Section 1: The immune system and CD4 count

1.1 Introduction
Section 1 starts with information about your body and the way your immune system fights infections.

- HIV is a virus, so you need to know how your body reacts to a virus.
- HIV is a virus that attacks the immune system, which are the parts of your body that fight viral infections. This means that you need to understand how your immune system is damaged by HIV.

1.2 Aims for this section
After reading section 1, advocates will have a basic understanding of:

- The ways a scientist or doctor understands the immune system.
- CD4 cells and CD4 tests and what they mean.
- How the CD4 count is used to monitor HIV infection.
- Use of CD4 count in treatment decisions and guidelines.
1.3 Definition of AIDS (SIDA)

Since effective treatment, the terms AIDS/SIDA are used much more rarely – see below.

AIDS stands for Acquired Immune Deficiency Syndrome

Acquired — because it is largely an infection that people get.
Immune — because it relates to your immune system.
Deficiency — because it reduces your immune system and makes it deficient.
Syndrome — because it describes a collection of different infections and illness caused by HIV.

For many people the meaning of the words that make up AIDS do not mean very much until they are explained.

SIDA is the abbreviation for AIDS in French, Spanish, Italian and Portuguese.

Since effective treatment (ART), the word AIDS is now much less used as a term for a medical diagnosis. It was historically used in the early years of the epidemic as an indication of advanced stage of illness. This distinction between being HIV positive and having AIDS is rarely used.

Referring to someone as being HIV-positive is now more accurate.

1.4 Basic organs in the body

It can be tricky to know the inside of your body.
Many people don’t know where their thymus, or kidneys or lungs are, or what these organs do.
Heart - your heart is between the two lungs at the front of your chest. The heart muscles continually circulate blood around your body. You know your heart is working because you can feel your heartbeat and you can feel the blood at your pulse. The heart pumps blood containing new oxygen to every part of your body. At the same time it pumps old blood without oxygen back through the lungs where it picks up new oxygen to repeat this cycle.

Lungs - are sponge-like organs. Every time you breathe they filter oxygen from the air through tiny vessels into the blood. It is then carried to the heart to be pumped round your body. The lungs filter carbon dioxide from your body when you breathe out.

Liver - your liver is the organ below the lungs that acts like a filter for the blood. Chemicals and impurities, including from drugs and medications, are filtered by the liver. The liver has many other essential functions. For example, the liver makes and processes many body fats. The liver is the only internal organ that can regrow.

Kidneys - are also filters. Some drugs are filtered more by the kidneys than by the liver. Waste products filtered by the kidneys leave the body as urine. The kidneys are in your lower back. Any blockage to your kidneys is extremely painful and can cause permanent damage. Although you are born with two kidneys, many people live very well with just one.

Stomach and intestines - the stomach is where food, drink and oral medications start to be broken down and processed in the body. Nutrients and drugs are absorbed through the stomach and small intestine walls. The small intestines are about 5 metres long. The large intestines are about 1.5 metres long.

Thymus - this is a small gland high in the chest. This organ is where CD4 cells and other white blood cells develop. CD4 cells are sometimes called T cells (from ‘thymus’). The thymus is very active in children and adolescents, and becomes much less active as you grow older.

Pancreas - your pancreas is a pistol shaped gland below the liver. It releases digestive enzymes into the small intestine, and releases hormones that control sugar levels in your blood. You can live without a pancreas but you need to take insulin to regulate blood sugar levels and take supplementary digestive enzymes.

Skin - your skin is the largest organ in the body and makes up 16% of an average body weight. It stops your body from drying out and is the main barrier against infection.

Bone - your bones are a living material and about 10% of bone cells die and are replaced each year. If bone cells are not replaced quickly enough, bones becomes brittle and break more easily. This means that over ten years you have grown and replaced your whole set of bones. It’s a bit like a snake shedding its skin.

Bone marrow - is the soft tissue inside bones. Blood cells originate from bone marrow.

Blood - Blood is the fluid pumped by your heart. It delivers oxygen and nutrients to every part of your body and carries waste products away. Blood contains cells (red cells, white cells, platelets etc) and plasma.

