# Tamil Cultural and Academic Society of Durham
# Science Fair 2012

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## Project Classification

### The Six Available Divisions

When registering, students must select one of the below mentioned 6 divisions of science, in order to participate in the fair: Earth & Environmental Science, Biotechnology, Life Sciences, Computing & Mathematical Science, Engineering, and Physical Sciences. Sometimes classification of a project is difficult because it crosses divisions. Students are encouraged to choose a new category and try different techniques.

### Age Groups

All participants are divided among the 4 different age groups. Elementary (Grade 3-6), Junior ( Grade 7& 8), Intermediate (9 & 10),and Senior ( Grade 11 & 12).

### Type

Projects are classified and characterized by the nature of work under these 3 different types: Experiment, Innovation and Study .All three types are equivalent, but differ somewhat in the way they are conducted and evaluated.

The following defintions may help you to understand the different types:

**Experiment**
Involves the testing of a specific hypothesis with the control of significant variables. Judging emphasis is on the experimental design and analysis of the data.

**Innovation**
Involves the development and evaluation of new devices, models, techniques or approaches, usually in technology, engineering or computers. Judging emphasis is on the design process, application of scientific and engineering principles and application or human benefit.

**Study**
Involves the collection and analysis of data from sources other than the student's own work to reveal evidence of a fact, situation, or pattern. Judging emphasis is on insightful analysis.

# An Introduction to the available categories

**Biotechnology**

Biotechnology is the application of knowledge of biological systems to solve a problem, create a product, or provide a service. Biotechnology projects will fall into one of the following three subject fields: Crop development, Animal science, or Microbial:

- **Crop Development** underscores that the interest is not in just plants, but in plants which are involved in an agricultural, horticultural or silvicultural (forestry) production. Projects in this area may investigate problems of herbicide tolerance, spacing, cultivation, irrigation, effect of soil variation, hybridization, etc.

- **Animal Science** projects would pertain to animals involved in agriculture and aquaculture, those domesticated as pets, or for sport, as well as projects where humans are participating in wild animals' lives, perhaps through habitat revitalization, population management, or harvesting. All projects involving animals demand careful planning so that any experimentation is not deleterious to the health, comfort, or physical integrity of animals. Study-type projects should be considered by pupils with an interest in Animal Science. Possible topics include enhancement of animal production, reproductive technologies, genetics and transgenics, animal health, housing, training and interactions.

- **Microbial** projects consider how microbials are affecting productivity in agriculture, horticulture and forestry. Possible topics include plant growth-promoting rhizobacteria, biological weed and fungus control, bio-fuel cells, etc.

**Engineering and Computing Science**

Projects which focus on the acquisition of knowledge about how something lives should be categorized as Life Science, not Biotechnology. The distinction is similar to that between Physical Science projects and Engineering projects. In both cases, projects in the latter division dealing with an application of knowledge to solve a problem. Often the discriminating factor is in the student's conceptualization of the project. There will be situations where the choice is not clear.

This division includes experiments, studies, or innovations primarily concerned with the application of scientific principles to the design of technology and innovative use of computational hardware and software. It includes, but is not limited to, projects that focus on one or more of the following:

- chemical engineering
- electrical engineering
- industrial engineering
- mechanical engineering

- metallurgical engineering
- computer hardware design
- efficient implementation of computational algorithms

The more mathematical aspects of computational science might, in some cases, be more appropriate for Physical and Mathematical Science.

**Computing (further Clarification)**

Each year students, teachers, and mentors have considerable difficulty placing projects that involve a computer in an appropriate division. Where, for example, should a project be placed in which the student has developed a piece of software that simulates the behaviour of forest fires? On one hand, the development of a software application is clearly eligible for the computer division, but the parameters and underlying algorithms require a significant knowledge of environmental science. If this project was judged by a computer software engineer, he/she would likely focus on the design and efficiency of the code, the user interface, and the application of computing technology to a real-world problem. Meanwhile, an environmental scientist might judge the project according to the accuracy and applicability of the simulation, the inclusion and control over appropriate parameters, and the student's knowledge of forest fire dynamics.

