



Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)

Project Title

A quantum biological approach to tumor treatment

Project Summary

(Minimum 500 and maximum 2000 characters)

PDT is the frontline treatment used to treat skin cancer. Although PDT works well for early-stage tumors, its utility in advanced tumors is hampered severely by hypoxia: there is no oxygen to undergo Dexter Energy Transfer (DET) with the pigment. Furthermore, the pigment itself has difficulty crossing the intact blood-brain barrier to reach the tumor cells, limiting its efficacy for brain cancer treatment. Here, we use a quantum mechanical approach to allow intracellular aromatic species (IAS) to enter the triplet manifold and subsequently undergo DET and/or electron transfer. Our quantum mechanical approach thus circumvents the oxygen and pigment requirements of PDT, enabling its use to treat advanced skin tumors. We aim for proof-of-concept demonstration, first showing the efficacy of our approach in solution through fluorescence lifetime experiments and then measuring skin cancer cell viability through microscopy and tissue culture assays.

Ph.D. Supervisors*
(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)

Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1*	Aarat Kalra	Centre for Biomedical Engineering	aaratkalra@iitd.ac.in
Supervisor 2	Parul Mehrotra	Kusuma School of Biological Sciences	pmehrotra@iitd.ac.in

*Supervisor 1 must be from IIT, Delhi.
+All cells in this table are mandatory fields that need to be filled by faculty for consideration of proposal.
§The date of superannuation of supervisors should be at least three years from the date of registration of selected candidates.

Project requirements (Student qualifications, experience required, etc)
*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)

- Student should have experience in cell biological assays
- Student should have a GPA >8.0 (or 80% marks)
- Student background should be one of: MSc, MPharma, MS(R) or MTech in a field related to life sciences or physical chemistry

Source of fellowship/funding and project number
(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Institute fellowship.

Role of Faculty Members involved:	
Supervisor-1	Prof. Aarat Kalra will supervise the physical chemistry aspects of the project. The student will perform simulations, calculations and experiments using the expertise that Prof. Kalra has, in the first half of the project.
Supervisor-2	Prof. Parul Mehrotra will supervise the cell biological aspects of the project. The student will perform assays, microscopy and experiments on individual cells in culture using the expertise that Prof. Mehrotra has, in the second half of the project.

Note :-

- 1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Full-time Institute Assistantship (Category-wise) (FIA)" for selecting the students in SRe.**
- 2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SRe student.**
- 3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.**
- 4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.**
- 5. A candidate applying with a valid JRF/INSPIRE/any national level fellowship should have at least two-year validity from the date of joining the Ph.D. program.**
- 6. The third supervisor’s name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.**
- 7. If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.**