Plasma - The fluid part of blood that contains nutrients, glucose, proteins, minerals, enzymes, and other substances but with the blood cells taken out.

Lymph - Lymph is a clear fluid that contains white blood cells and antibodies. It is distributed round your body through a series of lymph vessels, nodes, and organs. The lymph system supports the blood in removing waste products from the body.

Although a lot of information about your health and HIV comes from blood tests, less than 2% of the HIV in your body is in your blood. Some researchers think this may be less than 1%. Most of the other 98% is in the lymph system, including the gut.

Lymph nodes - are the little lumps that sometimes get enlarged in your neck, under your arms, and in the crease between your legs and your body. Most of the CD4 cells in your body rest and reproduce in your lymph nodes.
Further reading and web resources:
There are hundreds of sites on the internet that explain basic biology, immunology and other medical terms.

The following sites may be useful on anatomy:
In the US, a 39-year-old man on death row donated his body to science. After he was executed, his body was frozen, cut into one-millimetre-thick slices, and photographed. The data were made available in 1994 on the Internet by the US National Library of Medicine.

To view two- and three-dimensional representations of the human body based on these data, visit these sites:

BodyQuest - a site designed to explain human anatomy to students ages 11–16. Try starting with the tour, which gives you an overview of the human body and allows you to find more detailed information:
http://library.thinkquest.org/10348/?tqskip1=1&tqtime=0326

The Atlas of the Body - An interactive exploration of muscles, internal organs, and skeleton of the human body from the American Medical Association.
http://www.ama-assn.org/ama/pub/category/7140.html
1.5 How the immune system works (before HIV infection)

Protection from infection
Your skin is a major barrier to infections. If your skin is damaged, for example through a tiny cut or tear, an infection like HIV can enter your body. HIV can also enter through some mucous membranes without needing a cut. Mucous membranes are the moist tissue that line the vagina, anus or the inner foreskin of the penis.
A few infections can be transmitted in the air by being breathed in (like influenza or TB). If an infection enters the body it is attacked by the immune system.

Antigens and antibodies
Two medical words are often used when talking about the immune system and infections:
- **Antigen** is a word for a small particle of infectious material that has been broken down in the body and recognised by the immune system.
- **Antibody** is a type of protein made by certain white blood cells in response to a foreign substance (antigen) in the body. Each antibody binds to only one specific antigen. This binding helps to destroy the antigen. Some antibodies destroy antigens directly. Others make it easier for white blood cells to destroy the antigen.

Cellular and humoral (body fluid) immunity
Your body uses different cells to attack and break down an infection. There are two main ways that your body does this:

**Humoral immunity is based on antibodies.**
- In response to an infection your body makes antibodies to identify and sometimes destroy the foreign particles.
- HIV is routinely diagnosed using an antibody test. This looks for evidence of the body's response to HIV. This response usually takes 2-3 weeks from infection to develop, but can take several months and occasionally longer.

**Cellular immune responses are based on CD4 and CD8 responses.**
Generally your body uses cellular immunity to fight viruses, and to fight HIV.
- **T cells** are a type of white blood cell (lymphocyte). The two main types of T cells are CD4+ cells and CD8+ cells (T4 and T8 cells). The plus sign is used in medical writing but in everyday language they are referred to as CD4 and CD8 cells.
- **CD4 cells** are sometimes called helper cells because they help the immune response by sending signals to CD8 cells.
- **CD8 cells** are sometimes called killer cells because they recognise and kill cells that are infected with a virus.

Sometimes these cell processes and functions overlap.

**Macrophages** are another type of larger white blood cell. Macrophages engulf or swallow up infectious organisms or waste material from dead cells. They also send signals to activate other cells in the immune system.

**What does ‘CD’ stand for?**
CD stands for cluster of differentiation. Cells in the immune system are classified by these molecules (glycoproteins), which are found on the surface of the cell.
The number after CD (ie CD4, CD8, CD38 etc) is used to differentiate between the many different types of these surface markers.
1.6 How HIV interacts with the immune system

HIV is especially difficult for the body to deal with. This is because the cells that the body uses to fight a viral infection are instead used by HIV to replicate.

