

Course Name: I think Biology

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Week:1

Lecture:1

W1L1_What is Biology?

Welcome to the iThink Biology NPTEL course. My name is Sravanti Uppaluri and I am a faculty member in the Biology group at Azim Premji University. This course, iThink Biology, is meant as an introductory biology course for undergraduate students. So today we will get a brief introduction to the course, and the topics that we will cover, and we will primarily be asking a very basic question, which is really what is biology? So what is this vast discipline that we are trying to explore over the course of this term? So how would you define biology? If you were to ask your peers, if you were to ask other people on the street, what do they think when they hear the term biology? So let's turn to them and ask a few questions.

What comes to your mind when you hear the word biology?

So the first thing is like an image of a medical professional comes to your mind, you know, a proper doctor with a white coat and so on. Organisms, plants, and living stuff. Yeah, I get life in my mind. I guess plants, animals, and yeah, and labs. Biology, when I think about it, it's difficult. That's something I get in my mind because like even since in my childhood, when I used to see biology books I used to see the names of plants, the parts of the body, like I used to face a lot of problems in remembering the names. So that's why I feel the word difficulty in my brain when I see biology. Living things, things that are alive. Just like they said, living things and connections between them also. So stuff like ecosystems, food chains. Organic chemistry. When I hear biology, it's I think all about the study of the body or something like that. I don't know exactly what is biology.

When do you first remember ever encountering biology?

In seventh and eighth you start to distinguish it because you have different teachers teaching for different sorts of, I think biology came up for the first time during that time. Eighth grade I think. Yeah, until then it was just general science. I think in my seventh grade. I think in third grade because in our school they split sciences into chemistry, physics, and biology in third grade.

What was your opinion of biology as a subject?

For me, like school time it was mostly like torture because it was mostly remembering scientific names and all that rather than like really understanding how things work and everything. It was pretty interesting up to a certain point and then it went sideways, especially for me when we took cut-like plants and dissected animals. It felt like it was unnatural on our part maybe just doing things that we are not meant to do. A lot of mugging up and just sort of hated doing the diagrams. I absolutely hated them. I remember in ninth grade I hated it because we had to draw all these diagrams and we had to look at stuffed pigeons which I was terrified of. But I did quite enjoy it. I really liked studying except for the drawing part. I found genetics interesting but I hated anything to do with plants because it's so boring. A lot of memorizing stuff. I think once you get past memorizing there is some logic but then initially it's just remembering. It's an information-dense subject. The boring bits I think were meant like in all the genus names and other complex names I think that was the boring part.

What do you think that biologists do?

Look at butterflies. I guess they are just interested in the living world. The scale of organisms that biologists study is so tiny and you can't imagine that they make such huge changes to the way you live every single day. But it happens and it's beautiful to look at.

Alright, so we heard a few interesting perspectives about what is biology. So some of the things that came out was really that biology is maybe the study of plants and animals. Biology is the study of how plants and animals interact with each other, interact with their environment. Maybe somebody else might say that biology is really the study of genes, genetics, and DNA. Maybe how traits and characteristics are passed down from one generation to the next. So which of these definitions is really true? It's probably all of them and a little bit more.

But what ties all of these definitions together is actually the idea that biology is the study of living things and how living things interact with each other and their environment. If that's the case, what do we define as living? So why don't we take a moment, pause the video, and reflect on what it means to be living? So you might actually very quickly come to realize that defining life is not that easy. So one way of trying to define something is trying to assign some characteristics. To say that living things all have certain characteristics.

So the first thing that might come to mind is that all living things move. So they exhibit movement of some sort or the other. But of course, we know that plants don't move on their own. So movement isn't enough for something to be living. Maybe all living things require fuel because they need a source of energy.

Likewise, cars require fuel, right? They require a source of energy, but we would not call cars living things. Perhaps we might say that all living things must reproduce. That's a defining feature of life. Again, there are many things that we know to be living, that we define as living

that don't reproduce. For example, worker bees or ants in ant colonies or beehives, don't reproduce, right? But they are certainly living.

Maybe another sort of basic characteristic we can think about is waste production, right? So all living things must, will produce waste from whatever they've taken in, right? You know, a counter example of course is a city. Cities also produce a lot of waste. Would you consider cities a living thing? This is actually a really important question that I hope we will explore, that I hope you will explore further in this course. So what we can see from trying to assign characteristics to living things is first of all, that not all living things have exactly the same characteristics that define them. And secondly, that maybe we don't really need a very rigid definition of what life is, right? So it could be that living things have a subset of some of these characteristics and that's okay.

So let's take a few examples, right, to explore this question a little bit further. So on the top left, you see a picture of succulent plants, right? These succulent plants of course you might define as living because they grow, they increase their numbers of leaves, and so on, right? But what if I plucked off a single leaf from these plants? Is that leaf living by itself? What about when I take this leaf, put it in soil, and eventually, it develops roots and actually turns into a full plant again? So is that leaf still living or not? So one thing you might say is maybe it's not living, but because it has the potential for life, once you've planted it, it is actually living. Likewise, the image in the center on the top row is actually an image of all kinds of different seeds, right? You see that they come in such a diverse set of shapes and colors, right? So you might ask, are seeds living? This is a very important question and perhaps a question that there is no answer to. But again, once the seed sprouts, right, as is pictured on the right-hand side, you would certainly call this entity something that is living, right? So again, there's a potential for life there. So, what is that potential that is something else that you might want to think about? What about the plants and vegetables in your fridge, right? Are they living? You might think that they're living when they're still on the plant or the tree itself, right? But once I've plucked it, is it still living? Is the orange here still living? Is the brinjal still living or not, right? This pineapple that's imaged on the left-hand side at the bottom is the fruit itself living.?

