

Spontaneous generation and cell theory

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Spontaneous Generation and Cell Theory 1. Tradition thought is very hard to overcome- even with solid evidence to support new ideas * Social pressure has effect on acceptance of scientific ideas and technological advancements * Science is a social/political enterprise * New ideas often met with resistance * Sometimes ostracisms, persecution, death * Microscope helped to overturn some strange ideas * Disease processes * "spontaneous generation"

Attitudes and skills of scientific inquiry (questioning, predicting, observing and recording) are required to provide unbiased and factual info *

Investigations must follow ethical guidelines and results must be reproducible under controlled conditions * Example of way that science, technology and society are linked is found in development of the current understanding of the way living cells function * Microscope provided technology to explore the world of microscopic particles and organisms *

Then possible to obtain evidence for or against generally accepted opinions or theories about living things

Spontaneous Generation 2. Believed that life can emerge from non-living matter 3. A superstition- people unaware of microscopic forms of life * e. g. mice created from mixing wheat husks with sweaty undergarments * Maggots and flies emerge spontaneously from raw meat * Francesco Redi * Example of scientific method * Believed flies laid eggs on meat * Experiment to prove hypothesis Limited access to meat (air, no fresh air, flies, no flies) 4. Idea that life could emerge spontaneously from non-living matter = widely accepted from time of the Romans through to the 19th century * Even in time of Robert Hooke and Antoni van Leeuwenhoek * Believed that to produce mice, you put a sweaty underwear and husks of wheat in an open

jar and after 21 days, the sweat and husks would combine and change the husks into mice 5. 668, Francesco Redi (Italian physician and poet) questioned belief that maggots appeared from raw meat * He believed that flies laid their eggs in the meat * Set up experiment to test his hypothesis * Set out flasks containing raw meat but some were sealed, some were covered in gauze and some were open to the air * Controlled the access of flies to the meat * Maggots were found only in the flasks that were open and accessible to flies to lay their eggs * Despite evidence, idea of spontaneous generation still thrived 6.

John Needham (proving that living things could be produced from non-living matter) boiled chicken broth and put it in a flask and sealed it * Everyone accepted that boiling killed micro-organisms since boiling was a common method of removing substances that would make one ill * However, in his experiment, micro-organisms continued to appear * Suggested that there was a life force that produced spontaneous generation 7.

Lazzaro Spallanzani (Italian priest) claimed that there were micro-organisms in the air that were responsible for the new growth * Re-did Needham's experiment but drew off the air in the flask, nothing grew in the remaining broth * Critics suggested that all Spallanzani had shown was that air was required for spontaneous generation to occur * Spontaneous generation theory continued to be accepted 8. 859, French Academy of Sciences announced a contest for the best experiment to prove or disprove spontaneous generation * Louis Pasteur used the work of Needham and Spallanzani with important change * Before boiling meat broth in flask, Pasteur heated the neck of the flask and bent it into an " S" shape * Air could

reach the broth but micro-organisms and other particles would get caught in the S- bend * Nothing grew in this broth but if the flask were tipped so that the broth reached the S-bend in the neck, moulds would later appear 9.

Pasteur controlled his experiment in that he used the same broth, same type of flasks and same light and temperature conditions * Controlled variables (conditions that are held constant throughout an experiment): broth type, flasks type, light, temperature * Manipulated variable (condition deliberately changed in an experiment): access of dust to the flask * Responding variable (condition that changes in response to the manipulated variable in an experiment): ability to grow mould in the broth * Had experimental control, a part of the experiment which the manipulated variable is not changed in any way from its normal condition * Flask in which dust had normal access to the broth after boiling * Result: moulds occurred * Experiment treatment Prevent the access of dust to the broth, resulting in evidence of no growth of mould * To allow access of dust to the broth very briefly, resulting in evidence of mould growth * Strong evidence that says that spontaneous generation doesn't occur, but also that micro-organisms are found in the air * His work opened new doors to microbiology, immunology, biochemistry and gave credibility and new importance to the processes of conducting controlled experiments, maintaining detailed records of observations, and connecting results to conclusions

The Cell Theory 10. Importance of cell as the functional unit of life was recognized with the improvements in lens technology and increased number of observations made by scientists in several countries 11. 1833, Robert Brown identified an important cell structure, the nucleus, in study of orchids

* Saw an opaque granular spot within the cell * Others had seen it too but he was the first to recognize at this cell structure must have something for cell function 12. 1838, M. J.

Schleiden observed that all plants were composed of cells and he proposed that the nucleus was the structure responsible for the development of the remainder of the cell * Discussed his work with a friend (Theodor Schwann), who was studying animal physiology * Schwann believed that there must be similarities btwn plant and animal tissue * When Schwann searched for opaque spots in animal tissue, he found structures that resembled the cells that botanists were studying in plant tissue and the nucleus structure that Brown and Schleiden had identified 13. 839, Schleiden and Schwann proposed the cell theory as a result of observations of plant and animal specimens through the microscopes * All plants and animals were composed of cells and that the cell was the basic unit of all organisms 14. 1859, cell theory was further extended by Rudolf Virchow's statement that all cells arise only from pre-existing cells Cell Theory 15. All living things are made up of one or more cells and the materials produced by these cells 16. All life functions take place in cells, making them the smallest unit of life 17.

All cells are produced from pre-existing cells through the process of cell division 18. Applies to all living things regardless of size, shape or number of cells involved * Subcellular particles (viruses and prions) fall into category that is neither living nor non-living although they may exhibit certain characteristics of living cells 19. Evidence in support of cell theory came from Pasteur's experiment to investigate the concept of spontaneous generation

in micro-organisms * Cell theory has become the cornerstone of the study of biology