Biochemical analysis opens up new horizons...

Boerhaave was one of the first to make biochemical studies on blood.

Doctor Joseph Lister discovered that the coagulation of blood did not occur unless blood vessels were damaged, there were no flaws in his theory.

'Doctor Blade' flaw ▲
Caused by surplus ink not being removed from the printing cylinder

stamps perforated on all 4 sides, or stamps perforated on 4 sides in pairs with stamps perforated on 3 sides, the booklet as above containing the 4 x 3 pairs are AVAILABLE IN LIMITED QUANTITIES ONLY.

In 1840 Berzelius extracted iron from blood leading to the discovery by Leon Marchlewski and others of the structure of the iron containing protein, haemoglobin found in red cells.

The structure of haemoglobin was confirmed by Perutz in 1959 by X-ray crystallography

Swedish booklet issued in 1939 to commemorate the bicentenary of The Royal Academy of Sciences. Until 1940 booklets were prepared by hand, booklet panes were taken from sheets containing 10 x 10 stamps, 2 strips of 5 x 2 stamps were stapled between the covers, and contained either

Muller studied the chemical and physical properties of lymph, chyle, and blood.

Bayern PTPO stationery card

Gesellschaft für Morphologie und Physiologie zu München.

Einladung

zur Sitzung am Dienstag, den 20. November Abends 8 Uhr im „Hotel Stachus" (Speisesaal, 1. Stock).

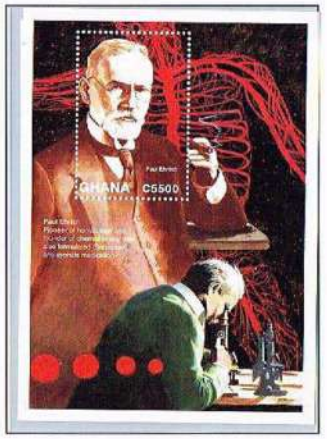
Tagesordnung:

1. Herr Prof. Dr. Rückert u. Herr Prof. Dr. Mollier: Über die erste Entstehung des Blutes und der Gefässe bei den Wirbeltieren. 2.Teil.
2. Herr Privatdozent Dr. L. Neumayer: Demonstration des Gehirnausgusses eines fossilen Primaten.

But up to the 1900s many hypothesis on blood cell formation and morphology existed... ...Ruckert and Mollier lectured on the subject at the Munich Society in 1900....

Bernard studied the exchange of gases in red cells and observed the resultant colour changes *trial colour plate proof*

Three 19th century scientists establish the formation of blood cells

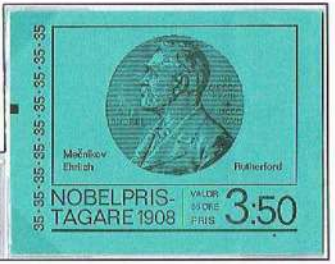


Ehrlich classified the different types of white cells, by staining the cells using different coloured dyes, some of which are illustrated in the stamp below.

Metchnikoff, a Russian working in the Pasteur Institute, Paris, discovered the ability of white cells to ingest foreign material

Booklet ▶ and stamp ▼ from within booklet

In 1908 they shared the Nobel Prize for medicine.

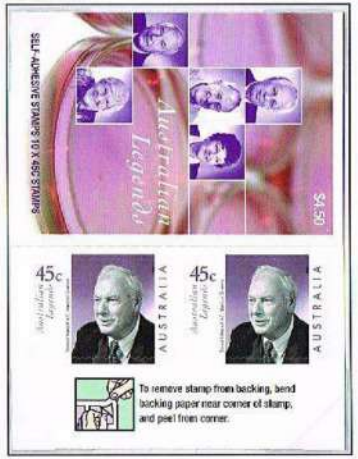


These discoveries were brought together by Metcalf, who has been called "the father of haematopoietic cytokines" for his pioneering work on the control of blood cell formation. in 1965, co-developed techniques permitting the growth of the various types of blood cells.

Virchow classified blood cell development, he also described thrombosis and leukaemia.

KULTURBUND
zur demokratischen Erneuerung
Deutschlands / KREIS LEIPZIG
SEKTION PHILATELIE

First issued in 1948 Russian Zone. Also used on private postal stationery. This copy above re-issued 1952 in DDR, with DDR watermark.



Developments in the 20th century were rapid

Krogh measured the oxygen content of blood and the gaseous exchange between blood and tissue, and Heymans investigated the vasomotor control and the regulation of blood pressure

Osler elucidated the role of blood platelets in heart disease.

