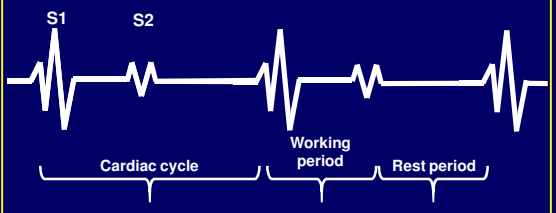
Functional Cardiac Testing

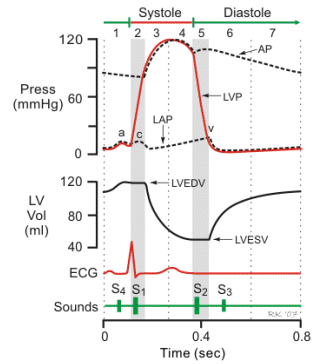
Chris Astill-Smith D.O., N.D., DIBAK
Gill Farr B.A., M.B.A., Dip. ASK

Those who have had occasion to make many heart examinations by means of diagnostic apparatus such as the phonocardiograph concur in the comment that a functionally sound or normal heart is as uncommon as a perfect set of teeth.

Perfection in either case is dependant upon adequate nutritional factors.
We know now that it is the great exception to find an individual without definite physical signs and symptoms of deficiency and the heart is no more immune to such deficiencies than are the teeth or the endocrine system.

Normal Heart Sounds





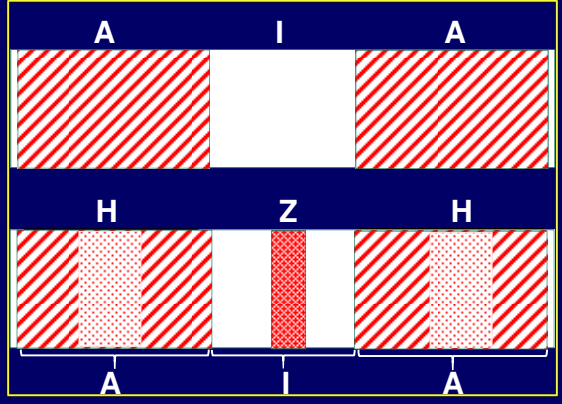
The first sound is 2 to 3 times louder than the second. The period between the second sound and the next first sound is twice as long as the period of time between the first sound and the second. This is normal. Anything different is abnormal.

Both auricular / ventricular valves must close at the same time. That closure is the **first heart sound (LUB).**
Pulmonary and aortic valves are closed by the blood pressure pushing back creating the **second sound (DUB).**

Rest period is longer as this is the period that the ventricles are opening again and should be twice as long as the closing period.

Muscle tissue

Muscle tissue
Skeletal muscle is composed of long thin cells know as muscle fibres. They are enclosed in a structureless outer coat know as the **sarcolemma.**
They are striated i.e. they show alternate dark and light bands along their length.



Each fibre is made up of a large number of **myofibrils.**
They are known as A bands (dark) and I bands (light).
At the centre of the dark band A is a light area H and at the centre of the light I band is a dark Z band.
The area between the Z bands is the contractile unit or **sarcomere.**

The Z bands become close together during a contraction. When the muscle fibres contract The I band shortens but the A band remains constant but the H band narrows.

Muscle is composed mainly of 2 proteins actin and myosin. Myosin is confined to the A band.
Actin filaments run from the Z band to terminate in the H zone.
Stiated muscle is built up of 2 overlapping series of filaments.
Cross bridges exist between the actin and myosin allowing the fibres to move past each other.

Ca ++ plays a key regulatory role in muscle contraction. Actin based regulation occurs in skeletal and cardiac muscle.

Cardiac muscle like skeletal is striated but exhibits intrinsic rhythmicity. In cardiac muscle the sarcoplasmic reticulum is less extensive and thus the intracellular supply of Ca_{++} for contraction is less, thus relying upon extracellular Ca_{++} for contraction. If deprived of extracellular Ca_{++} the heart ceases to beat within 1 minute.

Ca++ enters muscle cells through voltage gated Ca++ specific channels opening during depolarisation induced by spread of the cardiac action potential and closing when the action potential declines.
Activation of protein kinase enzymes (**Mg++ dependant**) modulate intracellular Ca++ entry.

Ca++ entry requires optimal cell membrane integrity and the presence of trans fatty acids or oxidised fatty acids will inhibit this. Thus the necessity for good **organic cold pressed unsaturated oils** such as flax seed etc. **Pyridoxal-5-phosphate** (Vitamin B6) is important in the stabilization of cell membranes.

Low magnesium levels have been found to be the best predictor of heart disease, contrary to the traditional belief that cholesterol or saturated fat play the biggest roles.

Research scientist Andrea Rosanoff, PhD., and her colleagues conducted a detailed review of cardiovascular disease research, using studies dating back to 1937.

Research has revealed low magnesium to be linked with all known cardiovascular risk factors like:
Hypertension, Arterial plaque build-up
Calcification of soft tissues, Cholesterol
Hardening of the arteries

"By 1957 **low magnesium** was shown to be, strongly, convincingly, a cause of atherogenesis and the calcification of soft tissues. But this research was widely and immediately ignored as cholesterol and the high saturated-fat diet became the culprits to fight. Ever since this early 'wrong turn', more and more peer-reviewed research has shown that low magnesium is associated with all known cardiovascular risk factors, such as cholesterol and high blood pressure."

Beryllium
Approximately 35 micrograms of beryllium is found in the human body, but this amount is not considered harmful. Beryllium is chemically similar to **magnesium** and therefore can displace it from enzymes, which causes them to malfunction.

Notable gemstones which contain beryllium include **beryl** (**aquamarine** and **emerald**) **chrysoberyl.**

The Nervous System of the Heart

The nervous system of the heart is affected by means of a balance of power of the two divisions of the autonomic nervous system – a resultant of the opposing stimuli received from the **sympathetic** and **vagus** (parasympathetic) innervation.

The sympathetic tends to speed up and increase the circulation of blood in response to physiological demands, the vagus inhibits according to similar demands.

The former being the accelerator and the later being the brake.

Physiology of the Heart

The Heart Beat

The two auricles contract almost simultaneously and are closely followed by a simultaneouis contraction of both ventricles. The entire cardiac cycle means from the beginning of one contraction to the onset of the next.

