M.Sc. LABORATORY ANIMAL SCIENCE
Executive Master Program

A two year, part-time study program
On behalf of the Medical Faculty of RWTH Aachen University, it gives me great pleasure to invite you to Aachen, Germany, for the RWTH Aachen Master Program, “Master of Science in Laboratory Animal Science”.

Animal welfare and laboratory animal science are strongly connected. The European Parliament’s directive 2010/63/EU on the protection of animals used for scientific purposes states within the introduction that “the Community acknowledges the importance of the protection and welfare of animals used for scientific purposes at international level”.

With the incorporation of the EU directive into national law, in all member states, a new era is dawning. The implementation of the directive has immediate consequences for researchers and specialized personnel, as well as members of the regulatory authorities, with regards to their training and educational needs. The level of training and the associated educational standards directly influence the well-being of the animals used for scientific procedures, as well as the quality of the data generated. Therefore, the aim of this M.Sc. program is to provide excellent educational training, based on the latest research developments, for a wide range of scientific personnel.

A significant advantage of this structured training program is the possibility to study a wide range of species, from rodents to non-human primates. This is a unique opportunity to study such a variety of animals, methods and technologies in one course and will help to broaden participants’ perspectives, as well as their scientific knowledge.

In addition to the educational aspects of the program, we invite you to enjoy the sights and sounds of our attractive historical city and its beautiful surroundings in the triangle border region of Germany, the Netherlands and Belgium. Aachen, the city of the former emperor Charles the Great or Charlemagne, with its hot springs, provided him with healing treatments. Following his example, kings and noblemen, as well as numerous other patients, have come to Aachen. Modern-day Aachen remains an important city for the medical profession and the biological sciences due to the excellent medical training facilities provided by the University Hospital and the Medical Faculty of RWTH Aachen University.

The architecturally striking University Hospital has developed into an important European center for research and provides interdisciplinary care for patients. The research interests of the medical faculty require animal experiments, without which scientific progress would not be possible. The Medical Faculty has a stringent animal welfare policy that is also applied to the Master program. The use of animals adheres to the principle that research on animals must be of considerable benefit to people. The sum of the advantages must be greater than that of the discomfort of the research animals. Likewise, we continuously strive, as an integral part of our research and development activities, to reduce, refine and replace the use of animals according to the 3R principles of Russell & Burch, 1959.

We look forward to welcoming participants from all around the world and we hope that the program will be a great success for both participants and organizers.

Sincerely yours,

Prof. Dr. René H. Tolba
INTRODUCTION
M.Sc. Laboratory Animal Science

The RWTH Aachen University is committed to the 3R principles: Reduction, Refinement and Replacement of animal experiments. Animal experiments for biomedical research must be restricted to a minimum and the highest animal welfare standards must be upheld. In order for these principles to be effectively implemented scientists must not only be sensitive and receptive to improvements but also receive outstanding training in this field. Therefore, RWTH Aachen University is pleased to offer a new executive Master program, M.Sc. Laboratory Animal Science, to address these guiding principles.

Refinement is achieved through high quality theoretical and practical education of scientists ensuring that they are better able to design targeted experiments and minimizing adverse effects. Furthermore, by applying a statistical approach and exact experimental planning the number of animals required can be reduced. The course also incorporates modules dedicated to alternatives to animal experiments, as well as ethics, to enable improved decision making and ensure animal experiments are replaced where ever possible.

The implementation of EU directive 2010/63/EU on the protection of animals used for scientific purposes has immediate consequences for scientific personnel, their training needs and the associated job market. The number of personnel qualified to plan, conduct and evaluate experiments on animals has been further restricted and additional training is required for a wide spectrum of professionals active in laboratory animal science.

• Detailed and specialist knowledge of laboratory animal science based on the latest scientific discoveries in order to deal with complex experimental methodology and conduct independent research.
• Ability to independently plan, conduct, evaluate and improve animal experiments, under consideration of the latest ethical criteria and species appropriate animal husbandry. This will positively influence the well-being of the animals in line with EU directives while enabling scientific data to be generated to the highest standards.
• Accredited M.Sc. qualification from a leading university for access to a wide range of careers in Laboratory Animal Science.
• Access to a network of internationally renowned specialists.
• The opportunity to study while continuing to pursue an outside career.
• Unique broad experience with a wide range of species, from rodents to non-human primates.