An argument can clearly be made for the value of each judge's assessment in the overall evaluation of the project. If the student prefers to be evaluated primarily on his/her engineering with the computer - the algorithm or hardware/software design - then he/she should enter the Engineering and Computing division. If his/her preference is for the project to be evaluated as an innovation in a particular field of science, it should be entered in that division.

When considering entering the Engineering and Computing division, participants should be encouraged to consider which aspect of their project they believe best showcases their knowledge and skill - their software/hardware design, or their work in biotechnology, environmental, health, life, or physical and mathematical science?

Further, while the development of interactive multimedia, relational databases, Internet web sites, analog/digital interfaces, control technology (robotics), etc. were once the domain of sci-tech fairs' finest, they are now standard fare in most Grade 7-12 curricula across the country. With this in mind, potential entrants to the Engineering and Computing division should also consider: Is the project's software/hardware design innovative, well-documented, and significantly advanced beyond the expectations or work of most others at a similar age/grade? If the student believes that the strength of his/her project is in software/hardware design and that the work is innovative and beyond the normal expectations of his/her peers, then the project may be entered confidently into the Engineering and Computing division. Otherwise, the student may be more successful entering one of the other divisions. In many cases where the Engineering and Computing division at first seems appropriate, a closer examination of the strength and focus of the student and the project will suggest another division. However, the final decision regarding division placement rests with the student exhibitor

**Earth and Environmental Science:** Projects in this division can include the pursuit of knowledge in any of the following disciplines:

- geology
- mineralogy
- physiography
- oceanography
- limnology
- climatology
- seismology
- geography
- ecology

Environmental science involves the study of pollution (air, water, and land) its sources and its control. It also can involve studies of biotic and/or abiotic factors in an environment where such studies enhance our understanding of biological relationships and abiotic cycles. Studies dealing with resource management or sustainable development would fall into this category. Examples of such studies might include capture/recapture studies for estimation of population densities, determination of bioproductivity in a specific ecosystem or niche, studies of plate tectonics and examination of mineral cycles (e.g., salt mills in the oceans).

**Health Sciences**

This division is intended to include any project dealing with human science or pertaining to humans.

Projects focused on the application of scientific knowledge to other species should submitted to the Life Science division.

Projects focused on the application of knowledge of biological systems to solve a problem, create a product, or provide a service are placed in the Biotechnology division.

**Life Science**

This division includes experiments, studies, or innovations primarily concerned with how living things function. Please see the exclusions at the end, directing some projects to either the **Health** or **Biotechnology** divisions. It includes, but is not limited to, projects that focus on one or more of the following:

- animal or plant biology
- animal or plant physiology
- mycology (fungi)
- microbiology
- cell biology
- molecular and developmental genetics
- evolutionary biology
- behavioural sciences- psychology, sociology

Projects focused on the application of scientific knowledge to the health of humans should submitted to the Health Science division.

Projects focused on the application of knowledge of biological systems to solve a problem, create a product, or provide a service are placed in the Biotechnology division, provided they do not concern the health of humans, in which case they should be submitted to the Health Science division

**Physical and Mathematical Sciences**

Physical Science projects would include experiments, studies, or innovations primarily concerned with the properties of matter and energy, and the principles of their interactions. It includes, but is not limited to, projects that focus on one or more of the following:

- inorganic and organic chemistry
- analytical and physical chemistry
- space science
- astronomy
- general physics
- condensed matter physics
- subatomic/particle physics

Mathematical Science projects would involve the abstract study of mathematical theories and structures and the theorems that can be proven to hold in these systems. It can also involve the use of mathematical models to simulate physical and biological systems.

Most areas of science require a careful use of statistics, and the study of the validity of the application of particular statistical techniques to particular areas of science would be a valid project in this category.

The more hardware aspects of computational science will normally be more appropriate for Engineering and Computing Science.