**Introduction to Biology**

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In biology, we are going to be looking at the plants and animals that form part of the environment in which the over-6 child lives and continues to develop. So we are back to development – I am reminding you that it is all about development. Now we all know that children develop through experiences they have in the environment. So the work we are going to offer will always be in relation to the nature and the characteristics of the child.

What are we dealing with? We are going to deal with plants and animals. We are going to introduce them, to get the children to take a look at the plants and animals that they live with in their daily lives. What is the point of looking at plants and animals? It is about their development. They live every day certainly with plants around them, perhaps not with so many animals around them. It is part of their lives.

Particularly in botany we make enormous use of impressionistic charts. For the most part they are all impressionistic. We are going to be appealing to the child’s reasoning powers and to the power of their imagination. The reason we are going to be doing that is because older children want to know the reasons for things. First plane children want to know the facts for instance that this is blue, this is a triangle. Second plane children want to know WHY it is a triangle. HOW, WHY and WHEN are the characteristics of the questions older children ask.

Always keep at the forefront of your mind that this work is about the development of the human personality. We are not trying to teach biology in and of itself. Now along the way they will pick up lots of facts and theories and so on. But that is not the point. They will of course pick up that a leaf has an apex, a petiole etc. They will get all that nomenclature but they will get that in relation to the job or the function. The job of the veins is to carry the water, the job of the petiole is to get as much light as possible from the sun. AGAIN THE EMPHASIS IS ON SERVICE TO SOMETHING BIGGER, NOT ON ONE’S OWN NEED.

We are not trying to teach them that a leaf has this and that and that. It is not boring and dry like that. Its like “Goodness! Isn’t it clever of the leaf that it can turn to catch as much sunlight as possible on that petiole?” I mean have you ever seen a field of sunflowers turn their heads to follow the sun? It is the most amazing sight. I remember stopping on the train, and there was a field of sunflowers, and I watched them turn their heads with the movement of the sun. It is the most amazing thing. I am just intrigued by just how clever nature is.

You aren’t meant to know everything. You are meant to help the children find out. You have got to leave your ego behind. Because I can tell you elementary children will pummel it into the ground.

What we are going to be doing is help the second plane child answer questions such as “WHY are the leaves green?” It is important to remember that second plane children need the facts; they need to know the facts. They need to know some of the nomenclature – the shapes of the leaves – before they can wonder about anything. Before they can look at the reason, they need to know the facts. The child needs the facts in order to investigate the reasons. The foundations in the first plane are absolutely essential.

I am a city child. No one ever bothered to tell me the names of the trees. To this day I have to look carefully and ask is that an oak? Now sycamores I realise. But what kind of tree is that? What I am saying is that they really need the nomenclature. I mean I can recognize a rose but the wild flowers? I have no idea. But I have a colleague who knows all those. Like me she is fascinated by nature, but she also had the advantage of growing up in the country and having an aunt who had both a fascination for and a knowledge of nature, and who shared both that fascination and knowledge with her.

What work can you do with the first plane child? Caring for the plants in the environment – watering plants, cleaning leaves, seed germination, flower arranging, planting bulbs, botany cabinet, germination experiments, and all the nomenclature to do with plants. With the second plane children we have to let them go out to investigate, we want them to be able to follow their interests. We appeal always to the reasoning mind and the imagination.

Montessori refers to the imagination as “the great power of this age.” (To Educate The Human Potential, p5) and that the “world is acquired psychologically by means of the imagination” (Childhood to Adolescence, chapter 5 Clio).

As always, we are going to present overviews, which give them impressions of the natural world. One of the really interesting charts is the first chart we use for the leaf. It is about photosynthesis, but it is really impressionistic. If you look at an ordinary leaf, the children can’t see what is going on. So we give them an overview of what is going on inside that leaf, in an imaginative way, in story form. The idea is that the children build their own picture in their minds of what is going on. The whole theme of needs is going to appear in biology as well as history. For example, the need for food in the animal kingdom. In terms of survival they have to move for it, they have to learn to protect it. By way of contrast in the plant kingdom, the leaves make the food for the plant. That seems much simpler. Needs explain the physiology of plants and animals. The idea is that children of this age are tougher psychologically and tougher emotionally and tougher physically. In the first plane children get measles and mumps and everything else, and you’re going to get that too.

These second plane children are just tougher. The fact that some animals hunt others for food – that’s just the way it is. This is how they satisfy their needs. The theme of needs helps the child to unlock and make manageable a huge amount of knowledge. A child may be particularly interested in foxes. The question then arises, how do foxes in an urban area find their food? That might be the first chapter of their knowledge on foxes. Whatever the children are interested in. They might then ask where they find shelter. And that’s another chapter, and so it is building up chapter by chapter.