At the 1953 European Haematology Congress, the synthesis & metabolism of haemoglobin, morphology & function of platelets and theories of blood coagulation were all discussed by eminent haematologists of the day.

R-registration label from mobile post office, 1953 Haematology Congress, Amsterdam

Bogomolets' contribution was on blood circulation.

He later became Director of the Institute of Haematology, later named after him.

With the developments previously outlined, the study of blood - haematology was now to become a major discipline within the hospital, with research into blood composition.

Blood cells and plasma are made of proteins, DNA is essential to the production of all proteins

Proteins are made by ribosomes, contained in the main body of the cell,

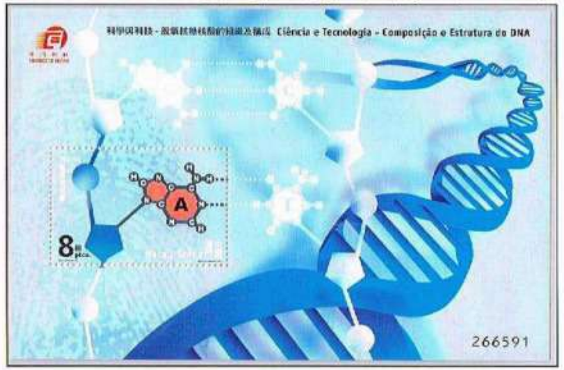
DNA (deoxyribonucleic acid) is the molecule that contains the genetic code of organisms, and tells the ribosomes what proteins to make.. Within cells, DNA is organized into long structures called chromosomes.

Mendel, by his work on cross-breeding pea plants would lead to the science of modern day genetics

In 1953 Watson and Crick proposed that DNA was a double-helix structure.

Part of limited edition sheetlet issued by Royal Mail for the 800th Anniversary of Cambridge University

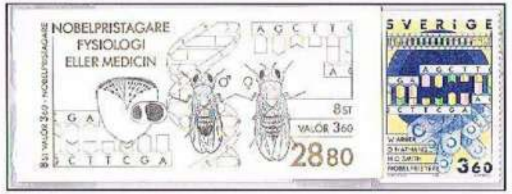
DNA is made of 4 nucleotides - Glycine Cytosine, Thymine, and Arganine (shown below).



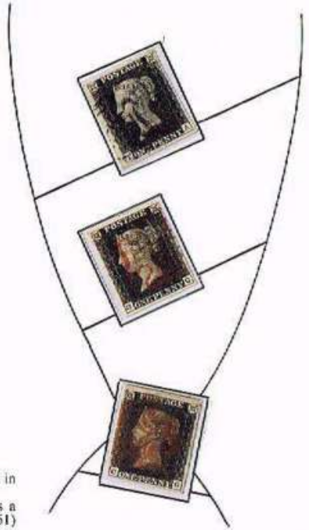
They are grouped in triplets - table of nucleotides of RNA. In RNA Thymine is replaced with Uridine, eg GCT is GCU in RNA and GCT in DNA

enlarged section

The 4 nucleotides and are paired together - Arganine with Thymine, and Glycine with Cytosine



The DNA chain is illustrated with the QV line engraved 1d issues and the relevant position letters. The black Maltese cross links the T-A bonds, and the red Maltese cross links the C-G and G-C bonds.



An error in the sequence of amino acids can result in the production of an abnormal protein. Queen Victoria had such an abnormality she was a carrier of the blood disease, haemophilia (see page 51)

The liquid part of blood is called plasma

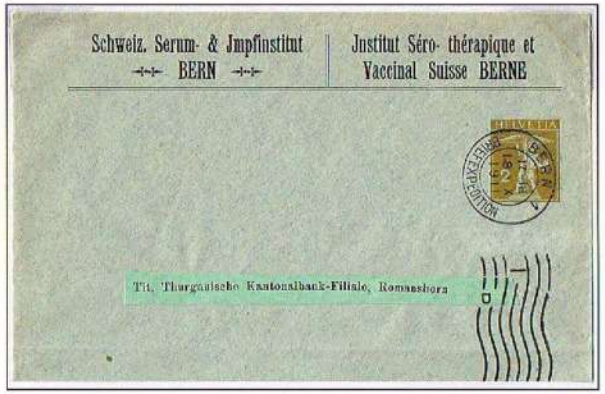
Purkyne first used the term plasma.

