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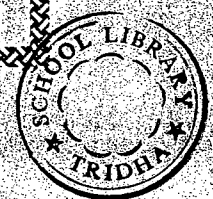
A
PATH OF
DISCOVERY

*A Program of a Waldorf
Grade School Teacher*

Volume Eight - Grade Eight

Including lesson indications, verses, poems, etc.,

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ACKNOWLEDGEMENTS

My acknowledgements and thanks to the authors and poets whose works I have freely included or quoted from in this volume. A complete list of reference books and authors may be found in the "Bibliography" at the end of this book.

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INTRODUCTION

Grade Eight Developmental Profile

'At fourteen, the pupils are 'into' adolescence; bodily and psychological changes are well underway, so that in general, the young person seems more robust and the tenderness of the previous two years has lessened somewhat. Growth in height and sexual development are clearly established, with the onset of the 'breaking voice' in boys and the establishing of the menstrual cycle in girls (Ed. although they may have commenced at a much earlier age). At this age, the world of ideas begins to take meaning for the young adolescent and the critical faculties of the fourteen year old are noticeably sharper and parts of the accepted framework - particular rules for example - are subject to questioning scrutiny. Counter-balancing this critical tendency, is the emergence of a reasoning or 'reasonable' side in the child.

The emergence of an independent life of feeling enters the 'labor and delivery' phase and the emotional turbulence which may attend this birth represents an important challenge to parents and teachers - how to accompany this birth or beginning of the emancipation of an individualised and independent inner life of thinking, feeling and intention without either being overwhelmed or swamped by the waves and tides of emotions, while being able to recognise that the state of crisis is part of a development.

.....both genders now stand before new and unknown vistas with sharpening minds, tender hearts and limbs that struggle to reach accommodation with gravity. By the end of this class, the pupils are already searching for new authorities and role models.'

'The Educational Tasks and Content of the Steiner Waldorf Curriculum'

Edited by Martyn Rawson and Tobias Richter.

Pub: Steiner Waldorf Schools Fellowship. UK

And what of the Future?

Grade Eight brings to a close the eight year journey along a

'Path of Discovery'

Many readers will have made all or part of this journey with me and will have had a multitude of experiences in and out of the school and classroom. Many of my 'little ones' of Grade One who once looked up into my face, are now of a height which enables them to look down at it! They have grown in confidence in all spheres and are well prepared to meet the challenges of the years ahead. It is with a multitude of emotions that I prepare to farewell them.

My career as a Steiner-Waldorf teacher begun many years ago at the Michael House School in Derbyshire, England which like all Steiner schools in the UK were faced with a constant battle for financial survival. My first class are now nearing middle age and support families of their own, with some of their offspring attending the school and in some instances, meeting the same teachers that taught their parents!

When I look back over these years of teaching, I cannot help but notice how children have changed over the decades. Gone are the days when a teacher could walk into a classroom where children stand prepared to receive the gifts which their teacher has to offer. No longer are students able to sit for extended periods of time on their chairs in their regimented rows of wooden desks. No longer are they content to listen to what is being offered without interruption and question. But have we as teachers and schools really awoken to these changes and the resulting need for change in our teaching methods, or do we hang on to tried and trusted methods in the false belief that that is 'how' the Steiner-Waldorf curriculum has to be presented??

The need for change is perhaps no more apparent than in the later years of the lower (primary) school, especially Grades Seven and Eight. Although boys have always tended to be restless in class, I have become even more aware with my last group of the increasing difficulty which the boys in particular, have in remaining in their places and sitting 'comfortably' in their seats. There is a constant restlessness with chairs tottering on their two rear legs; of students wriggling on their seats; of students stretching-out their long legs so that they are for all intents and purposes, lying on their chairs, etc. And what is our standard response? To give them even more desk work, such as writing, illustrating or embellishing books with 'pretty' borders.

Education, but Steiner-Waldorf education in particular (*public schools appear to be ahead of us to some extent!!*), needs to reassess where it stands in relations to the current needs of the student and how the wonderful Steiner-Waldorf curriculum is implemented.

I believe that our education needs to have a far stronger 'experiential' component to it. One which takes teacher and student out of the stifling confines of the classroom to work in a creative, constructional and meaningful manner, bringing to the student of the 21st century, experiences which have real meaning and purpose.

This does not mean rewriting the curriculum per se, but rather looking at avenues where subject matter can be directly related to the student's experiences in his/her immediate environment. I well remember observing a teacher some years ago teaching the theory of the 'pulley' in the lab. with the aid of sets of miniature pulleys and string! I made sure that my lesson took place outside with industrial pulleys and rope rigged up so that students could hoist each other up. Levers were addressed in a similar fashion. Another teacher recently taught mechanics via 'bicycle maintenance'! The class thoroughly enjoyed themselves and learnt a great deal about bicycles! However, horror or horrors.....there was hardly any material to be entered into the main lesson books!!!!

Nearly all of us learn by direct experience. Few have the capacity to remember everything through reading and listening. But our lessons are really geared for that small minority. Admittedly, there are some areas which do require more focussed 'head work' and such work does indeed have its place within the Steiner-Waldorf curriculum, but not to at the expense of other forms of learning.

Beginning in Grade One we construct our lessons so that they meet all three elements of Thinking, Feeling and Willing. There is no way in which the young child can be confined to their chair, so activity is very much the order of the day. But as the students progress up the school, this element becomes lost, along with a good proportion of the Steiner-Waldorf curriculum, in the desire to meet the requirements of external syllabi (*State requirements*) and thus secure much needed funding.

I do believe that with a little more lateral thinking, a curriculum can be designed and created that not only meets the requirements of the State syllabi, but also revitalises the Steiner-Waldorf curriculum for the higher grades, making it an exciting and rewarding experience for all who participate.

'A central theme for Grade Eight is the study of life in general, which includes plant ecology (following the previous years' study of geological ecology), and plant physiology - photosynthesis, and organic chemistry of starches, sugars and fats.

Transformation, of these processes, such as soap making and oil refining, can be examined in industrial setting.....' **Phases and Transitions in Waldorf Education.** Harlan Gilbert (Research Bulletin Vol. VII #1 Jan. 2002. AWSNA)

Environmental issues are foremost in most people's thoughts in this day and age, not least with our students. A curriculum could be developed around such environmental issues, a few of which I detail below purely as suggestions:

Environmental Technology and Conservation:

1. Expand on previous years' work and develop a Herb Garden - connect to Health and Hygiene lessons (drug education)
1. Research and produce a herbal soap
2. Research and produce a healthy 'sunscreen cream or lotion'
3. Research and produce an environmentally friendly/efficient diesel fuel (bio-diesel)
4. Convert a diesel engine to run on bio-diesel (car/tractor/boat engine)
5. Build and manage a 'weather station'
6. Water Watch - monitoring toxins in a river or creek
7. Design and build a 'Flow Form' for
8. Recycling of 'grey water'
9. Create a 'frog pond' to preserve frog species
10. Become involved in Wildlife/marine life/Native plant life conservation
11. Design and build a solar windmill to generate enough electricity to charge a battery which can be used for Information Technology:
12. Develop a functionable 'telegraph system' using solar power (perhaps run a line from the 'garden' to the 'office'!!)
13. Design and produce functionable articles from wood (Woodwork Lessons)
14. Design and produce more involved items of clothing using sewing machines
15. Build a straw/mud brick/rammed earth construction (for the kindergarten?)
16. Design and build a 'cob' oven for bread and pizza baking
17. Cooking classes (Health and Nutrition lessons)
18. Involvement in ALL aspects of producing an abridged Shakespeare play of at least 1.5 hours duration

The above are only a few ideas. No matter what the subject area, with a little bit of imagination teachers should be able to create numerous opportunities for 'experiential learning'

Finally, I would like to mention the:

GRADE EIGHT GRADUATION PROJECT

Grade Eight is a year when students benefit from real challenges, the class play being one of these. Unknown to many Steiner Waldorf teachers outside of Europe, is the Grade Eight Graduation Project.

This is a major undertaking for these young people, beginning before the end of Grade Seven when the class teacher will present the students with the idea of a major project which will generate excited discussion. Students will be briefed on the expectations regarding this particular project and then given the summer break to make their choice of project in full consultation with parents/guardians.

The guidelines which I gave my class were:

1. The chosen project should be one which opens up a whole new world of discovery, research and the development of new skills and knowledge.
2. Students should search for a 'mentor' who has the necessary expertise and knowledge required for a particular project. Parents/guardians must meet with and approve of this mentor.
3. The project should be 'costed' and approved by parents/guardians.
4. The proposed project must have the written approval of the class teacher prior to commencement.
5. Students will be required to sign a formal contract of commitment at the start of the new school year, which will be countersigned by parents/guardians and class teacher.
6. The project must be entirely the result of a student's own work.
7. A journal must be kept, giving a detailed written and pictorial record of the project in progress.
8. Regular oral progress presentations will be given to the class at 3 to 4 weekly intervals.

These then were the basic guidelines for the Class Eight Project. My class had six months in which to research and bring their work to completion. I feel that a longer period of time would result in some students losing interest. A shorter period would not give them sufficient time, bearing in mind that the entire project has to be completed outside of school hours.

On completion, students must be prepared to transport their work to a central venue at school where they are responsible for its set-up and display. Finally, students must prepare a three to five minute (max) speech which will give an overview of the process through which they have gone in bringing their work to completion. This speech will be given to assembled parents and teachers (in my case the audience numbered 200+ adults!!).

At the outset, students were aware that marks would be awarded for the project as follows:

Class presentations	10% max
Journal (content and format)	20% max
Speech (incl. personal presentation!)	30% max
Finished Item and display	40% max

Final grades would be as follows:

97 - 100%	Outstanding
87 - 96%	Excellent
77 - 86%	Highly Commended
67 - 76%	Commended
57 - 66%	Good
47 - 56%	Pass
0 - 46%	Fail

It is good to involve a colleague in the marking process. Needless to say, no student gained less than a 'Highly Commended' grade.

Each student was awarded a decorative certificate which will form part of their school leaving portfolio.

I was impressed with the wide range of projects and of the tremendous enthusiasm and application which individual students applied to the tasks in hand. Several had attended out-of-school classes and workshops to acquire the necessary skills and the results of their efforts were truly remarkable.

They included:

A double bed - *wood and metal*

Dress design and creation (*a popular choice amongst girls!*)

A film - original script

The script for an original play

Illustration of a children's book (*which will be published!!*)

An original children's story book (*to be published!*)

A video interview with and videod performances of an Australian 'pop-star'

A hexagonal bird cage

A surf-board

A sculpture

An oil painting

A large coffee table

Dog training (*the speech included a demonstration with the dog!*) and kennel

Japanese tie-dye (*a beautiful kimono*)

A model motorised boat

Original compositions and CD

The history of pancakes! (*a highly entertaining cookery demonstration*)

A transportable skateboard ramp

My time with my students came to a conclusion with the project presentations, which incidentally took place just one month after the class production of Shakespeare's 'Twelfth Night'. There was a real sense of achievement permeating the entire group and it was time to move-on to new pastures for both 'my' pupils and myself! They go on to high school and I finally graduate grade school after some thirty years of teaching and launch myself into a career as a 'smallholder' on the beautiful island of Tasmania off Australia's southernmost tip.

Eric. K Fairman. Tasmania. November, 2002.

PLATONIC SOLIDS

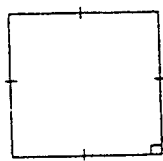
"...in the 8th class, one goes further with everything relating to equations, bringing the children as far as you can and adding to this the calculation of figures and planes, the theory of the loci..."

Rudolf Steiner.

"Three Lectures on the Curriculum of the Waldorf School"
(Stuttgart. 1919)

THE PYTHAGOREANS

Grade Eight 'geometry' is very much a continuation of the work undertaken in both geometry and mathematics in Grade Seven, for the two subjects are of course inextricably entwined and should at this stage definitely be treated as a 'oneness'. With geometry, there is always the temptation to spend too much time on the producing beautiful 'visual' results at the expense of developing a greater understanding and appreciation of the mathematical concepts. Rudolf Steiner suggests that students be able to calculate the volume of a variety of solids such as squares and rectangles. Students should also learn how to calculate the volume of the more complex forms of the Platonic Solids. To begin with, it would be beneficial to spend some time revising what the students have already learnt in geometry. This revision could include naming the of plane and solid shapes:



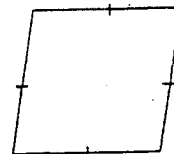
square



rectangle



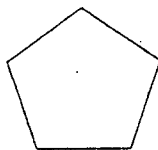
parallelogram



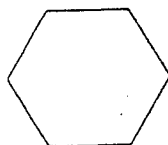
rhombus



trapezium



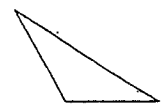
regular pentagon



regular hexagon

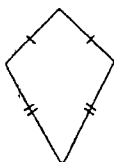


regular octagon

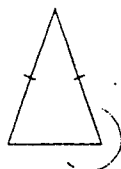


All sides different

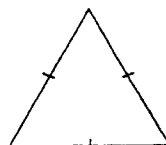
scalene triangle



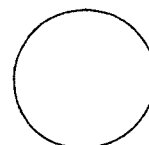
kite



isosceles triangle



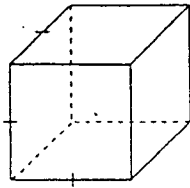
equilateral triangle



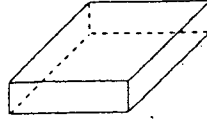
circle



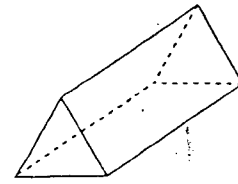
oval (ellipse)



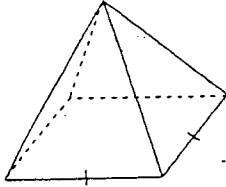
cube



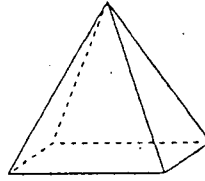
rectangular prism



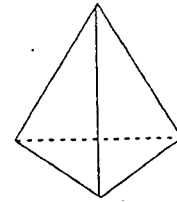
triangular prism



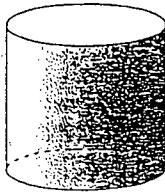
square pyramid



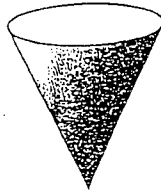
rectangular pyramid



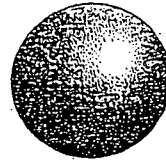
triangular pyramid



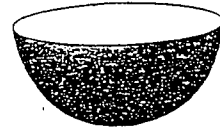
cylinder



cone



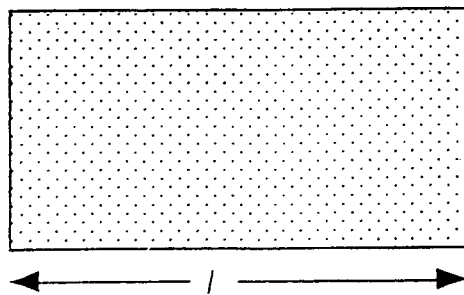
sphere



hemisphere

Area of a shape. We are able to determine this by measuring the amount of space which is enclosed within a shape. This means that we calculate the number of square units within that space.

Rectangle: To calculate the Area (A) of a rectangle, we multiply the length (l) by the breadth (b), eg:

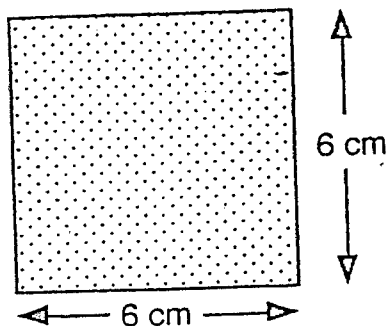


$$A = l \times b$$

If therefore, $l = 9 \text{ cm}$ and $b = 5 \text{ cm}$, then the solution would be:

Area = $9 \text{ cm} \times 5 \text{ cm} = 45 \text{ cm square}$ or more correctly, 45 cm^2

Square: This is of course a variation of a rectangle with length and breadth of equal length. If the measurements of each side is b cm, then the Area would be $b \times b = b^2$. eg:

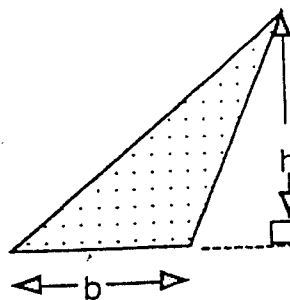
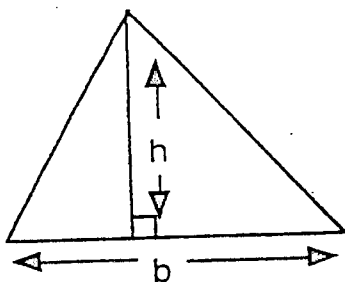


$$\text{Area} = 6 \text{ cm} \times 6 \text{ cm} = 36 \text{ cm}^2$$

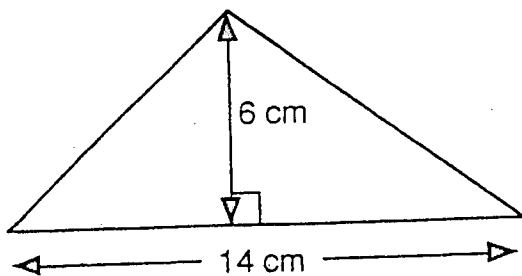
Triangle: To find the area of a triangle, we use the formula....

$$\text{Area} = 1/2 (\text{base} \times \text{height})$$

$$A = \frac{b \times h}{2} \quad \text{or} \quad A = 1/2 bh$$

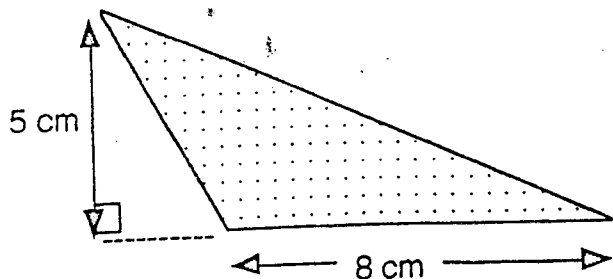


Examples:



$$A = \frac{b \times h}{2}$$

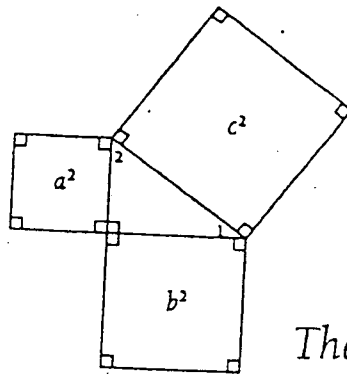
$$A = \frac{14 \times 6}{2} = 42 \text{ cm}^2$$



$$A = \frac{b \times h}{2}$$

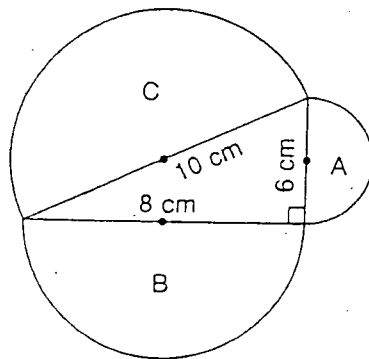
$$A = \frac{8 \times 5}{2} = 20 \text{ cm}^2$$

We can refer once more to Pythagoras who is perhaps best remembered for the theorem which bears his name. This theorem states that the sum of the squares on the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides of the triangle:



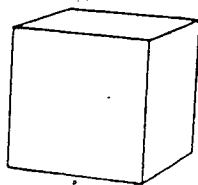
Therefore, $a^2 + b^2 = c^2$

Students would be interested in another 'proof' of the Pythagoras Theorem:

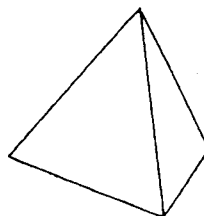


Therefore, $c^2 = a^2 + b^2$

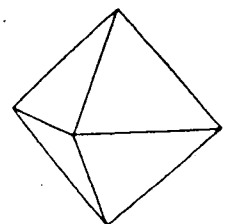
Pythagoras also showed that the sum of the angles of a triangle is equal to two right angles. He also discovered 'irrational numbers'....much to his dismay! Students of Pythagoras were deeply involved with all aspects of geometry in their endless search for 'universal harmony'. Their endless research finally resulted in their discovery of the five regular solids.