So whenever you take a slice of pineapple and you're eating it, are you actually eating something that is still alive? And our first response may be no. But perhaps let's watch a video of what a pineapple can do and then we can come back and explore this question a little bit further. So in this video, you see on the left-hand side a fresh slice of pineapple sitting on top of a solidified gel of gelatin. So gelatin is really very similar to the jelly that you might have eaten for dessert. Right? And it forms a very gelatinous kind of structure.

On the right-hand side, in the same size beaker, the same amount of gelatin is also placed. And on top of it is a slice of cooked pineapple. So this pineapple has been boiled in water for several

minutes and it's been placed on gelatin. So the only difference between these two beakers is that on the left-hand side, it's a fresh slice of pineapple. On the right-hand side is a cooked slice of pineapple.

So as I play this video, you will start to see that over time, on the left-hand side, the fresh pineapple seems to have an effect on the gelatin. You see it almost like the gelatin sort of melting away, right? And that gel-like structure is sort of disappearing. On the right-hand side, the cooked pineapple is not doing anything at all. So what is the difference between the cooked pineapple and the fresh slice of pineapple? It has a very clear effect on the gelatin, right? It is melting away. And that turns out that it's because there is an enzymatic activity that is acting on the gelatin, sorry, that is melting this gelatin away.

So the pineapple that is still fresh, right, still has some sort of biological activity present inside it. Okay, whether or not this means the pineapple is alive or not is a question that we can explore further. All right, so altogether, I think this set of examples has really shown us that trying to define life is really not as easy as we think, right? These are the kinds of questions and the way in which we will try to inquire into various kinds of biological problems over the course of this term in the iThink Biology course. The resource that we will be using for this course is a textbook called iThink Biology. iThink Biology is a freely available online textbook found at www.ithinkbiology.in. If you simply type this into the internet, you will find this freely accessible book. iThink Biology is a textbook that is based on case studies that are rooted in the Indian context. The textbook is meant to help you build capacities that are really important for a biology student. Okay, this textbook will be used a lot throughout this course. So it's really important for you to get to know how to use the resource properly.

You will find that we have categorized each chapter under different themes, the first being land and waterscapes, human health, food and agriculture, and finally interactions between organisms. The website itself is very interactive. There are many buttons that you can click, and you will find various links that will show you the path to sort of different interactive features of the book. So it's really important, as I said, for you to get to know how to use the book in the first place. So let's take a moment first to watch a video about how to use the book itself.

The first page you will arrive at is the home page. From this page, you will be able to access all other pages that this ebook holds. Scroll down to view the four themes and the chapters within them, including the four primers. Read about the five key capacities that we hope you will gain after reading this book. The Reading iThink Biology and About iThink Biology sections include details about how to use this resource if you are a student or teacher of biology.

All the pages of the book are also accessible through the navigation bar on the left-hand side of your screen. This includes the four themes, the ten chapters, and the four primers. You can also

find your way to particular sections of each chapter. Through this navigation bar, you will have access to other important pages of the ebook, such as the glossary, which holds all the definitions of important terms used in the book, the exercise answers from all the chapters, the research highlights present in the chapters, as well as all the recorded interviews with scientists in the videos page. On the Doing Biology page, we have also curated a list of work and research opportunities for biology students based in India.

Each chapter is designed with several interactive features. Each glossary term will be present in a box, which can be clicked to access the definition of that term. Any text that is underlined is a link. This could be a link to other locations of the ebook, as well as external sites that will aid your understanding of a particular concept. References are also available by clicking the number in superscript.

Some figures will be present in a slide show layout. You will need to click each slide to access the figures. Critical thinking boxes appear throughout the book. Click the arrow to access hints that will help you answer the question. Notice side notes on the right-hand side of your screen for interesting points relevant to the section that you are reading.

Attempt the exercises in the chapters and check if your answers are correct. You will also notice extra reading drop-down boxes in all the chapters. Click the button to access these readings. At the end of each chapter is a quiz. Attempt these questions and check if your answers are correct.

Finally, we have also added a bookmark function to this resource. Click on any portion of the book and use the bookmark symbol to activate the bookmark at that location. You can then view all your saved bookmarks from the navigation bar. In some of the chapters, you will find a research highlights box. This section will introduce you to a research paper.

Use the download button to download the paper to your device. Within the PDF file, the authors have left comments to help guide you read the paper. During the session, we have really explored this very fundamental question of what this discipline of biology really is and what we study in biology. What we have realized is that biology is really the study of living things and the interaction of living things with each other and with their environment.

But it's not that easy to define what is living. Surprisingly it's not that easy to define what is living. So we will explore various topics during this course. Some of the things that we will talk about include the process of science, the building blocks of biology, what is biology, and what are living things made up of. So we will explore the basics of cell biology, molecular biology, and genetics.

We will also discuss evolution and ecology. We will further discuss ecological interactions, public health issues, of course, which are very important for us as human beings, and environmental issues. We will also finish the course by discussing how biology, society, and the environment are really very strongly interlinked. So with that, we welcome you to the course, iThink Biology, and look forward to a semester of exploration with you. Thank you.