Normally a cardiac cycle requires about 0.85 of a second.
A cardiac cycle is divided into various time intervals.
Of the 0.85 of a second, about 0.15 of a second is consumed in auricular contraction and 0.23 - 0.33 of a second in ventricular contraction.

During the rest period which would be 0.38 – 0.48 of a second, the heart chambers are either in the process of relaxing or are resting in a relaxed state.

Contraction of the heart is designated as **SYSTOLE.**

There is Auricular systole or Ventricular systole. However when the term cardiac systole is used it refers only to the contraction of the ventricles.

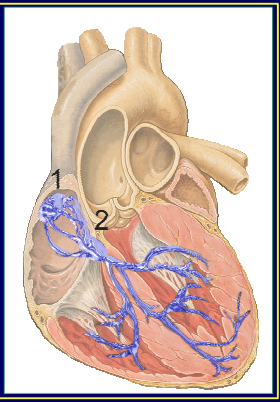
The period during which the heart is relaxing and resting is called **DIASTOLE**.

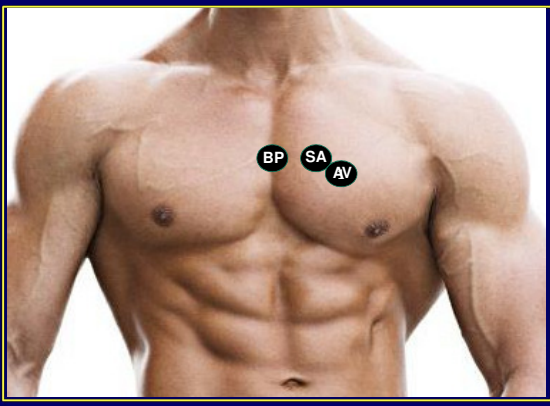
The Origin and Conduction of the Heart Contraction.
The heart differs in that it has a specific type of tissue not found anywhere else in the human body. This tissue instigates the originating and conducting the heart beat (cardiac stimulus). It is referred to as the **neuromuscular tissue** of the heart.

The reason for this is that it resembles both nerve and muscle. One important area is located in the appendix of the right auricle between the inferior and superior vena cava and is called the **SINOAURICULAR node (s.a. node).**

1. Sinoatrial node (SA node)

2. Auriculo ventricular node (AV node)





Another similar node is located in the septum (partition dividing the right and left sides of the heart) between the auricles, just above the ventricle, and extends down into the septum between the ventricles. This is referred to as the **AURICULOVENTRICULAR node (a.v. node).**

From the a.v.node a bundle of neuromuscular tissue called the **BUNDLE of HIS** extends down the interventricular septum and divides into left and right branches and enters the left and right ventricular walls. These branches ramify and give off large numbers of fibres called **PURKINJE fibres.**

These fibres branch out extensively through the ventricular muscle.
The first part of the heart to begin its contraction is the right auricle, the stimulus having its origin at the s.a. node.

At regular intervals, a wave of contraction spreads from the s.a. node out over the auricles in a fashion resembling a constricting rein being passed over them. The blood in the auricles is thereby milked into the ventricles.

The contraction wave in the auricle travels at a rate of 1 metre per second. When it has passed over the auricles it reaches the a.v. node at the junction between the auricles and the ventricles. The conduction at this point in the a.v. node is slower, being only 10 – 15 cm per second.

The cardiac impulse is therefore delayed at this point. The delay is responsible for the pause that occurs between completion of the auricular contraction and the beginning of the ventricular contraction referred to as conduction time or a.v. pause.

When the stimulus reaches the **Bundle of His** and the **Purkinje fibres**, conduction is speeded up. The rate being 3-5 metres per second with the result that the impulse reaches all parts of the ventricular muscle almost simultaneously.

Therefore it differs from the wave like contraction or the milking fashion of the auricle in that the ventricle for all practical purposes contracts as a whole.

The importance of the specialised neuromuscular tissue of the heart is apparent when realizing that if it were not present one part of the ventricle musculature would have finished contraction before the other had begun to contract.

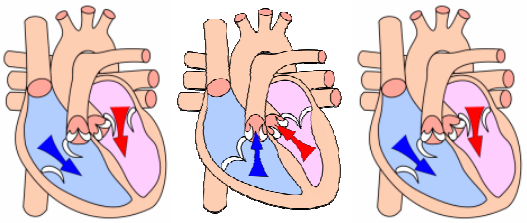
If the conduction wave was transmitted by muscle alone, the rate of the impulse would probably be too slow to permit a simultaneous contraction in all parts of the ventricle which would result in a loss of cardiac efficiency.

In actuality it is likely that all parts of the ventricle do not contract at exactly the same instant, but the lapse of time between the beginning of systole in the vigorous part of the ventricle is only a few hundredths of a second, which is too small an interval to be of any physiological importance normally.

Events of the Cardiac Cycle

Auricular systole
Auriculoventricluar pause
Ventricular systole begins
Period of rising tension
The semilunar valves open
Ventricular diastole begins
Period of falling tension
The A.V. valves open

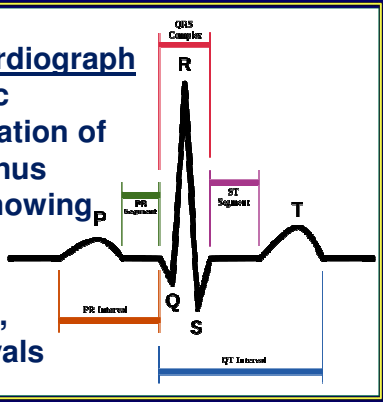
Atrial systole **Ventricular systole** **Cardiac diastole**

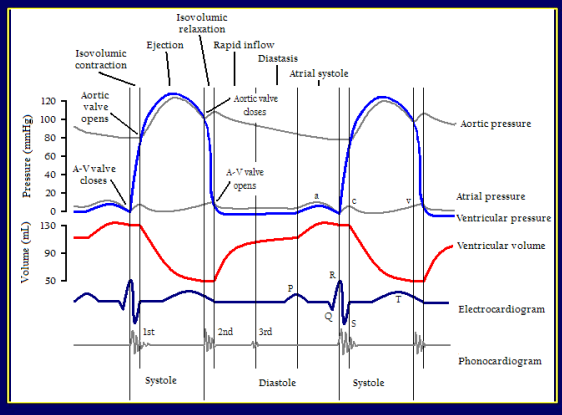


As the atria contract, the blood pressure in each atrium increases, forcing additional blood into the ventricles. 80% of the blood flows passively down to the ventricles, so the atria do not have to contract a great amount.