Currently, laboratory animal science is not a primary focus of human or veterinary medicine. Furthermore, interdisciplinary Bachelor and Master programs in bio-medical disciplines currently lack the required experimental skills, despite the potential for their graduates to access attractive careers in science or industry. Together with the accepted, on-going necessity for animal testing in medical research and development, as well as the more restrictive animal protection guidelines, there is an acute demand from industry, research institutions and the regulatory authorities for highly skilled personnel to lead and manage their laboratory animal research activities in a highly competent manner. Graduates of this M.Sc. program will be well equipped to take on leading roles and will be highly sought after. Furthermore, graduates of the RWTH Aachen, one of Germany’s Universities of Excellence, are highly regarded by employers.

The program is aimed at scientists, doctors and veterinarians, who plan, conduct and evaluate animal experiments and their facilities. The study course is conducted in English and open to national and international applicants who wish to enhance their skills for a successful career in Laboratory Animal Science. By employing a blended learning concept, incorporating e-learning and short attendance blocks, this two year, part-time course enables participants to receive the highest level of academic and practical training whilst continuing to pursue their outside careers.
CURRICULUM

M.Sc. Laboratory Animal Science

The M.Sc. Laboratory Animal Science is a two year, part-time study course for which, on successful completion, 90 ECTS credit points are awarded. The curriculum has been designed to enable international students to study a comprehensive range of topics adjacent to their careers and, therefore, combines e-learning with attendance sessions.

In the first three semesters three compulsory thematic blocks (55 ECTS) are taught:

- Ethics and Legislation in relation to the use of laboratory animals
- Management & Planning of Animal Facilities and Animal Experiments
- Laboratory Animal Science

Throughout each of the first three semesters lectures are held in the form of webinars, outside regular office hours and are accessed by students via the internet. The webinars are complemented by home study in the form of literature reviews and homework. At the end of each of these semesters there is a compulsory 9 - 10 day attendance block in Aachen during which skill training is performed in Aachen University Hospital’s facilities, group discussions are held and case studies are conducted. Furthermore, there are excursions to other leading laboratory animal facilities.

Additionally, during the first three semesters, an elective course (5 ECTS) must be completed. For example:

- In vivo Pharmacology, Applied Toxicology or
- Applied Anesthesia and Microsurgery incl. Medical Technology & Imaging

The fourth semester is dedicated to the completion of a science based Master Thesis (30 ECTS). The thesis can be literature based or based upon experimental data generated. Each student has access to an academic supervisor for the completion of the thesis and the suitability of the chosen topic should be addressed with the supervisor prior to commencement.

EXAMINATIONS

Progress is monitored throughout the course. Grades from examinations, homework, presentations and talks, as well as the master thesis, all contribute to the overall course score. Various examination formats are used throughout the course, e.g. multiple-choice or full written form, and may be held online or during the presence modules. Students will be given ample notice of impending tests. Formal details are available in the course examination rules.
MODULES

**M.Sc. Laboratory Animal Science**

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**WINTER SEMESTER (1ST SEMESTER)**

- Module 1
- Module 3
- Module 5
- Module 6

**SUMMER SEMESTER (2ND SEMESTER)**

- Module 2
- Module 4
- Module 6
- Module 7

**WINTER SEMESTER (3RD SEMESTER)**

- Module 2
- Module 3
- Module 7
- Elective Module* 8 or 9

**SUMMER SEMESTER (4TH SEMESTER)**

- Module 10: MASTER THESIS

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**ETHICS AND LEGISLATION IN RELATION TO THE USE OF LABORATORY ANIMAL**

- Module 1: Ethics & Philosophy; National and International Law
- Module 2: Regulatory Affairs

**MANAGEMENT & PLANNING OF ANIMAL FACILITIES AND ANIMAL EXPERIMENTS**

- Module 3: Biostatistics & Biometrics; Design and Evaluation of Animal Experiments; Architecture; Facility Design; Financial and Hygiene Management
- Module 4: Alternatives to Animal Experiments