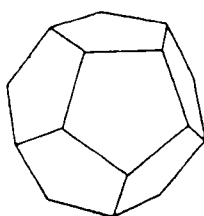
hexahedron



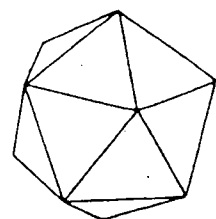
tetrahedron



octahedron



dodecahedron



icosahedron

We are of course surrounded in nature by manifestations of geometrical solids, most obviously in crystal formations. The Pythagoreans were well aware that geometry helped them to understand and explain the physical world. Everything which exists in creation has length, breadth and height. By constructing solids, we are able to enclose a portion of space. The most simple solids are spheres, cones, cylinders and polyhedrons.

HEDRON means a regular solid which has a definite number of faces. These are:

PENTAhedron - five faces

OCTAhedron - eight faces

HEXAhedron - six faces

ICOSAhedron - twenty faces

TETRAhedron - four faces

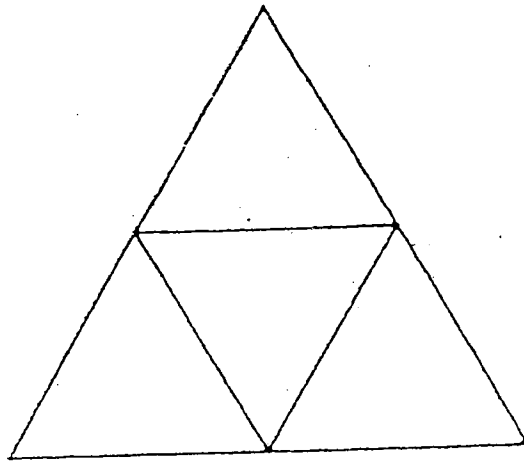
DODECAhedron - twelve faces

These 'regular solids' are shapes with many 'faces' forming most beautiful '**polyhedra**'. Polyhedrons are solids which have flat sides with straight edges and they are classified according to the number of faces which each has:

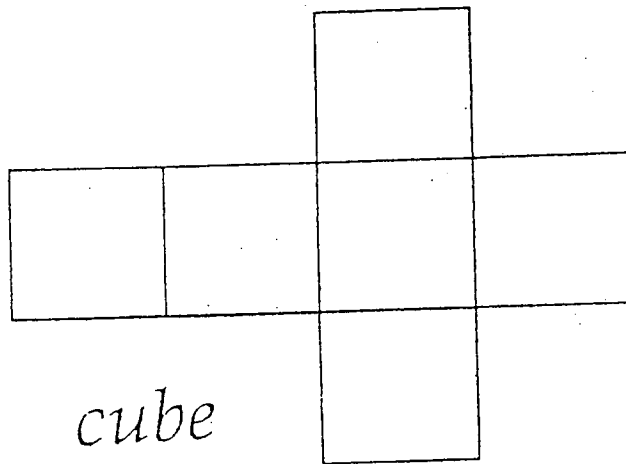
<u>Name</u>	<u># of Faces</u>	<u>Shape of each Face</u>
Tetrahedron (pyramid)	4	Equilateral triangle
Hexahedron (cube)	6	Square
Octahedron	8	Equilateral triangle
Dodecahedron	12	Pentagon
Icosahedron	20	Equilateral triangle

How the Pythagoreans arrived at their discovery of the five regular solids, has been lost over the ages, but it can be assumed that they would have begun with forms of which they were most familiar, such as the 'square', 'triangle' and 'hexagon'. These close-fitting shapes were in regular use for the floor tiling of the Grecian buildings.

Working with the two most well-known shapes (*square and equilateral triangles*), it was possible to form a 'net' for each and to raise-up the different sides to form two 'regular solids'.

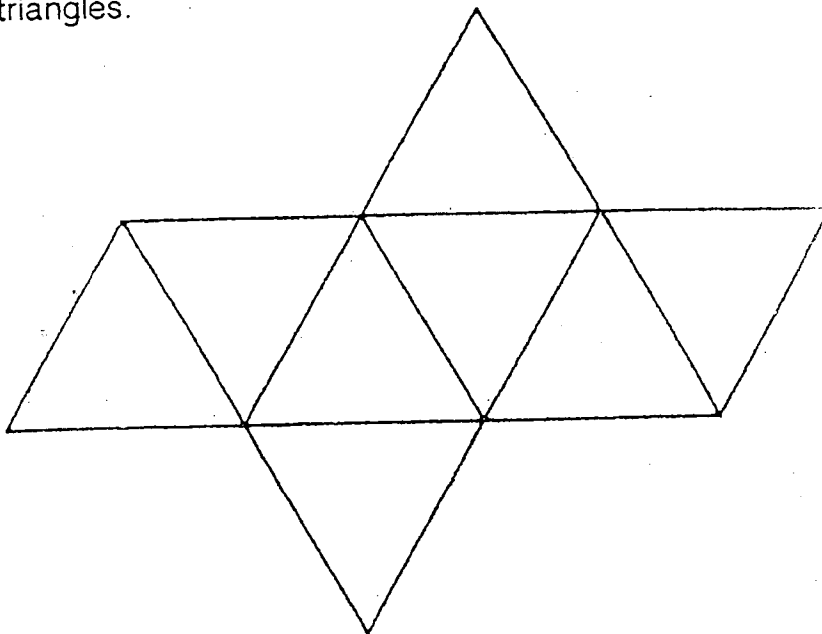


tetrahedron



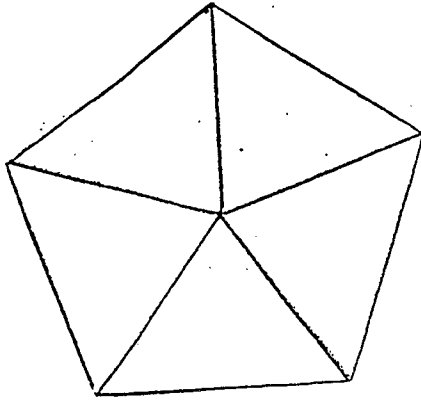
cube

Next followed the *octahedron* which was constructed from a net of eight equilateral triangles.

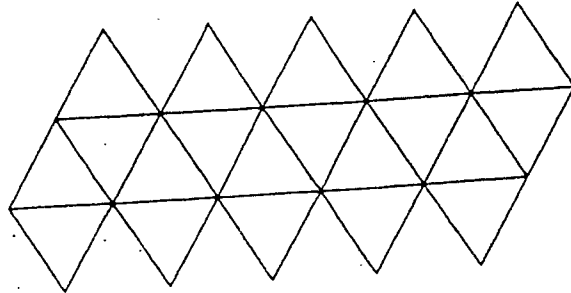


octahedron

By placing five equilateral triangles together, a pentagram could be created.



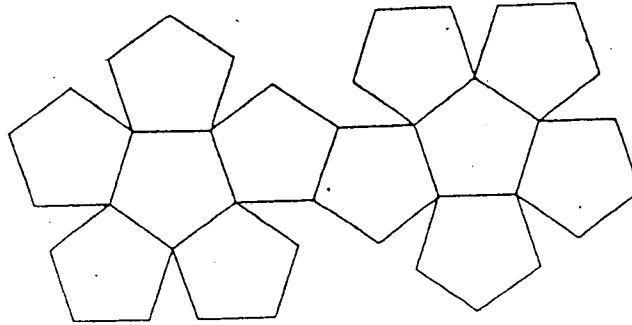
However, it took quite some while before the Pythagoreans discovered how to transform this into a third regular solid, which they finally achieved by creating a 'net' of 20 equilateral triangles which, when joined together, formed an icosahedron.



icosahedron

The 'pentagram' was a very special shape to the Pythagoreans, being used as their secret symbol and later, in the Middle Ages and Renaissance, it was used as a magical symbol to ward off evil spirits. When five of these were laid flat and placed around a sixth central pentagram, the result was a beautiful lotus shaped flower, but with gaps.

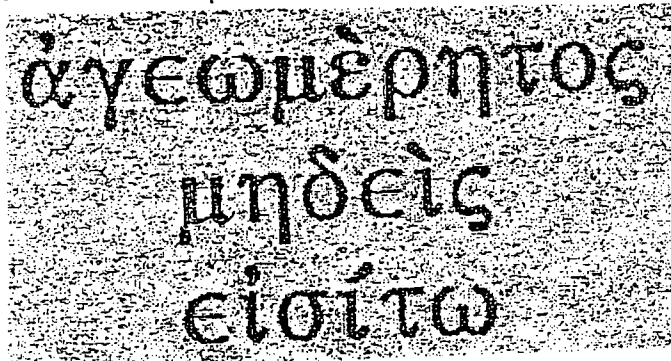
Eventually they came to the realisation that if the five 'petals' of the pentagram lotus flower were to be raised up slightly, it was possible for the abutting edges of each 'petal' to meet with its neighbour, thus forming a 'bowl' if attached to one another. Through trial and error they finally discover that if a second bowl was created, then inverted and placed atop the first, the upper edges of the bottom bowl would meet with their opposites around the upper bowl, thus creating the twelve-sided *dodecahedron*. To the Greeks, this was an awe inspiring discovery.



dodecahedron

PLATO'S ACADEMY

Remaining in Greece, but moving forward some 150 years, we meet another great philosopher and mathematician by the name of Plato who, in 387 BC, established an academy which had been inspired by the work and discoveries of the Secret Brotherhood of Pythagoras. This academy has frequently been described as being the first real 'university'. Plato was devoted to the art of geometry and had inscribed upon the stone lintel above the entrance to the academy:



Which, in English, means: "Let no one destitute of geometry enter my doors."

Plato was of the opinion that via the four branches of mathematics, the human being was drawn away from the falsehood and confusion brought about by the senses and instead, the mind was directed towards the contemplation of pure forms which Plato considered constituted Reality and Truth, leading to the 'Form of the Good' which was the pinnacle of human intellectual contemplation.

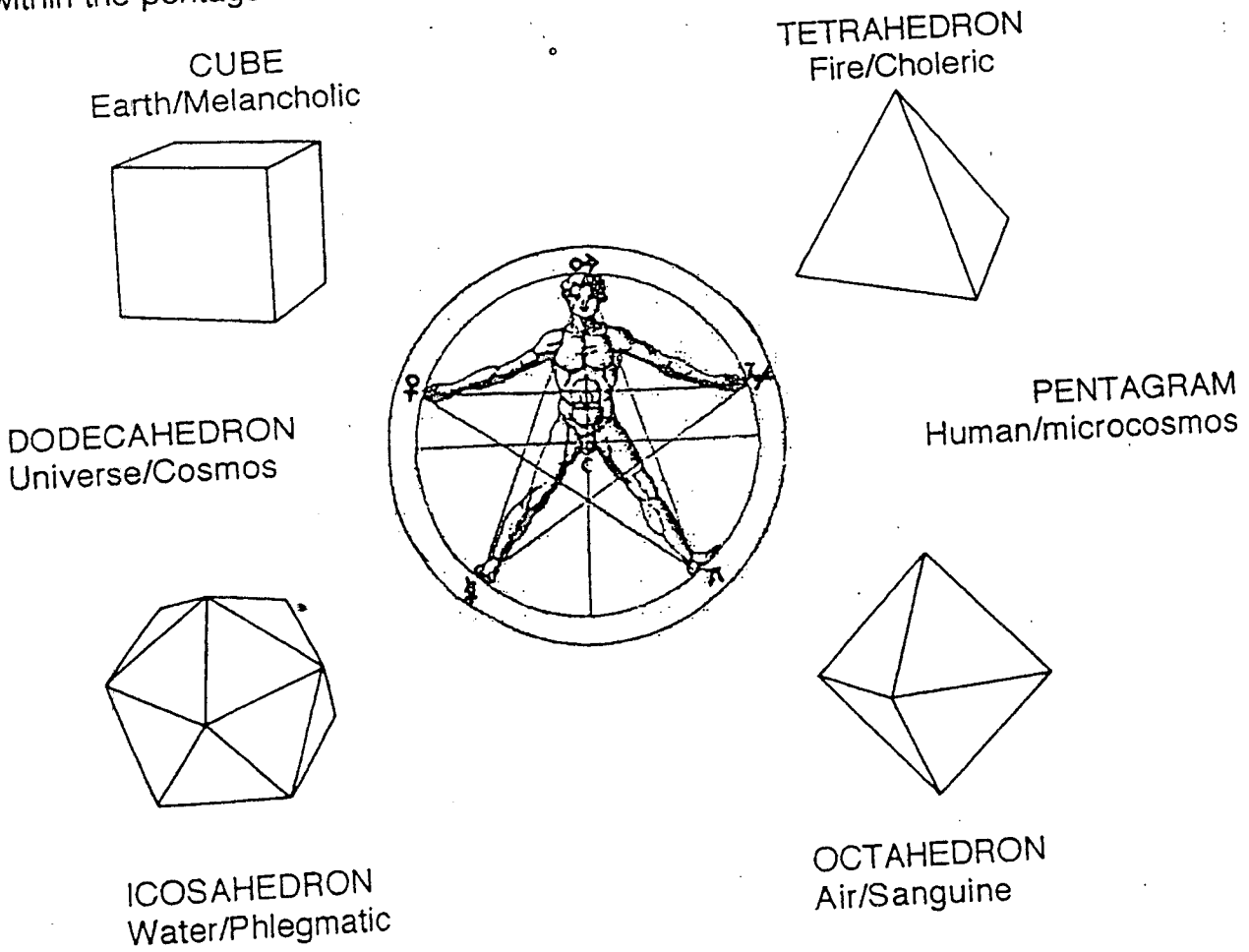
Plato believed that the origin of the Universe could be attributed to three things, namely: God, Matter and Form. Out of the chaos of the cosmos, God was able to take the Matter and give it Form, by so doing bringing order and beauty into what was disorderly and shapeless. For Plato, the importance of geometry lay not in the potential of its practical application, but rather as a discipline from whence one was able to acquire knowledge and wisdom. When we draw a geometrical shape, such as a triangle, it is merely an imperfect representation of that perfect triangle which we hold in our imagination.

Integral to Plato's creation of the universe theory, was his belief that the Creator had constructed the world out of perfect geometrical figures. The Four Elements - earth, air, fire and water - from which the ancient Greeks believed everything was composed, were allotted the first four solids. The cube was assigned to earth, being the least mobile of the four forms. The least mobile of the remaining forms would be the icosahedron, which was assigned to water. The tetrahedron, being next in order of mobility was assigned to fire, whilst the most mobile of all, the octahedron, was assigned to the air. This ordering of the four elements gives us the following picture with air/water holding the balance between fire and earth: $fire/air = air/water = water/earth$

But there were five regular solids as opposed to only four elements. Plato writes:

"There still remained a fifth construction, which the Creator used for embroidering the constellations of the whole heaven."

Later Greek philosophers assigned the dodecahedron to the universe or cosmos. Plato's reference to this fifth solid and its relationship to the cosmos could be related to the fact that it has twelve faces which correspond to the twelve signs of the Zodiac. Remembering that Plato's theory of the universe was based on order and form, consideration might be given to the 'Golden Ratio' as contained within the pentagon.

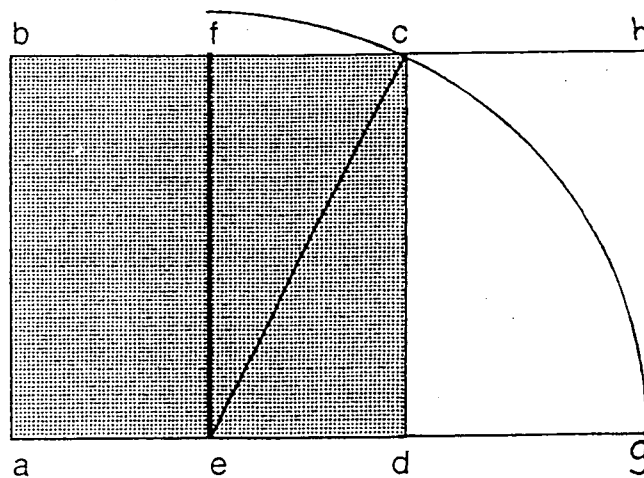


THE GOLDEN RATIO

Students will have worked with Fibonacci numbers in Grade Seven and should therefore be familiar with the Golden Ratio, Golden Section or Divine Proportion, whichever term is used. The relationship between any two Fibonacci numbers after 3 is approximately 1:1.6. This is the so-called 'Golden Ratio' which has intrigued humanity since Greek times. It occurs in pentagons, circles and decagons, but most notably in the Golden Rectangle, a figure whose two sides bear a magic relationship to one another.

The Golden Rectangle can be found in the pyramids of ancient Egypt, the Parthenon in Athens, through to works of the great Renaissance Masters. It can even be found in areas as diverse as pine cones and the earth-moon relationships, and more recently, it has been discovered in our DNA! Its presence is so widespread that it is accepted that there is a unifying mathematical principle at work in the universe which modern science has difficulty in defining.

The geometric construction of the Golden Rectangle begins with square $a/b/c/d$, which is divided into 2 equal parts by vertical line 'ef' :



Point 'f' is now the center of a circle, whose radius is diagonal 'fc'. An arc is now drawn 'cg' and the base line 'ad' is extended to intersect it and becomes the rectangle base. A new side 'hg' is drawn at right angles to this new base, with line 'bc' extended to intersect at 'h'.

Having completed this Golden Rectangle, we find that it has an unusual property in that if we were to subtract the original square, what remains would still be a Golden Rectangle.

*"The good is the beautiful.
Grant me to be beautiful in the inner man."*

Plato

ANATOMY

'One who looks at the skeleton in its present form - I mean in it's form as present-day science regards it - is like a person who says: There I have a printed page with the forms of letters upon it. He describes the form of these letters, but does not read their meaning because he is unable to read.

He does not relate what is expressed in the forms of the letters to what exists as their real basis; he only describes their shapes. In the same way the present-day anatomist, the present-day natural scientist, describes the bones as if they were entirely without meaning. What they really reveal, however, is their origin in the spiritual'

Rudolf Steiner. 'Man as Symphony of the Creative Word' Lecture XII (Dornach. 1923)

THE DEVELOPMENT OF MEDICAL SCIENCE

The human being was viewed quite differently by peoples in ancient times. They saw the human being as a 'being of light' still closely connected with the spiritual world from whence they came and inseparable in body, soul and spirit. As the human being became more 'earth-bound' there was an acceptance that the physical body was penetrated with special 'life forces' with which it had been endowed by the spiritual world. The body then, was viewed as a 'temple' and revered accordingly, without any clear or close observation of it's physical composition or structure.

If we look at Medieval art, we can observe how the proportionally inexact human figure is often depicted as emerging from a 'golden' background of light. The Renaissance gave birth to a new perception of the world and the human being. Artists and scientist began to look at the world from the perspective of exactitude. They studied landscapes, plants, animals and humans with renewed interest, studying form and proportion as at no other time in history and a new conscious relationship with 'death' awoke in the human being with the study of the skeleton. This 'awakening' led to the creation of new works of art depicting Death, such as Durer's 'Knight, Death and the Devil' or Holbein's 'Death Dance'. It was in this atmosphere of 'discovery' and 'rediscovery' that the seeds were sown for the development of anatomy and physiology leading to modern medical science. When we now look at the medical sciences, we should strive to relate what our research reveals once more with it's spiritual nascence.

*'To one who is able to behold rightly,
the skeleton reveals its spiritual origin'*

Rudolf Steiner. 'Man as Symphony of the Creative Word' Lecture XII (1923)

ANDREAS VESALIUS (1514 - 64)

Little was known or understood about the human skeleton until the 16th century through the work and studies of Andreas Vesalius. Prior to that time, the only knowledge which doctors had, dated back to the ancient Greek doctor Galen who had worked first with gladiators and then as physician to various Roman Emperors. For the next 1,500 years his writing were central to the world of medicine and as he had written somewhere in the region of three hundred books, his ideas were able to find a firm foothold.