Electrocardiograph

Schematic representation of normal sinus rhythm showing standard waves, segments, and intervals





There are typically six distinct waves (identified by the letters P, Q, R, S, T, and U) in a single beat of the heart in sinus rhythm, and they occur in a specific order, over specific periods of time, with specific relative sizes. While there is a significant range within which variations in rhythm are considered normal, anything that deviates from sinus rhythm by more than a certain amount may be indicative of heart disease.

The cardiac conduction (genetic) system is a pathway that consists of specialized cells, known as myocytes (cardiac cells), which create the natural electrical impulse that informs the heart when it needs to pump. The location within the conduction system that gives rise to electrical impulses is known as the pacemaker. The initial impulse originates in the SA node, which is located in the upper right atrium of the heart. The SA node is designated as the pacemaker of the heart.

From the SA node, the electrical impulse spreads through interatrial tracts that spread the electrical impulse through the right and left atria and therefore cause atrial depolarization. As a result, a P-wave is observed. After the atria depolarize, the electrical impulse spreads through the internodal tracts and reach the AV node. The AV node has its own pacing rhythm that serves as a back up pacemaker in case the SA node fails to initiate an electrical impulse.

Consequently, the AV node slows down the electrical impulse to allow the atria to project their blood into the ventricles. From the AV node, the impulse travels through the bundle of His, which bifurcate into the left and right bundle branches. From the branches, the impulse travels through the Purkinje fibers and allows the electrical impulse to end in the ventricles to initiate ventricular depolarization.

Consequently, a QRS complex is observed.

Sinus rhythm, commonly referred to as *normal sinus rhythm*, is designated as the normal rhythm of the heart. Several requirements must be met for an electrocardiogram to be classified as normal sinus rhythm. Criteria for a normal sinus rhythm include:

1. A heart rate of 60–100 beats per minute.
2. Regularity—Regular
3. The SA node pacing the heart. Therefore, a "P" wave must be present for every "QRS" complex in a ratio of 1:1.
4. PR interval is between 0.12 second and 0.20 second.
5. QRS complex width should be less than 0.12 second.

Properties of Heart Muscle

1. Automaticity.
Is most prominent in the s.a. node. If the s.a. node is destroyed experimentally, the a.v. node takes up the duty of initiating the beat. In this case the heart rate is slower and the auricles and ventriocles beat simultaneously because the impulse spreads in both directions.

When the heart is beating normally and the s.a. node is sending out stimuli regularly, the a.v. node functions only as a part of the conducting mechanism because it builds up impulses slowly. There is not time from one normal beat to the next for an impulse to be built up in and discharged from the a.v. node.

The property of automaticity is also present in heart muscle itself.

A small section cut from the heart of a cold blooded animal will often continue to contract at a regular rate.

The s.a.node is most highly automatic. Next in order comes the A.V. node, the Bundle of His, Purkinje fibres and the muscle itself – any one of which is capable of stimulating its own excitation.

2. Rhythmicity.
Under normal conditions, the heart beat is regular (allowing for heart rate variability HRV) and rhythmic. Like automaticity, this property is most highly developed at the s.a.node.

3. Conductivity.
Once a beat begins in the heart, whether at the s.a.node or some other point, the contraction is as complete as is possible for the heart muscle at that time.

This does not mean that all cardiac contractions are of equal strength. Many factors influence the ability of the muscle to shorten. The heart maybe fatigued, in which case the contraction will be weak, but will be all that is possible for the fatigued muscle.

A stimulus which is not strong enough to begin a contraction will not affect the heart at all, but one which is just strong enough to influence the heart will cause a maximum response. The strength of the contraction is also dependant on the amount of blood in the ventricles.

Stretching the cariac muscle during systole by a large inflow of blood increases the force of the beat. The heart will expel most of all the blood contained whether the amount is small or great. If the ventricles are only partially filled, the contraction will be weak, if they are completely filled it will be vigorous.

4. Refractory Period.

If a stimulus is applied to the ventricles during systole it will have no effect. Shortly after the end of systole, a very strong stimulus may produce a contraction but the response is weak because the state of the muscles is such that they are incapable of vigorous response.

During the period of systole the heart is thus said to be completely refractory, during the period of relaxtion it is relatively refractory. This attribute is important because if stimuli produced contraction at anytime there maybe in diseased haerts where stimuli are sent in irregularly, a condition of more or less constant contraction.

5. Tone.

There is much controversy as to whether or not the heart exhibits tone. It is defined as a sustained state of partial involuntary contraction.

If the heart had tonicity an increase in tone would result in decreased filling because a partial contraction would decrease the size of the heart during diastole and thus less blood could be accommodated in its chambers.

The Nerve Supply of the Heart

1. The Afferent System of Nerves

In the past attention has been directed almost entirely to the efferent fibres of the sympathetic and little consideration being given to the afferent fibres and practically none to the other nerves with which the efferent fibres of the sympathetic and vagus are intimately connected –

i.e. the afferent nerves from the various organs of the body. Efferent nerves are stimulated only by impulses which they receive from other nerves. The sympathetic and vagus do not themselves originate impulses, nor are their efferent fibres efferent fibres directly stimulated by any of the organs of the body.

The impulses that stimulate them are conveyed by the afferent fibres with which all the organs of the body are supplied. An increase in the influence of the sympathetic increases the rate of the heart but it has not been realised how the sympathetic itself came to be stimulated, nor how it caused the increased rate.

Stimulation of a nerve or other organ is brought about by the increase of the number of impulses which affect the nerve or organ and the question arises "where are these impulses produces?" ***Such impulses can only arise from cellular activity.***

It can be shown that one major source of impulse production is the contraction of muscle cells as in uterine contractions, when the impulses not only increase the heart rate but cause a number of other reactions.

Impulses from the brain can increase heart rate. Contraction of voluntary and involuntary muscles and mental activity influences heart rate and these organs can only do so by generating impulses which play upon the heart through the sympathetic and vagus nerves.

Impulses can also be conveyed by the sympathetic and vagus nerves from the heart muscle itself. Such impulses stimulate the efferent fibres of these nerves which affect the heart rate just like the impulses from the other organs of the body.

