Master of Research (MRes) in Biomedical Sciences and Translational Medicine

The MRes in Biomedical Sciences and Translational Medicine provides students with high level research training within the five research departments contributing to the programme. The programme is divided into 13 strands and students choose a strand that matches their research interests; this then becomes the over-arching area of their research projects. The strands in the MRes in Biomedical Sciences & Translational Medicine are listed below (strand descriptions are at the end of this document):

- Biology of Cancer
- Biomedical Imaging
- Biostatistics (with Health Informatics)
- Cancer Medicine
- Cellular and Molecular Physiology
- Drug Safety
- Medical Sciences
- Molecular and Clinical Gastroenterology
- Molecular and Clinical Pharmacology
- Nanomedicine
- Neuroscience
- Stem Cells, Tissues and Disease
- Women’s, Children’s and Perinatal Health

1. Structure of the MRes in Biomedical Sciences & Translational Medicine

The twelve month, full-time programme is structured to allow for 3 hours lectures per week whilst the rest of the time is spent in the lab or carrying out other research project related work.

MRes in Biomedical Sciences & Translational Medicine students undertake 3 research projects that comprise 10 weeks of lab work followed by 2 weeks in which to write a report. Students also present either a poster or talk at the end of every research project. During the project, all students are encouraged to suggest experiments, design experimental protocols, as well as being taught subject specific techniques and advanced knowledge in transferable skills.

The research projects will include at least three different research techniques to enhance experimental training skills that need to be clearly stated at the end of each project. The lectures relate to state-of-the-art research techniques, application of knowledge in scientific and clinical areas, and the development of personal and professional transferable skills. Important and innovative parts of the transferable skills students take part in include workshops on “IP and Commercialization (our own version of Dragon’s Den)” and “Writing a Grant Application”, journal clubs and taking part in debates for public understanding of science.

Further information, including the current student handbook can be found on our webpage: https://www.liverpool.ac.uk/media/livacuk/welcome/Your,Registration.pdf or you may also contact itmmres@liv.ac.uk.
2. Fees for the MRes in Biomedical Sciences & Translational Medicine:

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<th>Tuition Fee 2021/22</th>
<th>Research Support Fee</th>
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<tr>
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For students considering continuing on to a PhD, we are usually able to offer full and part funded competitive PhD studentships for those who successfully complete the MRes in Biomedical Sciences & Translational Medicine. All MRes students will be contacted about these studentships by the end of April 2022.

Postgraduate Progression Award

If you are a current University of Liverpool undergraduate or alumni, including Study Abroad and Exchange students, progressing to either full or part-time postgraduate taught study in 2020 you are eligible* to receive our Postgraduate Progression Award.

If you are a UK student with a 2:1 or above you will receive a £1,000 reduction in tuition fees.

If you are an international student with a first class undergraduate degree, you will receive a £2,500 reduction in tuition fees.

If you are an international student with a 2:1, you will receive a 10% reduction in tuition fees.

3. The University of Liverpool and Faculty of Health & Life Sciences

The University of Liverpool is one of the UK’s top 24 research-led universities. A member of the Russell Group of major research-intensive universities, the University of Liverpool has an enviable international reputation for innovative research. We are proud to be one of the UK’s most inclusive universities, welcoming students from a wide variety of backgrounds and from over 100 countries of the world.

We would like to invite applications for our Master of Research in Biomedical Sciences & Translational Medicine, which is currently run through the Faculty of Health & Life Sciences. Work takes place in the laboratory and in the clinic, forming a continuous cycle of scientific discovery and clinical research that is yielding remarkable advances in healthcare provision.

4. Making an application

Applications are available from here: [http://www.liv.ac.uk/study/postgraduate/applying/index.htm](http://www.liv.ac.uk/study/postgraduate/applying/index.htm).

The University will request references directly from your referees (those named on your online application form) please ensure they are aware references need to be on letter headed paper, signed and dated. Please contact the ITM Postgraduate Student Team if you need further information regarding the application process (Section 5 below).

