The ageing immune system: Emerging challenges for an ageing population

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What is Immunity?

Immunity (derived from *immunitas*: Latin for exemption from civic duties and prosecution) means protection from disease and especially infectious disease.

Cells and molecules involved in such protection constitute the **immune system** and the response to introduction of a foreign agent is known as the **immune response**.
Our immune system is important throughout life. It is necessary throughout life and the failure to make an immune response, in many cases, is detrimental.
The immune systems provides life-long protection against infectious agents

The first encounter with an antigen is known as the primary response. Re-encounter with the same antigen causes a secondary response that is more rapid and powerful.
Vaccination: The eradication of smallpox

- Highly infectious virus and fatal
- Known to have killed millions of people worldwide
- In 1967 World Health Organisation began a vaccination campaign to remove smallpox from the planet
- This programme, known as the Global Intensified Eradication Programme, was highly successful, and led in 1980 to the WHO declaration of the official eradication of smallpox
Cells of the immune system

The immune system is like the police service/army, their mission is to protect and like the police/army the immune system have many different methods to do this job.

- Scavengers - hunt and destroy
- Antibody - destroy
- Killers & Helpers
The organs involved with the immune system are called the **lymphoid organs**, which affect growth, development, and the release of white blood cells necessary to remove foreign agents.

**Lymph nodes:** Lymph nodes contain billions of white cells, multiplying rapidly to fight the invading germs.

**Bone marrow:** Site where all blood borne cells are produced.
All cells of the immune system is made from stem cells in the bone marrow except T cells. T cells are made in the thymus.
The changes of the immune system with age

**Thymus**

**Young:** High T cell output. T cells are fresh and raring to go (naïve)

**Middle age:** Low/moderate T cell output. Some T cells are still fresh, but many have acquired experience (memory)

**Old age:** Very litter T cell output. Most of the cells have in the body have an ‘experience’ look, but now present are some ‘defective’ ones
Scientist have now identified many of the age-associated changes in the immune system:

IMMUNOSENESCE
Many of the diseases amongst the elderly are associated with a poor immune system

- Poor response to vaccination
- Reduce ability to fight infections
- Increase in inflammatory diseases- arthritis, diabetes, autoimmunity
## HEALTH PROBLEMS, BY AGE: 2002 (Percent ever having)

<table>
<thead>
<tr>
<th>Condition</th>
<th>55-64</th>
<th>65-74</th>
<th>75-84</th>
<th>85+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>44.9</td>
<td>55</td>
<td>61.1</td>
<td>59.7</td>
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<tr>
<td>Diabetes</td>
<td>15</td>
<td>18.9</td>
<td>18.7</td>
<td>12.1</td>
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<td>Cancer</td>
<td>8.9</td>
<td>14.9</td>
<td>19.4</td>
<td>20.3</td>
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<tr>
<td>Lung</td>
<td>8</td>
<td>11.2</td>
<td>11.2</td>
<td>10</td>
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<tr>
<td>Heart</td>
<td>15.5</td>
<td>25.1</td>
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<td>42.6</td>
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<tr>
<td>Arthritis</td>
<td>49.3</td>
<td>63.7</td>
<td>67.6</td>
<td>72.1</td>
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<tr>
<td>Stroke</td>
<td>3.8</td>
<td>5.8</td>
<td>9.9</td>
<td>15</td>
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<tr>
<td>Psychiatric/Emotional</td>
<td>17</td>
<td>13.4</td>
<td>13.7</td>
<td>13</td>
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</table>

http://www.nia.nih.gov/ResearchInformation/ExtramuralPrograms/BehavioralAndSocialResearch/HRSfull.htm
TREND: AN AGING POPULATION
Since the beginning of recorded human history, young children have outnumbered older people. Very soon this will change. For the first time in history, people age 65 and over will outnumber children under age 5. This trend is emerging around the globe. Today almost 500 million people are age 65 and over, accounting for 8 percent of the world's population.

http://www.state.gov/g/oes/rls/or/81537
The government has identified that one of the biggest threats are infectious diseases.

**Figure 4.** New disease reports from likely New World (light) and Old World (dark) regions of origins, for sub-Saharan Africa and Europe.

Potential Therapies to prevent the defects of age-associated defects of the immune system:

Bone marrow transplant.

Gene Therapy

GH replacement, sex steroid ablation, IL-7 treatment. Thymic tissue transplantation.

Vaccinate early in life e.g. for CMV.
Summary

- Immune system vital for living
- Immune function decrease with age
- Scientists have begun to understand why this happens
- Major impact on society
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