There is no doubt that it is the afferent fibres of the vagus and sympathetic which convey impulses which produce pain and other reactions, as happens in angina pectoris.

Impulses conveyed by the afferent nerves affecting the vagus nerve decrease the heart rate (especially the left vagus) as in certain affections of the bowel when impulses arising from it produce a slowing of the heart and syncope. The so called vaso-vagal reaction.

2. The Sympathetic and Vagus Nerves

The efferent fibres of these nerves to the heart have their receptors in the CNS, while their discharging ends, on which their peculiar function depends, are distributed mainly to the s.a. and a.v. nodes.

The stimulation of the **sympathetic** results in an increase in the rate and in the strength of the ventricular contraction.
Stimulation of the **vagus** produces a weakening of the heart beat and a decrease in its rate.
Left vagus modulates the heart rate and the right modulates the heart rhythm.

3. The Relationship of the Sympathetic and the Vagus nerve to the Heart

It would seem that the contractions of the heart chambers are entirely under the control of the genetic system.

The s.a. node seems to possess the power of influencing not only the rate of the heart but the manner in which the auricles and ventricles contract. It is therefore possible that it is only on the s.a. node that the efferent fibres of the sympathetic and vagus nerves act, when they modify the the contraction of the heart when the rhythm is normal.

When there is an abnormal rhythm, as in fibrillation or flutter of the auricle, they then act upon the a.v. node but there is not that perfect regulation and control of the contraction of the ventricle which is exercised by the s.a. node.

However the afferent fibres of the sympathetic and vagus are in direct communication with the muscle cells for it is through the impulses thrown out by the muscle cells that the great complex of symptoms included in the term angina pectoris is produced.

4. Reciprocal Innervation

Heart rate varies on account of the movements of respiration. This is said to be vagal in origin as it disappears when the vagus is cut.

The removal of one influence merely allows the other to be uncontrolled. It is reasonable to assume that when impulses increase sympathetic activity, they at the same time decrease the vagal activity and vice versa.

5. The Denervated Heart

Starling's experiments using heart / lung totally denervated tissue. By varying the arterial pressure the strength of the heart beat could be made to vary within certain limits. But however varied the strength of the beat the output remained practically constant and the heart rate did not alter.

By increasing the inflow of venous blood considerable dilation of auricle and ventricle could take place with no variation in heart rate.

Thus it would seem that the s.a. node is quite independent of and indifferent to the work of the auricles and ventricles and that their distension has no direct effect upon the genetic system as far as the rate of the heart beat.

The fact that the heart varied in the strength of the beat shows there is within the heart itself a regulating influence and this regulating influence can only be due to the genetic system.

It is not clear how this influence which regulates the strength of the beat is produced. The factors concerned are mainly the genetic system and heart muscle, but there is present a nervous system which may exercise control on the activity of the genetic system similar to that of the sympathetic and vagus nerve upon the s.a. node.

6. Stimulation of the Vagus Nerve

If the vagus nerve is cut, its influence upon the s.a. node ceases and the action of the sympathetic is unrestrained and the heart rate increases. If the peripheral end of the cut nerve is stimulated, the rate of the heart is at once reduced

Atropine paralyses the peripheral fibres of the vagus (and other parasympathetic nerves) and heart rate increases.

Digitalis acts upon the vagal receptors increasing their excitability.

7. Stimulation of the Sympathetic
Does not give such typical reactions as stimulation of the vagus. May be stimulated by Adrenalin, Noradrenalin etc.

Variations in Heart Rate and Rhythm
All irregularities are due to an increase or decrease of activity of the different parts of the genetic system or an interference with the function of the control.

1. Variations due to Increased Excitability of Different Parts of the Genetic System
As any part of the conducting system may become more excitable than the s.a. node, the ventricles then respond to impulses from such excitable part.

The impulses then anticipate those from the s.a. node and the contraction of the ventricle occurs earlier than it otherwise would. Such contractions may occur singly or in groups and may start in the different parts of the genetic system.

The single contractions are extremely common and are recognised as the **EXTRA SYSTOLE** or ectopic excitation.

While usually the disturbances leads only to the production of a single beat, occasionally a series of beats may follow one another at a rapid rate, and may continue for brief or long periods. Such periods are called **PAROXYSMAL TACHYCARDIA.**

As these beats break in upon the dominant rhythm i.e. the rhythm which originates from the s.a. node, the paroxysm begins suddenly.
On the cessation of the paroxysm, the dominant rhythm resumes control and as it is set at a much slower rate, the termination of these attacks is always sudden.

The normal rate of the heart varies according to the excitability of the s.a. node and the causes are the agents that increase opr decrease its excitability.

The abnormal rates are due to an increased excitability of other limited portions of the genetic system.

2. Variations due to Decreased Excitability of Different Parts of the Genetic System

In the normally acting heart, when the pulse rate falls from a higher rate, the fall is due to a decrease in the excitability of the s.a. node. Other parts of the genetic system (conduction system) may be rendered less excitable and cause

a delay in the passage of impulses from the s.a. node to the auricle and ventricle or prevent impulses reaching the auricle or ventricle. Such disturbances are recognisable by the late appearance of the ventricular systole or by failue of the ventricle or auricle to respond to the impulses from the s.a. node.

Such conditions result in that form of decreased ventricular rate which is called **HEART BLOCK.** When one part of the genetic system is too slow in performing its function or fails to do so, the part nearer the ventricle may take up the function.

3. Variations due to the Cessation of Activity of Parts of the Genetic System.

When the disease process is such as to destroy or put out of action one part of the system, the other parts carry on their functions, but each part, although possessed of the faculty of independent activity, possesses individual peculiarities.

There are 5 parts where the independent activity can be studied.

1. The normal starting place in the s.a. node
2. The a.v. node
3. The Bundle of His
4. The Purkinje fibres
5. The muscle of the heart

When the s.a. node ceases to function or is destroyed, the a.v. node takes up its independent activity, so that the ventricles continue to contract.
When the a.v. node ceases to function or is destroyed, the Bundle of His takes up its independent activity and starts the contraction of the ventricles.

When the Bundle of His is destroyed, the Purkinje fibres take up its independent activity. When the Purkinje fibres are destroyed or cease to function, the muscle itself is still capable of stimulating and responding to its own excitation.

These 5 are not alike in their independent activity. The s.a. node possesses a high degree that function of control by which the rate of the heart and the trength of the beat are varied to meet the requiements of the body. This is brought about by its connection with the vagus and sympathetic nerves.