If you are a current University of Liverpool Student you can apply through your Liverpool Life account.
5. Key information

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<tr>
<td>MRes Programme Director</td>
<td>Dr Alec Simpson <a href="mailto:awms@liverpool.ac.uk">awms@liverpool.ac.uk</a></td>
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<tr>
<td>Deputy Programme Director</td>
<td>Dr Jeff Barclay <a href="mailto:barclayj@liverpool.ac.uk">barclayj@liverpool.ac.uk</a></td>
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<tr>
<td>Admissions Office</td>
<td>ITM Postgraduate Student Team <a href="mailto:hlsmres@liverpool.ac.uk">hlsmres@liverpool.ac.uk</a></td>
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*International applicants are advised to apply early so they have time for ATAS and visa processing.
† Home applicants may be considered after this date at the discretion of the MRes Programme Director.
6. Student profiles

Jennifer Mak (MRes graduate)

I chose to study the MRes course to gain more experience in a research environment, as I thoroughly enjoyed my undergraduate research projects. Speaking to previous students I knew I would be able to gain research experience to prepare me for PhD study. I really enjoyed conducting the research projects and how much time I was able to spend in the laboratory. The course provided me with the foundation to be able to carry out research at a PhD level and boosted my confidence in the laboratory.

I was accepted onto the neuroscience strand and accomplished research using the popular model organism, *C. elegans*, to manipulate their genes using a new genetic technique called CRISPR. I was really impressed by the level of support offered on the course by the supervisors, postdocs and current PhD students who were very approachable if help was needed. Alongside the research projects, I enjoyed the lecture course, as it informs you on the current techniques used in biomedical research; and the IP commercialisation workshop as you get to interact with other students.

Having obtained my undergraduate degree in pharmacology from the University of Liverpool I was aware of the internationally recognised research conducted at the university and the excellent research facilities they offer. The atmosphere and working environment within the laboratory and university was open and friendly, allowing me to settle in very quickly. The ITM Postgraduate Society is also a great opportunity to network and meet current students within the institute.

After my self-funded MRes I got accepted onto a fully-funded PhD studentship at the Max Planck Institute for the Biology of Ageing in Cologne, Germany. I believe the MRes course provided me with the necessary skills and experience to be accepted for this PhD and to become successful during this further study.

This year has been a great experience for me, having met interesting people passionate in science throughout the year - you won’t regret it!

Dayani Rajamanoharan (MRes graduate)

I completed the MRes course as a self-funding student and successfully applied for a funded PhD in the Department of Cellular and Molecular Physiology at the University of Liverpool. During the MRes I enjoyed working on my research projects and how much time I was able to spend in the laboratory. The MRes year prepared me well for my PhD, providing me with experience and confidence in the lab before starting.

I decided to do my Masters at the University of Liverpool, because it’s a research based University and from speaking to students already on a research programme I got to know that the University has great research facilities and a lot of collaborations to provide the best for every research project. I was also influenced because it is a Russell Group University and this was important to me. I really enjoy the atmosphere and work environment here and have found that everyone is open, friendly and welcoming. Additionally the Postgraduate Student Society is great and provides excellent opportunities for networking and making new friends.

In my opinion Liverpool is a great city for students. There are many shops and bars in the town with really good offers and student deals. There is always something on in Liverpool and you never get bored. I really enjoy Liverpool and the fact that the campus is so near to the city centre.

In terms of my future; the first time a PhD career really crossed my mind was when I was in my final year of my Bachelor course and really enjoyed the research project. I felt like all the theory we studied could finally be applied. That’s why I applied for the MRes course and then started a PhD. Upon finishing my PhD I would like to first follow an academic path by conducting postdoctoral research but eventually I see myself working in industry.

Finally, I would like to mention that I am really impressed about the help and support you get in every lab from the current PhD students as well as postdocs in the lab. You never feel lost or alone.
Adewunmi Adesanmi (MRes graduate)

I decided to study the MRes degree as I have always had a passion for research, and I spoke to quite a lot of people who had done a research masters and I was inspired by them.

My area of research is focused on the pharmacological aspect of tropical medicine. Tropical medicine is the branch of medicine that deals with health problems that occur uniquely, are more prevalent, or prove more complex to control. Examples of tropical diseases are malaria, tuberculosis, HIV, diarrhoea and they pose a major health problem causing a high mortality rate. Incorporating pharmacology helps us to improve and design more drugs to completely eradicate or reduce the mortality rate caused by this infection. Since I have a back ground in pharmacology I was interested in this aspect as it enables researchers to design experiments which can then be used therapeutically for the treatment of major tropical diseases.