Vesalius was born into a renowned family of Belgian doctors and it was perhaps not surprising that he too followed this path of study attending university in Paris. Although the dissection of corpses was frowned upon by society at that time, it was still possible for him to occasionally gain valuable knowledge of the human body through the dissection of cadavers (*corpses*). It was not long before Vesalius began to question the theories and statements of Galen, most of which had been based on information gleaned from the study and dissection of animals, such as dogs, pigs and monkeys. In actual fact, Galen was more a veterinary surgeon than a doctor of medicine! Vesalius's studies took him to Padua, Italy where the medical world was not so bound-up with Galen's ideas and Vesalius was free to pursue his own research, which inevitably led him to doubt Galen's ideas even more and it was in the year 1543 at the age of twenty-eight, that he published his world-changing book "De humani corporis fabrica" (*The Structure of the Human Body*). Artists in the studios of the Great Master, Titian had produced exquisite illustrations for the controversial book.

Many doctors at that time were horrified by the revelations contained within the covers of this sacrilegious publication. Vesalius had even dared to refute the long accepted fact that men had one less rib than women due to God having taken one from Adam's side wherewith to create Eve.

It was not long before Vesalius was appointed physician to the Holy Roman Emperor Charles V. However, Vesalius had rocked the establishment with his revelations, which resulted in his making many enemies. It was not long before these enemies conspired together and brought charges of heresy, body-snatching and even murder against Vesalius, claiming that he had started dissecting bodies before the hearts had stopped beating. Vesalius was in danger of facing a death sentence, but Charles spared him and instead sent Vesalius to Palestine on a pilgrimage of repentance. After twelve long years, he was invited back to Spain, for his teachings had now become more widely accepted. However, Vesalius was never to make landfall in Spain, for setting sail in 1564, his ship was caught in a violent storm and sunk. Vesalius survived and made it back to the island of Zante in the Mediterranean, but died soon thereafter at the age of fifty.

THE THREEFOLD HUMAN SKELETON

"If (then) you want to study how the will reveals itself in the outer bodily forms of the world, you must study the arms and legs, hands and feet. If you want to study how the intelligence of the world is revealed, then you must study the head, or rather the skull, as skeleton; you must see how the upper and lower jaws are attached to the head, and you must examine other parts of the head which are of a limb nature. You can regard all outer forms as revelations of what is within. And indeed you can only understand the outer forms when you look upon them as revelations of what is within."

Rudolf Steiner.

"Foundations of Human Experience"

(previously published as: 'Study of Man')

(Stuttgart 1919)

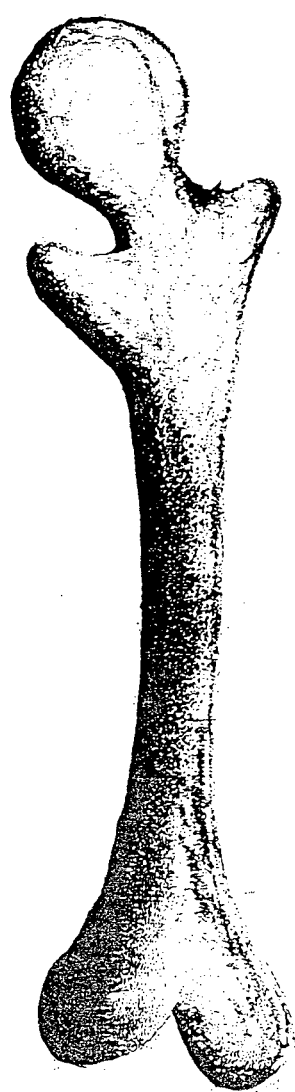
Rudolf Steiner suggests that educators need to pay far more attention to the 'how' of teaching a subject, rather than to the 'what'. As he says: *'...the what is the result of social necessities, we must apply our full interest in deriving it from a reading of what people should know and be able to do if they are to take their place in our times as good, capable individuals. The 'how' on the other hand, the how to teach the students something, can only result from a thorough, profound and loving understanding of the human being.'*

The 'how' applies in particular to the teaching of anatomy. We may be tempted to take the easy route and introduce the students to a dry, clinical classification of the some 200 bones of the human skeleton or, alternatively we have the option to follow a circuitous route leading to reverence born out of awe and wonder for the marvels of our skeletal system. The later may take longer and will require the educator to engage him/herself in far more study and research, especially with regards to the indications given by Rudolf Steiner:

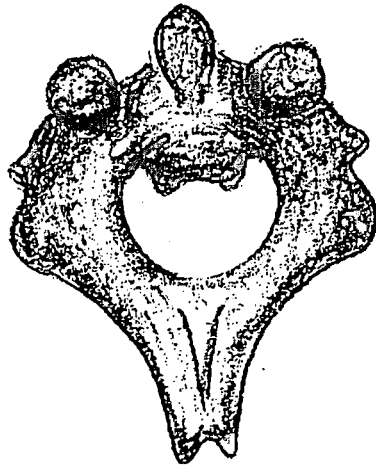
After a suitable introduction to this course of study, students could be asked to 'freely' draw a diagram of their own skeleton from what they already know about it. It is important that they do not have prior knowledge of the teacher's intent, otherwise the 'keen' students will do some research overnight and come to school armed with photocopied/downloaded diagrams, thus defeating the aim of the exercise. It will be a revelation to the students to realise just how little they know about their skeleton.

Although initially we can view the human skeleton as an assemblage of different shaped bones which do not obviously have any direct relationship to one another apart from their need to interconnect, closer inspection reveals that many bones bear, to a greater or lesser extent, a resemblance to the complete human form. We could take the opportunity to recapitulate work undertaken in Grade Seven lesson blocks where students have worked with the 'Golden Section' and its relationship to the human being (*this is also touched upon in the Grade Eight block course on 'Platonic Solids'*).

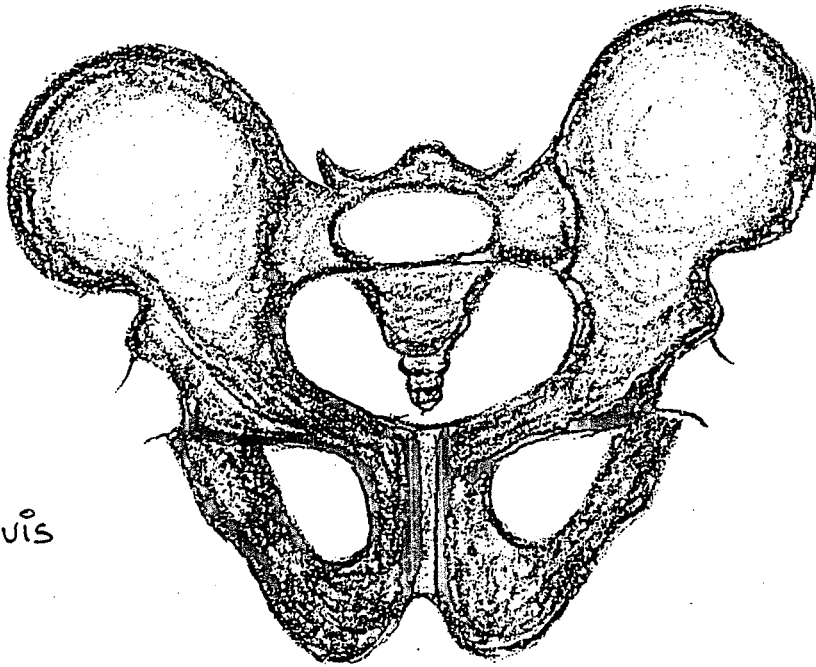
If we take a bone such as the **femur**, we cannot help but notice that it has a head, neck and trunk. Such a relationship to the complete human form can be found throughout the skeletal system. Discussion and further exploration through clay modelling, can lead students towards an appreciation of the unique relationship that exists between different bone structures of the human skeleton.



Each bone could appear to be a subtle metamorphosis of a neighboring bone. This is perhaps no more apparent than in the vertebrae (*spinal column*). The metamorphic progression from the **lumbar vertebrae** through to the **cervical vertebrae**, is a transformation of great beauty.



Atlas



Pelvis

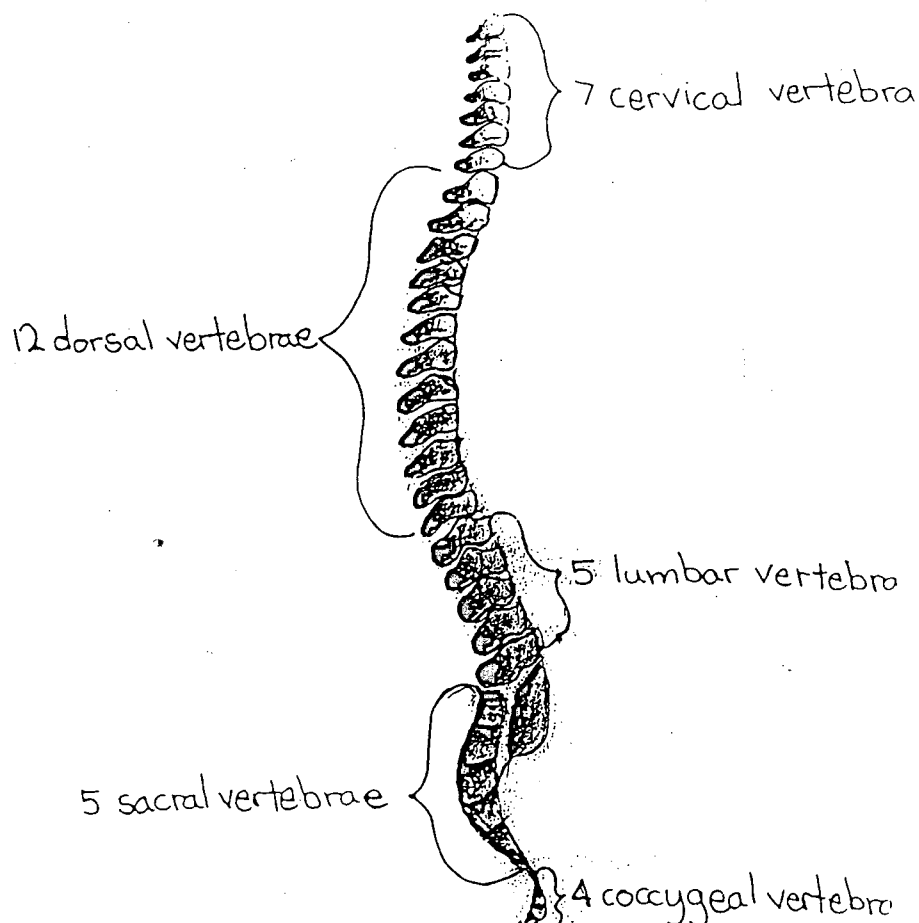
Having compared the **atlas** and **pelvis** for shape and form, we might proceed further by drawing the student's attention to the repetition of the roundness of the skull which is to be found in the roundness of the 'body-part' of each vertebrae. Through the center of each is a protective space through which passes the nerves of the **spinal cord**. It is via this 'cord' that messages or signals pass back and forth to different parts of our bodies enabling us to move and sense the world. Two short projections called **processes** grow from the roundness of the vertebrae, which are vaguely reminiscent of undeveloped limbs. Between each vertebrae is a soft cushion of **cartilage** which absorbs all the bumps and jolts which the spine encounters throughout out lives.

At the top of the spinal column are the seven small and light in weight **cervical vertebrae**, crowned by the **atlas** which is named after the legendary hero who supported the world on his shoulders. The role of the atlas is to support the world of the spherical head and it is aided in this task by the **axis** which is joined together with the atlas.

Below the cervical vertebra we find the perfect harmonic shape of the twelve **dorsal vertebrae**, whose role is to hold the **ribs** in place. Below these are the five **lumbar vertebrae** which have a much larger body than the other vertebrae greatly adding to their strength. Finally, we reach the five **sacral vertebrae**. These differ from the other vertebrae in that they are joined (*fused*) together. Finally we reach the **coccyx** which is formed from four fused vertebrae, although the last may be a separate piece.

Throughout the length of the vertebral column, we are able to observe the repetition of the three fundamental structures of the entire skeleton, from the 'body' of a vertebrae which can be likened to our 'head'. The rib-like form of the **transverse processes** and the **spinous processes** to our limbs.

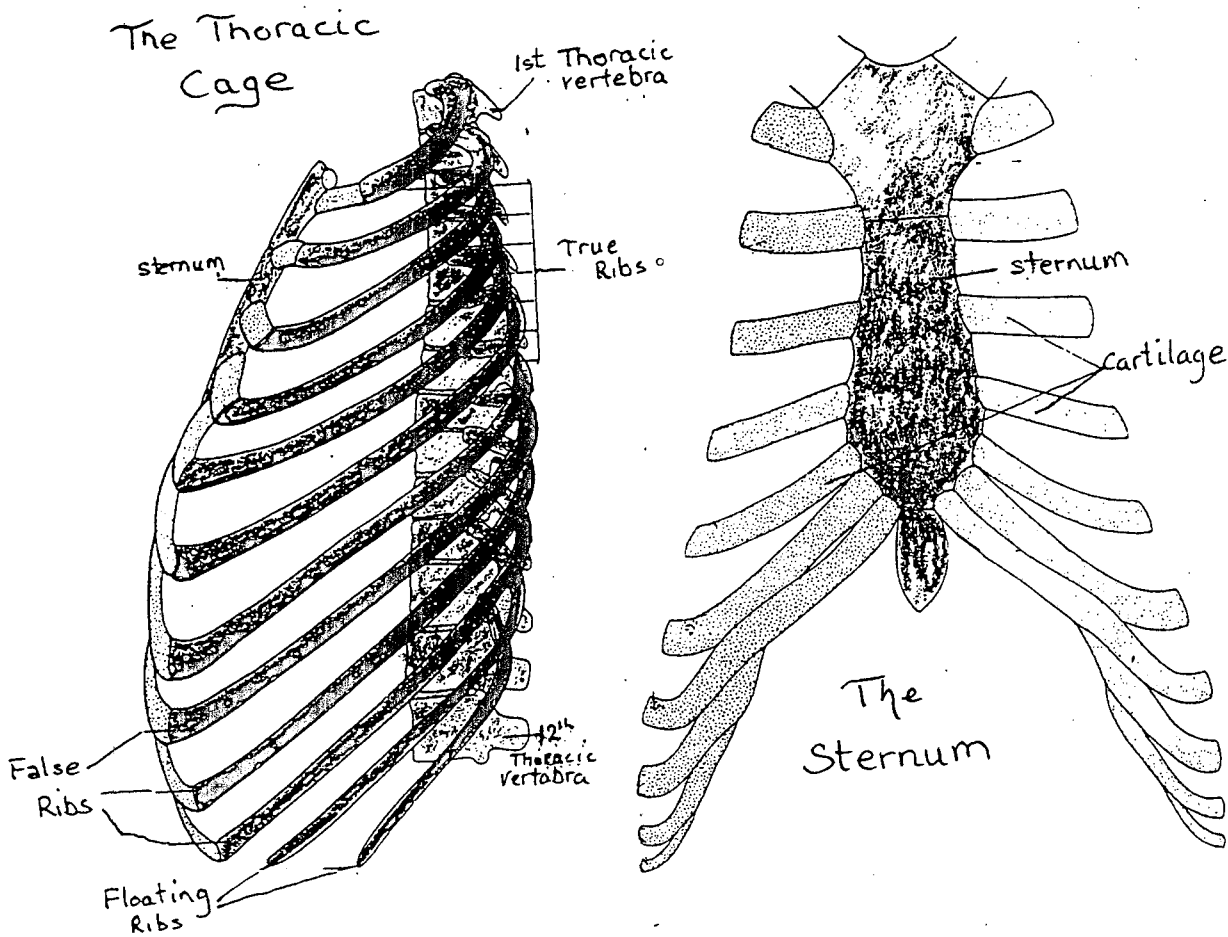
The spinal column is the first bony structure to form in the embryo. From the spine, all other bones gradually develop. We can see the two opposing forces of gravity and levity at work in the early period of a child's development. At birth, the spine is more or less 'straight' and it only gains its 'curvature' once the child begins to walk. The ability to stand upright is something which is not achievable by any other living creature.



Having established that there are bones which act like a column to support the body (such as the femur) and others which surround, protect and support (the vertebrae), we could lead the students over to a consideration of the bones of the chest region, the thorax.

Between the stillness of our head and the activity of our limbs, we have the rhythmic system of our middle region: the thorax. It is in this region that we experience a real connection to the world through our rhythmic and circulatory systems. The vital organs of lungs and heart are protected by the ripples of the ribs which form a cage of twelve pairs of rib bones attached to the twelve dorsal or thoracic vertebrae. Interestingly, the human being also possess twelve senses with which to perceive and experience the world.

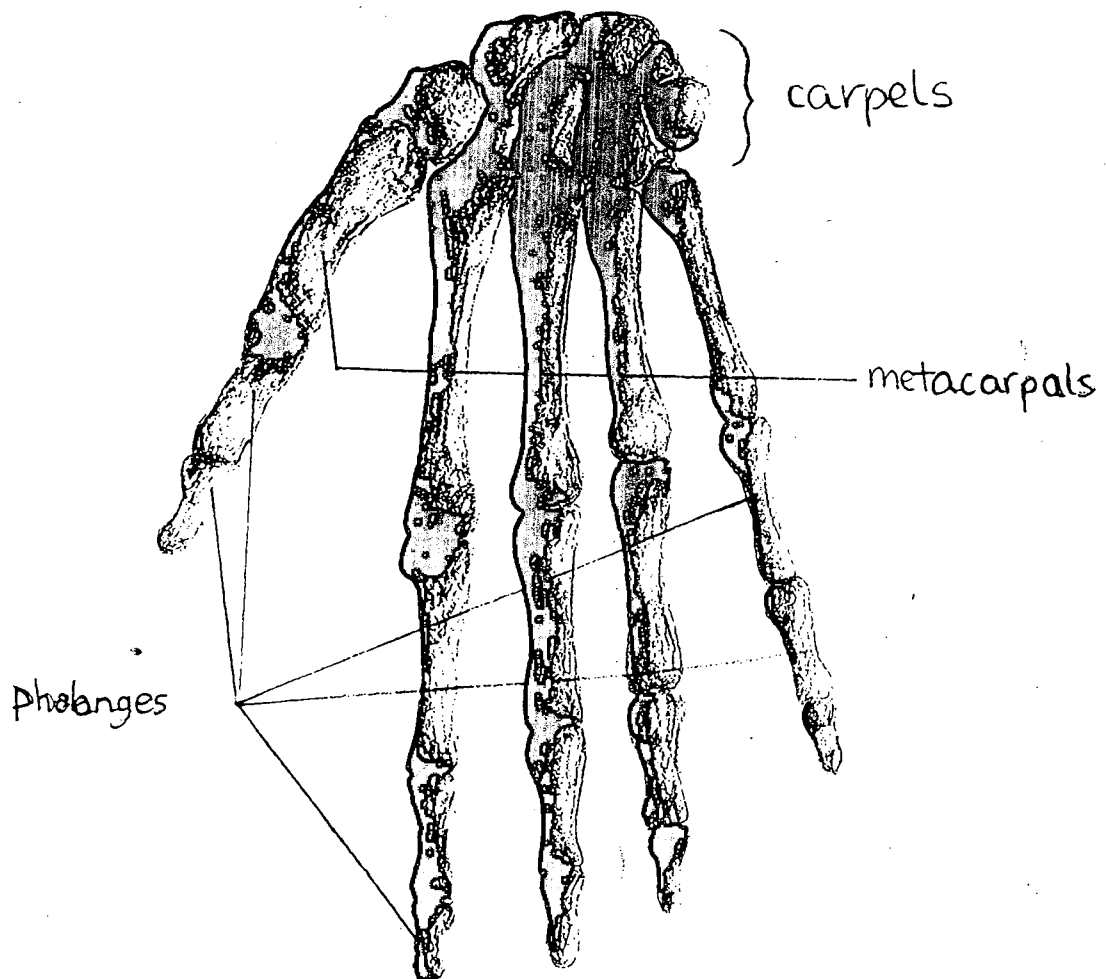
Our ribs have a wonderful flexibility about them, being able to respond to our breathing by expansion and contraction of the rib cage. This flexibility is made possible by their attachment to the sternum (a hard bone reaching down from our clavicle) with cartilage. The first four pairs of ribs are joined to it directly. Another six pairs are joined to the sternum indirectly, whilst the last two pairs are unattached and known as 'floating ribs', somewhat like our limbs.