These two factors are like a dog chasing its tail!

- HIV infection makes the body produce more CD4 cells to fight this new virus
- These new cells provide more target cells for HIV to infect and reproduce
- The body responds by making even more cells to fight the new virus

Most people develop immune cells that specifically try to fight the virus. These are called HIV-specific CD4 cells (or T4 cells). However, these cells get worn out and disappear in most people within 6 months after infection.

HIV then continues infecting other CD4 cells. Without HIV treatment (ART), the rest of the immune system is worn down, usually over many years.

These details of the immune response are very complicated. The main point is that HIV makes the immune system overactive, producing more and more cells. Over time the immune system loses out. This is why without ART your CD4 count drops over time.

Active cells with HIV die more quickly than uninfected cells: 1-2 days instead of 3-4 days. HIV infected cells also signal to infected cells to die more quickly. Therefore, HIV doesn’t need to infect every cell to cause them to die. Only 1 in 1000 CD4 cells are likely to be infected with HIV.

ART blocks HIV from reproducing, and returns your immune system back to an almost normal state.

HIV and the immune system before ART

<table>
<thead>
<tr>
<th>HIV infection</th>
<th>Immune system becomes activated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increased cell turnover (more CD4 cells produced and then die more quickly)</td>
</tr>
<tr>
<td></td>
<td>Non-infected CD4 cells also die more quickly</td>
</tr>
<tr>
<td></td>
<td>Numbers of CD4 cells are reduced</td>
</tr>
<tr>
<td></td>
<td>This activation leads to decline in CD4 cells over time</td>
</tr>
</tbody>
</table>

HIV and the immune system after ART

<table>
<thead>
<tr>
<th>HIV infection</th>
<th>Reverse abnormal immune activation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Decreased cell turnover</td>
</tr>
<tr>
<td></td>
<td>CD4 cells survive longer</td>
</tr>
<tr>
<td></td>
<td>Pool of CD4 cells increases</td>
</tr>
<tr>
<td></td>
<td>CD4 cells increase (and many OIs spontaneously get better)</td>
</tr>
</tbody>
</table>

AntiRetroviral Treatment
1.7 CD4 count as a surrogate marker

What is a CD4 count?

A CD4 count is the result of a blood test. It tells you how many CD4 cells are in a cubic millimetre of blood (mm$^3$). Information about units of measure for tests is at this link: http://i-base.info/qa/faq/units-of-measure

The full medical name is a CD4$^+$ T lymphocyte count. It is also called CD4$^+$ T cell count or a T4 count.

Everyone should have a CD4 count soon after they are diagnosed with HIV. The result is used, with other factors, to decide when to start treatment. Guidelines recommend starting treatment at different CD4 counts cut-offs depending on which country you live in.

- All guidelines recommend that treatment should be started before the CD4 count falls to less than 350.
- A few guidelines recommend treatment when the CD4 count drops below 500.
- Most guidelines now say that treatment can be started at any CD4 count, including when over 500. This is based on reducing transmission as well as health benefits to the person taking treatment.
- This change to earlier treatment came after the results of the START and TEMPRANO studies in July 2015.

How often your CD4 count is tested depends on:

- Current CD4 count. Lower CD4 counts are likely to need more frequent monitoring.
- Whether or not you are on ART (HIV treatment). Once on ART, viral load tests are more important than the CD4 count, especially if your CD4 count is above 350.
- Guidelines in your region or country.

What is a surrogate marker?

A surrogate marker is when one thing (usually a thing that is easy to measure) is used as a measure of something else.

The CD4 count doesn’t directly measure HIV. But it is a good surrogate (or indirect) marker for how HIV has damaged your immune system. It can indicate the risk of infections.

The normal range for a CD4 count in an HIV-negative person is between 400 and 1,600. This range covers 19 out of every 20 people (95%). But 1 in 20 HIV negative people (5%) have a normal CD4 count that is either less than 400 or higher than 1600.