The parts of the MRes course that I really enjoy are the debates as well as the research projects. I like interacting with the other students and discussing scientific topics. I am looking forward to the Frontier modules lectures and the IP commercialisation workshop. When I finish the MRes course I plan to continue studying and the MRes is helping me to develop my research, writing and analytical skills.

I chose to study at the University of Liverpool because I wanted to study in a University that is recognised worldwide for its integrity and also known to have a lot of international students from a range of countries. I have met different people from different cultures and it has been wonderful, very friendly and open to other people’s cultures. Liverpool and the international student community feel like home away from home. The University of Liverpool is just the place to be!

Elizabeth Brook (MRes graduate)

I chose to intercalate for several reasons - it’s something I had considered since fairly early on at medical school as a valuable opportunity to undertake an additional degree whilst still enjoying the perks of being a full-time student. Although not impossible to study for a Masters once working as a doctor, this is likely to be more difficult particularly when trying to balance clinical work with other lab commitments. Intercalating between 4th and 5th year also is not only a welcome break post-finals but provides the chance to do something completely new and separate from medicine - there’s going to be many many more years to do that!

The MRes in Biomedical Sciences and Translational Medicine is a structured 1-year course designed to provide foundation skills in research. Divided into a series of ‘strands’, a major focus of the course is completion of three research projects. I chose the Medical Sciences strand as this allowed me to work in separate labs in different research areas. I think in this way I gained significant experience in a wide variety of biomedical fields and developed numerous new lab skills. I chose this approach rather than directing my projects towards any particular medical specialty. On the other hand, if you are keen for O&G or Paediatrics for example, you might prefer to choose a strand more tailored towards this. There are benefits to both approaches but it is likely you will encounter many similar techniques whichever lab you’re assigned to – with cell culture, PCR and immunohistochemistry amongst some of the most common.

I very much enjoyed the MRes course here in Liverpool and I think it has set me up well for my time after medical school. I’m currently considering a career in Haematology, arguably a fairly academic specialty with a significant component of laboratory work. With the experience and confidence I developed during this past year I don’t feel overly daunted by this and at least feel I have a better idea about what I’d be letting myself in for! Labs aren’t for everyone but this MRes provides an opportunity to test out for yourself how you’d find working in this environment and whether research is for you.

More student profiles are available to view from our Findamasters.com adverts:
http://www.findamasters.com/masters-degrees/course/biomedical-sciences-and-translational-medicine-mres/?i326d4990c25470
7. Strand descriptions

Biology of Cancer
The Biology of Cancer strand offers students the possibility of undertaking research alongside internationally recognised scientists who are working to understand cancer and find new ways to detect and treat the disease.

Both fundamental and translational research is offered. Fundamental research includes activities such as dissecting the roles of specific oncogenes and tumour suppressor genes, and their signalling pathways. Translational research is more patient oriented, and includes activities such as examining patient samples for the presence of biological entities (DNA, RNA or protein biomarkers) that will enable early detection of cancer or allow predictions of which patients are likely to respond to particular treatments.

Students in this strand are allocated research projects that maximise their skills in the key research techniques of molecular biology, protein biochemistry, microscopy, and the statistical analysis of patient data sets.

Examples of research projects include fundamental and translational research of pancreatic cancer (supervisors: Costello, Greenhalf, Palmer, Ghaneh, Halloran), head and neck cancers (supervisors: Boyd, Jones, Shaw, Rubbi), blood cancers, such as leukaemias and lymphomas (supervisors: Pettitt, Slupsky, Kalakonda) and tumours affecting the eyes (supervisor: Coupland).

Biomedical Imaging
The Biomedical Imaging strand offers students an opportunity to work with world-renowned researchers who are using biomedical imaging and sophisticated image analysis techniques to answer basic physiological and biological questions for addressing clinical problems.