At the rear of our rib-cage are our **left and right scapulae** (*shoulder blades*), which together with the clavicles, form the **shoulder girdle**. These bones enable us to have a great degree of flexibility in the movement of our arms. Their shape is unlike any other bone in our body if taken separately, but if they are seen as a unity, then it is possible to see a resemblance to the thoracic vertebrae. Their protective role can also be compared to that of the pelvis which forms the pelvic girdle.

The protective, enclosing gesture of the ribs may also be likened to the form of the vertebrae in protecting the spinal chord, whilst our arms could be seen as ribs which have been freed from the body to either open to the world or to be brought together to protect the body. A contemporary of Wolfgang von Goethe by the name of 'Oken' is quoted as having said: "*The arms are ribs opened to the front, nothing new, only freed.*"

With our arms and legs, we are able to reach our and touch the world. There is great similarity between our upper and lower limbs, but each has gone through a metamorphosis to adapt to the different tasks which are required of them. Our arms and hands are there for us to serve the world by meaningful deeds, our legs and feet are there to carry us over the earth to carry out these same deeds. Each finger and each toe affords us the opportunity to sense the world through touch. It is as if they were the '*eyes-of-our-limbs*', each finishing with a rounded bone like a tiny head.



Our head is a synthesis of the entire skeleton. No other creature is able to hold its head high as the human being can. Within the skull we can see images of all other regions of the body from our limbs which are reflected in the movement of our **mandible** (*jaw*), the protective form of the **zygomatic arch** similar to that of the ribs; the plates of the **cranium** protecting the soft tissue within the skull could be likened to the pelvic and shoulder girdles.

Within the dome of the skull rests the center of our capacity to Think, a form which has inspired countless architects to create structures resembling the dome of the skull as with St. Peter's in Rome, St. Paul's in London or in the countless mosques and places of worship and pious thought throughout the world. The State Capitol building in each US state also bears domes as reminders of the human head as being the seat of knowledge.

It is our head which enables us to remain in constant contact with the world. Three of our most valuable sense organs are located in the head, namely the eyes, ears and nose.

The eye sockets afford a large and deep cavity for the protection of our delicate eyes, whilst the nasal cavity has a form similar to that of a lung. Our ears are formed from cartilage which as well as catching passing sound, also protect the small and delicate ear canals. Closer inspection of the base of the skull reveals a marked similarity between the skull and the atlas.

Our skull is composed of twentytwo bones and is one of the heaviest parts of the body. The **cranium** forms the upper portion of the skull and contains eight cranial bones. At birth, these bones are apart, leaving spaces which are called **fontnella**. Eventually, they grow together forming **sutures** which allow very little movement.

In summary, the students have been led to an understanding of the three-fold division of the skeletal system, as follows:

HEAD	<i>Skull</i>	rounded bones to shield and protect the delicate brain.
	<i>Cheek</i>	open, curved bones mirroring the gesture of the ribs and protecting the eyes and nasal regions.
	<i>Jaw</i>	the movable 'limb' of the skull.

CHEST	<i>Scapula</i>	flat bones which shield and protect organs of the chest
	<i>Ribs</i>	curved bones with both a protecting and a supporting role fixed at the sternum. Their shape is neither rounded nor flat.
	<i>Floating ribs</i>	two flexible bones which are not attached to the sternum.
LIMBS	<i>Pelvis</i>	the two 'ilium' which shield and protect
	<i>Pelvis</i>	the 'ischium' and 'pubis' bones which fuse to form a firm ring of bone to give added protection to the organs.
	<i>Femur/Fibula</i>	bones which support the skeleton and give the possibility of movement.

The skeleton has long been portrayed as the symbol of death and many students may initially demonstrate a sense of unease when they are confronted by a skeleton for the first time, even though it may be made of synthetic material. Through a carefully prepared introduction to this subject, followed by time to contemplate the 'beauty' of the bone through drawing and modelling, students can be led to an appreciation and understanding for the skeletal system prior to a skeleton being brought into the classroom.

Although there is always the tendency to treat the skeleton with macabre sense of humor, I am of the opinion that both teacher and students should treat the skeleton (*even a synthetic one!*) with genuine respect. Sticking a pipe in it's mouth or plonking a hat at a jaunty angle on it's head would not be appropriate, for such actions would immediately erase most, if not all, of the feelings of reverence which have been awakened within the students during the course of the lesson block to date.

CHEMISTRY

FOOD AND NUTRITION

*'The soul can never be infected by the corruption of the body,
but acts in the body like the wind in an organ,
wherein, if one of the pipes is spoiled,
the wind cannot produce a good result in that pipe.'*

Leonardo da Vinci.

The whole process of nutrition and digestion is a process which holds fascination and interest for young students. As a teacher preparing this subject for presentation, many questions arose regarding the importance of nutrition, not just from the perspective of nutritional value for the development of our physical bodies, but more importantly from the perspective of its value for our spiritual development. In the **Agricultural Course** (June 1924) Rudolf Steiner writes (Lecture IV):

'.....the idea used to be that the essential thing in human nutrition, is what a human being daily consumes. Undoubtedly our daily food is important, but the greater part of what we daily eat is not there to be received as substance into the body - to be deposited in the body substantially. By far the greater part is there to give the body the forces it contains, and so call forth in the body inner mobility, activity..... Therefore, the important question in the metabolic process is not the proportion of the weight, but: Are the foodstuffs providing us with the proper living quality of forces? What the body needs, on the other hand, so as to deposit substances in itself - to provide itself with substances (which are expelled again every seven or eight years as the substance of the body is renewed) - this, for the most part, is received through the sense-organs, the skin and the breathing. Whatever the body has to receive and deposit in itself as actual substance - this it is constantly receiving in exceedingly minute doses, in highly diluted state. It is only in the body that it becomes condensed. The body receives it from the air and thereupon hardens and condenses it, until in the nails and hair, for instance, it has to be cut off..... On the other hand, what we receive through the stomach is important by virtue of its inherent life and mobility - as of a fuel. It is important in as much as it introduces the necessary forces for the will which is at work in the body.'

If we desire to be in a position whereby we are able to assimilate and transformed those cosmic substances which are active in the food we eat, then we have to develop a strength of inner activity to the extent that we become responsive and receptive to our environment through our breathing, our skin, in fact through all our sense-organs, including the eye.

Wolf.D.Storl. **Culture and Horticulture** - a philosophy of gardening (1979):

'We transform the macrocosmic, celestial and terrestrial impulses, by means of the process of digestion, into microcosmic impulses. Our digestion breaks the substances down completely and releases the forces that had been fixed into it. Animals use these forces for running, springing, frolicking and giving expression to their astrality. The human being does this, too, but takes it a step further, using the energy to think and reflect, to intuit and imagine, to speak and to love. He has the free will to decide what to use these energies for that the plants have given him; to do good or to do works of evil, to give to himself, like the plant, or to self-indulge.'

In order to have the cosmic energies available to carry on a healthy culture and sustain the life of our body, soul and spirit on earth, we must see to it that we have the right kind of food. Food which comes from plants that have been grown under the best conditions and which is eaten with only minimal loss of variety through cooking and preparing. Inadequately grown food and badly cooked food will not only harm the body, but make it impossible to think, feel and will in a wholistic manner.

Rudolf Steiner suggests that it is the etheric body, or body of formative forces which activates the life processes in every living thing.

Mineral substances	physical body
Plant substances	physical and etheric bodies
Animal substances	physical, etheric and astral bodies
Human Being	physical, etheric, astral and Ego

The above would strongly indicate that substances of the mineral kingdom, which lack any etheric forces, are the most challenging for our digestive system. For us to be able to transmute mineral substances, they need to have been brought to a state which makes them readily available for consumption by the human being.

Rudolf Steiner. **Man as Symphony of the Creative Word** (Lecture XI) (Dornach. 1923):

".....everything mineral within the human being must be transformed until it reaches the condition of warmth-ether. This means that everything of a mineral nature which enters into the human organism must be so far metamorphosed, so far changed, that at least for a certain period of time, it becomes pure warmth, becomes one with the warmth which the human being develops as his/her own individual temperature independent of the warmth of his environment.

No matter whether it is salt or something else that we absorb, in one way or another it must assume the form of warmth-ether, and it must do this before it is made use of in the up building of the living organism.

But something quite different is also connected with this: solid substance loses its solid form, when it is changed in the mouth into fluid, and is further transformed into the condition of warmth-ether. It loses its weight when it gradually passes over into the fluid form, becomes more and more estranged from the earthly, but only when it has ascended to the warmth-ether form is it fully prepared to absorb into itself the spiritual which comes from above, which comes from world-spaces. Thus if you would gain an idea of how an internal substance functions in the human body, you must say the following: There is the mineral substance; this mineral substance enters into the human being. Within the human being, passing through the fluid conditions, and so on, it is transformed into warmth-ether. Now it is warmth-ether. This warmth-ether has a strong disposition to absorb to itself what radiates inwards, what streams inwards, as forces of world-spaces. Thus it takes into itself the forces of the universe. These forces of the universe now form themselves as the spiritual forces which here imbue the warmth-etherised earth-matter with spirit. And only then, with the help of the warmth-etherised earth-substance, does there enter into the body what the body needs for its formation."

Plants are of course the great transformers of mineral substances and it is through the consumption of plant substances that we are able to ingest many of the minerals which we require. Plants have transformed inorganic substances to a stage which enables us to carry it to a higher stage in the warmth process.

MILK

However, the transformation of vegetarian foods requires us to expend a greater level of effort and activity in the digestive process. Rudolf Steiner indicates the importance of the inclusion of milk in our diet, being a food which is directly related to the Earth. Not to include milk and milk products in our diet could lead to an imbalance between the Earth and Cosmic forces.

The role of milk as an Earth food is more easily understood if we consider the new born infant. Instinctively, almost the first activity which the new born involves itself in is that of sucking the life giving milk from its mothers breast.

To quote from the aforementioned lecture by Rudolf Steiner once again:

"....A child is as yet quite unable to change what is lifeless into the warmth-etheric condition; he has not enough strength in his organism. He must drink the milk which is so nearly akin to the human organism in order to bring it into the condition of warmth-ether, and apply its forces to carrying out the full diffusion of plastic activity which is necessary during the years of childhood for the processes of bodily formation....."

Despite the advances in modern science, it is not yet possible to replicate mothers milk, full as it is of minerals and nutrients necessary for the developing child's physical and spiritual growth, including that of building up the child's immune system so as to ward off disease and illness. We are well aware of its importance with regards to bone and teeth development.

Curative Education (Lecture 12) Rudolf Steiner (1924):

"In mothers milk we still have....astral formative forces that work spiritually; and we must realise what a responsibility rests upon us when the time comes to let the little child make the transition to receiving his nourishment directly for himself. The responsibility is particularly great for us today, since there is now no longer any consciousness of how the spiritual is active everywhere in the external world...."

HONEY

In ancient times, humankind knew of the importance in the living of a healthy life. In the Bible (Torah), the Israelites are told of the ...Land flowing with milk and honey. What they were actually being told was there was a land where God's people could live in health and safety.

Just as mothers milk enables babies to strengthen their formative forces, honey is able to accomplish this for the older person. When we need to strengthen our dwindling formative forces in later life, Rudolf Steiner suggests that we take honey in modest amounts, for: *".....By the way of the beehive, the whole cosmos enters into the human being and makes us strong and able...."* **Nine Lectures on Bees.** Rudolf Steiner.(Dornach. 1923).

However, the consumption of too much honey can in turn be harmful and can lead to our formative forces becoming too active, possibly leading to rigidity in the body and illness. Honey in small quantities can also be beneficial to children, especially during adolescent years.

"...When honey is eaten it furthers the right connection in the human being between the airy and the watery elements. Nothing is better for the human being than to add the right proportion of honey to our food. For in a wonderful way, the bees see to it that the human being learns to work with his or her soul upon the organs of the body. In the honey, the bee gives back again to the human being what is needed to further the activity of the soul-forces within the body. Thus when we add some honey to our food, we wish so to prepare our soul that it may work rightly within our body - to breathe rightly...." (Ibid.)

As mentioned earlier, breast milk is almost exclusively the only food which the infant imbibes during the first year of its life. But as the child gradually incarnates into an Earthly existence, he or she is introduced to an ever increasing array of foodstuffs.....each one of a poisonous nature!!

That the child is able to survive, is entirely due to the miraculous functioning and efficiency of the liver, which is able to detoxify and eventually transform the varied substances. Once we have transformed these alien substances, we then permeate them with our own life forces.

As human beings, it is important that we are involved in this transformation process to the fullest extent possible. The plant has transformed the mineral elements to a point where they are more accessible to human beings, although we will need to expend considerable effort in transmuting a vegetarian diet to the stage where it is relatively easily absorbed by the body. This hard work experienced in the digestive process can, according to Rudolf Steiner, assist with our spiritual development!

We may choose to 'miss-out' this middle stage of the transformation of plant food-stuffs by letting them first pass through the animal kingdom. We then are using the animal to perform the task which was in essence, ours. The transformation of flesh foods requires far less effort than that needed to transform plant foods. However, it occasionally happens that some animal foods take longer to digest and thus our life-forces must act more strongly in the digestive tract, ensuring that digestion does result or that the undigested flesh food is expelled from the body. The transformation of flesh is a real will activity on the physical level.

Nutritionists claim that this side-tracking of this important digestive process can result in later disorders, such as diabetes, rheumatism, etc.,. During my preparation, I read passages from **Man, The Unknown** by Alexis Carrel (Nobel Prize Winner 1912. (out-of-print publication) I found the following remarks of interest:

".....Man is literally made from the dust of the earth. For this reason his physiological and mental activities are profoundly influenced by the geological constitution of the country where he lives, by the nature of the animals and plants on which he generally feeds. His structure and his functions depend also on the selection he makes of certain elements among the vegetal and animal foods at his disposal.

The chiefs always has a diet quite different from that of the slaves. Those who fought, commanded, and conquered used chiefly meats and fermented drinks. Whereas, the peaceful, the weak, and the submissive were satisfied with milk, vegetables, fruit and cereals. Our aptitudes and our destiny come, in some measure, from the nature of the chemical substances that construct our tissues. It seems as though human beings, like animals, could be artificially given certain bodily and mental characteristics if subjects from childhood to appropriate diets (Ed: or inappropriate!!)."

Does the above indicate that anthroposophists or those following an 'alternative' spiritual path (and with a preference for a vegetarian diet) are to be considered as lacking in 'will'? I think not, for what is required from such individuals is for them to develop greater forces of the 'soul', and to find 'courage of heart' in facing life's challenges, and to aspire to a greater spiritual awareness.

*"It is not the bread that feeds us!
What feeds us in the bread,
Is God's eternal light -
Is Life and Spirit too!"*

Angelus Silesius

PLANTS IN NUTRITION

It would seem appropriate to commence this lesson by looking more closely at the place and role of plant substances in our life. When contemplating the plant world, we are first and foremost struck by the enormous diversity of plants in the world (see: Path of Discovery. Vol.5/Gd.5). The seven major divisions of the plant world can be summarised as follows:

Bacteria

these are the smallest, simplest and most primitive plants.

Fungi and Lichen

have no chlorophyll and are therefore unable to make their own food. Lichens are special types of fungi which contain algae in their bodies and can therefore make food.

Algae

these contain chlorophyll and can manufacture their own food.

Mosses and Liverworts

the simplest true land plants. They have primitive stems and leaves, but no roots. They are able to manufacture their own food.

Ferns, Horsetails/Club Mosses

have a complex system for the circulation of food and water. They also have a complex reproductive system.

Conifers

the most primitive living seed plants, usually pollinated by the wind. Seeds are not protected as are those of the angiosperms.

Flowering Plants

these are the highest plants with enclosed seeds and usually with conspicuous flowers.

Rudolf Steiner tells us that we can view the plant as the soul gesture of the Earth and shows how we can relate the different parts of the plant to our soul and physical spheres

<u>Human Being</u>	<u>Plant</u>	<u>Chemical Element</u>	<u>Senses</u>
Nerve/Sense System	Root	Sulphur (cold)	Thinking
Rhythmic System	Stem Leaf	Carbon (balance)	Feeling
Metabolic System	Flower Seed	Phosphorus (warmth)	Will

Perhaps one of the first things to strike us is that it is possible to exist on a purely vegetarian/plant diet to the exclusion of meat products. We are able to obtain all the minerals we need from such a diet.

It is of great importance for us to note that whereas animals and humans gain their greatest nourishment from the gifts of the earth, plants on the other hand gain most of theirs from the cosmos! In Grade Five, the students will have been introduced to the concept of photosynthesis and in all probability they would have forgotten all about it by now!! So it is time to refresh their memories on this important process:

In the plant, a complicated process takes place in the leaves called PHOTOSYNTHESIS. Each plant contains a substance known as CHLOROPHYLL (which gives the plant its green colour) that helps the plant to make its food, together with the LIGHT from the Sun.

LIGHT is captured or absorbed by the CHLOROPHYLL in the leaves and taken into the leaf. The air which we and the animal world breathe out is called CARBON DIOXIDE. Carbon is a residue left over when something is burnt-up. The air that we breathe-in is therefore somehow consumed by the warmth of our bodies and the residue (carbon) is exhaled. It is this form of AIR which is required by the plant kingdom. Carbon dioxide enters the leaves through minute holes (pores) whilst WATER enters the plant via the roots.

Once the leaf has absorbed these substances, they will join together to go through a miraculous transformation, being formed into grains of STARCH which is the ENERGY food for the plant. when transformed into GLUCOSE (sugar).

That the plant is able to produce carbohydrates, is due to its ability to absorb carbon dioxide to aid in the assimilation of light in the process of photosynthesis and then by reversing this process, to create oxygen for both human beings and animals. Carbon expelled by us is reabsorbed by the plants to act as food in the production of organic plant material. There is a constant transformation of starch-to-sugar-to-starch within the plant, made possible by the central position held by carbon, and its ability to combine with both air and water elements. We can compare the function of carbon in the plant and with its function in our Rhythmic System (see: **Path of Discovery**. Vol.7/Gd.7).

CARBOHYDRATES

"When you eat and take pleasure in the taste and sweetness of the food, bear in mind that it is the Lord who has placed in the food it's taste and sweetness. You will, then, truly serve God by eating."

Baal Shem Tov

One will have to be very selective when determining what is suitable for presentation to the students. One idea that springs to mind is that of individual student projects researching the Life of the Bee.

I would recommend that after an introduction based on the foregoing pages and giving students the opportunity to discuss different dietary preferences (meat, vegetarian, vegan), that we become more specific and introduce the students to the CARBOHYDRATES as being substances which are made up of CARBON, HYDROGEN and OXYGEN. The hydrogen and oxygen being in the same proportions as in water, that is twice as much hydrogen as oxygen. Carbohydrates are of tremendous importance to us. They make up a large part of our food supply in the form of sugars and starches. Another carbohydrate, called cellulose, helps to clothe us (cotton, linen) and shelter us (wood). It is recommended that sugar be taken as the first focus.

SUGAR

Sugar, which results from the breaking-down of CARBOHYDRATES, has a special significance for the human being. Through this transformative process in the metabolic system, we are preparing a substance which we are able to utilise in the region of our Ego-organization. Where sugar is present in the organism, our body is able to orientate the vegetable and animal substances towards the higher human stage.



It would be wrongly assumed that in order to assist the digestive transformation of substances that we should eat copious quantities of sugar! Quite the contrary. By consuming quantities of manufactured sugar, it becomes impossible for the human organism to put this to the service of the Ego-organisation. A high consumption of sugar can also lead to 'egotism'. Conversely, someone who suffers from a feeling of inadequacy and loneliness, can benefit from a higher sugar intake.