It also regulates and controls the a.v. node and Bundle of His and when it ceases to function, not only is the auricle uncontrolled (FIBRILLATION), but the a.v. node is also freed from control and exhibits peculiar features.

Under normal circumstances, the a.v. node is subject to the control of the s.a. node. It has not that function of regulation and control so highly developed as the s.a. node. It is supplied by the sympathetic and the vagus, but does not respond to them with the delicate purposive efficiency of the s.a. node.

At this rate it fails to respond either by increase or decrease to the varying activity of the body. When, as in complete **HEART BLOCK,** the independent a.v. node governs the ventricle, there is a total absence of that function which regulates the ventricles to meet the requirements of the body.

The consequence is that the ventricle reacts in a manner which differs remarkably from its behaviour when the s.a. node is in control. This is often seen as the **AURICULAR FLUTTER.** At rest the rate maybe about 50. A slight bodily effort that would increase the normal heart rate 5-10 beats increases the ventricle rate to 150.

When the a.v. node is destroyed the Bundle of His takes up the function of starting the contraction of the ventricle and is not exposed to impulses discharged by the s.a. node, a.v. node, muscle cells of the auricle, sympathetics or vagus nerve.

Coronary disease, one characteristic and result of using devitalized foods

Coronary heart disease is the leading cause of death in the western world inspite of all the emphasis laid on cholesterol, triglyceride and weight management. Dr Morgan of the University of California put a group of dogs on a diet of white flour "enriched" with synthetic vitamins and compared their behaviour with

Another group fed on the same white flour, not "enriched". The surprising result was that the dogs on the enriched flour died first and tended to die after their actions became that of sedate senility by sudden heart failure. Dr Morgan concluded that the addition of the synthetic vitamins to the flour increased the demand for some

Of the unknown factors in the diet which, as a consequence, became actually deficient sooner than with the diet with the non enriched flour. These unknown factors could, therefore quite appropriately be called the “heart protective group”.

When a cardiac crisis appearsd, as evidenced by precordial pain, palpitations, breathlessness and cyanosis, prompt action is necessary. Symptoms are identical to those of beriberi. However in beriberi cases the administration of thiamine did not relieve the symptoms of paralysis. This was only relieved by the administration

of an alcoholic extract of rice polishings. It follows that there is some substance in the extract which exerts a direct and immediate action on the heart. Prolonged acetylcholine administration will consistently cause coronary disease and death in experimental animals. Acetylcholine is produced at the

myoneural junction (of the coronary vessels) causing the arterial muscles to contract. After activation acetylcholine is metabolised by the enzyme ***cholinesterase***. Nervous strain and shock increase the production of acetylcholine and is detrimental to the angina and coronary case. General artherosclerosis has been produced

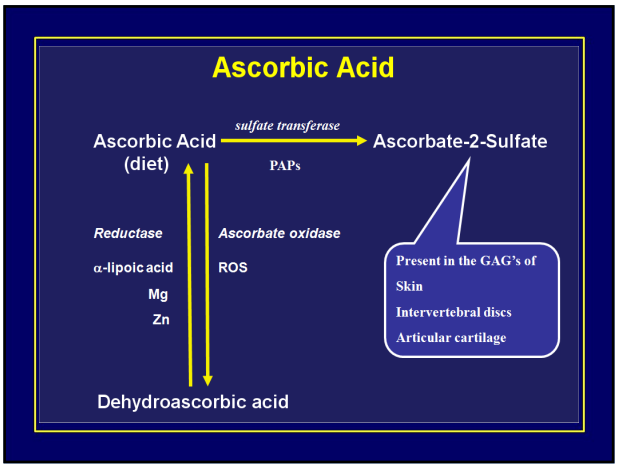
Clinically by the administration of acetylcholine when tried for its remedial action on arthritis. The coronary artery is the most worked artery in the body especially as a consequence of emotion and exercise, and is often the first to be sclerosed.
Cholinesterase is co-factored by Vitamin B2 and Vitamin B3.

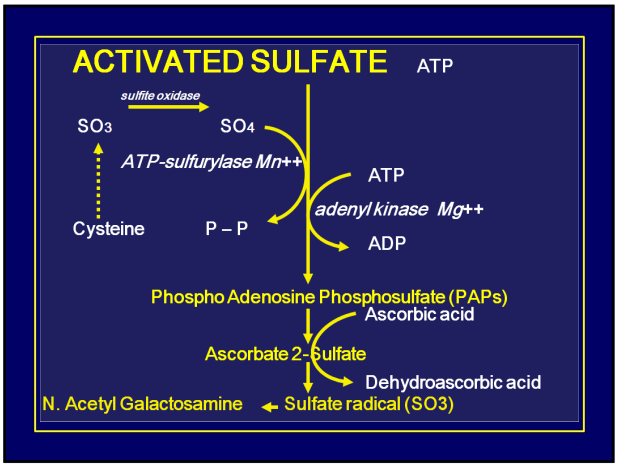
The Vitamin E complex is now known to embrace the tocopherol and tocotrienol groups, the xanthine group, the phospholipid group, the lipositols and the sex hormone precursors. The tocopherols appear to act purely as antioxidants and to be the protective agent for the morecomplex parts of the vitamin E assemblage.

In coronary thrombosis, the G complex is far more important than the tocopherol, the effect is immediate. Since the G Complex and the Vitamin E complex are all found in whaet germ, the part of the wheat discarded in white flour making. The effect of the G complex is to promote better coronary circulation

There is still only one natural way to get natural Vitamin E. Fresh butter contains 10% as much Vitamin E as wheat germ oil.

VITAMIN C
much more than just ascorbic acid





Vitamin C Complex
is
Ascorbic acid – protective part.
***Tyrosinase* enzyme – Cu++ dependant. Rich in Shiitaki and Reishi mushrooms, beetroot and potato juice.**
Vitamin P – from rutin (buckwheat), citrus bioflavonoids.
Fagio – John Hopkins University 1932

The white blood cells contain the highest content of Vitamin C of any tissue. It stimulates phagocytosis.
It works with Vitamin E to protect against free radicals.
Important in the synthesis of cortisol and hemoglobin.
Metabolises histamine.

