**3.3 – The Impact of Research in Cell Biology**

* Environmental factors can affect the health of cells, tissues, organs, and organ systems.
  + Smoke from cigarettes
  + Smog
* Our knowledge of cells has increased enormously since the middle of the 20th century due to the refinements to the microscope, but there is still much research to be done in order to understand cell processes fully.
  + What areas need to be researched in the field of microbiology?
    - *Environmental*
      * *Discover biological tools to clean up pollution*
    - *Food* 
      * *Food Engineering (e.g.: Seedless Watermelons)*
    - *Agricultural* 
      * *Increase world food production*
    - *Medical*
      * *Immunology – Stop the development of cancers*
      * *Regenerate nerve cells to repair spinal cord injuries*
      * *Genetics*
    - *Pharmaceutical* 
      * *Develop vaccines to prevent disease*
      * *Prepare to stop the spread of infectious diseases not yet known*
* Aboriginal people (NA), Ayurvedics (India), Homeopaths (Germany) and Herbalists (Greek) had a great knowledge of anatomy and the various systems of the body, including what types of plants in varying combinations affected those systems. Many of those remedies are now being studied by scientists.
* Cell biology is a growing and highly varied field of study.
  + New technologies have opened new areas of study.
  + New health challenges have required the development of new technologies.

Working to Stop Cancers

* Cancer is a disease related to the uncontrollable and rapid reproduction of cells through cell division (P. 73, Fig. 3.20).
* Normal healthy cells proceed with their activities. They divide and reproduce at certain times according to signals issued by their organelles.
* Cancerous cells continue to reproduce rather than carrying out their required cellular activities.
  + The result is a tumour (a mass of cells that are continually reproducing but are otherwise non-functional)
  + Tumours can appear in any organ in the body and can spread from one organ to another.
* The work of cell biologists and other specialists has focussed on a number of areas, including
  + How to turn off the cell’s non-stop reproduction
  + How to destroy tumours
  + Finding out why the process begins
* Research on prevention has looked into factors related to
  + Characteristics that can be inherited
  + Lifestyle choices (e.g. smoking)
  + Environmental issues (e.g. chemical pollution in air and water)
* Successful studies have led to the development of
  + Effective treatments for some cancers
  + Improved technology for the detection of many cancers
  + Insights into lifestyle choices that can help us protect ourselves from some cancers

Repairing Damaged Spinal Cords

* Spinal cord includes cells that transmit nerve impulses from the senses to the brain and carry impulses from the brain to the various muscles to instruct them to move.
* The spinal cord is located in the body’s spine, connecting to nerves branching out into various parts of the body.
* Damage to the nerves branching out into the body can create problems with numbness and problems sending sensory information to the brain.
* Damage to the spinal cord that severs it results in a loss of both, information from the senses and the means of instructing the muscles to move.
* Paralysis is the inability to move muscles.
* If the spinal cord is severed below the shoulders, the lower body and legs are paralyzed.
* If the spinal cord is severed in the neck area, all four limbs can be paralyzed.
* Successful technologies have been developed to compensate for the lack of mobility.
  + Wheelchairs have improved (P. 73, Fig. 3.21)
  + Access to buildings and transportation has been redesigned to assist those who have been paralysed.
* Cell biologists continue to work to solve key problems relating to regenerating the cells in the spinal tissue that transmit the impulses.
* While skin, bone, and muscle cells can repair themselves, finding a way to trigger similar repair in the cells in spinal tissue is a challenge.

Preparing for new infectious Diseases

* Improvements in technologies for studying cells and cellular processes have led to successful treatments for many infectious diseases and the following have been brought under control in much of the world.
  + Small pox
  + Polio
  + Malaria
  + Tuberculosis
* The challenge for researchers in cell biology and related fields is to know how bacteria and viruses are adapting to create new infectious diseases.
* Researchers have recently solved some of the mysteries related to diseases such as the West Nile virus and Lyme disease, which are transmitted to humans through insect bites
* A bigger challenge was the emergence of severe acute respiratory syndrome (SARS), which was first reported in November 2002 and lasted until July 2003.
* Researchers around the world remain alert for the next outbreak of an unknown infectious disease.

Improving World Food Production

* Plants are at the beginning of every food chain and the successful cultivation of plants is the key to feeding the world’s population.
* In the past the farmers experimented with techniques such as crossbreeding to increase the amount of food their crops produce.
* Cell biologists changed plants so they can grow in different conditions
* More recently, researchers have found ways to modify plant cells to improve an organism’s resistance to insects and the chemicals that are used to kill weeds, rodents and bugs.
  + Example: A form of corn known as Bt corn can kill an insect known as the European corn borer (P. 75, Fig. 3.23). This insect has destroyed millions of dollars’ worth of crop each year.
* Cell Biologists have also changed plants to increase their nutritional value.
  + In 2000, Swiss researchers announced the development of a modified type of rice, which they named golden rice.
    - This rice has higher vitamin A and iron content than other rice.
    - It was created by introducing genes and enzymes from beans, wild rice, daffodils, and a fungus called aspergillus.
  + It is now grown and eaten in a number of countries (P. 75, Fig. 3.24).
* Supporters believe that this type of research will solve many of the world’s problems with the supply of nutritious food.
* Critics are concerned that this type of food contains modified cells that animals and humans have never digested before. They fear that the food may affect human cells in ways that no one has anticipated.