A most helpful book for preparatory (anthroposophical) research for this main lesson, is Gerhard Schmidt's book: **The Dynamics of Nutrition** from which I quote the following:

'Man's need for sugar originates from the interaction of sweetness with the Ego. Rudolf Steiner spoke several times of the connection which the taste of sweetness has to the Ego.Man needs a relatively large quantity of glucose for the nourishment of his brain (approx. 110 gm/day) and for that reason it is also very purposeful that the mother's milk has, in relation to animal milk, such a high sugar content (more than 7%). The fact that sugar serves as the basis of thinking, for the unfolding consciousness, says nothing about the quality of thinking. It does, however, increase the state of wakefulness.

.....it would be incorrect to believe that by increasing the sugar consumption one would enhance the strength of consciousness. On the contrary, the consequences would most likely be increased egotism.

Rudolf Steiner also spoke of this problem, emphasising that sugar permeates man 'with a kind of natural Egotism', through which a counter-force can be created, if man strives towards selflessness by spiritual training. The sugar will enable him, 'despite any advance into the spiritual worlds, to remain with both legs on the earth.' We have to constantly remind ourselves that we need sugar in our nourishment, but we can only use it if we continually dissolve it.....'

Where do we stand in relation to sugar? Students could spend time working on their own projects researching the earliest uses of sugar and history of sugar. In all probability the earliest sweetener would have been honey from bees or 'sugar' from the Sugar Ant (Australia). What of modern sugar and sweetener production? It is interesting if we consider the progression from sugar derived from the flower (honey), to cane sugar and maple sugar (stem), beet sugar (root) and to the artificial sweeteners created in the laboratories from mineral products. Many questions can be posed and responded to, including:

- What are the effects of sugar on our everyday health?
- Why does sugar act upon our tooth enamel?
- Why does an excess of sugar affect our behaviour?
- What is diabetes and how is it controlled?
- What types of sugars are there?
- How do sugars react to the elements of water and fire?

This will naturally lead us to simple experiments. Care must be taken at all times when conducting experiments. It is strongly advised that instructors and students wear appropriate eye protection at all times.

If you are living in a climate which experiences warm days and cool nights, then you may be in a position to make your own 'maple sugar candy', which could be the introductory experiment for this section.

Experiment #1 Maple sugar candy

Into a mature sugar maple tree, drill a small hole and insert a 'bung' made from a piece of bamboo, piping or better still, a bung with a tap of the type used for wine casks!

Hang a light-weight container from the bung so that the tree will 'bleed' into the container. Check after a couple of hours to ascertain the speed of flow enabling you to judge when to expect the container to be full to capacity.

Strain the sap to remove any foreign material and insects, then gently simmer over a camp fire or on the stove, until the evaporation has taken place to the point where the sap begins to thicken and to acquire a sweet tasting maple syrup.

Continual simmering will result in further thickening of the syrup. Pour the thickened syrup into a pre-oiled shallow container and allow to stand and cool. Use a knife to mark the setting toffee into acceptably sized portions and leave to stand until the toffee has hardened. Result: a delicious maple sugar toffee!

Experiment #2 Combustion of Refined Sugar

- a. Heat a dessert spoonful of refined sugar in a metal container and observe the transformation from crystal state, through molten to carbon remains. Note the acrid smoke given off in the combustion process.
- b. Heat a dessert spoonful of refined sugar together with an equal amount of Sodium Bicarbonate - NaHCO_3 (baking powder) in a disposable metal container over a naked flame and observe. Within a very short space of time, the mixture will begin to rise up in a puffy, black pillar of charcoal which consists primarily of sugar charcoal expanded by the carbon dioxide gases given off by the sodium.

DIFFERENT SUGARS

Introduce the students to different types of sugars and their occurrence, although one or more of the different sugars may be found in any one source:

Glucose - occurs in honey and fruit juices

Fructose - occurs in fruit juices and honey

Sucrose - occurs in sugar cane, beet, carrots and fruit

Lactose - occurs in milk

Maltose - occurs in the germination of barley (for beer making)

Glucose is the sugar which is produced by the plant in the process of Photosynthesis which has been mentioned earlier. There is a difference between ordinary 'refined sugar' and 'glucose' which we are able to identify by conducting a simple test.

Experiment #3 Copper Hydroxide Test

Obtain a quantities of pure glucose and refined sugar and make separate saturated solutions of each. To these solutions, add a small amount of COPPER HYDROXIDE and gently heat over a bunsen flame.

After a short while, a yellow precipitate of CUPROUS OXIDE (Cu_2O) will appear in the glucose solution which will gradually turn to red. The sugar solution will remain unaffected.

Testing for the presence of Glucose: Have the students taste both refined sugar and glucose. First check discretely for anyone suffering from diabetes.

Experiment #4

Cut 3 or 4 small pieces of (sweet) apple about the size of a pea and place them into a test-tube with a drop of Benedict's solution (or a teaspoon of washing soda crystals). Add about an 2 cm (1") of water and heat the test-tube over a bunsen flame.

When the liquid begins to boil, continue heating for a few minutes. A reddish-brown solution will appear in the tube which will gradually darken until almost black. At the same time a faint smell of burnt sugar will be given off.

A more sensitive test can be carried out by using a container of preheated water into which the test-tube containing the fruit and Benedict's solution is partially immersed. This ensures a unilateral temperature level for all tests (have a thermometer to hand to ensure that a steady temperature is maintained).

Students could be encouraged to bring to school and test their own food samples for the presence of glucose, also known as grape-sugar because of its occurrence in grapes. These could include fresh, dried and processed foods. It would also be good to test for the presence of glucose in soft drinks.

Rather than applying the copper hydroxide test as described in Experiment #3, it will be easier for the students to use the commercially available BENEDICT'S SOLUTION or failing that, one can use washing-soda crystals (sodium chloride - NaCl)!

The following experiment can show how glucose can be made from refined sugar:

Experiment #5

Boil .5 of a teaspoon of sugar in a test tube, together with 2 cm (1") of DILUTE sulphuric acid or sodium bisulphate solution. Keep the liquid boiling for 2 or 3 minutes and then cool the test tube under flowing tap water. To show that the solution now contains GLUCOSE, first neutralise the remaining acid with sodium carbonate or DILUTE sodium hydroxide solution (test with Litmus paper). Then test with Benedict's solution.

Extra combustion experiments:

Experiment #6 Potassium Nitrate and Sugar

Grind up 3 gms of sugar together with 1 gm of Flowers of Sulphur and 5 gms of Potassium Nitrate. Place the mixture onto a metal sheet and ignite at full arm's length with a LONG lit wooden spill. This was used in the past for the manufacture of primitive gunpowder.

Experiment #7 Potassium Permanganate and Glucose

Grind up Potassium Permanganate with half the quantity of Glucose and place on a metal sheet. Ignite the mixture with a lit wooden spill. The ignition can be made easier by adding a few drops of sulphuric acid to the mixture with the aid of a LONG glass pipette. Expect a violent reaction.

Experiment #8**Manufacture of toffee**

Dissolve half a cup of refined sugar in 2 tablespoons of water and 2 tablespoons of golden syrup over a low heat, stirring all the time.

Once dissolved, continue to heat without stirring until a sample of the solution dropped into cold water, forms a brittle thread. Drop spoonfuls of the glutinous liquid onto a sheet of aluminium foil. Push a lolly stick into each. Leave until cold. (similar to Experiment #1)

STARCH

In plants, STARCH is only formed when sunlight is present and is a prerequisite for sugar. At the setting of the sun when the process of photosynthesis ceases, the starch which has been formed during the day is now turned into sugar. This sugar in soluble form known as 'sap', travels to the extremities of the plant as nourishment where it is converted once more into starch to be stored to assist with the forces of growth in the future. Thus it is that we find storehouses of starch, for example, in the cereal grains and in potatoes.

Turning our attention to the potato, we find that we have a source of plant food which has limited value because of the poor digestibility of its starch. Eugene Kolisko. Nutrition. #1 (1932) said the following with regards to the potato:

...Let us consider for instance the potato. The tuber is a stem, built in such a way that it can take the place of a seed or fruit. It looks like a root; something is formed underneath the surface of the soil similar to a fruit, and containing starch. The effect is that of a root, and we can see this quite clearly, because the metabolic system is not interested in the potato in the same way as it would be interested in a real fruit. We might even say that a potato is a very boring substance in so far as the organs of nutrition are concerned.

But on the other hand, there is something fruit-like in it. The breathing system is also not interested in potatoes. The main effect is directed towards the nervous system. Still, there are so many nutritive substances contained in it that they are transported, through the root-forces, so far upwards that the digestive process which is usually enacted in the lower regions of the body, is continued into the nerve-sense-system.the nerve-sense-system gets burdened with activities which otherwise are enacted within the metabolic system. carried to its extreme, one would arrive at a certain effect of dullness (in the brain).... We do not notice this so much in adults as we do in children.... To use potatoes as food is of course perfectly justified. They contain many valuable nutritious substances. But on the other hand it is necessary to be very careful not to form a habit of eating too many, because if we do, we burden the brain too heavily with an activity which does not belong to it, an activity that should be taken over by other organs.

Too many potatoes would produce, especially in the middle part of the brain, a too strong metabolic function, instead of a nerve-sense process directed towards spiritual activity.'

Later in the same course of lectures, Eugene Kolisko goes on to say:

'Whenever we absorb starch, it becomes converted into sugar. The sugar enters the blood, is burnt, and finally exhaled. All the various substances which are included in the chemistry of carbohydrates, flour and sugar-substances which are drawn especially from the plant kingdom, are not only digested; man exhales them. Not only the metabolic system, but also the breathing system is engaged in this process of digesting plant food.'

Another prime source of starch is of course that found in the cereal grains, especially wheat. If we were to eat raw fresh-ripened wheat containing all that the plant has accumulated by means of light and warmth (energy), then we would be ingesting a plant substance of the highest food-value. However, the modern baking industry goes to extreme lengths to ensure that we eat the whitest of white breads which in the process has been made quite valueless for its real purpose of nourishment. Generally, it is just 'filling', lacking any food value.

In the process of producing flour for the bread making industry, those parts of the grain which are of value have been removed. The first layer of cellulose is removed which is generally too tough for our digestive system to process.

Next follows the layer known as the '*aleurone cell*' which contains many valuable food stuffs, including protein mineral salts and vitamins which are needed to build up energy in the human organism. This too is dispensed with!

Now we have the white kernel of the cereal, consisting primarily of starch which our body utilises in the producing warmth and for laying down of fat deposits in the organism. Within this kernel is contained the highly valued 'germ' active in building up the nerve-sense-system and brain, as well as containing within itself the potential life forces (*energy*) for the building of a new plant. Its thrown away!!

Effectively, our brilliant white supermarket bread is nutritionally valueless.....although the industry does in some instances, reintroduce cellulose and germ during the course of bread making (*together with other additives*)!!!! Recent research by Australian author and food-intolerance counsellor Sue Dengate into calcium propionate, or 282 as it is commonly known, has finally proven a link between this specific additive and children's behavioural problems. At the time of writing (*August 2002*), Ms Dengate's findings are to be published in the prestigious Australian '**Journal of Paediatrics and Child Health**'.

Sadly, the majority of students come to school with lunch boxes packed with this excuse for food.....it would be an insult to the cotton plant to refer to such bread as cotton wool!!

Returning once more to starch, as well as being present in potatoes and wheat, we find it in oats, barley, rice, maize (corn) and in fact starch is present in nearly all plants. As well as being a food stuff, starch is also used in stiffening linen when ironing and for the making of adhesive paste.....and glucose!

Experiment #9 To show a potato contains starch

Cut a potato in half and pour a few drops of IODINE solution on it (*or other sources of plant foods*). Starch gives a dark-blue coloration with iodine.

Experiment #10 Identifying the qualities of starch

a. Obtain some pure starch powder and starch in the form of potato, wheat or other types of flour, and let the students rub samples between their thumb and forefinger. Notice how it differs from sugar.

b. Obtain some pure starch powder (*or potato powder*) and sprinkle some onto the surface of a glass container of water. Observe how the starch at first floats on the surface, before sinking in an undissolved state to the bottom of the container.

c. Heat a quantity of dry starch powder over a flame. It will be observed that the starch eventually flares up burns giving off a smell reminiscent of burning leather, until it eventually carbonises.

If we compare the characteristics of SUGAR and STARCH, we notice that the former unites, dissolves and flows, whereas with starch we see a separation into countless grains and an inability to dissolve.

Experiment #11 Boiling of Starch

Mix a quantity of starch into an empty saucepan. Heat-up some water and add it gradually to the starch, stirring constantly. Students should notice how the starch begins to coagulate into a smooth paste which can be used as an effective paper glue! If left to cool, it will be observed that the paste becomes even stiffer. Compare the preparation of the paste with the preparation of a healthy porridge on a cold winters morning!

Experiment #12 Obtaining Starch

We are able to extract starch from a potato by first grating it and then adding the shredded remains to a glass container of water. Swirl this around for a minute or two to aid in the separation of the starch from the potato. Pass the liquid through a fine sieve. Any cellulose will remain behind, the starch will travel through in a dissolved state with the water.

Pass the starch-water through a fine sieve once more and then allow to stand for awhile. The water will eventually turn a brown colour and this should carefully poured out and fresh water added to the container, which is once again allowed to stand. Gradually a thin layer of starch will begin to settle at the bottom of the container.

Experiment #13 Starch into Glucose

Boil .5 of a teaspoon of starch together with .5 of a test tube of DILUTE sulphuric acid or sodium bisulphate solution for 2 minutes. Pour off a few drops of the liquid into a second test tube and cool it under the flowing water from a tap. Add a drop of IODINE solution. The starch has been transformed into a sugar called DEXTRIN.

Return to the original test tube and boil the remaining liquid for another 3 minutes. Cool the liquid and neutralise with dilute sodium carbonate (*test with litmus paper*). Add Benedict's solution and a yellow precipitate will appear gradually turning to red indicating the conversion of dextrin to GLUCOSE.

Experiment #14 Starch into Sugar with Saliva

In each of 5 test tubes, put 5 ml of water and 1 drop of an iodine test solution (5 ml iodine to 45 ml water). In another test tube add two drops of saliva to 5 ml of starch solution. Stand this in a container of warm (*not hot*) water. At 2 minute intervals, drop 3 drops of the saliva-starch solution into the iodine solution. Shake the test tube. Notice how the color becomes less and less blue. The reason is that the saliva is digesting the starch and changing it into a sugar.

CELLULOSE

With starch and sugar, we have a vacillation between solid and fluid states. The sugar is able to be absorbed into our blood stream and builds for us the foundation of our mobility and production of warmth.

With the plants, the function of sugar is different in that it builds up the plants immobile form.....its cellular structure.

The structure of the plant is dependent on the third carbohydrate: CELLULOSE. This contains little of nourishment for the human being, but is useful in the diet as roughage to aid the digestive process. It is possible for strong acids or certain bacteria to break down the cellulose into glucose.

Experiment #15

Sugar in Cellulose

Place a small amount of cotton wool into a test tube and cover with concentrated sulphuric acid. After a short while, it can be seen that the contents has dissolved completely. With care, pour the liquid into a container of cold water and then test with Benedict's solution. The presence of a sugar will become apparent.

Cellulose is important to the human being in that it can be utilised in the production of cotton and linen (*flax*) cloth material. It is also present in wood, straw, hemp and in the Papyrus plant which the Egyptians used for paper manufacture.

Experiment #16

Paper Making

Take a quantity of cotton wool and place in a solid bowl, add a small quantity of water and with a pestle, commence grinding the mixture for an extended period of time.

Obtain some very fine wire gauze and spread the thoroughly ground and beaten fibres of cotton wool onto evenly upon the gauze. The water should be allowed to drain off.

Having obtained a piece of plain 'felt', invert the gauze so as to create a 'sandwich' of gauze, cotton pulp and felt. Facilitate the pressing of this sandwich in a strong press. Four woodworking clamps and two boards could prove effective. Finish by pressing the sheet of 'paper' between two metal sheets.

PROTEIN (ALBUMEN)

*"....I am a great eater of beef,
and I believe that does harm
to my wit."*

Sir Andrew Aguecheek
'Twelfth Night'. William Shakespeare

In his lecture series '**Mystery Knowledge and Mystery Centres**' (Dornach. 1923), Rudolf Steiner spoke of the Lemurian Age as being a time when warmth, light and air permeated the fluid substances upon the Earth. This primal albuminous fluid atmosphere was further imbued with '*the in pouring cosmic ether which imbued it with life....*'

From this albuminous substance came first the minerals which were to harden into the rocks of the earth, to be followed by ethereal plant-like forms which were in a constant state of vacillation between condensing and dissolving.

Cosmic forces were constantly working upon the albuminous fluid, giving rise to forms which resembled formless, gelatinous creatures which we might liken to jelly-fish or garden slugs constantly extending and contracting their tentacles or antennae. In the later Lemurian epoch, these gelatinous forms absorbed calcium from the atmosphere, giving rise to primal skeletal creatures. Gerhard Schmidt writes in his book '**The Dynamics of Nutrition**' (Bio-Dynamic Literature 1980):

.....The earth, while still in the Lemurian Epoch, was not a solid mineral yet; it was still permeated by a strong inner life and brought forth living and ensouled formations which had a great capacity for transformation. Formation and transformation were then still characteristics of the life of natural beings. The formative forces could take hold of the mouldable matter and create forms. A significant remnant of that stage is still evident in the early years of childhood and much more so in embryological development.'

The Etheric/Life Forces are constantly at work in the realm of protein, which is carried throughout the body in a semi-liquid state. There are many different types of protein, not least amongst which is animal protein. When the protein from an animal meets the incompatible protein of a human being, then a struggle takes place because of the difference in the chemical composition of the protein carrying blood. The result of this struggle is that the alien protein is humanized. Looked at from another perspective, we can conclude that the animal protein has been consumed and transformed by the human protein.

Meat is the prime source of protein in Western societies, but due to its tendency to quickly decay, it is not deemed healthy to rely on meat as the prime source of protein. Fish is also a great source of protein, but again it has a tendency to quickly decay and must be eaten as fresh as possible. The consumption of both meat and fish can result in intestinal putrefaction and high acidity. Other sources of protein are eggs, which should be eaten in moderation.....two to three a week is ample. Milk products, especially cheese is an excellent source of protein, although 'green' and 'fermented' cheeses should be avoided. Both eggs and milk proteins, although derived from animals, are far more easily transformed in our digestive system than meat.

Although we generally see plants as being primarily composed of carbohydrates, there are those plants which have a high content of protein, such as those known as 'legumes', including beans, peas, pulses (e.g. lentils), etc.. Soya is a well-known source of protein, having double the amount which can be derived from meat, however there is currently (2002) considerable controversy concerning its detrimental effects in humans and therefore a cautionary approach is recommended with regards to its regular consumption. Nuts too are an excellent source of protein.

Excess protein in our bodies is stored in the liver and kidneys, to be eventually eliminated from the body as non-toxic urea. It follows that in a meat diet, the liver and kidneys of animals are rich sources of (animal) protein.

The proteins contained in eggs and milk are interesting in that the former is in the process of entering the animalic stage, whilst milk has emerged from that stage of existence. Eugene Kolisko suggests that "In reality milk is a complete balance between animalic and vegetarian food. The animal has the capacity to transform what, in its organism is animalic, back into something which is very similar to vegetable substance."

Whereas a meat diet is very much orientated towards our entire digestive system and a vegetarian diet to our rhythmical and nerve-sense systems. Mother's milk has the ability to act positively upon all internal systems. However, recent research indicates that milk from other mammals is not as healthy as 'milk marketing boards' would like us to believe.

Returning once more to proteins, we see that they are absolutely essential for the growth and repair of bodily tissues. It contains nitrogen (N), in addition to the carbon (C), hydrogen (H) and oxygen (O) which are present in plants as carbohydrate.

Students could conduct various experiments to test the solubility and combustibility of proteins. Well-worn, tried and tested experiments include:

Experiment #17 Egg-white

Break an egg and separate the white protein from the yolk (maybe a 'brave' student will volunteer to swallow the yolk raw!). Let students experience it's glutinous texture and its interaction with cold water.