**LABORATORY ANIMAL SCIENCE**

- Module 5: Genetics & Breeding; Anatomy & Physiology
- Module 6: Pathology & Diseases; Biochemistry, Hematology and Molecular Biology in Laboratory Animal Science
- Module 7: Animal Models in Biomedical Research; Anesthesia & Experimental Surgery

**ELECTIVES**

- Module 8: Applied Anesthesia and Microsurgery incl. Medical Technology & Imaging
- Module 9: \textit{In vivo} Pharmacology and Applied Toxicology

**MASTER THESIS**

- Module 10: Master Thesis

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Attendance Block: approx. 9 days; generally two weekends with the working week in between

*subject to the number of students, elective courses may also be offered during the first and second semester

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PROGRAM
M.Sc. Laboratory Animal Science

COURSE FORMAT
This part-time course has been designed to maintain the highest educational standards whilst minimizing absence from the regular work place. A blended learning concept, which incorporates e-learning with short attendance blocks, enables participants to receive the highest level of academic and practical training whilst limiting time away from home.

The course starts with a one day opening ceremony in September. On this day applicants officially enroll at RWTH Aachen University, receive an introduction to the e-learning systems, and enjoy a get-together with the course directors and fellow students.

In the first three semesters weekly webinars are held outside regular office hours and supported by an e-media skills lab. At the end of each of the first three semesters a nine day attendance block is held in Aachen. Each attendance block incorporates two weekends and the working week and provides practical and clinical skill training under expert supervision, as well as excursions to leading laboratory animal science facilities. The elective course Applied Anesthesia and Microsurgery requires an additional two days of attendance which are usually scheduled in conjunction with one of the semester attendance blocks in order to minimize travel. The fourth semester will be dedicated to the completion of a scientific master thesis.

Successful graduates are also offered the opportunity to attend a graduation ceremony. It is anticipated that, with 15 - 25 students per course, lively group discussions can be held and a high level of supervision provided.

QUALIFICATION & ACCREDITATION
Successful graduates will be awarded the academic title, Master of Science (M.Sc.) by RWTH Aachen University. 90 ECTS Credit points are attributed to this program. The program has been accredited by ASIIN e.V. and FELASA accreditation has been applied for. The program is recognized by the German Federal Veterinary Chamber and veterinarians licensed in Germany can apply for 483 ATF training points.

LANGUAGE
This course will be conducted in English. Applications from national and international participants are welcome.

ENTRY REQUIREMENTS
This course is aimed at graduates from the biological sciences and related fields with at least one year’s relevant work experience as well as graduates of human or veterinary medicine. As the course will be conducted in English proof of English language ability is also required.

COURSE FEE
The current course fees and applicable discounts can be viewed online: www.MSc-Lab-Animal.com
The course fee includes tuition, relevant course documentation, use of the e-learning platform, excursions, as well as a comprehensive extra-curricular program including evening events, lunch and refreshments. Certificates and legalization (Apostille) of the master degree certificate for application abroad are also included. Additionally, the price covers RWTH Aachen University semester fees and “Semesterticket” (free use of public transport in the North Rhine Westphalia region) for the standard study period of four semesters.

FINANCIAL SUPPORT
A list of potential sponsors and scholarships can be viewed online (www.MSc-Lab-Animal.com).
PROGRAM

*M.Sc. Laboratory Animal Science*

Located where Germany, Belgium and the Netherlands converge, Aachen is the ideal European study location. Well served by the European motorway network (E40, E314, A44/A46 and A4), linked to major European cities by the high-speed rail system and close to five international airports (Maastricht-Aachen, Liege, Cologne-Bonn, Dusseldorf and Brussels), Aachen is easy to access.

Once in Aachen the sights of the historical city center await you. This UNESCO protected world heritage site has evolved into a technology orientated city offering a wide variety of accommodation and entertainment. Study in Aachen can not only be combined with a trip to a major European city but also a visit to a more tranquil setting such as the nearby Eifel National Park.

As one of Germany’s universities of excellence, RWTH Aachen University prides itself on providing educational programs to the highest academic standards while remaining relevant to industry.

With 34 specialized clinics, 25 institutes and five interdisciplinary units the RWTH Aachen University provides a complete spectrum of medical care. The University Hospital provides patient orientated care, teaching and research to internationally recognized standards. With treatment, teaching and research facilities housed in one central building, the University Hospital facilitates intensive interdisciplinary exchange and close clinical and scientific networking.