Richest tissues
Lymphocytes
Adrenal glands
The eye
Gonads
Pituitary gland
Brain
Liver
Spleen
Pancreas

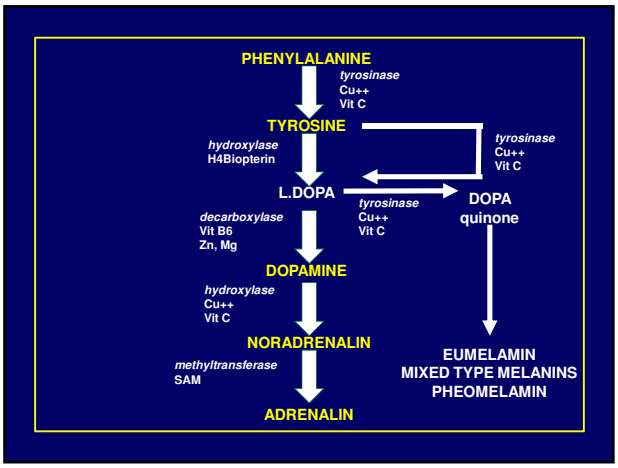
Vitamin C acts as an electron donor for eight different enzymes

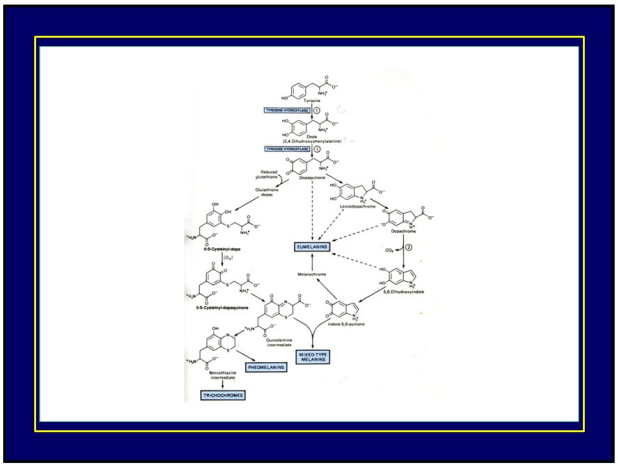
Three enzymes (prolyl-3-hydroxylase, prolyl-4-hydroxylase, and lysyl hydroxylase) that are required for the hydroxylation proline and lysine in the synthesis of collagen hydroxylation. These reactions add hydroxyl groups to the amino acids proline or lysine in the collagen molecule via prolyl hydroxylase and lysyl hydroxylase, both requiring vitamin C as a cofactor. Hydroxylation allows the collagen molecule to assume its triple helix structure, and thus vitamin C is essential to the development and maintenance of scar tissue, bloo vessels, and cartilage.

Two enzymes (ε-N-trimethyl-L-lysine hydroxylase and γ-butyrobetaine hydroxylase) that are necessary for synthesis of carnitine. Carnitine is essential for the transport of fatty acids into mitochondria for ATP generation.

The remaining three enzymes have the following functions in common, but have other functions as well:

- dopamine beta hydroxylase participates in the biosynthesis of noradrenalin from dopamine.
- another enzyme (peptidylglycine alpha-amidatinmonooxygenase) adds amide groups to peptide hormones, greatly increasing their stability.
- 4-hydroxyphenylpyruvate dioxygenase modulates tyrosine metabolism.





Deficiency

A deficiency of Vitamin C complex reduces the capacity of the blood stream to carry oxygen. May drop by 50%.
It primarily causes a degeneration of the intercellular substance of bone and teeth.
It causes a fatigued state.

It is responsible for the reduction in the germicidal enzymes in the saliva. All infections exhaust vitamin C supply.
Hence why good teeth equate with lack of infections.

Smart Vitamin C Complex
Ascorbic acid 250mg
Organ Reishi mushroom 50mg
Organic Shiitaki mushroom 50mg
Organic Beetroot 50mg
Hesperidin 25mg
Rutin 25mg
α-Lipoic acid 25mg

SMART PRODUCTS

Smart products are our range of supplements that contain freeze dried extracts of plants containing organic sources of the specific nutrients. When natural sources of nutrients are added to synthetic compounds they act as biological catalysts for the body to function most efficiently.

For instance A. Szent –Gyorgy who discovered Vitamin C studied a disease involving capilliary fragility of the walls of the blood vessels. He treated one group of laboratory animals with peppers, a narural food known to contain large amounts of Vitamin C. The second group received synthetic Vitamin C (ascorbic acid).

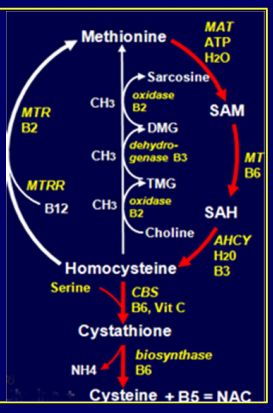
The disease was cured only in the first group of animals.
It has been suggested that natural vitamins contain in association with them certain essential trace minerals as well as enzymes and co-enzymes that act as organic catalysts, without which they cannot producetheir full vital effects.

In each product the natural source is from plants that contain the highest percentage of the active nutrient.
e.g.

Calcium	Arrowroot
Copper	Mushroom
Magnesium	Buckwheat
Potassium	Alfalfa
Zinc	Celery seed

Smart RED Complex
A multi vitamin / mineral complex product specifically researched and developed for people with a RED constitution. Clinical research has shown that RED constitutional people require higher optimal levels of specific Vitamin B's associated with regulating Homocysteine and strengthening collagen.

Homocysteine is normally metabolised to Cystathione and then to Cysteine requiring Serine (rich in Beetroot), Vitamin B6 and Vitamin C.



Vitamin B6 (as Pyridoxal-5-phosphate) supports most hormones and neurotransmitter synthesis. It regulates collagen formation and aids in the metabolism of Homocysteine. Folic acid (coupled with zinc) is essential in all tissue repair and cellular regeneration.

Smart Vit C contains ascorbic acid, the protective part of the vitamin complex, rutin and hesperidin powerful bioflavonoids which optimise blood vessel permeability, beetroot, a rich source of *tyrosinase* the organic Cu++ enzyme and alpha lipoic acid that recycles ascorbic acid when it has become oxidised,

Vitamin B12 as its co-enzyme Methylcobalamin is the methyl donor in the recycling of homocysyeine along with folic acid as methyltetrahydrofolate.
Folic acid (coupled with zinc) forms methyltetrahydrofolate in the body and is also essential in all tissue repair and cellular regeneration.