Expertise is available in Magnetic Resonance Imaging (MRI) and Multi-Spectral Optoacoustic Tomography (MSOT), which is a novel imaging method utilizing pulsed-laser light and ultrasound to generate imaging data. Other imaging technologies in the Centre include Optical imaging, Ultrasound, PET, SPECT and microCT. Investigators are also developing sophisticated segmentation and registration methods for analysis of imaging data to solve major clinical and research questions. Ongoing research projects include MRI for applications in neuro-imaging, brain cancer, kidney function and liver regeneration; MSOT imaging for assessing kidney and liver function; tissue pH and electrical conductivity measurement of tissues using MRI.

Students will have an opportunity to develop skills in data acquisition, analysis and interpretation of biomedical imaging, a rapidly progressing field in the modern world of clinical research. Specific skills set may include a combination of the following: (1) developing animal models of diseases (2) image processing and analysis (3) statistical analysis of imaging data (4) basic MATLAB programming and hands on experience in image processing software like AMIRA, FSL, ImageJ and (5) critical interpretation of imaging data.

Participating faculties include investigators from the Centre for Pre-Clinical Imaging (CPI); Department of Molecular Physiology and Cell Signalling; Department of Molecular and Clinical Cancer Medicine, Department of Pharmacology, Neurology; Centre for Mathematical Imaging and Techniques (CMIT); The Walton Trust (Neurosurgery and Radiology) and the Alder Hey Children’s hospital (Radiology).
Biostatistics (with Health Informatics)
Expertise available includes the development and application of methods for evaluating biomarkers, survival data, multivariate and multilevel data personalised dosing algorithms, design and analysis of randomised controlled trials. Students will develop (1) their understanding of statistical methodology, (2) their skills in applying these techniques to real data, and (3) experience in critically interpreting the clinical and biological findings. Examples of biostatistics-based project topics are: randomised controlled trials, systematic reviews and meta-analysis, multivariate modelling, pharmacogenetics, pharmacokinetics, pharmacodynamics, personalised dosing algorithms, analysis of laboratory-based data, quality of life, statistical shape and image analysis, survival modelling, health informatics and applied health research.

Cancer Medicine
The Cancer Medicine strand provides a unique opportunity to undertake research alongside internationally recognised basic and clinical scientists who are focussed on understanding processes leading to cancer development, and utilising existing and novel approaches for optimal cancer therapy.

Both fundamental and translational research is offered. Fundamental research includes activities such as dissecting the role of stroma in cancer progression, and investigating DNA damage repair mechanisms following ionising radiation. These utilise key research skills in molecular biology and cellular biology techniques. Translational research includes identification and development of novel biomarkers for early detection and treatment of cancer. Students in this strand are allocated to research projects that match strategic research areas, such as basic mechanisms underpinning cancers of the pancreas, lung, eye and head and neck.

Examples of research projects include fundamental and applied research of the role of stromal cells, such as macrophages, in pancreatic cancer progression (supervisors: Schmid, Mielgo); prognostic biomarkers in uveal melanoma (supervisor: Coupland); targeting the DNA damage response to enhance the impact of radiotherapy in 2D/3D models of head and neck cancers (supervisor: Parsons).

Cellular and Molecular Physiology
The Cellular and Molecular Physiology strand covers a wide range of different research areas, from fundamental studies of cell biology to translational work on mechanisms of disease. Despite this diversity, the various research areas share a common aim in trying to understand complex physiological phenomena at the cellular and molecular level. Students in this strand are therefore allocated research projects that maximise their skills in key techniques to address this, such as molecular biology, protein biochemistry, calcium imaging, genetics and microscopy.

Examples of general research project areas include calcium signalling (supervisors: Criddle, Haynes, Simpson and Tepikin), cell signalling and ubiquitination (supervisors: Clague, Coulson, Prior, Urbe), protein interactions (supervisor: Sanderson, Hammond), cancer microenvironment (supervisors: M Morgan,) neuronal function/dysfunction (supervisors: Barclay, A Morgan, Sanchez-Soriano, Stagi, Swan) and oxygen sensing (Rocha and See).
Drug Safety
Drug Safety is an exciting branch of experimental science that combines Pharmacology and Toxicology which informs how to design safer drugs through knowledge of mechanisms of adverse drug reactions.

The Department of Pharmacology and Therapeutics has longstanding expertise in chemical, molecular, cellular and clinical aspects of research in adverse drug reactions, with particular expertise in biomarkers. We undertake a significant amount of research in collaboration with the pharmaceutical industry.

