

Use of Animals in Biomedical Research

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What is Experimental Research?

Experimental research is any **research**:

- **conducted with a scientific approach**,
- where **a set of variables are kept constant** while the **other set of variables are being measured** as the subject of experiment.

Experimental research is one of the founding quantitative **research** methods.

Experimental research is a planned scientific study performed

- to enlighten a subject
Or
- to develop a solution/to address a problem
Or
- to reach certain conclusions/laws

What is an Experiment?

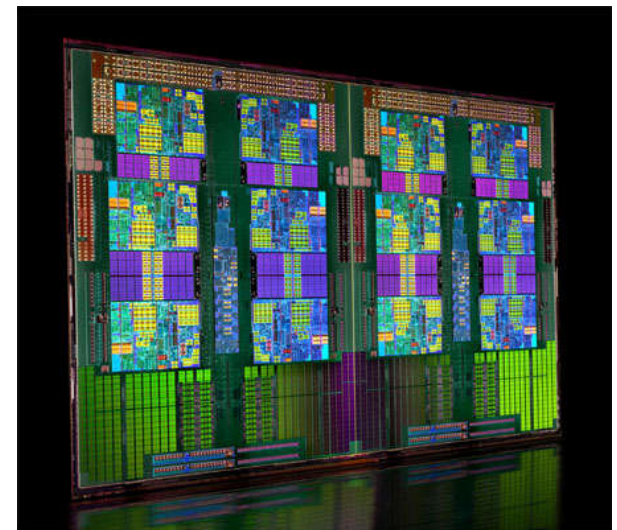
- Experiment is a research method **for testing different assumptions** (hypotheses) **by trial and error** under conditions constructed and controlled by the researcher.
- During the experiment,
 - one or more conditions (called **independent variables**) are allowed to change in an organized manner, and
 - the effects of these changes on associated conditions (called **dependent variables**) are **measured, recorded, validated, and analyzed** for arriving at a conclusion.

Medical and Biological Research Include at Least One of These:

- *Computer programs*
- *Bacteria, yeast, protozoa*
- *Embryo, organ, cells and tissues*
(human, animal or plant origin)
- *Animals*
- *Volunteers*
 - It should be selected in a way that allows the solution of the subject or problem to be solved in the simplest way.

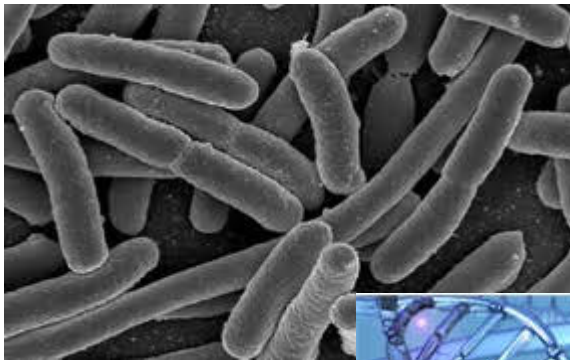
Use of Computer Models and Data Banks

- *Formation of data banks in order to prevent repetition of pre-made biological tests, preventing the use of live models again*
- *Mathematical relations of biological events (receptor studies)*
- *New drug design*



Use of Single Cells

- *Molecular biology research (E. coli)*
- *AMES test for carcinogenesis studies (Salmonella typhimurium)*



Cell Culture



- **Benefits**

- ✓ *Uncontrolled developments are limited*
- ✓ *No individual deviations*
- ✓ *The result can be interpreted directly because the conditions that affect the study are limited*
- ✓ *When human cells are used, the results could be directly applicable to human*
- ✓ *Ability to do 3D cultures*

- **Drawbacks**

- ✓ *The result obtained can be difficult to interpret as a cell isolated from the body is removed from interaction with other systems*
- ✓ *It may undergo phenotypic changes when used with continuous passages and may cause problems related to standardization of the results obtained.*
- ✓ *It is not possible to use it in studies that require continuity of the integrity of living things.*