Heat egg-protein in a water and observe the coagulation.

Apply a naked flame to raw egg-protein and observe its transformation, including smell. Students should be able to identify the smell as being the same as that emitted by burning hair/fur/feather, skin, nail, hoof or horn. Discuss the resulting carbonised remains in relation to earlier chemistry lessons on combustion (Grade Seven).

Add a small amount of dilute Sulphuric Acid (H_2SO_4) to a glass test-tube containing egg-protein. Notice its transformation. Carefully pour the coagulated protein into a alkali solution of Sodium Hydroxide (NaOH) - *Caustic Soda* - and gently heat. Observe how the protein dissolves once more.

Experiment #18 Milk

When we consume raw milk, it combines with the natural acids in our stomach resulting in coagulation.

Demonstrate this process by carefully adding a few drops of Sulphuric Acid to raw milk in a test-tube.

Acid, in the form of 'rennin' is present in the stomach of calves. This can be obtained commercially as 'rennet'. When added to raw milk, we are able to create a dessert known as 'junket', which is delicious when served with a sprinkling of sugar and cinnamon powder!

Experiment #19 Testing for protein

Students can be shown how to test various substances, such as cotton and synthetic threads, for the presence of protein by the use of dilute Nitric Acid (HNO_3). Place some threads in a small glass dish and add a few drops of acid. Watch for any results.

This is known as the 'xanthoproteic acid test' used to reveal the presence of proteins. As all proteins contain nitrogen, they react with the nitric acid to form yellow xanthoproteic acid. However, the nitric acid may react with other chemicals present in the material being tested and it is therefore necessary to confirm one's findings. With care, flush-off the surplus nitric acid and then add a few drops of Ammonia (NH_4OH), which is an alkali. If protein is present, the material will turn a bright orange.

FATS AND OILS

".....The yellow/white (light) color of oil and fat, indicates its essential nature - that is, as a product of the Life Body itself. Oils of industry are the condemned life forces of plants that lived aeons ago. Both plants AND animals produce oil - certain amounts of this are necessary to sustain our Life Bodies, helping combat illness and providing energy. ..."

From: 'House of the 3 Froggies'.
Alan Whitehead (1990) (Golden Beetle Books)

Fats are an important source of energy, having a greater energy value than carbohydrates. Like carbohydrates, fats also contain the elements carbon, hydrogen and oxygen, but in different proportions.



Fats can be found in both a liquid and solid states. Fats which are liquid at room temperature are known as 'oils' which include all vegetable oils, apart from chocolate and coconut fats which are solid at this temperature. The greatest concentration of fats (oils) is found in the seeds of plants, such as sunflower, hazelnuts, brazil, walnut, etc.,. Fats that solidify at room temperature are all those fats derived from animals, apart from fish-oils which generally remain liquidified.

We need to consume fats in appropriate amounts as part of a healthy diet. Fats on their own are not generally looked upon as an appetising food serving in western cultures. However, in some cultures, it is not unusual to serve lumps of animal fat at a meal, especially amongst the Mongolians in parts of Siberia.

Apart from being a source of energy, fats also carry those vitamins that are unable to dissolve in water, called 'fat soluble vitamins namely: Vitamins A, D, E and K.

In addition to the aforementioned benefits of fats in our diet, they also lend flavor to food. However, it serves no purpose to add copious quantities of fat in the hope of improving the flavor of a dish. All that will happen is that the food will become more greasy and the calorie content will increase.

If we eat too much fat at any one time, then our digestive system becomes over-loaded and we have the feeling of a satisfied appetite.

As fats take much longer to digest than other food, this feeling of satisfaction can last for quiet a period of time and the need for eating something between meals becomes unnecessary.

We could easily reach the conclusion that by consuming fats, we are in actual fact reducing the amount of food consumption overall and consequently, either reduced our overall body-weight or at we are at least maintaining it at an acceptable level! In actual fact, most people experience indigestion caused by inflammation of the small intestine brought about by the fermentation of the fats. The resulting 'feeling' is one of hunger rather than satiety.

When we consume fats, we are asking the digestive system to work overtime in breaking them down. In '**The Dynamics of Nutrition**', Gerhard Schmidt writes:

".....In the digestion of fat, a process takes place which today is usually labelled 'fermentation', but is more appropriately termed 'becoming rancid'. It takes place in the upper small intestine, in the duodenum. While decaying, with its associated gas formation, is related to smelling, 'rancifying' of fats represents a more inward process which manifests itself in tasting.

The tendency towards rancidity must be held back by human beings and that happens through the activity of the astral body. If it is unable to deal adequately with fat digestion, 'then we have an unpleasant taste in the mouth'.....In the way, we get stomach and intestinal ailments from the rancid fats within ourselves.'

Fat is, without question, an important part of our diet and should not be avoided. We not only require it for 'energy', but also for 'warmth'. We can see how fat works as an insulator against cold if we contemplate the whale or seal. Those mammals which hibernate during the winter spend the preceding weeks storing-up reserves of fat in their bodies to sustain them through the long winters.

Excess fat is stored in a semi-liquid state under the skin or around the internal, such as the kidneys. However, fat may also be deposited around the heart which can prove very bad for our health and well-being. Students attention should be directed to the relationship of fats/oils to the elements of fire and water.

Experiment #20 The solubility of oil in water

If a few drops of vegetable oil are dropped into a glass container of water, it is possible to observe how the oil immediately forms into globular droplets to float upon the surface of the water. If more oil is added to the water and then the whole is given a good shake, we can observe how the globules are dispersed throughout the water, giving it a 'milky' color effect.

Left to stand, the oil globules will gradually rise to the surface to form a layer of oil.

Have the students watch as a few drops of liquid soap are allowed to fall upon the film of oil. The oil immediately disperses in small particles. This phenomena is utilized in instances where there has been an 'oil-spill' at sea.

Relate the above experiments to everyday circumstances, such as those experienced in a household where the washing-up is still done by hand!!

Experiment #21 The solubility and solidification of fat

Obtain a small quantity of solid fat and gently heat. Observe how the fat becomes soluble. If left to stand and cool, it will eventually revert to its solid state.

Experiment #22 The combustibility of fat through

Place a small quantity of solid fat in a crucible or other heat-resistant container and apply direct heat. Continue to heat the fat after it has melted until it ignites. Observe how the fat/oil only ignites after heating, the color of the flame and the amount of smoke given off.

Removing the heat source, carefully tip the crucible and pour a little of the burning oil into another dry container. Observe how the fat continues to burn.

With students standing at a very safe distance from the burning fat, take a medicine dropper (pipette) containing water and allow a few drops to fall onto the burning fat. Students will be astonished at the reaction.

This would be an appropriate time to speak about the heating of oil in the cooking process and of the inherent dangers. How should a fat/oil fire be extinguished in the kitchen or elsewhere?

Demonstrate the use of a 'fire blanket' or emergency alternative use of a kitchen towel soaked in water and then thoroughly wrung out (*remember the dangers of water!*).

Through these simple experiments, students will have been led to an understanding and appreciation of the inherent 'warmth element' present in fats and oils, and how they have very little connection with the element of water.

As the efficiency of our digestive system is dependent on the solubility of the foods which we consume, it can be easily understood that fatty or oily foods pose problems for the digestive process. An opportune moment to discuss 'fast foods' and the high levels of animal fats which they contain.

Brief mention could be made of saturated and unsaturated fats, although I would see this as being an area to pursue in greater depth during Grade Nine chemistry.

If time allows, it would be good to show students how to obtain 'soap' as a by-product of converting ordinary cooking oil to what is generally known as 'bio-diesel', an alternative and efficient fuel for diesel engines.

Interestingly, Frederick Diesel designed his engine to run on vegetable oil! When the diesel engine was first shown to the general public, it was running on peanut oil!

I shall not attempt to describe how to make 'bio-diesel', as it falls outside of the intent of this article. However, suffice it to say that there are many sources where the relevant information can be gained, one being: Mike Pelly's bio-diesel recipe at: http://journeytoforever.org/bio-diesel_mike.html Alternatively, enter *bio-diesel* into a search engine and await results!

In short, vegetable oils and animal fats are known as triglycerides, containing from 7 to 13% glycerine. One of the processes for the production of bio-diesel uses sodium hydroxide (lye) as a catalyst in the transformation of the oil into esters. During this process, glycerine is separated out which sinks to the bottom of the vessel as a deposit. The bio-diesel which remains floats and can now be siphoned off.

The glycerine can be made into soap!

Experiment #23

Making liquid soap

Soap used to be made from animal fats, but vegetable oils are more commonly used.

Pour seven dessert-spoonfulls of unadulterated olive oil (or similar) into a heat-resistant container. Add three times the quantity of sodium hydroxide (NaOH) solution. Gently heat until it reaches boiling point.

Try to ensure that the boiling process is a steady one, without any bumping or jolting of the contents of the container best obtained by turning the source of heat down. This process can also be aided by the simple addition of a few shards of (very clean) broken pottery or pebbles to the liquid prior to heating. Make sure that the container is covered so that any steam is able to condense and prevent the loss of moisture.

Boil steadily for approximately thirty minutes and then allow the container and contents to cool down. This can be speeded-up by placing the container in a second container containing cold water.

Once the original container and contents are quite cold, carefully skim-off any fat on the surface or tip and carefully pour-off any oil. Add two teaspoons of table salt to the contents and stir until thoroughly dissolved.

This should result in the separation of soap in the form of a white precipitate of a jelly-like consistency. Carefully pour off the remaining liquid. Add some cold water to the 'soap' and swill it around so as to separate out any remaining salts or alkali. Repeat this a couple of times, pouring the liquid away after each 'wash'.

The remaining sticky substance is 'liquid soap'. Have the students test the sticky soapiness of the liquid by rubbing it between their fingers. Add some of the 'soap' to a test tube or other similar glass container, together with warm water. Shake vigorously to obtain a good lather!

MINERAL SALTS

'.....What the human being absorbs in the way of mineral substance is carried upwards within us until it becomes of the nature of fire. And what is of the nature of fire has the disposition to take up into itself the influences of the higher hierarchies; and then this fire streams back again into all our internal regions, and builds up, in that it resolidifies, the material basis of the separate organs. Nothing that the human being consumes remains as it is; nothing remains earthly. Everything, for example, that comes from the mineral kingdom is so far transformed that it can take into itself the spiritual-cosmic, and only then, with the help of what comes from the spiritual cosmos, does it become resolidified into the earthly condition.'

'Take a bone for instance, a fragment of calcium phosphate. This is in no way the calcium phosphate which you find outside in nature..... It is the calcium phosphate which, while it arose from what was absorbed from outside, could only take part in building the human physical form, with the help of the forces which penetrated it during the time when it was changed in the warmth-ether condition.'

'Man as Symphony of the Creative Word'
Rudolf Steiner. (Dornach. Oct/Nov. 1923)

Minerals are those inorganic substances which are derived from the food which we eat. Although a predominantly meat diet will supply us with the minerals which we need, they can also be found in abundance in a purely vegetarian diet. This should not be surprising, for from where else would the animals acquire their minerals!?

There are about twenty essential minerals widely distributed in foodstuffs and the following is but a short list of the source of some of these. Without delving into the subject of ions (cations and anions), students should be brought to an awareness of the great importance of 'keeping-a-balance' between the different minerals. Through their previous studies, they will be aware of what which minerals required by the body are either classed as metallic or non-metallic. The following is a list of such classification:

METALLIC

Sodium

Potassium

Calcium

Magnesium

Zinc

Iron

Carbon

NON-METALLIC

Chlorine

Iodine

Sulphur

Phosphorus

Of all the minerals, we should ensure that we include sufficient amounts of both calcium and iron in our diet.

CALCIUM - Ca (alkaline)

One of the most important minerals is calcium. Its prime purpose is to aid in the growth and development of bones and teeth, and the metabolism of vitamins. The tasks of calcium includes maintaining a balance between acidity and alkalinity throughout the body; assisting in the regulation of the heart muscles; increasing mental awareness and warding off fatigue. Calcium is also very important for mother's during pregnancy so as to aid with the growth of the unborn child's bones. For us to be able to utilise the calcium in our bodies to the full extent, it is important for us to expose ourselves to direct sunlight (with obvious cautionary measures), for the sunlight in the form of Vitamin D activates the calcium. Oxalic acid.....found in coffee, tea, meat and rhubarb.....inhibits its absorption, as do 'fatty based' foods..

The body has an abundance of calcium, which is kept in fluid state by the sodium in our bodies. If this fluidity is not maintained, then calcium is deposited within the arteries to form plaque, thus slowing down the blood flow giving rise to high blood pressure and the possible onset of heart disease.

Some sources of calcium include:

<i>Milk</i>	<i>Cheese</i>	<i>Eggs</i>	<i>Spinach</i>	<i>Cabbage</i>	<i>Cauliflower</i>
<i>Parsnips</i>	<i>Carrots</i>	<i>Beans (dried)</i>	<i>Lettuce</i>	<i>Citrus Fruits</i>	
Herbal source:	<i>Parsley</i>	<i>Coriander (concentrates calcium)</i>			

IRON - Fe (alkaline)

As well as being the carrier of oxygen to all parts of our body. Iron is vital for the building of our red corpuscles; for keeping the blood pure; for the rebuilding of tissues and cells, and for carrying oxygen to every part of our body. Iron foods assist in the metabolism of protein. Absorption of this mineral is also inhibited by coffee, tea, etc

Mental and muscle fatigue, dizziness and anaemia can all be caused through a lack of iron in our diet. Such a lack of iron can also be detrimental for various of our internal organs. Female biological functions are such that she requires from three to four times as much iron as a male. A good source of iron are diets with a high 'green leaf' (chlorophyll) content.

Some sources of iron include:

- Liver* *Egg yolk* *Whole Wheat* *Carrots* *Leeks*
- Tomatoes* *Lettuce* *Spinach* *Raisins* *Soya Beans* •
- Herbal source: *Fennel* *Nettle* *Chives* *Dandelion*

PHOSPHORUS - P (acid)

Phosphorus combines with calcium in the formation of strong teeth and bones. Its presence is also promotes the healthy growth of hair, skin and nails. It assists with maintaining a balance of energy levels throughout the body as well as being highly valuable in the development of our Sense/Nervous System. A lack of phosphorus may result in poor memory and concentration.

Some sources of phosphorus include:

- Meat (beef)* *Salmon* *Oysters* *Milk* *Cheese* *Egg Yolk*
- Whole wheat* *Nuts* *Spinach* *Watercress* *Apples* *Pear* *Prunes*
- Herbal source: *Anise* *Fenugreek* *Caraway* *Parsley*

IODINE - I (acid)

Iodine acts as a stimulant for the Circulatory System, as well as aiding the nutritive processes of digestion. A lack of iodine can adversely effect our Nerve/Sense System, leading to depressions and mental inefficiency.

It is also very important for the proper functioning of the Thyroid Gland. This gland, situated in the neck just below the larynx, contains a large amount of iodine which is indirectly needed by the Metabolic/Digestive System in the control of the metabolic rate.

A deficiency of iodine can cause the thyroid gland to swell, forming what is known as a GOITRE. This occurs particularly in mountainous regions where the drinking water is deficient in iodine. This is usually remedied in such regions by using 'table salt' to which has been added a small amount of iodine.

Lack of iodine may also contribute to illnesses of the Circulatory System in the form of irregular heartbeats (arrhythmia), hardening of the arteries and rapid pulse.

Some sources of iodine include:

Kelp (sea weed) Fish Radish Asparagus Cucumber

Beetroot Potatoes Lettuce Cabbage Tomatoes

Herbal source: *Kelp Garlic Watercress*

FLUORINE - F (acid)

Fluorine has many areas of responsibility, not least its role in the formation of enamel on teeth and the prevention of tooth decay. It also builds up resistance to disease and assists in the destruction of germs. Fluorine is generally present in natural water, but government authorities have deemed it their prerogative to add fluorine to the drinking supply, effectively 'drugging whole populations'... *what other 'drugs' might they add or do add already!?* Such 'mass medication' can lead to an excessive level of fluorine accumulating in the body, resulting in toxicity and the bodies inability to absorb calcium, which in turns leads to calcium deficiency.

Fluorine deficiency on the other hand, may contribute to impairment of the functions of the liver, kidneys, heart and the nervous system. It is also believed that the lack of fluorine may detrimentally effect our eyesight.

Students will be especially interested to hear that a lack of fluorine causes: perspiration of the feet; bodily odors; some skin diseases, ulcers and other organic diseases.

Some sources of fluorine include:

Cod Liver Oil Milk Cheese Raw Egg Yolk Kelp
Cabbage Cauliflower Spinach Beetroot Endive

Herbal source: *Parsley Garlic*

CHLORINE - Cl (acid)

Chlorine is a wonderful mineral to have in the body. Apart from helping to reduce fat, keeping joints supple and creating energy, it also acts as a general cleanser of the body, keeping the blood pure and assisting with the expulsion of waste. Our Digestive System benefits by its presence as it is important for the formation of gastric acid needed for digestion. Chlorine also helps with the generating of nerve impulses and in the formation of new body tissues. A deficiency of chlorine may result in asthma and other disorders of the Respiratory System.

Some sources of chlorine include (in order of importance):

Cheese	Lettuce	Spinach	Cabbage	Parsnips	Beets
Turnips	Milk	Watercress	Celery	Fish	Dates
Coconut					
Tomatoes	Bananas	Meat	Potatoes	Onions	Eggs

Herbal source: Chives

MAGNESIUM - Mg (alkaline)

Magnesium has a wide variety of roles. It is active in the building of cellular structures, especially in the Nerve/Sense and Respiratory Systems. It aids chlorine in the elimination of waste from the body and works with calcium and phosphorus in the building up the skeletal structure, making both teeth and bone harder.

Magnesium also plays an important role in our Circulatory System, counteracting poor circulation and other illnesses associated with a poorly functioning circulatory system.

Some sources of magnesium are:

Tomatoes	Spinach	Lettuce	Watercress	Cabbage	Celery
(Apples	Bananas	Figs	contain a small % of magnesium)		

Herbal source: Fennel (seeds) Burnet Dandelion

SODIUM - Na (alkaline)

We depend on the presence of sodium for the solubility of the calcium and magnesium salts, which together prevent our blood from becoming too thick. It is also helps in the prevention of Arthritis and Rheumatism.

Sodium occupies a special place in our diet. Whereas all other minerals contained in our diet are to be found in the foods we ingest, sodium is the only one which we often choose to add to our food in its natural mineral form, although some table salts are adulterated in one way or another!

The addition of salt to our food helps to enhance the flavor. Apart from that, we don't actually need to add salt to our food, for we are able to obtain our daily needs from a healthy diet. We have a tendency to consume too much salt, which eventually leads to an habit and addiction! We can frequently observe adults adding salt to the food on their plate before they have even tasted it!

Unfortunately, salt is added in copious quantities to much of the prepackages/processed foods which we buy. Salt is added to popular canned drinks such as Coca-Cola. Not that Coke actually require any salt to enhance the flavor! There is another simple motive behind its addition: consuming salt gives us thirst, thirst ensures that we drink more.....another Coke?? This also results in an 'imbalance' of liquids in our body. We then produce more urine which contains minerals (such as potassium) which have been displaced by excessive sodium consumption. In extreme cases, this can lead to high blood pressure. Even baby food has large quantities of salt added (as a preservative). The baby will become accustomed to salty food over a period of time, although their food can be perfectly healthy minus added salt.

We must of course also guard against sodium deficiency which can manifest itself in a variety of non-specific ways, including nausea, dizziness, general weakness of the Muscular System, disturbance of the Respiratory System and more specifically, Diabetes.

Some sources of sodium are:

Cow Milk and Dairy products *Meat (especially processed)*

Baked goods (due to added salt, baking powder and/or baking soda)

Canned Vegetables (due to the added salt used as a preservative)

Natural sources: *Spinach* *Celery* *Lettuce* *Tomatoes*

Herbal source: *Chives* *Caraway* *Dill* *Fennel* *Nettle*

The advent of 'Juice Vendors' in the shopping malls and elsewhere makes other sources of salt readily available to us. Juices from the following vegetables are an excellent source of sodium:

Celery *Beet* *Dandelion* *Watercress*



'...When the human being develops a need for salt (Sodium Chloride), then that represents a manifestation of the relationship of the life processes to the soul-spiritual in the human being. If a person 'craves for everything salt-like, then one has a person in whom there is an excessively strong connection of the Ego and Astral body with the Physical body and the Etheric body.' (E.K. Dahl. *Essentielle Hypertonie*. Berlin. 1960).