For HIV negative people, having a higher or lower CD4 count does not mean a stronger or weaker immune system. This is the range for a normal balance.
A few weeks after infection with HIV the CD4 count falls.

Then the immune system begins to fight back. The CD4 count goes back up again, though not to as high as before HIV infection.

This lowest level is usually 3 to 6 months after infection (if not on ART). This is called CD4 set point. The lowest-ever CD4 count is also called the CD4 nadir.

Without ART, the CD4 count will gradually drop – usually over several years. When not on ART, the CD4 count drops by an average 50 cells/mm$^3$ every year. In some people CD4 counts will fall much faster, and in some people much slower.

In most people, the immune system can control HIV without treatment for many years.

However, untreated HIV increases the risk of serious infections even with a high CD4 count. This is why in 2015 most guidelines changed to recommend ART for all HIV positive people.
1.8 How quickly does HIV progress without ART?

Without HIV treatment (ART), HIV progresses at different rates in different people.

The graph below shows three rates for how the CD4 count can drop to 200 cells/mm$^3$ in someone who is not taking ART.

Having serious illness when they are first infected (during seroconversion) is a risk for faster HIV progression.

There is no test to know how quickly HIV will progress, other than by monitoring the CD4 count over time.

People who progress more quickly get as good a response to treatment, as people who progress more slowly.

Approximate time for CD4 count to drop to 200 (without ART):

- 25% people take 1-2 years (and are fast progressors)
- 50% people will take 2-10 years
- 25% people will take 10-15 years
- Less than 1% people will not see any drop in their CD4 count even after 15 years. These people are called long term slow progressors (LTSPs). Even more rarely, a few people not only keep a strong CD4 count, but they also keep an undetectable viral load. These people are called elite controllers. Viral load is discussed in the next chapter.

These time to progression results are based on a UK study of people who were diagnosed during seroconversion. Everyone in the study was then followed over time to see how their CD4 count changed. These results may overestimate how quickly HIV progresses because people are often diagnosed early because of symptoms.

Link to UK Seroconvertors Study: http://journals.lww.com/aidsonline/Fulltext/2008/01020/Survival_following_HIV_infection_of_a_cohort.11.aspx

Time between infection and the need to start treatment

Since July 2015, most guidelines recommend ART at any CD4 count. This means that CD4 monitoring until treatment is started is becoming less common; most people now start ART after they are diagnosed.
1.9 Interpreting CD4 results: CD4 count and CD4 percentage

A CD4 count is the number of CD4 cells in a cubic millimetre (cells/mm³).
This is sometimes written as cells in a microlitre (cells/μL) of blood or as cells x 10⁶/L.
See this link: i-base.info/qa/factsheets/units-of-measure
A CD4 count is sometimes called an absolute CD4 count, because it counts the actual number of cells in a blood sample.

A single CD4 count doesn’t mean very much. You really need to get several results over time to see the trend.

CD4 counts fluctuate. They go up and down during the day. For example, CD4 counts are lower when you first wake up and higher later in the day. They are higher immediately after exercise – even running up and down stairs. They can also be affected by diet, by having other infections, or even if there were just more or fewer cells in that sample of blood. None of these variations means that your immune system is stronger or weaker.

This is why the trend of CD4 results is more important than any single count. The trend looks at the average of several results.

When you have several results you can see whether the trend is going up or down and how quickly it is changing – or whether it is generally stable.

Looking at a CD4 count trend

![Graph showing CD4 count trend]

Each point on the dotted line shows an individual (absolute) CD4 count.
The solid line shows the average of these results. In this example it shows that the trend is for the CD4 count to fall over time.

Because CD4 counts vary, an unexpectedly high or low count should be checked with a second test, if possible.

CD4 percentage (CD4%)
The CD4 percentage (CD4%) is the percentage of white blood cells (lymphocytes) that are CD4 cells.
The immune system contains lots of different cells. The two main types of lymphocytes are T cells and B cells. CD4 cells are a type of T cell. So the CD4% looks at the CD4 count in relation to other immune cells.
CD4% is sometimes a more stable indication of whether there has been a change in the immune system. An unexpected drop in CD4 count when the percentage hasn’t changed indicates this drop is not clinically significant.

