

Understanding how information in science is typically organised: How can I apply this to help my learning?

Studying in the Sciences

What is in this guide

- How information is typically organised?
- Why is understanding this organisation important?
- Organising scientific information to assist my learning
- Other related guidy

How is information in science typically organised

Information in science is typically organised in an ordered structure starting with major or key concepts that contain secondary or supporting concepts (see Figure 1). Specific terminology, and commonly formulas and equations, are used. Terminology is established through definitions. These provide specific meaning in the relevant scientific field. Details of concepts are explained and these details often involve the use of terminology and equations. Relationships between concepts are identified and applied in new contexts or to 'real world' (practical/ applied) examples. This ordered structure can be considered as a conceptual framework for organising scientific information (Figure 1). An example, using the major scientific concept of cell membrane transportation, is provide over the page showing how definitions and concepts are structured in such a framework (Figure 2).

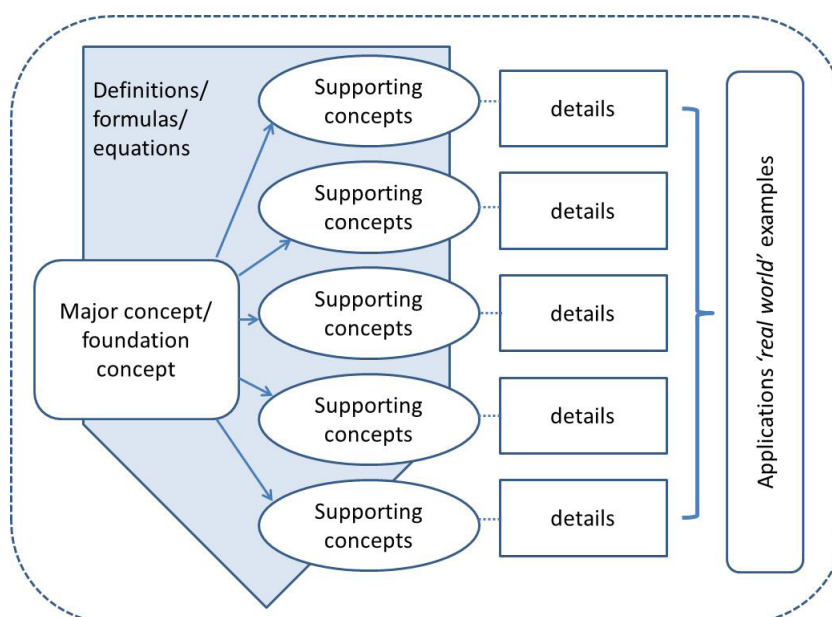


Figure 1 Example of a conceptual framework for organising scientific information

If you look at any typical 'science' textbook the pattern of naming or introducing terminology, classifying concepts and explaining these concepts occurs over and over. From the following example based on a physiology textbook chapter about cell membrane transportation, you can look at the how the chapter is organised and see how this organisation fits with the conceptual framework model introduced in Figure 1. The **blue text** has been added to help you identify how scientific information is typically arranged (based on the conceptual framework, Figure 1) and the circled text identifies terminology in the discipline that would be defined.

Chapter: **Transportation through the Cell membrane** (Major Concept)Subheading level 1: **Diffusion** (Supporting or Sub Concept)

Diffusion through the cell membrane

Net diffusion through the protein

Channels of the cell membrane and factors that affect it

Osmosis across selectively permeable membranes

Definitions: Discipline specific terminology are defined throughout the text**Details explained**
using these sub headings in the texts**Applications**

Application to real world or practical/applied examples provided. This is often included in the text, particularly in the fields of applied or clinical sciences

Subheading level 1: **Active Transport** (Supporting or Sub Concept)

Basic Mechanisms

Secondary active transport

Active transport through active cellular sheets

Details explained
using these sub headings in the texts**Definitions:** Discipline specific terminology are defined throughout the text

So, using the conceptual framework (Figure 1) the organisation of this information and how it fits together would be represented in the following way.