.....In nutrition we cannot go far beyond the plants. Most minerals are contained in the plants we eat. Sodium Chloride is an exception. That the human being wants to take in sodium chloride as a mineral, in addition to those minerals contained in plant or animal foods, indicates that we have the need to go through a dissolving process, a process of overcoming dense earth formations in the human being.' Gerhard Schmidt. (Ibid)

VITAMINS

No lesson on Nutrition would be complete without at least a brief mention of the role of Vitamins in our diet. Vitamins are complex organic substances, but which the body is unable to produce from within itself. They are nevertheless vital for the growth and well-being of the human being, having a very important role in the conversions of foodstuffs through the process of metabolism. Only very small amounts of vitamins are needed and these can be divided into two groups, depending on their ability to either dissolve in fat or water.

Fat soluble vitamins are:

<u>Vitamin</u>	<u>Needed for</u>	<u>Found in</u>
A	Growth To ward-off infection Eyesight	liver green vegetables carrots egg yolk watercress dandelion parsley nettle
D	Tooth formation Bone formation	sunlight liver oily fish sunflower seeds
E	Metabolism	wheat germ green vegetables vegetable juices red meat

K	Clotting of blood	digestive system green vegetables cereals shepherd's Purse
Water soluble vitamins are:		
B Complex (B1, 2, 3, 6, 12)	Nervous System Prevention of beri-beri Prevention of pellagra Skin Memory	bread peanuts soya beans marmite/vegemite fruit watercress (B1 and B2) parsley
C	Growth in children Purification of the blood Prevention of scurvy Prevents aging	citrus fruits bananas tomatoes green vegetables coriander shepherd's purse watercress

AQUA VITÆ

Water is the very source of life, not just for us as human beings, but also for the animal and plant world. Water forms the basis for all liquid beverages, from fruit juice to vinegar, from milk to soft drinks.

The cells of our body contain anywhere from 60 - 90% of water! It is especially important for our our Digestive and Nerve/Sense Systems. Dehydration slows down both our metabolic and thinking functions. For us to be able to function well, it is imperative that our body is well hydrated.

How much water should we drink and in what form should it be...or not be? Firstly, one has to be aware that there is a continual loss of fluids (water) during the course of a day through natural processes including respiration, perspiration, bowel and urinary tract functions. We frequently add to this lost of fluids by the use of diuretic substances in our drinks, such as caffeine (coffee, cocoa, tea, coca-cola) and nicotine (smoking) which causes unnatural losses of fluids. Admittedly, these drinks do supply us with a certain amount of liquid sustenance, but the overall effect is one of lost fluids. This is partly because water is also diuretic and encourages the kidneys to excrete more urine. The quantity of water which we should drink varies greatly from one person to another. A useful guide is the color of urine, which will be almost colorless in a person who is sufficiently hydrated. Satisfying ones thirst does not necessarily indicate that one is well hydrated.

It is good to start the day with a healthy drink....preferably water! The milk that we add to our cereals should be viewed as a 'food' rather than a 'drink', and for that reason, it should be drunk slowly. Drinking acts as a catalyst for the production of urine which in turn helps with the cleansing of the body. It also stimulates activity in the digestive tract, promoting regular bowel movements. Warm drinks help to assist this latter function.

As to the question of 'what' we should drink, attention could be directed to the benefits of fresh fruit and vegetable drinks. Highly sugared and carbonized 'soft drinks' should be avoided, together with 'ice-cold' drinks. Coffee and tea are both bad for our nerves and both effect the healthy functioning of the heart. Dandelion/chicory coffee or herbal teas can be drunk as substitutes. Alcohol, in any form, is injurious to our health.

We have become accustomed to having a drink with our meals. It is a fallacy to think that drinking whilst eating aids in food digestion. In actual fact, drinking inhibits the activity of the salivary glands, dilutes the enzymes in the mouth and digestive tract. Drinking whilst eating also encourages us to swallow our food before it is well masticated. Altogether, these actions or lack of them, slows down the rate of metabolism. Coupled with this is the need for the stomach to work overtime in producing greater quantities of acid to hold a steady pH level. Drinks should only be taken thirty minutes before or after a meal!

HERBS

Time could be profitably spent in giving students an overview of the positive value of herbs in our diet and their use in complementary medicine. such as:

HERB	MEDICAL USE
Burdock	Overall cleanser, especially blood
Chamomile	Digestive problems and has a 'calming' effect
Dandelion	Cleansing of the liver, kidneys and bladder
Echinacea	Immune stimulant, recommended for most bacterial and viral infections
Fennel	Provides quick and effective relief from stomach disorders (especially if used in conjunction with Turmeric)
Ginseng	Increases energy levels after illness

Kelp	Assists with the function of the thyroid
Lime (Linden) Flowers	Soothing effect in instances of discomfort of the nervous system
Marigold	Healing cuts and grazes
Nettle	Purifies the blood
Sage	Good for sore throats
Slippery Elm	Excellent for Intestinal disorders
Yarrow	Can be used for disorders of the Circulatory System

No discussion of herbs and their uses would be complete without some attention being given to the abuse of herbal substances. This area was briefly covered in Grade Seven, but it should definitely be included as part of this lesson.

DRUGS AND ADDICTIONS

In all probability, some students will have already begun to experiment with smoking (*although some may have begun much earlier*). It is important that this subject is broached with the students, but one has to be careful to present 'facts', rather than give moralistic monologues, for to do so will more than likely put the students 'off-side'.

What are the effects of smoking **TOBACCO**. What does cigarette tobacco contain, apart from addictive **NICOTINE**? Why do cigarette manufacturers (*and governments*) refuse to divulge the exact chemical components of cigarettes? Have students write questioning letters to the Health Department!

What of **MARIJUANA** (*also called cannabis, pot, weed, grass, etc.,*) which creates the "illusion" of well-being? It is known, but not widely publicised, that the imbibing of marijuana in any form has a long term affect on the memory and the power to think.....and also (*according to some sources*) reduces libido. It has been observed that individuals who have only smoked marijuana 'socially' suffer from long term weakness of will. They are very often unable to sustain working with a demanding program or in a demanding work environment, such as school!!

Mention could also be made of drugs such as **AMPHETAMINES** which speed up the rate of the heart, giving a "feeling" of boundless energy. The after effect is depression which leads to the desire for more drugs to overcome the depression. One begins on a never ending cycle of increasing **ADDICTION**.

ALCOHOL, even if drunk in moderation, can lead to first light headedness and a feeling of gaiety and false confidence. After a short while, the drinker can experience a change in their emotions, which may result in joy and laughter, or sadness and crying.

Next the speech becomes slurred and vision is affected. The drinker no longer has control of her/himself and will say the most stupid and outrageous things, or worse still, he or she may even begin to act totally out of character. Finally, the person will collapse and drift into unconsciousness. Alcohol has a very detrimental effect on our long term memory and ability to think clearly. Continuous and excessive drinking of alcohol can result in a person becoming an **ALCOHOLIC**. The fermentation and distillation of alcohol is discussed in Grade Nine.

AND FINALLY

This section on 'Food and Nutrition' has unintentionally taken-up the major portion of this volume. However, I feel that I have only 'scratched-the-surface', so to speak, for there is so much more that could be said and written on this most important of subjects. So much of what has been touched upon in this lesson block can be followed-up in other areas of the curriculum, such as cooking and preparing a meal for a group of people. 'How can we create the proper soul mood to prepare for a meal?' Gerhard Schmidt writes:

....This questions is especially pertinent if we realize the close relationship between the body and the soul-spiritual. Modern behavioral science has hardly recognized (in fact it has not even noticed) the importance of the "table prayer" - the saying of a grace.

Rudolf Steiner supplied a table grace which is valid for persons of all ages and also meets the needs of modern man. This grace addresses the soul which sprouts within, as do the plants outside which provide our nourishment. It points to the relationship of the germinating, sprouting, ripening of this earth food with the soul-spiritual sprouting and ripening process:

*The plant seeds are quickened in the night of the earth;
The green leaves are sprouting in in the power of the air;
The fruit becomes ripe in the light of the sun.*

*So quickens the soul in the shrine of the heart;
So blossoms spirit power in the Light of the World;
So ripens Man's strength in the Glory of God.*

FOOD AND NUTRITION

Main Lesson Test

CARBOHYDRATES:

Marks:

1. Name them: _____ and _____ (2)
2. What function do carbohydrates have in the life of a human being? (2)
3. How can we detect the presence of GLUCOSE in fruit? Describe the test: (4)
4. How can we detect the presence of STARCH in food stuffs? What chemical is utilized and what results therefrom? Describe in your own words: (2)

PHOTOSYNTHESIS:

5. Describe in your own words the process of 'sugar formation in plant leaves'. (8)

HOMWORK

A BANE OR A BOON?

A survey undertaken in the UK revealed that the majority of parents have difficulty in understanding their children's homework. It would appear that mathematics proves the greatest challenge to parents, with 48% of those interviewed admitting that they have difficulties to varying degrees. Parents struggle with the increasing complexities of current educational practise and expectations, often feeling that what is demanded of their children today, is far in advance of what they themselves learnt when at school.

Children are frequently given homework which they are unable to complete without adult input. Thus, when a child naturally turns to a parent for help, they are unable to assist and the parent frequently experiences this as personal failure. The results can be varied, but include derogatory remarks about the stupidity of the school, or more frequently the teacher, in setting such work; criticism of the child for not being able to cope with the work; heated family arguments about how a piece of work should or should not be solved or completed.

This obviously leads us to the all-important question as to why homework should be set in the first place! A child is at school each day for some seven hours plus, and expecting him or her to complete another one to three hours homework after school is, I strongly believe, an unnecessary imposition on the child. I can just imagine the resulting explosions if an employer were to insist that his employees completed extra work at home. So, if we are not prepared to do 'homework', why should we expect our children to delight in the opportunity!!

Of course, teachers always have good reasons why students should do homework. Maybe it is to catch-up on work....this may be as a result of a student's absence from lesson; inattentiveness in class or because the teacher prepared far too much material for completion within the given lesson time (*in which case, the teacher should complete the work for the students!!*). Other reasons for homework could include:

- to develop self-discipline
- to develop the ability to work independently
- to develop research skills
- to practise skills already learnt

or even:

to keep students away from tv and senseless video games

and last, but not by any means, least: because parent's ask for homework as a 'baby sitting aid'.

Little heed is paid to the environment in which the said homework is to be completed, apart maybe from some indications given to parents at a class evening.

Robin Stewart wrote in 'Sydney's Child' (June 200) on the subject of homework:

".....We spend so much time making sure our lessons are suitable for every student in our classrooms, but as soon as we set homework, we are giving the privileged few an advantage.As soon as homework is mentioned, there are always students who will be disadvantaged in one way or another.

It might be the inability to work alone at home, without parental assistance, the lack of parental interest, the aggravation caused when parents take an interest, or the basic lack of facilities that would enable the satisfactory completion of any sort of meaningful work. Whatever the reason, schools' attitude to homework does not fall in line with equal opportunities policies. As soon as homework is set, discrimination has taken place."

Referring once more to the list of possible benefits to be derived from homework, it is not difficult to see that some of these laudable reasons can quite easily and adequately be developed as part and parcel of family life. All of us can develop our 'self-discipline' and 'ability to work independently' by shouldering responsibility for a household task and ensuring that it is completed to a high standard of perfection.

Even tv and computer games can be easily avoided if the family is together, actively engaged in one leisure activity or another. And of course, there is the alternative possibility of throwing the tv out and 'trashing' all the computer games!!

There is no denying the benefits of developing both the child's reading and mathematical skills. The selection of a book containing good literature by the student from the school library to be read within a given time at home, is 'sensible' homework.

As teachers and parents, we also need to be aware of the fast-paced life which the modern day child is exposed to. No longer do children return home from school to change into 'play clothes' and run off to the garden, recreation ground or bush. Their lives are too full of prearranged activities such as sport, music, dance to name but three. If children are not involved in one or another structured activity, then parents feel that they are depriving their child of valuable opportunities. Such structured lives leaves little or no time for imaginative play or creativity.

Children need times when their lives are unstructured, time to decide for themselves what activity they should occupy themselves with. Too often parents feel responsible when their child complains of 'boredom' and set about organising something. When a child complains of being bored, a suitable oral response would be: "Is that the best you can find to do?!" Rather than: "Haven't you got any homework to do?!" Homework should definitely not be used as a substitute for boredom!

My personal preference is for no school homework. However, if it is felt necessary to set homework to assist the child in one form or another, then that homework needs to be individualised to meet the specific needs of that child. Work of a generic nature given to the entire class, regardless of interests and ability, is merely a time-filler or more accurately, a time-waster! If a school purports to meet the individual needs of the student, then teachers and parents should ensure that that philosophy is extended to include homework.

A much more useful and far more meaningful 'homework' would be to ask each child to work upon an area of special interest to themselves. This may include math and literacy skills, but more than likely students would choose homework centered around an activity such as horse riding/management; pets; model building, woodwork, 'inventions'; etc.,. This leaves room for imaginative thinking and also to meet those high ideals of independence and self-motivation.

Most of what is really useful to us (what we *use-to-the-full*) in life has not been learnt from books and definitely not from regurgitating facts learnt in class or drawing pretty borders for our books for homework, but rather from those activities where we have been physically involved in the creative/learning process.

Teachers should be able to convincingly justify the giving of homework and should be prepared to mark it accordingly. If homework is given, then it is to be assumed that the teacher holds great importance for its benefit to the student and consequently, will have spent as much effort preparing this 'important homework' as he/she will have spent preparing a lesson!! When 'projects' are given then the teacher will need to spend time with each student going over the work in detail. Is the student, through the giving of an oral report, able to show that they have a thorough understanding of the written content for which they have been awarded an 'A grade', or is the writing the result of parental input or the simple downloading of material from the internet?! Grading will reflect the effort of each student according to their ability and understanding of what they have presented. Parents have a responsibility to satisfy themselves that the homework is justified and that when completed, that the work is duly marked.

Teachers and parents need to seriously reassess their reasons for giving homework and weigh these up with the benefits which the students derive from such an activity. For homework as it stands, causes considerable unnecessary stress to students, families and the school.

IN CONCLUSION

"...The restoration of man to the harmony of his physiological and mental self will transform the universe.We must liberate man from the cosmos created by the genius of physicists and astronomers, that cosmos in which, since the Renaissance, he has been imprisoned.

Despite its stupendous immensity, the world of matter is too narrow for him. Like his economic and social environment, it does not fit him. We cannot adhere to the faith in its exclusive reality. We know that we are not altogether comprised within its dimensions, that we extend somewhere else, outside the physical continuum. Man is simultaneously a material object, a living being, a focus of mental activities. His presence in the prodigious void of the intersidereal spaces is totally negligible. But he is not a stranger in the realm of the inanimate matter. With the aid of mathematical abstractions his mind apprehends the electrons as well as the stars.

*He is made on the scale of the terrestrial mountains, oceans, and rivers.
He appertains to the surface of the earth, exactly as trees, plants, and animals do.*

He feels at ease in their company.

He is more intimately bound to the works of art, the monuments, the mechanical marvels of the new city, the small group of friends, those whom he loves.

But he also belongs to another world. A world which, although enclosed within himself, if his will is indomitable, he may travel over the infinite cycles:

The Cycle of Beauty, contemplated by scientists, artists, and poets.

The Cycle of Love, that inspires heroism and renunciation.

The Cycle of Grace, ultimate reward of those who passionately seek the principle of all things.

Such is our universe....

....We must arise and move on.

We must liberate ourselves from blind technology and grasp the complexity and the wealth of our own nature.

.....Our destiny is in our hands. On the new road, we must now go forward."

'Man the Unknown' (1935). Alexis Carrel.
Surgeon, Scientist and Winner of the Noble Prize 1912

**'We shall not cease from exploration
And the end of all our exploring,
Will be to arrive where we started
And know the place for the first time.'**

'Four Quartets'. T.S. Eliot

VERSES AND POEMS

PSALM EIGHT

(in connection with Anatomy)

O Lord, our Lord,
how majestic is your name in all the earth!

You have set your glory above the heavens.
From the lips of children and infants
you have ordained praise
because of your enemies,
to silence the foe and avenger.

When I consider your heavens,
the work of your fingers,
the moon and the stars,
which you have set in place,
what is man that you are mindful of him,
the son of man that you care for him?
You made him a little lower than the heavenly beings
and crowned him with glory and honor.

You made him ruler over the works of your hands;
you put everything under his feet:
all flocks and herds,
and the beasts of the field, the birds of the air,
and the fish of the sea,
all that swim the paths of the seas.

O Lord, our Lord,
how majestic is your name in all the earth!

PRAYER FOR SHABBAT

(in connection with Physiology/Anatomy)

Blessed is our Eternal God,
Creator of the Universe,
Who has made our bodies with wisdom,
Combining veins, arteries and vital organs
Into a finely balanced network.

Wondrous Fashioner and Sustainer of Life,
Source of our health and our strength,
We give You thanks and praise.

PAUL REVERE'S RIDE

(Henry Wadsworth Longfellow. 1807 - 1882)

Listen, my children, and you shall hear
Of the midnight ride of Paul Revere,
On the eighteenth of April, in Seventy-five,
Hardly a man is now alive
Who remembers that famous day and year.

He said to his friend, 'If the British march
By land or sea from the town tonight,
Hang a lantern aloft in the belfry arch
Of the North Church tower as a signal light -
One, if by land, and two, if by sea;
I I on the opposite shore will be,
Ready to ride and spread the alarm
Through every Middlesex village and farm,
From the country folk to be up and to arm.'

Then he said 'Good night!' and with a muffled oar
Silently rowed to the Charleston shore,
Just as the moon rose over the bay,
Where swinging wide at her moorings lay
The *Somerset*, British man-of-war;
A phantom ship, with each mast and spar
Across the moon like a prison bar,
And a huge black hulk, that was magnified
By its own reflection in the tide.

Meanwhile, his friend, through alley and street,
Wanders and watches with eager ears,
Till in the silence around him he hears
The muster of men at the barrack door,
The sound of arms, and the tramp of feet,
And the measured tread of the grenadiers
Marching down to their boats on the shore.

Then he climbed to the tower of the Old North Church,
By the wooden stairs, with stealthy tread,
To the belfry chamber overhead,
And startled the pigeons from their perch
On the sombre rafters, that round him made
Masses and moving shapes of shade -
By the trembling ladder, steep and tall,
To the highest window in the wall,
Where he paused to listen and look down
A moment on the roofs of the town,
And the moonlight flowing over all.

PAUL REVERE'S RIDE - continued

Beneath, in the churchyard, lay the dead,
In their night-encampment on the hill,
Wrapped in silence so deep and still
That he could hear, like a sentinel's tread,
The watchful night-wind, as it went
Creeping along from tent to tent,
And seeming to whisper, 'All is well!'
A moment only he feels the spell
Of the place and the hour, and the secret dread
Of the lonely belfry and the dead;
For suddenly all his thoughts are bent
On a shadowy something far away,
Where the river widens to meet the bay -
A line of black that bends and floats
On the rising tide, like a bridge of boats.

Meanwhile, impatient to mount and ride,
Booted and spurred, with a heavy stride
On the opposite shore walked Paul Revere.
Now he patted his horse's side,
Now gazed at the landscape far and near,
Then, impetuous, stamped the earth,
And turned and tightened his saddle-girth;
But mostly he watched with eager search
The belfry-tower of the Old North Church,
As it rose above the graves on the hill,
Lonely and spectral and sombre and still.
And lo! as he looks, on the belfry's height
A glimmer, and then a gleam of light!
He springs the the saddle, the bridle he turns,
But lingers and gazes, till full on his sight
A second lamp in the belfry burns!