- A CD4% of 12-15% is about the same as a count of under 200 cells/mm³.
- A CD4% of 29% is about the same as a count of over 500 cells/mm³, but there is a wider range for higher values.
- The average normal CD4 percentage for someone who is HIV negative is about 40%. The normal range is anywhere from 25% to 65%.

The CD4% count is used to monitor children under 12 years old. This is because you are born with very high CD4 levels. A baby can have a CD4 count that is 3000 cells/mm³.

### 1.10 CD4 differences between adults and children

**Children generally have much higher CD4 counts than adults. Babies have higher CD4 counts than children.**

- Children under 12 years old with HIV are monitored by CD4% rather than absolute CD4 count.
- After the age of about 60, the adult CD4 count drops gradually.

**Table: CD4% and CD4 counts for babies and children**

<table>
<thead>
<tr>
<th>HIV disease category</th>
<th>CD4%</th>
<th>CD4 0-12 months old</th>
<th>CD4 1-5 years old</th>
<th>CD4 6-12 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – no damage</td>
<td>25% or over</td>
<td>over 1,500</td>
<td>over 1,000</td>
<td>over 500</td>
</tr>
<tr>
<td>2 – moderate</td>
<td>15-24%</td>
<td>750-1,500</td>
<td>500-1,000</td>
<td>200-500</td>
</tr>
<tr>
<td>3 – severe</td>
<td>under 15%</td>
<td>under 750</td>
<td>under 500</td>
<td>under 200</td>
</tr>
</tbody>
</table>

The 2015 WHO guidelines include a detailed discussion of why ART is now recommended for children of all ages.

The guideline on when to start antiretroviral therapy, and on pre-exposure prophylaxis, for HIV 2015 can be found here: who.int/hiv/pub/guidelines/earlyrelease-arv/en/

Direct link: for pdf
apps.who.int/iris/bitstream/10665/186275/1/9789241509565_eng/pdf?ua=1
### 1.11 Different stages of infection

Stages of HIV infection are described differently by the World Health Organisation (WHO) and the US medical system. These stages are less important now because of effective HIV treatment (ART).

- **WHO stages** use symptoms only and do not test results.
- The **US Center for Disease Control (CDC) categories** use both symptoms and test results.

#### WHO classification

The WHO performance stages do not include CD4 counts. These performance stages are described using a person’s ability to do things (performance stage) plus signs of illness (symptoms).

- Performance stage 1: no symptoms (asymptomatic), normal activity.
- Performance stage 2: symptoms, but nearly fully ambulatory (walking around).
- Performance stage 3: in bed more than normal but less than half of normal daytime during the previous month.
- Performance stage 4: in bed more than half of normal daytime during previous month.

WHO clinical stages increase with severity of opportunistic infections.

WHO classification system for HIV infection, 2007. (PDF download)
http://www.who.int/hiv/pub/guidelines/HIVstaging150307.pdf

#### US CDC categories

**Clinical categories** are shown with the letters: A, B and C.

This is qualified by **CD4 count**, shown by numbers: 1, 2 or 3.

#### Table: CDC categories of HIV infection

<table>
<thead>
<tr>
<th>CD4 count</th>
<th>A</th>
<th>B*</th>
<th>C**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Symptoms inc primary infection</td>
<td>Symptoms (if not A or C)</td>
<td>AIDS-defining infections</td>
</tr>
<tr>
<td>1 = 500 or over</td>
<td>A1</td>
<td>B1</td>
<td>C1</td>
</tr>
<tr>
<td>2 = 200-499</td>
<td>A2</td>
<td>B2</td>
<td>C2</td>
</tr>
<tr>
<td>3 = less than 200</td>
<td>A3</td>
<td>B3</td>
<td>C3</td>
</tr>
</tbody>
</table>

* Less serious or early symptoms include: candida (thrush) in the mouth, or vagina if not responding to treatment, fever (over 38.5 degrees C) or diarrhoea lasting over 1 month, cervical abnormalities or cancer, pelvic inflammatory disease (PID)

** AIDS defining infections include all the most serious infections including: oesophageal candida, CMV disease, active lymphoma, pulmonary TB, KS, MAI, PCP, weight loss more than 10%, bacterial pneumonia, PML, toxoplasmosis. See Appendix I for a full list.
In the US (but not Europe) a CD4 count under 200 cells/mm$^3$ is a definition of an AIDS diagnosis.

