

Answer Sheet

**TYPE I – e.g. nasal polyp**

- A1. IgE antibodies are bound by their Fc portion to high affinity Fc receptors expressed on **Mast cells** and **basophils**.
- A2. **Pollen, house dust mite** and **faeces** (Der P1 contained in faeces of *Dematophagoides pteronyssinus*), **domestic pets** or **moulds**.
- A3. Antigen binds to IgE antibody on the surface of mast cells and activates them. Activation of mast cells leads to release of vasoactive mediators (including histamine, Leukotrienes C<sub>4</sub>, D<sub>4</sub> and E<sub>4</sub> and prostaglandin D<sub>2</sub>), which cause vasodilatation and increased vascular permeability. Fluid leaks out of the blood vessels into the tissue spaces forming oedema.

A4.

Chemotactic mediators	Vasoactive mediators
<i>Leukotriene B<sub>4</sub></i>	<i>Histamine</i>
<i>PAF</i>	<i>Platelet activating factor (PAF)</i>
<i>Cytokines e.g.(1) TNF-<math>\alpha</math></i>	<i>Leukotrienes C<sub>4</sub>, D<sub>4</sub> and E<sub>4</sub></i>
<i>recruits other leucocytes;</i>	<i>Prostaglandin D<sub>2</sub></i>
<i>(2) IL-4 recruits eosinophils</i>	

- A5. Nasal irritation with water rhinorrhoea (“runny nose”) and/or nasal blockage due to the large size of some polyps hanging down in the nasal air passages. Also itchy eyes.

**TYPE II – e.g. Hashimoto’s thyroiditis**

- A6. Yes, there is evidence of tissue destruction – the thyroid follicles are small and lined by fewer epithelial cells. In some areas, thyroid follicles are absent.  
Yes, this is a cytotoxic process mediated by the immune system.
- A7. CD4+ (helper) T lymphocytes interact with B lymphocytes and stimulate the secretion of antithyroid antibodies, which activate antibody dependent cytotoxicity mechanisms. Also the helper T lymphocytes induce the formation of CD8+ (cytotoxic) T lymphocytes which can directly kill the thyroid follicular epithelial cells.
- A8. Yes – lymphoid follicles with germinal centres are visible in the sections provided.
- A9. B lymphocytes mature into plasma cells (and some memory cells), which secrete antibodies, in this case resulting in increased anti-thyroid antibody production and destruction of the thyroid follicular epithelium.
- A10. Plasma levels of thyroxine (T4) and tri-iodothyronine (T3) are **decreased** due to extensive loss of the thyroid epithelium that makes them.  
The low plasma levels of thyroxine (T4) and tri-iodothyronine (T3) **stimulate** the anterior pituitary to secrete Thyroid Stimulating Hormone (TSH) as part of the feedback system, and

the high levels of TSH “over-stimulate” the remaining thyroid follicles, so that they have little colloid and tall epithelium.

Some patients may have auto-antibodies capable of stimulating the TSH-receptor as well.

### TYPE III – e.g. Systemic Lupus Erythematosus

- A11. An immune complex is composed of **antibodies and antigen molecules** bound together to form large aggregates of many antibodies and antigens stuck together. These are variable in size – the size depends largely on relative antigen and antibody concentrations.
- A12. Immune complex deposition is determined by several factors, including the physicochemical properties of the complex (e.g. cationic antigens bind avidly to the **basement membrane** of kidney glomeruli) and anatomical factors (**capillaries** in renal glomeruli and synovia are where plasma is ultrafiltered). In terms of organ distribution common sites include: **renal glomeruli, joints, and skin, (and sometimes heart, and serosal surfaces)**.
- A13. Immune complexes activate complement, thus recruiting and activating inflammatory cells (particularly neutrophils and macrophages – the extra cells in the glomeruli in this form of glomerulonephritis) by binding via their Fc or C3b receptors.

### TYPE IV – e.g. Tuberculosis

- A14. Mycobacteria have an **unusual waxy cell wall** compared to gram-positive and gram-negative organisms – it is very hydrophobic and has a high lipid content. The wall enables mycobacteria to survive inside macrophages as it renders them resistant to the usual concentrations of lysosomal enzymes. The wall also limits the rate of nutrient transfer into mycobacteria so they are slow growing in comparison to other bacteria.
- A15. Antigen is presented in the **lymph node**. Alveolar macrophages that have ingested mycobacteria are carried by lymphatics to the lymph node.
- A16. **CD4+ T lymphocytes (Th1 cells)** produce cytokines, in particular **IFN- $\gamma$** , which activate macrophages so that they can kill mycobacteria, leading to the transformation of macrophages into epithelioid cells and multinucleate giant cells.
- A17. HIV infection results in the death of CD4+ T lymphocytes, producing an overall decrease in the number of CD4+ T lymphocytes in the blood – the key cell for the response to mycobacteria.
- A18. A granuloma consists of a **collection of macrophages**. In the granuloma, the macrophages are often transformed into epithelioid cells. The granuloma is usually surrounded by a collar of lymphocytes.
- A19. The host immune response causes the tissue damage – a key property of type IV (delayed) hypersensitivity.

## PROCESS IDENTIFICATION & REPORT WRITING

### 9.9 Spleen 55.274

Catalogue Number	Small Image	Image Map	Large Image
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A_TB_ML_SP_01.jpg	<a href="#">Miliary tuberculosis</a>		<a href="#">Miliary tuberculosis</a>
A_TB_ML_SP_02.jpg	<a href="#">Miliary tuberculosis</a>		<a href="#">Miliary tuberculosis</a>
A_TB_ML_SP_03.jpg	<a href="#">Miliary tuberculosis</a>	<a href="#">Image map</a>	<a href="#">Miliary tuberculosis</a>
A_TB_ML_SP_04.jpg	<a href="#">Miliary tuberculosis</a>		<a href="#">Miliary tuberculosis</a>

This is a section of spleen from a severely ill old person.

Note there are two different types of follicle-like structures within the substance of the spleen. There are **normal lymphoid follicles**, some with germinal centres in the white pulp. There are also numerous **granulomata** typical of tuberculosis, some with central caseating necrosis, epithelioid macrophages and a few giant cells, with a rim of lymphocytes. A Z–N stain could be performed to confirm the presence of tubercle bacilli (acid and alcohol-fast red rods on a blue background). The scattered pattern of numerous small granulomata indicates miliary spread of tuberculosis.

The pathological process is type IV delayed hypersensitivity (also called granulomatous chronic inflammation) in response to tuberculosis of the spleen due to miliary tuberculosis.