A hurry of hoofs in a village street,
A shape in the moonlight, a bulk in the dark,
And beneath, from the pebbles, in passing, a spark
Struck out by a steed flying fearless and fleet:
That was all! And yet, through the gloom and the light,
The fate of the nation was riding that night;
And the spark struck out by that steed, in his flight,
Kindled the land into flame with its heat.

PAUL REVERE'S RIDE - continued

He has left the village and mounted the steep,
And beneath him, tranquil and broad and deep,
Is the Mystic, meeting the ocean tides;
And under the alders, that skirt its edge,
Now soft on the sand, now loud on the ledge,
Is heard the tramp of his steed as he rides.

It was twelve by the village clock
When he crossed the bridge into Medford town.
He heard the crowing of the cock,
And the barking of the farmer's dog,
And felt the damp of the river fog,
That rises after the sun goes down.

It was one by the village clock,
When he galloped into Lexington.
He saw the gilded weathercock
Swim in the moonlight as he passed,
And the meeting-house windows, blank and bare,
Gaze at him with a spectral glare,
As if they already stood aghast
At the bloody work they would look upon.

It was two by the village clock,
When he came to the bridge in Concord town.
He heard the bleating of the flock,
And the twitter of birds among the trees,
And felt the breath of the morning breeze
Blowing over the meadows brown.
And one was safe and asleep in his bed
Who at the bridge would be first to fall,
Who that day would be lying dead,
Pierced by a British musket-ball.

You know the rest. In the books you have read,
How the British Regulars fired and fled,
How the farmers gave them ball for ball,
From behind each fence and farmyard wall;
Chasing the red-coats down the lane,
Then crossing the fields to emerge again
Under the trees at the turn of the road,
And only pausing to fire and load.

PAUL REVERE'S RIDE - continued

So through the night rode Paul Revere;
And so through the night went his cry of alarm
To every Middlesex village and farm -
A cry of defiance and not of fear,
A voice in the darkness, a knock at the door,
And a word that shall echo for evermore!
For, borne on a night-wind of the Past,
Through all our history, to the last,
In the hour of darkness and peril and need,
The people will waken and listen and hear
The hurrying hoof-beats of that steed,
And the midnight message of Paul Revere.

THE SEED SHOP

(Muriel Stuart)

Here in a quiet and dusty room they lie,
Faded and crumbled stone or shifting sand.
Forlorn as ashes, shrivelled, scentless, dry -
Meadows and gardens running through my head.

In this brown husk a dale of hawthorne dreams.
A cedar in this narrow cell is thrust
That will drink deeply of a century's streams,
These lilies shall make summer of my dust.

Here in their safe and simple house of death,
Sealed in their shells, a million roses leap.
Here I can grow a garden with my breath
And in my head - a forest lies asleep.

THE VITAMIN ALPHABET

(Author Unknown)

(For possible use in 'Health and Nutrition' lesson)

I'm Vitamin A, the first one of all.
I furnish vitality and make you grow tall.
I fight disease germs of the nose, throat and lung,
I am good for all ages, especially the young.
If I'm used freely nine months before birth,
healthier mothers and babies would inherit the earth.
For when I'm left out of your diet you know,
You may grow too tall, or else be too low.
The eyes may get sick or the thyroid cavort
With all other glands, if of ME they are short.

In all dairy foods you will find me the thickest,
In veges and fruit, I fool you the quickest.
For it they're not green, or if they're not yellow,
You're not eating me, but some other fellow.

I'm chubby and plump, I am Vitamin B
Good health you'll not have unless you eat ME.
I give you the appetite of the little pink pig,
Then aid digestion and make you grow big.
If you put me in water I'll swim right away,
And soda and alkalies will make me decay.
You can boil me and broil me, even seal me in cans,
And I'll travel in safety to far distant lands.
If you eat plenty of me, regularly three times a day,
You'll feel well and happy, and ready for ply;
But if you don't eat me, your plight will be sad,
Beriberi you'll have and your nerves will be bad.

If you are not in good condition,
With vitality much too low.
If you've had a bad infection that is healing awfully slow,
If your gums are soft and bleeding, teeth forever need repair,
And pains like sharp rheumatics just fill you with despair;
Don't waste your time in worrying - that only brings more grief,
Take ME a dozen times a day and I'll give you quick relief.
You say you don't know who I am - then astonished you will be
I am the repairman of the body - I am Vitamin C.

Of course you've already heard of ME.
I'm the baby's sunshine Vitamin D.
Sound teeth, strong bone and good muscle tone,
If you have me quite freely until you are grown,
You can eat me in food or absorb me in play,
Or take me in tablets if there's no other way,
But please, I do beg you, to be sure and see
That all babies always have plenty of ME.

To be strong as you can be.
O'er bubbling with vitality.
You really can't dispense with ME,
For I'm Vitamin E.
I keep the skin both soft and clear,
And you high blood pressure falls,
For I stop the slow congestion
In all blood-vessel walls.

I tone the nervous system,
Increase fertility;
Defying age that comes to all,
As long as you'll let me.
But take me daily, I adjure,
If of good health you would be sure.

CARGOES

(John Masefield)

Quinquireme of Nineveh from distant Ophir,
Rowing home to haven in sunny Palestine,
With a cargo of ivory,
And apes and peacocks,
Sandalwood, cedarwood, and sweet white wine.

Stately Spanish galleon coming from the Isthmus,
Dipping through the Tropics by the palm-green shores,
With a cargo of diamonds,
Emeralds, Amythsts,
Topazes, and cinnamon, and gold moidores.

Dirty British coaster with a salt-caked smoke stack,
Butting through he Channel in the mad March days,
With a cargo of Tyne coal,
Road-rails, pig-lead,
Firewood, iron-ware, and cheap tin trays.

THE SONG OF THE SHIRT

(Thomas Hood)

With fingers weary and worn,
With eyelids heavy and red,
A woman sat, in unwomanly rags,
Plying her needle and thread -
Stitch! stitch! stitch!
In poverty, hunger, and dirt,
And still with a voice of dolorous pitch
She sang the "Song of the Shirt."

THE SONG OF THE SHIRT - continued

Work! work! work!
While the cock is crowing aloof!
And work - work - work,
Till the stars shine through the roof!
It's Oh! to be a slave
Along with the barbarous Turk,
Where woman has never a soul to save,
If this is Christian work!

Work - work - work!
Till the brain begins to swim;
Work - work - work
Till the eyes are heavy and dim!
Seam, and gusset, and band,
Band, and gusset, and seam,
Till over the buttons I fall asleep,
And sew them on in a dream!

"Oh, Men, with Sisters dear!
Oh, Men, with Mothers and Wives!
It is not linen you're wearing out,
But human creatures' lives!
Stitch - stitch - stitch,
In poverty, hunger, and dirt,
Sewing at once with a double thread,
A Shroud as well as a Shirt.
But why do I talk of Death?
The Phantom of grisly bone,
I hardly fear its terrible shape,
It seems so like my own -
It seems so like my own,
Because of the fasts I keep;
Oh, God! that bread should be so dear,
And flesh and blood so cheap!

Work - work - work!
My Labour never flags;
And what are its wages?
A bed of straw,
And a wall so blank, my shadow I thank
For sometimes falling there!

THE SONG OF THE SHIRT - continued

Work - work - work!
From weary chime to chime,
Work - work - work!
As prisoners work for crime!
Band, and gusset, and seam,
Seam, and gusset, and band,
Till the heart is sick, and the brain benumb'd,
As well as the weary hand.
"Work - work - work,
In the dull December light,
And work - work - work,
When the weather is warm and bright -
While underneath the eaves
The brooding swallows cling
As it to show me their sunny backs
And twit me with the spring.

Oh! but to breathe the breath
Of the cowslip and primrose sweet -
With the sky above my head,
And the grass beneath my feet
For only one short hour
To feel as I used to feel,
Before I knew the woes of want
And the walk that costs a meal!
Oh! but for one short hour!
A respite however brief!
No blessed leisure for Love or Hope,
But only time for Grief!
A little weeping would ease my heart,
But in their briny bed
My tears must stop, for every drop
Hinders needle and thread!"

With fingers weary and worn,
With eyelids heavy and red,
A woman sat in unwomanly rags,
Plying her needle and thread -
Stitch! stitch! stitch!
In poverty, hunger, and dirt,
And still with a voice of dolorous pitch, -
Would that its tone could reach the Rich! -
She sang this "Song of the Shirt!"

THE CRY OF THE CHILDREN

(Elizabeth Barrett Browning)

Do you hear the children weeping, O my brothers,
Ere the sorrow comes with years?
They are leaning their young heads against their mothers,
and **that** cannot stop their tears.
The young lambs are bleating in the meadows,
The young birds are chirping in the nest,
The young fawns are playing with the shadows,
The young flowers are blowing toward the west -
But the young, young children, O my brothers,
They are weeping bitterly!
They are weeping in the playtime of the others,
In the country of the free.

Do you question the young children in the sorrow
Why their tears are falling so?
The old man weep for his tomorrow
Which is lost in Long Ago;
The old tree is leafless in the forest,
The old year is ending in the frost,
The old wound, if stricken, is the sorest,
The old hope is hardest to be lost;
But the young, young children, O my brothers,
Do you ask them why they stand
Weeping sore before the bosoms of their mothers,
In our happy Fatherland?

They look up with their pale and sunken faces,
And their looks are sad to see,
For the man's hoary anguish draws and presses
Down the cheeks of infancy;
"Your old earth," they say, "is very dreary,
Our young feet," they say, "are very weak;
Few paces have we taken, yet are weary -
Our grave-rest is very far to seek;
Ask the aged why they weep, and not the children,
For the outside earth is cold,
And we young ones stand without, in our bewildering,
And the graves are for the old.

"True," say the children, "it may happen
That we die before our time;
Little Alice died last year; her grave is shapen
Like a snowball, in the rime.

THE CRY OF THE CHILDREN - continued

We looked into the pit prepared to take her;
Was no room for any work in the close clay!
From the sleep wherein she lieth none will wake her,
Crying, 'Get up, little Alice! it is day.'
If you listen by that grave, in sun and shower,
With your ear down, little Alice never cries;
Could we see her face, be sure we would not know her,
For the smile has time for growing in her eyes;
And merry go her moments, lulled and stilled in
The shroud by the kirk-chime.
It is good when it happens," say the children,
"That we die before our time."

Alas, alas, the children! they are seeking
Death in life, as best to have!
They are binding up their hearts away from breaking,
With a cerement from the grave.
Go out, children, from the mine and from the city,
Sing out, children, as the little thrushes do;
Pluck your handfuls of the meadow-cowslips pretty,
Laugh aloud, to feel your fingers let them through!
But they answer, "Are your cowslips of the meadows
Like our weeds anear the mine?
Leave us quiet in the dark of the coal-shadows,
From your pleasures fair and fine!

"For oh," say the children, "we are weary,
And we cannot run or leap;
If we cared for any meadows, it were merely
To drop down in them and sleep.
Our knees tremble sorely in the stooping,
We fall upon our faces, trying to go;
And, underneath our heavy eyelids drooping
The reddest flower would look as pale as snow,
For, all day, we drag our burden tiring
Through the coal-dark, underground;
Or, all day, we drive the wheels of iron
In the factories, round and round.

"For all day the wheels are droning, turning;
Their wind comes in our faces,
Till our hearts turn, our heads with pulses burning,
And the walls turn in their places;
Turns the sky in the high window, blank and reeling,
Turns the long light that drops adown the wall,
Turn the black flies that crawl along the ceiling -
All are turning, all the day, and we with all.
And all day the iron wheels are droning,
And sometimes we could pray,
'O ye wheels' (breaking out in a mad moaning),
'Stop! be silent for today!'"

THE CRY OF THE CHILDREN - continued

Aye, be silent! Let them hear each other breathing
For a moment, mouth to mouth!
Let them touch each other's hands, in a fresh wreathing
Of their tender human youth!
Let them feel that this cold metallic motion
Is not all the life God fashions or reveals;
Let them prove their living souls against the notion
That they live in you, or under you, O wheels!
Still, all day, the iron wheels go onward,
Grinding life down from its mark;
And the children's souls, which God is calling sunward,
Spin blindly in the dark.

Now tell the poor young children, O my brothers,
To look up to Him and pray;
So the blessed One who blesseth all the others,
Will bless them another day.
They answer, "Who is God that He should hear us,
While the rushing of the iron wheels is stirred?
When we sob aloud, the human creatures near us
Pass by, hearing not, or answer not a word.
And we hear not (for the wheels in their resounding)
Strangers speaking at the door -
Is it likely God with angels shining round Him,
Hears our weeping any more?"

"Two words, indeed, of praying we remember,
And at midnight's hour of harm,
'Our Father,' looking up in the chamber,
We say softly for a charm.
We know no other words except 'Our Father,'
And we think that, in some pause of angels' song,
God may pluck them with the silence sweet to gather,
And hold both within His right hand which is strong.
'Our Father!' If He heard us, He would surely
(For they call Him good and mild)
Answer, smiling down the steep world very purely,
'Come and rest with me, my child.'

"But, no!" say the children, weeping faster,
"He is speechless as a stone;
And they tell us, of His image is the master
Who commands us to work on.
Go to!" say the children - "up in Heaven,
Dark, wheellike, turning clouds are all we find.
Do not mock us; grief has made us unbelieving -
We look up for God, but tears have made us blind."
Do you hear the children weeping and disproving,
O my brothers, what ye preach?
For God's possible is taught by His world's loving,
And the children doubt of each.

THE CRY OF THE CHILDREN - continued

And well may the children weep before you!
They are weary ere they run;
They have never seen the sunshine, nor the glory
Which is brighter than the sun.
They know the grief of man, without its wisdom;
They sing in man's despair, without its calm;
Are slaves, with the liberty of Christdom,
Are martyrs, by the pang without the palm;
Are worn as if with age, yet unretrievingly
The harvest of its memories cannot reap -
Are orphans of the earthly love and heavenly,
Let them weep! let them weep!

They look up with their pale and sunken faces,
And their look is dread to see,
For they mind you of their angels in high places,
With eyes turned on Deity.

"How long," they say, "how long, O cruel nation,
Will you stand, to move the world, on a child's heart -
Stifle down with a mailed heel its palpitation,
And tread onward to your throne amid the mart?
Our blood splashes upward, O gold-heaper,
And your purple shows your path!
But the child's sob in the silence curses deeper
Than the strong man in his wrath."

READING LIST

Age 14 - 16 and older
(dependent on reading ability)

ap = Australian Publication

Far From the Madding Crowd	Thomas HARDY
The Mayor of Casterbridge	ditto
Tess of the D'Urbervilles	ditto
Jane Eyre	Emily BRONTE
For Whom the Bell Tolls	Ernest HEMINGWAY
A Farewell to Arms	ditto
True at First Light	ditto
Death in the Afternoon	ditto
To Kill a Mockingbird	Harper LEE
Cannery Row	John STEINBECK
The Grapes of Wrath	ditto
Tortilla Flat	ditto
The Moon is Down	ditto
East of Eden	ditto
The Winter of our Discontent	ditto
The Long Valley	ditto
Anna Karenina	Leo TOLSTOY
War and Peace	ditto
Short Stories	ditto
Divine and Human	ditto

Metamorphosis and Other Stories	Franz KAFKA
Crime and Punishment	Fyodor DOSTOYEVSKY
Demons	ditto
The Idiot	ditto
Doctor Zhivago	Boris PATERNAK
The Man Who Was Thursday	G.K. CHESTERTON
Don Quixote	CERVANTES
Tom Jones	Henry FIELDING
Les Miserables	Victor HUGO
The Hunchback of Notre Dame	ditto
Mansfield Park	Jane AUSTEN
Northanger Abbey	ditto
Persuasion	ditto
Anna of the Five Towns	Arnold BENNETT
Rebecca	Daphne DuMAURIER
My Cousin Rachel	ditto
Selected Stories	O HENRY
A Step from Heaven	An NA
The Land	Mildred D. TAYLOR
Roll of Thunder, Hear My Cry	ditto
Zazoo	Richard MOSHER
True Believer	Virginia Euwer WOLFF
Mahalia	Joanne HORNIMAN (ap)
Angela's Ashes	Frank HARCOURT

'Tis - a memoir	Frank HARCOURT
Rabbit-Proof Fence	Doris PILKINGTON Nugi GARIMARA (ap)
Casper Hauser - The Enigma of	Jakob WASSERMANN (Floris Books)

Inspirational Biographies/ WW2:

Bring Larks and Heroes	Thomas KENEALLY (ap)
Schindler's List (Ed: Inspire. Bio. of Oskar Schindler)	ditto
Righteous Gentile (Ed: Inspirational Raoul Wallenberg story)	John BIERMANN
Reach For the Sky (Ed: Inspirational biography of Douglas Bader)	Paul BRICKHILL
Odette (Ed: Inspire. Bio. of Odette Churchill)	Jerrard TICKELL
All Quiet on the Western Front	Erich Maria REMARQUE
Flight to Arras	Antoine de SAINT-EXUPERY
Wind, Sand and Stars	ditto
Love and War in the Apennines	Eric NEWBY

Travel and Exploration:

A Short Walk in the Hindu Kush	ditto
Slowly Down the Ganges	ditto
The Kon-Tiki Expedition	Thor HEYERDAHL
The Lost World of the Kalahari	Laurens VAN DER POST
The Heart of the Hunter	ditto
Venture to the Interior	ditto

Endurance - Shackleton's incredible voyage to the Antarctic	Alfred Lansing
Antartica - Escape from Disaster	Peter LERANGES

Rediscovery and Adventure:

The Brendan Voyage	Tim SEVERIN
The Simbad Voyage	ditto
The Jason Voyage	ditto
The Ulysses Voyage	ditto
Crusader - by horse to Jerusalem	ditto
In Search of Genghis Khan - by horse thro' Mongolia	ditto
The China Voyage - a Pacific Quest by Bamboo Raft	ditto
The Spice Island Voyage - in search of Wallace	ditto
In Search of Moby Dick - quest for the White Whale	ditto
Seeking Robinson Crusoe	ditto

The availability of titles in this list may vary from country to country.

BIBLIOGRAPHY**ADOLESCENCE**

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| Observations on Adolescence
- The 3rd phase of human Development | Rudolf Steiner |
| Adolescence: The Search for the Self | Eugene Schwartz |
| Millennial Child | ditto |

CURRICULUM

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| Waldorf Education and Anthroposophy -
Volumes 1 and 2 | Rudolf Steiner |
| The Educational Tasks and Content of
the Curriculum | Martin Rawson (editor)
Tobias Richter (co-editor) |
| Creativity in Education | Rene Querido |

PLATONIC SOLIDS

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| Geometric Drawing and the
Waldorf School Plan | Herman von Baravalle |
| Solid Geometry - the geometry of Platonic
Solids & of the Cylinder, Sphere and Cone | Harry Kretz |
| Geometry and the Imagination | A. Renwick Sheen |
| Geometry for the Waldorf High School | Herbert Swanson |
| String, Straightedge and Shadow | Julia E. Diggins
(out of print) |

ANATOMY

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| Foundations of Human Experience
(formerly: Study of Man) | Rudolf Steiner |
| Man as Symphony of the
Creative Word | Rudolf Steiner |
| An Occult Physiology | Rudolf Steiner |
| Man and Mammals | Wolfgang Schad |

Child and Man Extracts: First Lessons in Physiology	M. Sergeant
Basic Anatomy and Physiology	H. G. Q. Rowett

HEALTH AND NUTRITION

Man as Symphony of the Creative Word	Rudolf Steiner
An Occult Physiology	Rudolf Steiner
Curative Education	Rudolf Steiner
The Agricultural Course	Rudolf Steiner
Nine Lectures on Bees	Rudolf Steiner
Man, the Unknown	Alexis Carrel (out of print)
Culture and Horticulture	Wolf D. Stori
The Dynamics of Nutrition	Gerhard Schmidt
Nutrition and Education	ditto
The Living Earth	Walther Cloos
Nutrition No. 1 and 2	Eugene Kolisko
The World of Matter and the Education of Man	Frits H. Julius
The Wonders of Waldorf Chemistry	David S. Mitchell
Chemistry in Classes 7 and 8	Graham Kennish
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