Clinical and skill training will be held in the Institute for Laboratory Animal Science’s (ILAS) facilities located within the University Hospital. These facilities are DIN ISO 9001:2008 certified, modern, state of the art facilities for biomedical research. The institute includes animal housing rooms, necropsy rooms, laboratories for cell culture, biochemistry and molecular biology (RT-PCR, PCR, Westernblot, ELISA) and fully equipped operation theaters (anesthesia units, monitoring systems, x-ray, heart-lung machines etc.). Additional equipment for various non-invasive and invasive measurements of different parameters are available e.g. Oxygen to See (O2C), Laser-Doppler, Ultrasound, IVIS-System (x-ray, luminescence & fluorescence). Within the Institute two IZKF-funded core facilities are located, the “transgenic services” and the “two-photon microscopy”, providing cutting edge knowledge in their respective fields. The central laboratories, providing services in hematology, clinical chemistry and histopathology/immunohistochemistry, dispose of modern technology and equipment. The staff of the institute comprises animal care takers, technicians, animal welfare officers, administrative personnel, veterinarians and scientists of different specializations within the University Medical Center.

Students will have the opportunity to visit other leading facilities, e.g. House for Experimental Therapy (HET) at the University of Bonn’s University Hospital and the German Primate Center (DPZ) in Gottingen.
LECTURERS

M.Sc. Laboratory Animal Science

Key-Lecturers include:

PD Dr. Margarete Arras joined the Institute of Laboratory Animal Science, University of Zurich (CH) in 1997 as an executive veterinarian. In 2009 she was appointed Head of the Surgical Skills Laboratories and Veterinary Services and in 2012 took on the additional role of Head of the Animal Facilities at the University Hospital Zurich. PD Dr Arras's current research interests focus on laboratory animal welfare, anaesthesiology and pain in laboratory animals. Furthermore, she is the Director of the Swiss ECLAM training program and Supervisor for licensed veterinarians in the European College of Laboratory Animal's Swiss and German training programs. PD Dr. Arras is a member of numerous scientific organisations and since 2011 has served as the Vice President of GV-SOLAS (German Society of Laboratory Animal Science).

PD Dr. Arras will teach the following aspects of the M.Sc. Laboratory Animal Science program:

• Applied Anesthesia and Analgesics Regimens: basics, advanced protocols and tips
• Microsurgery: basic training and advanced skills

Prof. Dr. Dr. Dr. Dominik Gross is the Director of the Institute for History, Theory and Ethics in Medicine at the RWTH Aachen University and Chairman of the Clinical Ethics Committee at Aachen University Hospital. Prof. Gross studied dentistry, history/philosophy/archaeology and medicine, completing each with a doctorate, and in 1998 received postdoctoral qualifications in history, theory and ethics in medicine. In 2005 he was appointed Chair of History, Theory and Ethics in Medicine at RWTH Aachen University. His main teaching and research areas are the professionalization of health care professions, ethical questions in clinical medicine, technology ethics and technology acceptance, as well as animal ethics. In addition to his scientific and teaching activities he is an active political consultant including for the German Federal Ministry of Health, the German Federal Ministry for Education and Research, the Institute for Quality and Efficiency in Health Care (IQWiG) and the German Medical Association.

In the sessions with Prof. Gross the following topics will be addressed:

• Ethics in animal experimentation
• Introduction to ethics with a special focus on ethical theories and technical terms (ethics, bioethics, medical ethics, clinical ethics)
• Animal experimentation and ethics: General remarks
• Moral status of animals and personhood criteria
• Positions concerning animal ethics (strong egalitarianism, weak egalitarianism, hierarchism, speciesism)

Prof. Dr. Stefan Jockenhövel has a cross-faculty bridging professorship between the Institute for Textile Technology (Faculty of Mechanical Engineering) and the AME-Helmholtz Institute for Biomedical Engineering (Faculty of Medicine) at the RWTH Aachen University. This position enables him to build a bridge from the material sciences, utilizing the textile production chain, toward the development and (pre)clinical testing of innovative implants. Based on 11 years of clinical experience in cardiothoracic and vascular surgery, the focus of his research is the development of textile reinforced, tissue engineered implants, for example heart valves, vascular prostheses and vital stent structures. The key focus of Prof. Jockenhövel’s research group is the translation of innovative implants into clinical use. Therefore, the group possesses major expertise in in vitro and in vivo (pre)clinical implant testing.