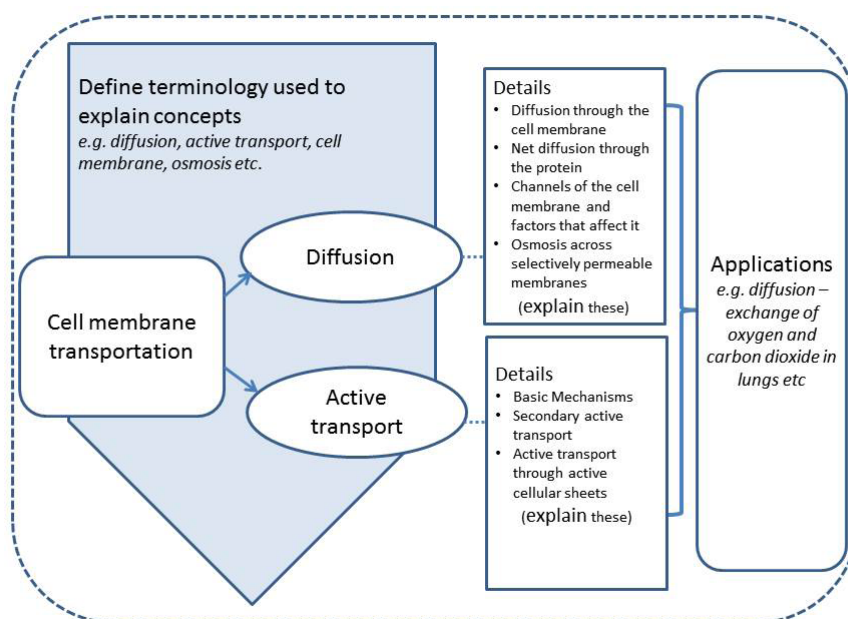


Figure 2 Conceptual framework for organising information about cell membrane transportation

The concept of cell membrane transportation fits into a larger concept – the cell. Likewise, the concept of the cell is just part of a much bigger picture or concept, the structural and functional organisation of living organisms or in this case a human (Figure 3). In science, it is important to try to see the big picture of how each of the major concepts (and related sub concepts) fit together to give the overall picture. Look at Figure 3 as an example of how the hierarchical framework for the structure and function of the human body is established by building on and connecting concepts.