Examples of research projects include:
- Development of novel preclinical test systems to identify toxicological potential in new drug candidates;
- Development of novel clinical genotyping screens to identify susceptible individuals and inform their therapeutic management;
- Informing the drug design process at an early stage to avoid incorporation of potentially toxic chemical motifs.

Medical Sciences
The Medical Sciences strand may involve up to three separate projects in different areas of medically relevant research, and so may appeal to students who do not wish to specialise in one single research area.

The projects can be drawn from any of the wide range of research areas covered by staff within the Institute of Systems, Molecular and Integrative Biology. Information on research project areas within ISMIB can be found in the descriptions of the various other MRes strands contained in this document and from the Institute website.

As with the other strands, projects will be allocated by the strand convenor (the member of staff who organises the strand) after consultation with students about their research interests. This strand is primarily designed for intercalating medical or dental students, but is also available to non-clinical students.

Molecular and Clinical Gastroenterology
The gastroenterology research group provides excellent opportunities for laboratory and clinical research focusing on the pathogenesis of diseases of the gastrointestinal tract in humans and animals (www.liv.ac.uk/gastroenterology). ‘The high quality of our research is widely recognised and we have funding from sources including MRC, BBSRC, Wellcome Trust, NIHR, CRUK and the EU”. Our focus is on “translational” research that will take advances in basic medical research out of the laboratory and into the hospital or veterinary clinic ‘from the bench to bedside’ in order to improve the health and welfare of people and animals worldwide.

Examples of research projects include: Inflammatory Bowel Disease (IBD) – role of bacterial factors, the development and assessment of novel therapies (Campbell, Yu); gastrointestinal cancers (Pritchard, Yu, Probert); organoid models of human gastrointestinal disease (Duckworth); gastrointestinal metabolomics (Probert).
We employ the whole range of cutting-edge experimental techniques from mechanistic studies involving cell-lines and gastrointestinal tissues through to patient studies and clinical trials.

Laboratory research is based mainly in the main campus in the Henry Wellcome Laboratory of Molecular & Cellular Gastroenterology. Clinical research and trials are conducted at the NIHR Biomedical Research Centre in Microbial Diseases at the Royal Liverpool University Hospital, and at the Leahurst Veterinary Field Station within the Philip Leverhulme Equine Hospital and Small Animal Teaching Hospital.

Molecular and Clinical Pharmacology
Students are provided with the opportunity for acquisition of research skills and knowledge across modern pharmacological issues. This encompasses fundamental mechanistic studies, clinical analyses and mathematical modelling to understand the mechanisms that underpin pharmacokinetics and pharmacodynamics for therapy of infectious diseases, cancer, immunological and CNS disorders. Students will have a choice of research projects that will provide training in methodologies to address key questions in these areas and opportunity to test a number of hypotheses.

Examples of techniques that may be acquired include: molecular biology, cell biology, immunology, mass spectrometry, genetic analysis, in silico approaches and/or cloning/transfection. Projects take place in research labs with strong international reputations in general areas such as hypersensitivity, drug safety and personalised medicine.

Nanomedicine
This strand offers a wide range of research projects in the areas of nanomedicine synthesis, pharmacology and safety. Nanomedicines, and nano-delivery systems, are increasingly being used to address novel infectious diseases via vaccine delivery and oncological applications. Research projects will cover a variety of ambitions, from development of novel methodological tools for evaluation of nanomaterials, to implementation of pharmacological techniques to aid accelerated translation of bespoke materials towards clinical applications.

Expertise available predominantly relates to drug delivery applications and includes methods for developing nanoparticles as drug delivery vehicles, which spans solid drug nanoparticles, lipid-based materials, or polymer nanoparticles. Expertise for in vitro and in silico characterisation of nanoparticle interactions with biological systems as they relate to the efficacy and safety of nanomaterials is a local strength, which is complemented by in vivo models to confirm nanoparticle pharmacokinetics and distribution. Successful applicants will join an interdisciplinary team of researchers with expertise in pharmacology, material chemistry, pharmacokinetic modelling, and nanomaterial biological compatibility (particularly immune and haematological interactions).

Students will develop (1) their understanding of the benefits and risks of nanomedicine development, (2) their skills in generating and assessing these benefits and risks, and (3) experience in critically interpreting their research findings.