Experimental Animal

- *Animals used in scientific research and in biological tests*
- *Purpose of Use:*
 - *Obtaining biological substances such as hormones and antibodies*
 - *Measurement of physiological responses*
 - *Investigation of biological events or mechanisms*



The use of animals in scientific testing has always been, and will continue to be a controversial subject

Animal Model

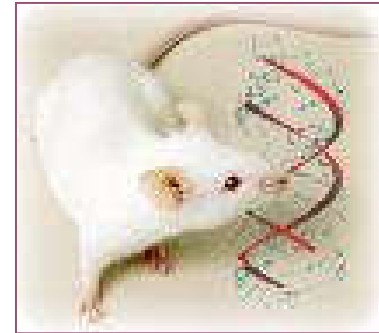
It is a model in which:

- *Normal biology or behavior can be studied*
 - *A spontaneous or induced pathological condition can be investigated*
 - *Animals are similar to human or other animal species in terms of a biological function.*
-
- *A large part of the information on the general biochemistry, physiology and endocrinology of the human body is derived from animal experiments whose findings can be adapted to humans.*

Animal Model

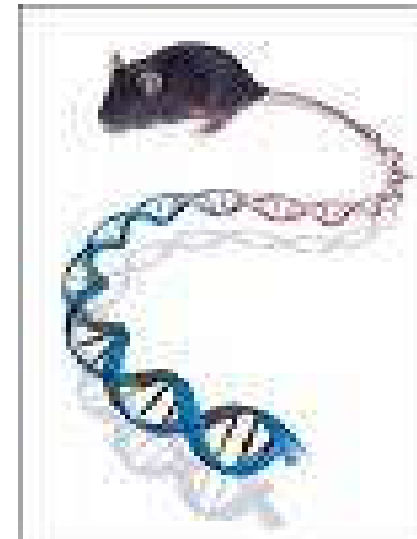
- **Induced Models**

- Pathologies induced in animals surgically or through chemical agents that are similar to those seen in the target organism
- Induction of emphysema with cigarette smoke
- Transgenic models



- **Spontaneous Models**

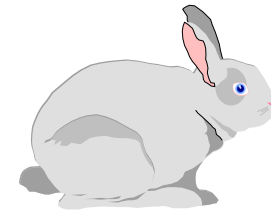
- Models on animals that spontaneously develop genetically and show pathology and symptoms similar to disease in humans
- Knock-out mice: Asthma may occur without the need for allergen sensitization, thus creating a good model for intrinsic asthma



Animal Model

- *Negative models*

- *Opposite to spontaneous models*
- *Use of animal species or strains where some diseases do not develop at all*
- *i.e., Gonococcal infection does not develop in rabbits*



- *Possible (Orphon) models*

- *Some diseases were first described in animals*
- *Studied due to the facts that the models can be described in human beings in similar ways.*
- *If a similar disease is seen in humans then the model is adapted*
- *Mad cow disease*

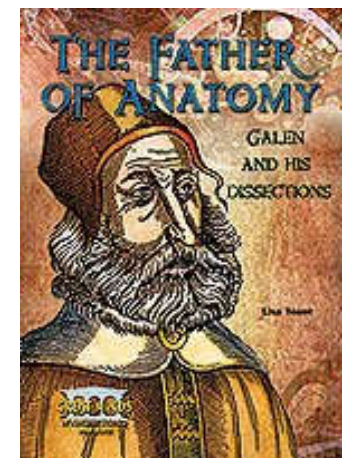
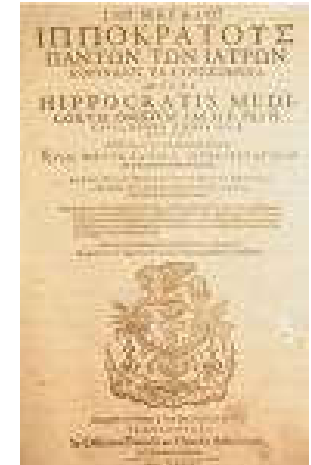


History

- *The first book to report the use of experimental animals:*
 - *Corpus Hippocraticum (400 BC)*
 - *To determine the anatomical structure*