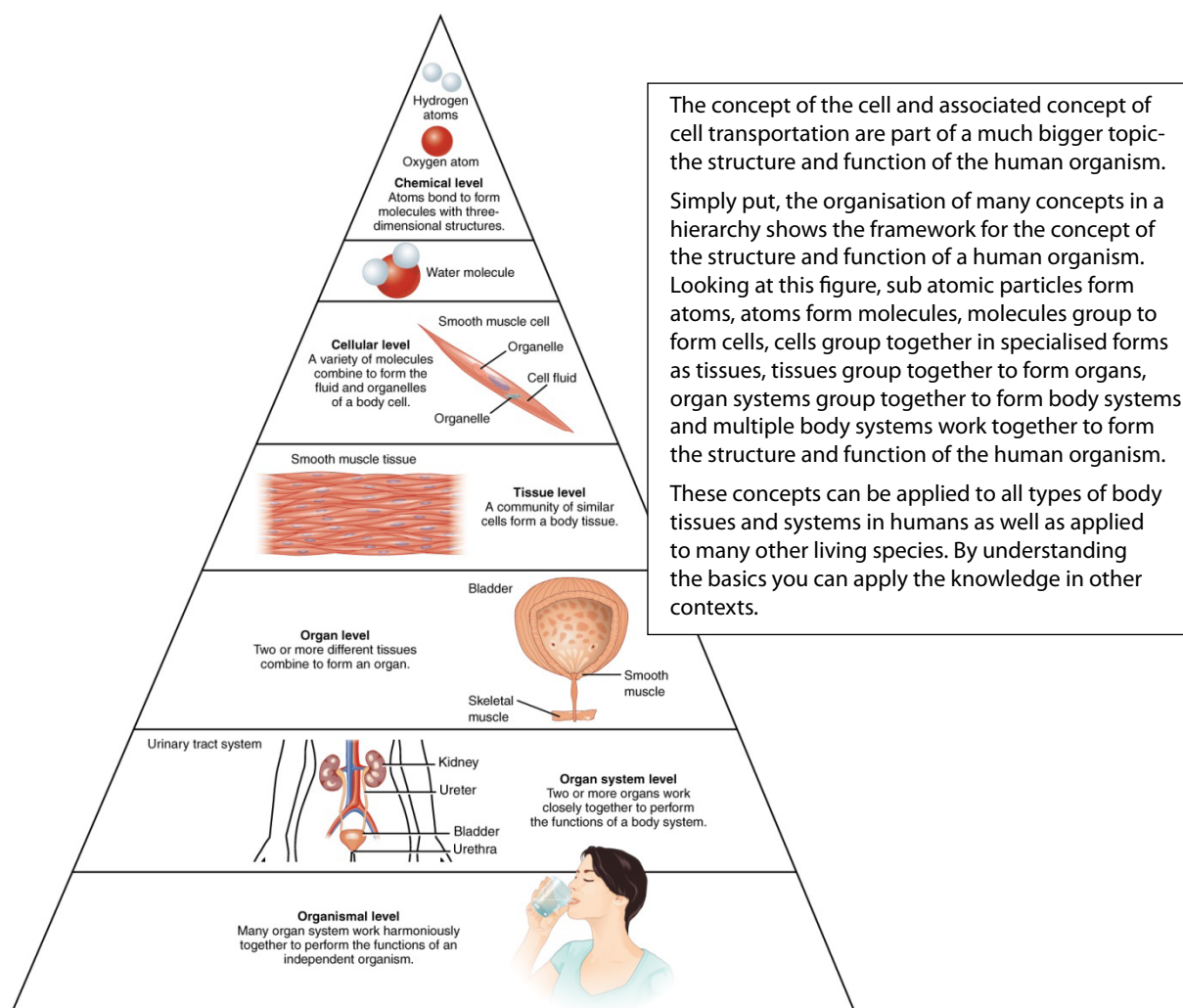


Figure 3 Structural Organisation of the Human Body
(reproduced with permission from Open Stax College, 2013).

Open Stax College. (2013, June 27). *Structural organization of the human body*. Retrieved from the Connexions <http://cnx.org/content/m45985/latest/>

Why is understanding this organisation important?

When you are studying science, memorising facts by highlight written information and then reading and re-reading these is not enough to succeed. This process might help you to retain information in the short term but is not the best way of learning for the purpose of applying information to new contexts and solving new problems – and this is what is required in science.

Knowing that typical frameworks exist when learning new information will help your understanding. By applying such frameworks to organise concepts and information as you study in the sciences will assist with understanding, remembering and developing the capacity to apply the information in new contexts for problems solving.

You may find it easier to relate to the previous concepts by considering the following example, adapted from **Bates College** (2012, para 2), on building houses as an analogy to studying science.

Studying, by just trying to memorise information, is like staring at a pile of building materials (e.g. bricks, tiles, beams, nails, etc.) and attempting to memorise all the components hoping you can understand it and from this, construct a house. In practice, those materials can be combined to make a house, but without the blueprints, (i.e., **conceptual plans** of how to assemble the materials to make a house) and an understanding of these it would be difficult to know how all the materials piece together. If you first study and understand the blueprints from the foundation (**major concepts**), you will recognise more readily how the components of the house (**supporting or secondary concepts**) come together and how the different materials (**facts and other details**) are used at each level to build the overall structure (**conceptual framework**). A builder thinks about

construction as a series of modular activities, for example, excavation and site preparation, preparing and pouring the foundations, erecting a frame, framing windows and doors, installing the wiring and so on. While the house design may be different for another project, it will primarily be a rearrangement of recognisable and routine construction components. Acquiring knowledge in science can be approached in this way: see the big picture, learn the supporting components and concepts learn the details of each and how they work together. Once you have “built” a house, you will be able to apply that knowledge to other projects.

Bates College. (2012). *Tips for studying to learn biology: conceptual frameworks*. Retrieved from <http://abacus.bates.edu/~ganderso/biology/resources/studytips.html>.

By understanding the smaller components (concepts) and how they relate and connect together rather than just trying to remember everything you will be better placed to understand the big picture. This in turn makes it easier to apply this information to solve problems and apply the information in new contexts.

Organising scientific information to assist my learning

Try to apply a consistent conceptual framework to assist your learning. Define and understand terms, classify and organise information, use concepts and supporting concepts and provide relevant details and explanations, connect and / or reconnect this with what you know apply to the real world examples.

1. **Define** and understand relevant terms.
2. Use a **conceptual framework** to identifying and organise **major** and **supporting concepts** and the add specifics (**details** and explanations).
3. Make information meaningful and demonstrate your understanding by relating or associating it to something familiar (**Application** – real world examples or relate to other past learning).
4. **Connect** and show **relationships** with the **concepts** it to the big picture by using headings/ charts/ maps/numbers etc. to organise information.



Tip

Use frameworks that are already developed e.g. organisational structure of text books and lecture notes.

Other related guides

- Studying in the sciences: Strategies for learning and understanding scientific concepts