Vitamin B2 (Riboflavin previously known as Vitamin G) and Vitamin B3 (Nicotinic acid) both are involved with the recycling of Homocysteine and energy production. Both are powerful vasodilators.

Choline has a special role in the metabolism of Homocysteine via the liver to genereate three methyl groups.
Choline and Inositol are members of the Vitamin B group and are lipotrophic thus regulating triglyceride and cholesterol.

Iodine as potassium and magnesium iodides bonds with tyrosine to form thyroxin and other thyroid hormones. Iodine also acts to regulate the steroid estradiol – estrone balance. It is also involved in the production of hypoiodite in the neutrophils via the *myeloperoxidase* enzyme.

Magnesium cofactors 70% of all know body enzymes and is vital to both energy production and neuronal firing.
Manganese is a trace element necessary in the production of collagen, acetylcholine and urea.
Molybdenum is a trace element that cofactors the oxidation of sulphites to sulphates.

Selenium is vital in the conversion of the thyroid hormone conversion of T4 to T3 and also in the enzyme glutathione peroxidase.
Silica is an important component of the ground matrix and aids oin the integrity of bones, nails, hair and teeth.

Zinc is a cofactor in over 300 body enzymes and is vital for immune system, optimal wound healing, mental well being and skin, nails and hair.
Beetroot is a root vegetable rich in the amino acid serine which conjugates Homocysteine, the Cu++ dependant enzyme *tyrosinase* and folic acid

Smart RED Complex

Pyridoxal-5-phos	Iodine
Smart Vitamin C Complex	Magnesium
	Manganese
Methylcobalamin	Molybdenum
Folic acid + Zinc	Selenium
Riboflavin	Silica
Niacinamide	Zinc
Choline + Inositol	

In a base of organic Beetroot, a rich source of serine and *tyrosinase*

Why Vitamin B and G Separately

Vitamin B Complex (Thiamine, Adenine (Vit B4), Pantothenic acid, B12)
Soluble in alcohol. Heat stable. Associated with the nervous system.
Acts as a vasoconstrictor. Increases blood pressure and enhances blood vessel tone. Destroyed by *thiaminase* in clams and salted herring.
Deficiency - Most symptoms due to high lactic acid levels. Burning in soles of feet. Tenderness of the calf muscles, Back pain at night.
Poor breath holding less than 20 seconds, low body temperature, frequent yawning, fatigue, lack of appetite, bloating. Symptoms worse with exercise.
Increased psychotic tendency, intolerance to noise, apprehension.
Bradycardia, irregular heart beat, atrial fibrillation, heart block. Split S1 and / or S2. Increased body weight.
Lack of vibration sense. Hat on or tight band sensation around the head.
Lack of appetite. Drowsiness after meals. Enhances salivary glands and pancreas to produce their alkaline enzymes thus aiding carbohydrate metabolism. Helps overly acidic patient.
Goes to sleep but wakes up and cannot get back to sleep. Nocturnal frequency.

Smart Blue Complex
A multi vitamin / mineral complex product specifically researched and developed for people with a BLUE constitution. Clinical research has shown that BLUE constitutional people require higher optimal levels of the alcohol soluble B vitamins –

Vit B1, Vit B5 and Vit B12 along with adequate supplies of adenine previously know as Vit B4 to maintain cardiovascular neuronal firing.
Vitamin B1 (Thiamine) is necessary in cellular energy production converting pyruvic acid to acetyl CoA.

Conditional deficiency will lead to excess production of D. lactic acid and mitochondrial hypoxia.
Vitamin B5 (Pantothenic acid) is necessary in the synthesis of Acetyl CoA and Co enzyme Q10 both necessary in the production of energy.

Vitamin B12 (Hydroxycobalamin) is required for cellular maturity especially the red blood cells and also to recycle Homocysteine in order to generate adequate amounts of methyl donors.

Adenine (B4 factor) prevents nerve paralysis or loss of conduction power. Deficiency leads to split sounds culminating in fibrillation. It prevents heart dilatation or enlargement which distorts the heart valves causing regurgitation. Nutritional yeast is the most abundant source of this important nucleotide.

Boron is a trace mineral that plays a role in postmenopausal estradiol synthesis and thus regulating bone density.
Magnesium cofactors 70% of all know body enzymes and is vital to both energy production and neuronal firing.

Sulfur is an important component in phase 2 liver sulfation which detoxifies many neurotransmitters, steroid hormones, certain drugs and many xenobiotic and phenolic compounds such as paracetamol, tyramine, MSG, aspartame and many pesticides.

Selenium is vital in the conversion of the thyroid hormone conversion of T4 to T3 and also in the enzyme glutathione peroxidase.
Zinc is a cofactor in over 300 body enzymes and is vital for immune system, optimal wound healing, mental well being and skin, nails and hair.

Smart Blue Complex

Thiamine	Boron
Pantothenic acid	Magnesium
Hydroxycobalamin	Selenium
	Sulfur
	Zinc

In a base of organic Nutritional Yeast, a rich source of Adenine (Vit B4)

Vitamin G Complex (Riboflavin, Niacin, Pyridoxine, Folic acid, Choline, Inositol, Betaine)
Insoluble in alcohol, heat labile.
Nerve relaxing, acts as a vasodilator, aids hypertension.
Deficiency
Excessively worried, moody, apprehensive, suspicious, depression.
Tachycardia, Ventricular ectopic beats, pre angina pectoris, Pre-myocardial infarction. S1 and S2 equally spaced.
Aids in stomach HCl production. Helps overly alkaline patient. Spastic gall bladder. Bright red tip of the tongue. Purple or strawberry tongue with Vit B2 deficiency.
Rectal and vaginal irritation.
Frequent crying for no cause.
Cracking of the lips especially in the corners. Loss of substance in the upper lip.
Loss of capillary tone. Bloodshot eyes. Spider nervi.
Regulates oxygen / hydrogen. Role in sugar and aids fat metabolism. Deficiency leading to photophobia, burning, itching and blepharospasm. Things go in and out of vision.
Stimulates both acetylcholine synthesis and metabolism. Stimulates acetylcholinesterase so deficiency leads to spasms, atherosclerosis including coronary vessels, restless legs- jumpy or shaky legs.
Low levels of tissue choline as lecithinase is R/N dependant. Leads to fat deposition

Smart Green Complex

Relaxes muscle tissue especially the coronary arteries by its adrenalin action – adrenalin tones up small arteries but relaxes the coronary. Contains also the lipotrophic factors to metabolise cholesterol and triglycerides. Deficiency causes tight feeling in chest on exertion.