And then there is the other theme of function. By function I mean the job that is done. Function concerns itself with the job that is done. The function of the leaf, which is always in relation to the rest of the plant, is that it makes the food for the plant. First of all, that is a fascinating idea. And they are going to use their mind and their imagination to grasp concepts that aren’t available to their senses. You can’t exactly *see* it happening.

To do that, to make this food, what does the leaf need? It needs water, it needs carbon dioxide, it needs sunshine. And if you think about the physiology of the leaf, it needs to have an expanded surface to get as much of that sunlight as possible.

And there is a third theme, which is that of relationship with the rest of the environment. By environment I mean different environments. Leaves in a certain climate might have expanded surfaces. In a dry area the leaf doesn’t way to be giving away too much moisture, and so their leaf is different. Think of the cacti – their leaves have changed to thorns, and it is the green stem that makes the food. But if you are in a rainforest, then your leaves are going to be huge, because you live in a rainforest and there is loads of rain. If you live in Ireland there is also loads of rain.

The physiology of plants is going to be different depending on where they are on the planet. Think about the animals, about the fish. Think of how they have adapted to their watery environment. They have gills, for a start, which enable them to take the oxygen from the water. They have wonderful streamlined bodies and many of them have scales so that their bodies don’t get waterlogged. A LEAF DOESN’T EXIST FOR ITSELF. IT EXISTS TO MEET THE NEED OF SOMETHING BIGGER. THE LEAF HAS ITS OWN NEEDS, BUT ITS EXISTENCE IS NOT TO MEET ITS NEEDS. ITS EXISTENCE IS TO MEET THE NEEDS OF SOMETHING GREATER. COSMIC TASK MUST PRECEDE NEED. I EXIST FOR SOMETHING. I HAVE NEEDS BECAUSE I EXIST.

The fourth theme is classification. Classification is about organizing facts, grouping them into like and unlike. When we do the botany we look at simple classification exercises, and these are exactly what they say. The children find out that when we talk about leaves, we have basically two kinds of leaves – reticulate and venetian. It is a simple classification exercise, but it really appeals to the intellectual orientation of the second plane child. The important thing is that the children are doing this classification based on knowledge, knowledge that comes from experience.

Nature is just experimenting. Okay we’ve got to have a leaf. So why don’t we just have lots of kinds of leaves. Depending on where we are and what sort of thing we do. Look at the African violet. It has hairy leaves so it doesn’t give off too much moisture. Well if I buy an African violet in Ireland it doesn’t really need hair leaves, but it has got its hairy leaves.

You have to really hold back from wanting a product – a product of a child. The real thing this work is about is human development. What we want is a child who is a whole child, with a humanity about them. And it would be wonderful if they know more than you do when they leave you. But do not lose sight of our focus on their development.

The essence here is to awake their interest. We want to wonder with them at the magic and mystery and the sheer brilliance of nature. The second plane child loves what is different, what is special, what is unique – they are hero worshippers – that fills them with admiration and wonder. And we build that into the nature of the work. I mean take this leaf. It makes food for the plant; okay that’s amazing enough. But while it does that, it splits up the molecule of water and frees up oxygen for us to breathe. I mean this is extraordinary! Children are intrigued and amazed at these ideas. They are particularly fascinated by the work of the worms, these tiny little things that put air into the soil as it travels along. So you have elementary children who say Don’t Touch The Spider, it has a job to do.

We give them work for their hands – experiments to do and so on. This work feeds their intelligence and imagination, and leads to greater interest. They become more and more curious about how each aspect of the natural world functions and relates with the rest. You will find there are children who want to read about and write down their findings, but that is a by-product, it is not your aim.

We usually begin with the botany because it offers more hands-on experience. Once you’ve begun that, then you can do some work in the zoology area using the children’s interests as your guide. There is a sequence in which we give the work on this course, but in the classroom it is all happening in parallel. In a 9-12 class you do the scientific classification having prepared for it in the 6-9 class. Parallel to that we will introduce ecology. Different trainers present it differently. The only thing you need to know is the pre-requisites.

The sequence we follow is more or less:

Experiments about the needs of plants

 Beginning with the leaf

 Followed by the root and then the stem

 And finally flower, fruit and seed

The most important thing is to follow the children’s interest. It is really nice to start with the leaf because of the idea of it being a food factory. But if they are interested in the roots – do the roots. And if you see the wild flowers appearing or disappearing – then do the flowers. The important thing is to follow their interest. You can do the leaf with one group, flower with another group, and the root with a third. The knowledge spreads and you create a kind of “fashion” – it is always nice to have these kinds of fashions, the children inspire each other.

You need to do the flower BEFORE you can do the fruit and seed.

You want to always keep alive the sense of wonder and admiration, and the work is ONLY THE MEANS THROUGH WHICH YOU KEEP THIS ALIVE.

>> Please read *Man’s Place in the Cosmos* in Child, Society and the World, Ch 6