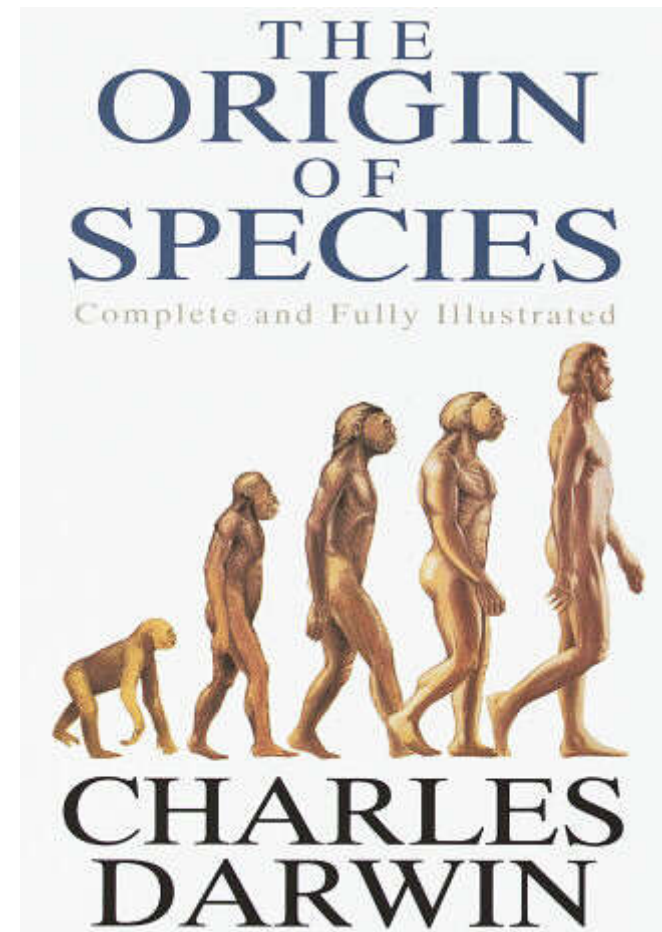
- *Galen (200 AD) have obtained basic data for physiology by studying the functions of organs with studies on blood circulation and nervous system, while the animals were alive.*

*Using animals such as pigs, monkeys and dogs
(vivisection)*



Darwin..

- *As a result of Darwin's «Origin of Species», the homology of animals with humans- it was shown that the information obtained from animals also applies to humans.*



Progress of Studies..

- *After the founding of the «French Research School» in the 19th century, the experimental medicine gained pace with the work of Claude Bernard.*
- *The necessity of using live animals for physiological experiments (1865)*



Progress of Studies..

- *Robert Koch (1884) explained that the pathogenesis of microorganisms can be determined by infecting healthy animals.*
- *The need for antiserum and vaccine production increased the use of experimental animals*
- *It was found that animal experiments were mandatory to measure pharmacological and toxic doses of drugs.*



History

<i>Date</i>	<i>Progress</i>	<i>Animal Model</i>
1880	Anthrax vaccine	Sheep
1885	Rabies vaccine	Dog, Rabbit
1902	Life cycle of malaria	Monkey, Mouse
1905	Pathogenesis of tuberculosis	Sheep
1923	The discovery of insulin	Dog, Fish
1932	Function of neurons	Dog, Cat
1939	The discovery of anticoagulants	Cat
1954	Polio vaccine	Monkey, Mouse
1956	Pacemaker development and open heart surgery	Dog

History

<i>Date</i>	<i>Progress</i>	<i>Animal Model</i>
1970	Use of lithium in health	Rat, Guinea pig
1982	Treatment of leprosy	Armadillo
1984	<i>Discovery of monoclonals</i>	Mouse
1992	Laporoscopic surgery	Pig
1995	<i>Gene transplantation in cystic fibrosis</i>	Mouse, Primate
2001	Drugs against AIDS	Monkey
	Organ transplantation	<i>Various species</i>

