Industrial Projects offered by Professor Jonathan Black:

**General Notes:** Prof. Black supervises M.Eng. design projects on a team basis, with the intention of providing a group experience that closely replicates industrial design activities. The chartering of any one team depends upon the appropriate group of students, with individual skill sets, being available for that project. The attached project briefs are correct as of 7/10/12 but are subject to change. Several others are under discussion and Prof. Black is open to considering student initiated design problems.

**Schedule:** A full presentation concerning each project will be made during MEng orientation on Monday, August 13. Prof. Black will be available during the following week for individual discussions (Weill 406); enquiries may be made by email: jb2245@cornell.edu.

Prof. Black will be holding extended, open office hours Tuesday August 21, 10:30a – 12:30p in Weill 221. Teams will then be selected and finalized within 24-48 hours. Students interested in any of these projects should email the following information to Prof. Black, as soon as possible:

1. Projects desired, in order of preference.
2. Summary, by course titles, of courses you took during your Junior and Senior years as an undergraduate.
3. Title and date of any academic degrees (or other professional preparation) that you have completed post-High School.
4. Particular personal skills that may be applicable: foreign language reading/ translation abilities, graphics and/or FEA program familiarity, etc.
5. Best way to contact you (as well as email address, and AIM or Skype name).
6. A brief personal statement touching on:
   a. Reasons for electing to enter the M.Eng program at Cornell.
   b. Reasons for selecting the particular design project (primary choice).
   c. Primary initial objective after completing the M.Eng degree.

4). Project Title: *Functional repair of the Temporomandibular Joint (TMJ)*
Sponsor: TMJ Association, Milwaukee, WI
Contact: Terrie Cowley info@tmj.org (Jonathan Black is the project advisor)

**Problem statement:**

Disorders of the temporomandibular joint (jaw joint or TMJ; positioned bilaterally between the maxilla and the mandible) and associated musculature and nerve processes affect 10 million US patients acutely or chronically. Temporomandibular Joint Disorders (TMJDs) are a complex and poorly understood set of conditions characterized by pain in the jaw joint and surrounding tissues and limitation in jaw movements. Injury and other conditions that routinely affect other joints in the body, such as arthritis, also can affect the temporomandibular joint. One or both joints may be involved and, depending on the severity, can affect a person's ability to speak, eat, chew, swallow, make facial expressions, and even breathe. Also included under the heading of TMJD are conditions involving the jaw muscles. These may accompany the jaw joint problems or occur independently and are often confused with jaw joint disability because they produce similar signs and symptoms. TMJD is frequently accompanied by a confusing array of
painful and debilitating conditions (comorbidities) in other parts of the body.

Research and treatment to date have focused on pharmacological alleviation of pain and mechanical restoration of joint structure. An initial design study identified biological restoration or replacement of the TMJ disc as a promising approach to definitive treatment.

**Project field:** Problem and application analysis, device design, in vitro testing, biomechanics/biomaterials (orthopaedic), animal studies (surgery, neurophysiology)

**Team requirements:** This is a team project for 4-5 people with various engineering and (possibly) biological backgrounds. It is essential that one or more members either have FEA experience or will be taking a course in analysis in the Fall ’12 Semester.

**Project elements:** The project will be conducted as a classical 1st phase design project:

- Background and literature research – Tissue engineering of load bearing soft tissues.
- Define problem
- Analyze key performance aspects and specify target parametric values (and criticality)
- Develop alternative design approaches
- Screen for feasibility and select two or more designs to elaborate, leading to a final design

In Fall, 2012, the team will address one of the selected design approaches through a traditional Design History development and documentation program. There will be periodic intermediate design reviews. A final design will be presented in a formal public review in late Fall ‘12. There will be opportunities to meet with experts, surgeons and patient representatives, referred by the sponsor. Several of the team members will continue in Spring ’13, working with Prof. Lawrence Bonassar’s Tissue Engineering group, to reduce the selected design to practice.

Mentors: Prof. Jonathan Black (jb2245@cornell.edu, Skype: jonathanblack39), Terrie Cowley (sponsor representative) and Robert Karpman, MD.

* Adapted from: Sponsor’s web site: [http://www.tmj.org/site/content/tmjdbasics](http://www.tmj.org/site/content/tmjdbasics)