Examples of nanomedicine-based projects include: a) synthesis of nanotechnology-enabled medicines for the treatment of diseases; b) pharmacological evaluation of route-dependent nanoparticle pharmacokinetics; or c) early evaluation of nanomaterial safety (e.g. interactions of drug nanoparticles with the immune system).
Neuroscience
The Neuroscience strand covers a wide spectrum of research interests, encompassing studies of the basic cellular and molecular properties of neurons and neuronal signalling, analysis of the neurobiological basis of health and disease, exploration of the structure and function of the human nervous system, and investigation of the characteristics and underlying mechanisms of neurological and neuropsychiatric disorders in clinically-orientated research projects.

Projects are based in laboratories across campus in multiple academic departments in the Institute of Translational Medicine and other research institutes. They can also be conducted in collaboration with brain imaging scientists at the LiMRIC facility and with clinical neuroscience researchers at the Walton Centre NHS Foundation Trust in North Liverpool. Major areas of active research include epilepsy, demyelinating disorders, neuro-behavioural disorders, neurodegeneration and MRI-based brain imaging.

Techniques utilised within this strand are highly varied and project-specific but are typically drawn from the broad disciplines of structural and molecular biology, protein biochemistry, pharmacology, electrophysiology, microscopy, genomics and epigenetics, structural and functional MRI neuroimaging, neuropsychological assessment, and clinical disease phenotyping.

Stem Cells, Tissues and Disease
This strand is focussed on stem cell research and also the cellular and molecular mechanisms that underlie a variety of human diseases. The research programmes span from single cell-based studies investigating the molecular mechanisms of pathogenesis, to whole organism-based preclinical studies investigating the therapeutic potential of stem cells in disease.

Depending on their allocated research project, students in the Stem Cells, Tissues and Disease strand will receive training in various key techniques, such as stem cell and induced pluripotent cell tissue culture, embryo dissection, animal handling, immunostaining, ELISA, flow cytometry, histology and biomarker analysis, microscopy (including immunofluorescence and confocal), cloning and quantitative PCR.

Examples of research project areas include embryonic stem cell and induced pluripotent cell biology (supervisors: Goldring, Murray), mesothelial, endometrial and neural stem cell biology (supervisors: Hapangama, Wilm, Plagge), calcium signalling in disease (supervisors: Criddle, Simpson, Tepikin), reporter gene constructs and vectors for stem cell labelling and tracking / in vivo imaging (supervisor: Plagge), Cardiovascular disease (Dart, Helassa, Simpson and Wilm) and cell migration (Zech).

Women’s, Children’s and Perinatal Health
This strand covers a wide range of different research areas, from laboratory based cell biology work to clinical trials. Despite this diversity, the various research areas share a common aim in trying to understand health and the disease related to women’s, children’s and neonatal health.

Students in this strand are therefore allocated research projects that maximise their skills in key techniques to address this, such as research synthesis (meta-analysis) clinical trial management, drug development, a wide variety of advanced laboratory techniques including histopathology and immuno-histo/cyto chemistry, primary cell culture and culturing cell lines, molecular biology including PCR, Western blotting, qFISH, and microscopy.
Student projects take place in the Department with strong international reputations in the areas related to Obstetrics & Gynaecology and Neonatology. Examples of research project areas include: clinical trials in women and in the newborn in areas of pre-term labour, third stage of labour, global maternal health, RCTs in to the long term follow up of post natal growth restriction, neonatal drug development (supervisors; Weeks, Alfirevic, Weindling, Cooke & Turner), maternal obesity and misopristol (supervisor; Weeks), Bioinformatics of endometrial disease (Supervisors: Hapangama, Vasieva), endometrial stem cells and endometrial biology (supervisor: Hapangama), telomere biology in endometriosis & endometrial cancer (supervisor: Hapangama).
Faculty of Health & Life Sciences

Master of Research (MRes) in Biomedical Sciences and Translational Medicine
MRes in Biomedical Sciences & Translational Medicine

STRAND CHOICES FORM

| Student Name: |  |
| Student ID No: |  |

Please indicate your top 3 strand choices in the boxes below:

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<td>Medical Sciences</td>
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Please support your strand choices with a brief summary of research areas that interest you.