Before effective ART, people were frequently categorised based on how ill they were and on their life expectancy. In 2015, this system is less relevant.

Before HIV treatment, people did not generally get better, so that the progression though stages A, B, and C was a ‘one-way’ direction.

CDC revised clinical categories for classification (1993 revision): Can’t find ref, RT

1.12 CD4 count cut-offs, risks of opportunistic infections (OIs)

An opportunistic infection (OI) is the name given to an HIV-related illness. These are often infections that without HIV your body would normally fight.

The lower the CD4 count, the higher the risk of OIs. This is why HIV treatment (ART) is especially important with a low CD4 count.

You can still feel well and healthy with a low CD4 count. Even when the CD4 count is below 200, below 100, or even below 10. The risk of serious health-related problems increases as the CD4 count drops. And even with a high CD4 count, some serious HIV related illnesses can occur.

All guidelines recommend ART for anyone with a count below 350.

Since 2015, most guidelines routinely recommend ART for HIV positive people at any CD4 count.

Different illnesses become more likely at different CD4 counts. Many serious and life threatening illnesses become a risk when the CD4 count drops to under 200 cells/mm$^3$.

Oportunistic infections that occur at different CD4 counts

At any CD4 count:
- The risk of TB is higher in HIV positive people. This can occur at any CD4 count.
- Kaposi’s Sarcoma (KS) can occur at any CD4 count, though the risk increases as the CD4 count drops below 350-500.

CD4 count below 300:
- Diarrhoea from bacterial infections microsporidia and cryptosporidia
- Skin problems – candida (thrush), dry skin, etc

CD4 count below 200:
- PCP (fungal pneumonia) and chest infections
- Toxoplasmosis – parasitic infection that can cause brain lesions

CD4 count below 100:
- MAI / MAC (mycobacterium avium complex) – bacterial infections similar to TB
- Cryptococcus – fungal infection that can cause meningitis in the brain and PCP-like symptoms in the lungs

CD4 count below 50:
- CMV (cytomegalovirus) – a viral infection that can cause permanent vision loss and blindness. It can also affect other organs.
Information on these infections are included in the OI chapter of this resource.

- The lower your CD4 count the higher the risk of OIs and other illnesses.
- CD4 count increases after starting ART, this often means your immune system can deal with these infections by itself.
- After CD4 increases on ART, treatment to prevent OIs can often be stopped. Primary prophylaxis is the medical term for using a medicine to prevent a new infection. Secondary prophylaxis is when meds are used to prevent the return of an earlier infection.

1.13 Use of CD4 count for starting therapy (ART)

Until 2015, the CD4 count was used to decide when to start ART. Although some guidelines still use the CD4 count as a criteria for starting ART, the main use of CD4 counts is to know how much HIV has damaged your immune system.

At what CD4 count should someone start ARV treatment?

- WHO, European, UK and US guidelines recommend people who have no symptoms can start ART at any CD4 count. This includes when the CD4 count is higher than 500.
- A few guidelines still only recommend ART after the CD4 count has dropped below 500 or even 350.
- If there is limited access to treatment, some guidelines recommend that people with the lowest CD4 count have a more urgent need of ART.

Several large studies have also shown that ART reduces the risk of HIV related infections even when the CD4 count is higher than 500. Several years ago both the UK and US treatment guidelines recommended starting at lower levels (at 500, 350 and even 200). This was because of the higher risk of side effects with early HIV drugs.

Modern ART is now much safer. More recently approved drugs have fewer risks of side effects. Modern combinations also require fewer pills and numbers of daily doses – this makes taking treatment easier.

