

Production of a photographic atlas for independent learning of the anatomy of the mouse

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Abstract

The resemblance between the genomes of the mouse and the human being and the development of mutagenic techniques, have made the mouse the basic pre-clinical research tool for understanding the physiopathology and treatment of human diseases. The main objective of this project is to produce a high quality photographic atlas of the anatomy of the mouse, as there is no book of this type available on the international market. The teaching tool we are producing must enable independent learning by graduate and postgraduate students in the health and biomedical sciences and improve their education and achievement. This atlas must also enable the anatomical changes in genetically modified mice to be included.

General area of interest of this innovation

The photographic atlas of the anatomy of the mouse will be of great interest for graduate and postgraduate students in the Biomedical sciences (Biochemistry, Genetics, Medicine, Biology, Veterinary Medicine, Pharmacy, etc). It will also be very useful for researchers using the mouse as a model, which occurs in the majority of research laboratories working in biomedicine.

1. Objectives

The main objective of the project is to produce a high quality photographic atlas of the anatomy of the mouse, which enables independent learning by graduate and postgraduate students working in the health and biomedical sciences and improves their education and achievement. This objective entails providing them with the skills to recognise and understand the anatomical structures of the body of the mouse and to interpret the images obtained using some of the latest imaging techniques (CAT, NMR, Ultrasound Scanning).

2. Description of the project

Human beings and mice are very similar in their development, physiology and biochemistry. This means that the mouse is a key model for research in human medicine. Identification of all the genes in the mouse and humans (the Mouse and Human Genome Project, respectively) has showed that around 99% of the mouse's genes have an equivalent gene (or counterpart) in humans. This is very important, because 5,000 diseases have so far been proven to be the result of a genetic error; examples of these are cystic fibrosis and Down syndrome. Furthermore, in many other diseases, an error in the genome may make a significant contribution to their appearance, as is the case with diabetes. The resemblance between the genome of the mouse and that of human beings enables the genes associated with diseases to be researched in mouse models.

While the potential for generating transgenic mice is increasing very rapidly, the ability of scientists to analyse the morphological changes that can be detected in transgenic mice is very limited. The first transgenic mouse was obtained in 1982 and over 18,000 new transgenic mice have been produced to date. In general, each transgenic mouse is a «new» animal and must be considered as a candidate for presenting anatomical variations. Our graduate and postgraduate studies in health and biomedical sciences place a great deal of emphasis on these animal models. Unfortunately, there are very few books about the anatomy of the mouse (see attached bibliography) and furthermore, they are incomplete and mostly show drawings rather than real images. An atlas of the anatomy of the mouse is essential for complete morphological phenotyping of genetically manipulated mice, which will help in understanding the function of genes and to improve the scientific skills of our students and future researchers. In this article, we present some of the anatomical images of the mouse (Figs. 1-9) which are included in the atlas, which will consist of over 680 original images.

3. Methodology

The techniques used to obtain the images of the mouse's anatomy were: Conventional dissection, which enables the organs making up the various mechanisms and systems to be viewed; the preparation of bones by soaking in pancreatin, which enables each

item in the skeleton to be isolated; moulds of blood vessels, which enable the complex distribution of the blood vessels in the various organs to be understood; cross-sections, which provide an understanding of the spatial relationship between the various organs of the body; histological sections, which provide an understanding of the cellular constitution of the tissues and organs; scanning and confocal electron microscopy, which enable understanding of cellular and subcellular organisation in tissues; radiography and computed axial tomography (CATs), which use X-rays to show the skeleton; nuclear magnetic resonance (NMR), which uses high intensity magnetic fields to observe the distribution of new tissues, and finally, ultrasound scanning, which uses ultrasound waves to view some specific internal organs.

4. Results

While the atlas was being produced, it was presented at various Spanish and international meetings and congresses in the field of biomedicine. These meetings highlighted the general interest in the material presented, as it fills an important gap observed by the scientific community and biomedicine professionals and as a consequence, it is becoming a necessary complementary tool for the learning, training and the skills of our students. The production of this atlas has enormously facilitated the preparation and consolidation of the Mouse Anatomy course, which is taught as part of the Transgenic Animals and Gene Therapy module in the Master's degree in Biochemistry, Molecular Biology and Biomedicine at our University. A representative sample of the material provided by the Atlas is shown in the images (Figs. 1-9) obtained from the various mechanisms and systems in the mouse using some of the techniques described in the Methodology section.

5. Conclusions

The graphic material produced has been shown to be of great interest to the scientific community and very useful in graduate level teaching (Anatomy I and II of the Veterinary Medicine degree course) and postgraduate teaching (the Transgenic Animals and Gene Therapy module of the Biochemistry, Molecular Biology and Biomedicine master's degree) at the Universitat Autònoma de Barcelona.

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Keywords

Independent learning, Anatomy, Phenotyping, Mouse.

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Supplementary materials on the CD-ROM

Images from the photographic atlas of mouse anatomy.

Project leader

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Presentation of the project leader and the working group

Dr. Jesús Ruberte, professor of Anatomy and Embryology in the Faculty of Veterinary Medicine at the Universitat Autònoma de Barcelona and his group have a great deal of experience in the publication of teaching material. Among other works, they have published three volumes of *Dog and Cat Anatomy*, which have been translated into other languages, and are key reference books in the Anatomy field in Spain and internationally. He is currently Head of the Morphological Analysis Unit at the Animal Biotechnology and Gene Therapy Centre at the UAB, and his research focuses on the study of the vascular system in genetically modified mice as models for human diseases.

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