Proposed Research:

The goal of the project is to design, prototype, test, and refine whale-inspired blades for application in wind turbines using both experimental and computational fluid dynamics methods. I will be working alongside fellow HMC researcher Alex Krause, a Concordia University graduate student, and under faculty adviser Professor Ng of the Concordia University's Mechanical and Industrial Engineering Department.

Alex and I have already begun preliminary research on traditional blade design. Per the recommendation of our HMC Liaison, Professor Lori Bassman, Professor Baumgartner of HMC has already been contacted about work completed on traditional blade design at HMC. In the upcoming weeks before the beginning of the project, I will continue to gain understanding of fluid dynamics over blade surfaces and Horizontal Axes Wind Turbines (HAWT) design.

The project will begin with one week of practice using SolidWorks and CFDesign software packages to model traditional blades. CFDesign uses numerical methods to model airflow over surfaces that can be imported from SolidWorks. During this first week, both Alex and I will also become acquainted with the test setup and operation of Professor Ng's wind tunnel.

After this point, two weeks will be spent on blade designing. With both of us now on the project, we will take a two day trip to Tadoussac, a small village in Quebec that is famous for being one of the great whale-feeding grounds of the world. This trip will provide us with a first hand, up-close view of humpback whale fins. We will be able to obtain pictures and complete sketches that could prove tremendously helpful to our blade design. While Alex will focus on using SolidWorks to make 3D designs of whale-inspired blades, I will be responsible for using the software CFDesign to compare airflow across new 3d designs with those of traditional blades.

An additional two weeks will be allotted for the building of small wood prototypes, one by each student. These prototypes will be individually tested using the wind tunnel during this time period. Angular speed of the turbine will be measured using an optical probe or a high speed digital camera (1000fps), both of which Professor Ng has available in his laboratory. This angular speed data will provide preliminary feedback on the performance of these prototypes.

During the following three weeks, more rigorous testing will be completed; Alex will be setting up the blades on the turbines, while I will set up the electrical system for the turbines to be placed in series. I will also focus on improving the electromechanical configuration to maximize the power output of the system.

The final weeks of the project will be spent investigating the topology topics: height of turbine, tilt of turbine, and rotation of turbine away from perpendicular to the flow. Each topological effect will be investigated independently and then in combination. Any noted improvement in power output will then be implemented to the developed system by both Alex and me.

Proposed Budget:

Item	**Cost**	**Total**
Student Stipend	$400 per week	$4000
Round trip to Montreal	$700	$700
Local Travel	$70 per month	$210
Two day whale viewing trip to Tadoussac(transportation, lodging and entrance fee costs)	$400 per student	$800
Housing(minus food) (10 weeks)	$600 per month	$1500
Discretionary Funds	$200	$200
Total		**$7410**