The sessions with Professor Jockenhövel will cover:

• Fundamental aspects for the development of medical devices
• Principles for the development of vital, tissue engineered implants and their in vitro evaluation
• Planning and conducting preclinical studies on tissue engineered implants in the field of cardiothoracic and vascular surgery
• Regulatory aspects and translation of vital implants (ATMPs) into clinical use
Prof. Dr. Franz-Josef Kaup is a veterinarian and has been based at the German Primate Center (DPZ) in Göttingen for over twenty years. He is the Scientific Director’s Representative and Head of the Pathology Unit. Furthermore, he is responsible for primate husbandry and is the DPZ’s Animal Welfare Officer. Since 2000 he has also been Chair of Laboratory Animal Pathology, a bridging professorship with the University of Veterinary Medicine Hannover. He is also a Diplomate of the European College of Veterinary Pathologists and ECLAM. Prof. Kaup’s main research areas include diseases in non-human primates, in particular infectious diseases. Using various animal models (SIV/HIV, Orthopocks, Helicobacter pylori, Echinococcus multilocularis) pathogenetic investigations into pathogen spread within the organism, affected cell types and associated morphological changes are performed in Old and New-World monkeys.

In the session with Prof. Kaup the following topics will be taught:
- Knowledge of zoonoses and their spread: Human and laboratory animals as reciprocal sources of infection
- Knowledge of dissection techniques for common laboratory animal species
- Pathomorphological methods, including tissue sampling, for further investigations
- Possibilities and limits of pathology in disease diagnosis
- Pathology as part of health monitoring in animals
- Fundamentals of tumor pathology
- Pathology and diseases of non-human primates

Prof. Dr. René H. Tolba is Professor and Director of the Institute for Laboratory Animal Science & Experimental Surgery, Medical Faculty RWTH Aachen University. He is also the current President of the German Society of Laboratory Animal Science (GV-SOLAS). His research focus is visceral organ transplantation and preservation, as well as animal models for various disciplines. He is responsible for training and education according to FELASA recommendations and teaching in M.Sc. in Biomedical Engineering.

Additionally, the Institute has several research projects within the 3R topics and a project funded by the German Ministry for Research and Education (BMBF) for developing educational media for Laboratory Animal Research.

In the session with Prof. Tolba the following topics will be taught:
- Regulatory affairs needed for the registration of medical products
- How to design and evaluate your experiments
- Architecture and Facility Design and the implication for routine mode of the facility
- Applied Anesthesia and Analgesics Regimens: basics, advanced protocols and tips
- Microsurgery: basic training and advanced skills

PD Dr. phil. nat. Julia Steitz is a senior scientist and Director of the Central Laboratories of the Institute for Laboratory Animal Science, Medical Faculty RWTH Aachen University. The Central Laboratories include Hematology, Clinical Chemistry, Microbiology, and Histopathology. She is also a Principal Investigator in several research projects focusing on the development of tumor models for the analysis of novel immunotherapeutic agents. Additionally, her research activities include the analysis of efficacy, safety and toxicity of medical products and tumor therapeutics in vitro and in different in vivo animal models. PD Dr. Steitz is a lecturer in educational programs run according to FELASA recommendations and in the RWTH’s M.Sc. in Biomedical Engineering program.

In the sessions with PD Dr. J. Steitz the following topics will be taught:
- Regulatory Affairs in preclinical studies
- How to design, perform and evaluate experiments (basic training and skills)
- How to use cell culture systems to reduce, refine and replace animal experiments
- Basics of Clinical Chemistry, Hematology and Molecular Biology and their methods
- How to choose the right animal model
- Animal models in Immunology, Oncology and Infectious Diseases
SCIENTIFIC DIRECTOR & PROGRAM PARTNERS

Prof. Dr. med. René Tolba
Scientific Director of the Program M.Sc. Laboratory Animal Science
Director of the Institute for Laboratory Animal Science
University Hospital Aachen
RWTH Aachen University