Smart GREEN Complex

A multi vitamin / mineral complex product specifically researched and developed for people with a GREEN constitution. Clinical research has shown that GREEN constitutional people require higher optimal levels of the alcohol insoluble B vitamins –

Vitamin B2, Vitamin B3, Vitamin B6 and Folic acid with adequayte supplies of the lipotrophic factors Choline, Inositol and Biotin. Vitamin B2 (Riboflavin previously known as Vitamin G) and Vitamin B3 (Nicotinic acid) both are involved with energy production and are powerful vasodilators.

Vitamin B6 (as Pyridoxal-5-phosphate) supports most hormones and neurotransmitter synthesis. It regulates collagen formation and aids in the metabolism of Homocysteine. Folic acid (coupled with zinc) is essential in all tissue repair and cellular regeneration.

Choline, Inositol and Biotin are members of the Vitamin B group and are lipotrophic thus regulating triglyceride and cholesterol. Boron is a trace mineral that plays a role in postmenopausal estradiol synthesis and thus regulating bone density.

Copper is a trace element that cofactors noradrenalin and collagen and elastin formation. It also cofactors the production of SOD, monoamine oxidase and tyrosinase.
Selenium is vital in the conversion of the thyroid hormone conversion of T4 to T3 and also in the enzyme glutathione peroxidase.

Silica is an important component of the ground matrix and aids oin the integrity of bones, nails, hair and teeth.
Zinc is a cofactor in over 300 body enzymes and is vital for immune system, optimal wound healing, mental well being and skin, nails and hair.

Smart Green Complex

Riboflavin	Boron
Nicotinic acid	Copper
Pyridoxal-5-phosphate	Selenium
Folic acid	Silica
Inositol	Zinc
Choline bitartrate	
Biotin	

In a base of Lecithin, a rich source of phosphatidylcholine and inositol

Essential Fatty Acids

Act as a calcium ionizing agent for the use of muscular tissue without which the muscle contractions become reduced so that the heart, the power to complete the contraction cycle is limited and the cycle is not completed, the second sound recorded being weak or totally absent.

Smart C Complex

Includes the ***tyrosinase*** enzyme essential to all muscle especially the heart which undergoes atrophy with replacement fibrosis in deficiency. Needed when the heart shows increased contraction time, indicating an overworked muscle. Note disappearance of "shortness of breath" with supplementation.

Smart C Complex

Ascorbic acid 250mg
Organ Reishi mushroom 50mg
Organic Shiitaki mushroom 50mg
Organic Beetroot 50mg
Hesperidin 25mg
Rutin 25mg
α-Lipoic acid 25mg

WGO (Smart E Complex)
Deficiency causes a 250% rise on oxygen demand in the muscles. Deficiency specifically causes necrosis of the heart muscles leading to sudden death. Tocotrienols have a nitroglycerine effect at vaso-dilating the coronary arteries in angina pectoris.

Smart Potassium Complex
Deficiency characterized by tachycardia, paroxysmal tachycardia in acute form. Normal autonomic control of the heart is lost. Potassium is absorbed from the blood by the stowing away of sugar after a heavy carbohydrate meal bringing on heart labouring. Sugar is stored as phosphagen instead of glycogen.

Smart Potassium Complex
Potassium (chloride) 35mg
Potassium (sulfate) 30mg
Citric acid 40mg
Alfalfa organic 260mg

Smart Magnesium Complex
Magnesium (sulphate) 38.4mg
Magnesium (Chloride)24mg
Buckwheat organic 100mg
Citric acid 40mg

Smart Magnesium Complex
Magnesium cofactors 70% of all know body enzymes and is vital to both energy production and neuronal firing.

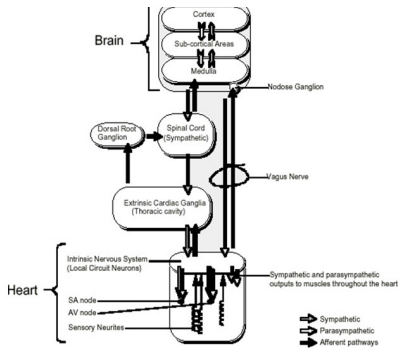
Smart Zinc Complex
Zinc is a cofactor in over 300 body enzymes and is vital for immune system, optimal wound healing, mental well being and skin, nails and hair.

Smart Zinc Complex
Magnesium (sulphate) 7mg
Magnesium (Chloride) 8mg
Celery seed organic 100mg
Citric acid 40mg

Smart Heart Tissue Extract
A new heart muscle extract that acts as a heart muscle tonic. Its action can be immediate on a patient with a weakened or flabby heart. It is indicated when the patient has poor muscle tone, muscular fatigue or hypertrophy. Usually shows up as a weakened first sound.

Heart Math

The "Heart Brain"



The Three Heart Feelings

1. Forgiveness RED
2. Appreciation GREEN
3. Non-Judgement BLUE

The Three Core Fears

1. Fear of separation – if we use words in our relationships like devasted or crushed. Someone has ripped a part of you away, we feel abandoned.

The Three Core Fears

2. Fear of self worth, a sense we are not good enough in our world, issues of low self esteem. We accept things as they are as we cannot expect anything else.

The Three Core Fears

3. Fear of trust, feeling that we have come to a world that is not safe, it's a dangerous, scary place. We feel incapable of surrendering our personal selves. We have the feeling we need to be in control of our world.

The Sense of Smell

The olfactory bulb sends olfactory information to be further processed in the amygdala, the orbitofrontal cortex (OFC) and the hippocampus where it plays a role in emotion, memory and learning.

The main olfactory bulb connects to the amygdala via the piriform cortex of the primary olfactory cortex and directly projects from the main olfactory bulb to specific amygdala areas. The amygdala passes olfactory information on to the hippocampus.

The orbitofrontal cortex,amygdala, hippocampus, thalamus, and olfactory bulb have many interconnections directly and indirectly through the cortices of the primary olfactory cortex.

These connections are indicative of the association between the olfactory bulb and higher areas of processing, specifically those related to emotion and memory.