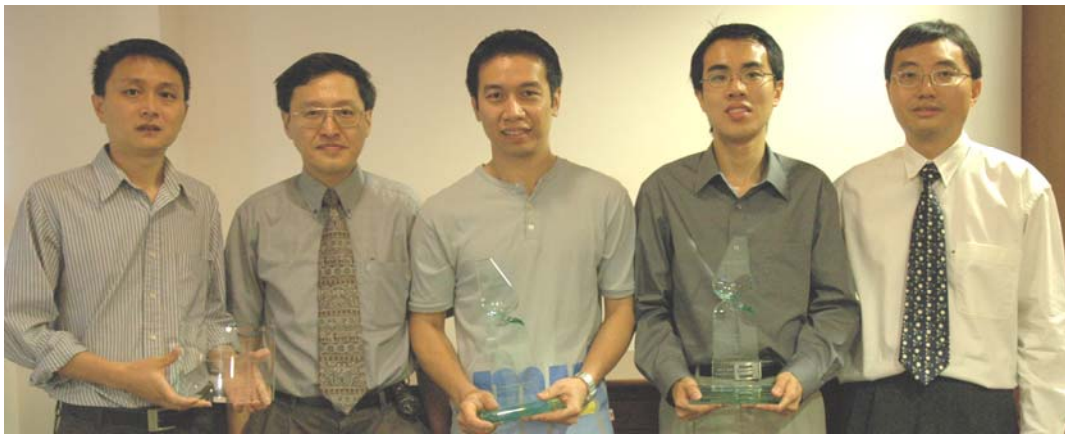


TSS SINGAPORE ENGINEERING DESIGN CHALLENGE 2005—First Prize

As an enhanced procedure to address male factor infertility over in-vitro fertilization (IVF), Intracytoplasmic Sperm Injection (ICSI) is a relatively new technique which has exciting applications in human reproduction. IVF counts on the probability factor to have eggs fertilized in petri dishes with 0.5 to 5 million motile sperms. With ICSI, this tremendous sperm requirement reduces from millions to one viable sperm injected directly into an egg utilizing an extremely delicate micromanipulation technique. This makes it the most viable technique to-date for treating infertility problems arising from low sperm count, low sperm motility (a measure of how well they move) and inadequate morphology (an assessment of shape and structure).



Prize Winners and Supervisors – From left, Dr. Huang Sunan, Prof. Lee Tong Heng, Mr Terrence Chian (2nd Price Winner), Mr Jerry Tai (1st Price Winner) and Assoc Prof. Tan Kok Kiong.

Student **Jerry Tai Fook Lim** (working alongside Assoc Prof Tan Kok Kiong, Dr. Huang Sunan, Prof. Lee Tong Heng and Prof Ng Soon Chye) developed a systematic and efficient method to assist the operator to execute the ICSI process efficiently and to achieve a high oocyte survival rate. The basis of this technique is to use a piezo actuator to advance the injection pipette mechanically, rather than manually. The piezo actuator is controlled to execute rapid and precise motion in the submicron or micron ranges. MATLAB and SIMULINK are used for rapid prototyping of the highly precise piezo control system. This control offers the operator highly repeatable motion at both very high speed and ultra-fine resolution. A novel vibration pattern generated at the needle tip allows very effective oocyte penetration with a high survival rate, without having to use mercury to increase the needle inertia, unlike a leading approach. Clinical tests carried out on mice oocytes have shown successful and subsequent development to the blastocyst stage. Other applications have also been demonstrated including nuclear reprogramming from somatic cells, enucleation and assisted hatching of blastocysts via zona thinning.

The competition attracted 62 entries, out of which 10 were selected for the final round held on 17 June 2005 at Sheraton Towers. The panel of six judges came from IES, IEE, and DSO National Laboratories. Jerry's entry won the first prize as well as the innovation prize. The awards included cash of \$3500 in total, trophy and memberships for both IES and IEE.