PD Dr. phil. nat. Julia Steitz
Scientific Co-Director of the Program M.Sc. Laboratory Animal Science
Director of the Laboratory of Clinical Chemistry/Hematology & Microbiology
Institute for Laboratory Animal Science
University Hospital Aachen
RWTH Aachen University

Program Partners

RWTH AACHEN UNIVERSITY
RWTH Aachen University is one of Germany’s Universities of Excellence and one of the most highly recognized technical universities in Europe. With 260 institutes within nine faculties, it is one of Europe’s leading institutions for science and engineering research. With innumerable industrial cooperation partners, the education that students receive at RWTH Aachen University is firmly rooted in real-world applications. As a result, RWTH graduates are highly sought after by business and industry and one in five board members of German corporations is an alumnus of RWTH Aachen University.

INSTITUTE FOR LABORATORY ANIMAL SCIENCE, RWTH AACHEN UNIVERSITY
The RWTH Aachen University’s Institute for Laboratory Animal Science is both a service and a research unit within the university’s Medical Faculty. The institute centrally supports essential medical research that requires animal experimentation whilst ensuring that state of the art animal welfare standards are upheld. The Institute for Laboratory Animal Science also conducts its own scientific research directed towards optimization of vital organ transplantation, the development and testing of novel cancer treatment concepts, as well as basic research. Several core facilities are integrated within the institute e.g. the generation of genetically modified mouse lines and the imaging of living animals which can be utilized in various research fields. Training seminars and consulting services regarding experimental techniques and animal welfare issues are also key focus areas. The institute is a DIN ISO 9001 certified facility and also collaborates with the pharmaceutical and medical product industry.

RWTH INTERNATIONAL ACADEMY
As the official executive education academy of RWTH Aachen University, the RWTH International Academy is backed by the diverse knowledge of the various institutes and research organizations of the university. Through this close cooperation, practical executive education programs are professionally conceived, organized and offered. The institutes of RWTH Aachen University are responsible for the technical content of the programs.

JANVIER LABS
JANVIER LABS is an international company which offers a large range of traditional or customized rodent research models as well as transgenic and laboratory services to all biomedical research stakeholders. Thanks to its excellence in health and genetic management, JANVIER LABS is well known and valued by researchers for its reliability. With over 250 staff members, a site of 12,355 acres, a production capacity of more than 3,000,000 rodents, JANVIER LABS is the largest and most modern European breeding site.
Applications can be submitted by completing the online form, available online under www.MSc-Lab-Animal.com, or by sending the application to

RWTH International Academy
Mrs. Doris Kraus I Program Manager
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E-Mail: info@msc-lab-animal.com
Phone: +49 241 8027610
Fax: +49 241 80 92525

During the application procedure the following documentation must be submitted:

- Diploma and transcript of records
- A copy of your passport
- Curriculum Vitae
- Proof of suitable health insurance cover
- Proof of English language ability (Test of English as Foreign Language - TOEFL Internet-based with a minimum score of 80 / TOEFL Paper-based with a minimum score of 550 / IELTS Test with a minimum score of 6.0 / Cambridge Test - Certificate of Advanced English (CAE).
- Signed course contract
- References from your employer or a third party (e.g. professor from the degree awarding university) outlining relevant work experience

Applications will be considered on a first come first served basis.

The RWTH International Academy serves as your service partner in all, course related, organizational matters including course contracts and financial issues. Additionally, we are happy to assist with accommodation recommendations, travel suggestions and tips regarding life and study in Aachen.

A down payment of 1,000 € is payable with the application. This payment will be returned to unsuccessful applicants. For successful applicants the fee is non-refundable but will be credited, in full, towards your study fees. The remaining course fees will be invoiced in four equal installments for payment throughout the course. The detailed payment schedule is outlined in the course contract. The course fees are not subject to German VAT (§ 4 Nr. 21 a) bb) UStG). Payment should be made by bank transfer to the account nominated by RWTH International Academy and the participant is liable for all bank fees incurred.

A full copy of our terms & conditions is available online under www.academy.rwth-aachen.de

The information included in this brochure is correct at the time of going to press but may be subject to change without notice or liability.

Applicants names and addresses will be entered into our database and may be used for the provision of information relating to similar courses.