ms. Chklovski has established for this program, note that the Office of Naval Research has awarded Ms. Chklovski \$7,800,000 over a three year period to support this program in Los Angeles, San Francisco and New York. Ms. Chklovski is also about to receive an award of \$1,500,000 from the National Science Foundation for a proposal in which we are fortunate to be one of the co-PIs. Do not rush out and place an order for a Tesla Roadster 2.5! Very little of this funding comes directly to The Cooper Union.

What this does mean to you is that *you* are about to become part of a highly esteemed program – one that we are privileged to be a part of. Being the ‘guinea pigs’ has advantages and disadvantages: the advantages are that the rollout program has a very high profile – you will meet the Mayor of New York, the Secretary of the Navy and other luminaries of the local establishment. More important are the disadvantages – we have a steep learning curve: the course is being run for the first time, we are teaching two sequences of Family Science Courses in ten schools – and we represent *Iridescent*, everything it stands for and its initial perception by New York City.

Do not be daunted by these responsibilities but do realize that by signing up for this course, you are making a commitment to complete the program. You are committing to a class time of at least three hours/week (to be front loaded), to completing a sequence of assignments – and then, working in pairs, to design and present two sequences of four two-hour lectures on mutually agreeable topics at a mutually convenient time for both you and your school.

The first Family Science Course teaching period comprises the four weeks of October; the second commences two weeks prior to the week of Thanksgiving and culminates in the two weeks after Thanksgiving. The course will conclude with final presentations and a celebratory dinner.

### *The Challenge*

How do you present a complex scientific topic to an audience with the composition described in the Introduction? Answer – you are unbelievably familiar, completely understand and are completely at ease with the concepts and material that you are going to teach. This is probably where the bulk of your energies will go – asking yourselves question, after question, after question – to enable you to reach the core of your topic. From there you will work upwards – building the story in a way that enables you to carry your audience into your framing of the in-class experiment they are going to undertake.

Hands-on experience is the heart of *Iridescent*’s teaching philosophy for the Family Science Courses. Each family works on a project with sufficient instruction to enable them to learn by exploring different routes to their solution for the problem presented. The classroom exercises must be extremely carefully designed so that the participants are able to complete them in the allotted time with minimal input from the ‘teachers’. You are there to answer any questions, to encourage those with not quite enough confidence and generally enliven the session.

The duration of your direct instruction is 15 minutes – the experiment lasts 40 minutes to an hour – and the class finishes with a 5 to 10 minute reflection followed by 5 to 10 minutes during which the

participants complete an exit questionnaire. The lesson usually runs for about two hours.

It is not possible to predict the actual class sizes until much closer to the event – we anticipate attendances of between 10 and 50 families – yes, *you* and your partner could have a class with 150 people or more: in California, Family Science Courses have attracted upwards of 250 participants. I am telling you all this because I want you to walk into this class with your eyes wide open. If the thought of 150 people hanging upon your every word is terrifying – you are not alone. One of the outcomes of this class is that we will help you ‘control’ your fear.

However, the principal reason for placing these numbers in front of you is not to frighten you – but to make you really appreciate how well prepared you must be. Your lesson plan must be unambiguous, perspicuous, lean and enlightening. Your directions and guidelines for the experiment must be crystal clear – you must endeavor to anticipate everything that can go wrong and be in a position that, should something unexpected occur, the change is easily accommodated. We are very fortunate in that we will have Ms. Erika Allison and Ms. Jennifer Hsu with us in the classroom – and Ms. Chklovski when she visits us from California.

The final goal may seem an impossible task. However I have no doubt that we will succeed – the determination and tenacity prevalent within The Cooper Union student body coupled with the experience of Erika, Jennifer and Tara guarantees that your preparation will be as rigorous as it can be. The program will require commitment and application from each of you. We expect full participation in the class as your different ideas are circulated and critiqued. From this interaction, you will learn how to present complex ideas with approaches that are accessible by all – you will learn how to translate the jargon of textbooks and engineers into clear and concise language, instruction and direction – so enabling those who attend your classes the opportunity for true comprehension of fundamental scientific and engineering principles. Through this process you will learn how to approach generic conceptual material and problems – how to break down the seemingly impossible into the feasible and the workable. The outcome will be of direct benefit to you now and assist you as you move forwards in your career.

However, the satisfaction derived from this intellectual activity will pale into insignificance when you see a room full of people ‘get it’ as they embrace the material and ideas you place in front of them. You will carry the smile on their faces with you for the rest of your life – you will have made a difference. From this activity will emerge future STEM students at The Cooper Union, Princeton, Columbia, NYU-Poly and so on. The families with whom you interact will have been presented with a unique situation within which to engage ‘real’ (nascent) engineers in free and open discussion – you

will have given them the insight to 'see into' a phenomenon or concept and understand it – you will open their eyes to science and engineering and the opportunities therein.

A handwritten signature in black ink that reads "Toby Cumberbatch". The signature is written in a cursive, slightly slanted style.

Toby Cumberbatch

1.02 11/08/10