In practice, many people start ART at much lower CD4 counts because they are diagnosed later in infection. But ART will still work very well.
### 1.14 Glossary: Section 1

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute infection</strong></td>
<td>early infection (first few months with HIV)</td>
</tr>
<tr>
<td><strong>Antibody</strong></td>
<td>cells in your immune system that recognise antigens</td>
</tr>
<tr>
<td><strong>Antigen</strong></td>
<td>infectious material produced by a virus or bacteria</td>
</tr>
<tr>
<td><strong>TB</strong></td>
<td>tuberculosis – bacterial infection that commonly infects the lungs but which can affect other organs</td>
</tr>
<tr>
<td><strong>CD4 cell</strong></td>
<td>cell (lymphocyte) in your immune system that signals CD8 cells to destroy a virus. CD4 cells are also used by HIV as factories to reproduce in</td>
</tr>
<tr>
<td><strong>CD8 cell</strong></td>
<td>cell (lymphocyte) in your immune system that kills cells that are infected with HIV</td>
</tr>
<tr>
<td><strong>Chronic infection</strong></td>
<td>established infection (everything after the first 6 months)</td>
</tr>
<tr>
<td><strong>CMV</strong></td>
<td>cytomegalovirus – infection that can produce permanent loss of sight. Occurs mainly with CD4 count under 50. Can also affect other organs.</td>
</tr>
<tr>
<td><strong>Immune system</strong></td>
<td>different parts of your body used to fight infections</td>
</tr>
<tr>
<td><strong>MAC / MAI</strong></td>
<td>bacterial infection similar to TB called MAI in Europe and MAC in the US</td>
</tr>
<tr>
<td><strong>Opportunistic infections</strong></td>
<td>also called ‘OIs’ – infections that occur after your immune system has been damaged by HIV</td>
</tr>
<tr>
<td><strong>Prophylaxis</strong></td>
<td>a drug that you take in order to prevent a future illness</td>
</tr>
<tr>
<td><strong>Surrogate marker</strong></td>
<td>an indirect measure for something else that can not be easily measured directly (i.e. a CD4 count is an indirect marker for HIV disease)</td>
</tr>
<tr>
<td><strong>Toxoplasmosis</strong></td>
<td>infection that affects the brain (can cause fits and memory loss). Risk increases with CD4 under 100. Co-trimoxazole (Septrin) can protect from toxo.</td>
</tr>
<tr>
<td><strong>WHO</strong></td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>
I.15 Questions: Section 1

1. **Immune system and immunology basics**

   **Give simple explanations:**
   1. What does AIDS stand for?
   2. What is a CD4 T cell?
   3. What is a CD8 T cell?
   4. What is the range of a CD4 count for an HIV-negative adult?
   5. Give other names for each of these cells
   6. What is CD4% and when is it used?
   7. What is the difference between cellular and humoral immune responses? Which responses are used by the body to fight HIV?
   8. What is a ‘surrogate marker’?
   9. How often should a CD4 test be done? (describe several different circumstances)
   10. How does CD4 test results relate to when to start treatment?
   11. Describe the general pattern of what happens to your CD4 count after HIV infection, in early infection and through chronic infection?
   12. Draw a graph to show this.
   13. Which OIs become more likely after your CD4 count falls below these levels: 300, 200, 100, 50?
   14. What is the main difference between children’s and adults’ CD4 counts?
   15. What is an antigen?
   16. What is an antibody?

   Now write 1000 words about the immune system including this and other information you learnt about CD4 cells and CD4 cells counts. (i.e. a basic leaflet that you would send to someone who wanted to know about this).
1.16 Course evaluation for Section 1

Please take a few minutes to complete this evaluation. Any comments are appreciated, including on the usefulness of the evaluation.

Session One:

How much of the information was new? None 1 2 3 4 5 All

How useful was the source material? Very 1 2 3 4 5 Not

How much support time did you need in 1-2-1 questions?

Were you given enough support for this section?

Did you find better internet sites for information, if so, which ones?

Did the questions relate to the information you found yourself?

What was your pass rate?

Sit the test again in one week to see how much you remember.

Did your pass rate improve?