The liquid plasma contains coagulation proteins such as fibrinogen

Serum is plasma after blood has coagulated

During coagulation fibrinogen is converted to fibrin, a jelly like substance which stops bleeding from an injury

Later the fibrin is removed by a process called fibrinolysis



Other essential substances are carried by plasma such as ...

albumin

Meter: francotyp C

vitamin B12

Iron (Fe)

enlarged section

Printed to private order, postal stationery. Printed paper rate

salt (sodium chloride NaCl)

Muestra perfin, sample proof

glucose

Enlarged section - the design shows the incorrect formula for cori ester, a derivative of glucose. a line is incorrectly drawn to the second 'O' in 'OPO 2-3'. It should be drawn to the first 'O'.

Plasma also transports waste products eg urea, away from tissues

Many of the substances mentioned above such as iron and vitamin B12 are essential for red cell production...

Most creatures are dependant on oxygen, and transporting oxygen to all parts of the body is a major function of blood...

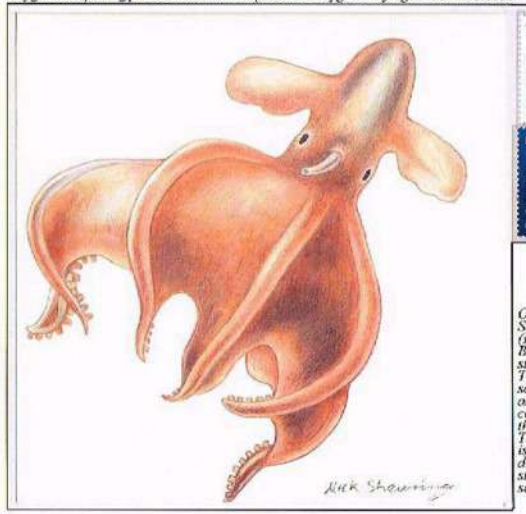
Meter: postalia

... several Antarctic fish species including the the Mackerel Ice fish (Champsocephalus gunnari), have nearly colourless blood as a consequence of a total lack of oxygen carrying cells. They can still flourish because of the high oxygen content of the cold waters of the Southern Ocean and in part because oxygen is absorbed and distributed directly by the plasma.

Like many related Antarctic fishes, they also carry compounds in their blood that prevents the blood from freezing

To survive in the deep ocean, octopuses evolved a copper rather than iron-based blood called haemocyanin, which turns its blood blue. This copper based protein is more efficient at transporting oxygen then haemoglobin when water temperature is very low and not much oxygen is around.

... the majority of animal species 45% of their blood is made up of oxygen-binding and oxygen-transporting proteins contained in specialised oxygen carrying cells of the blood...



Original artwork by Nick Shewring for the 2016 (£1.22) and 2017 (66p) British Antarctic Territory stamps. The printers Pobjoy Mint scanned the image of this artwork into a pre-designed computer template both for the 66 stamp and the £1.22. The image in the 66 stamp is slightly larger and at a different angle to match the stamps that were printed in se-tenant format.

In most animals including humans it is haemoglobin, an iron containing protein contained in the red cells which carries oxygen to all parts of the body, it is haemoglobin that gives blood its red colour.

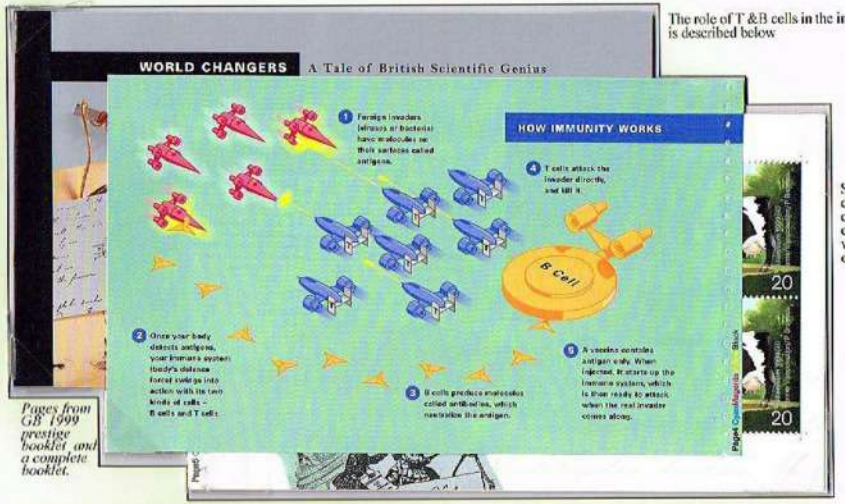
... below red cells viewed under the light microscope and below right (stamp) red cells viewed under electron scanning microscope

Structure of the haemoglobin molecule, stamp below left, and postmark below right

◀*GB stamp designed by Keith Bassford, based on an original black & white drawing by A. Kolliker, in 'Handbuch der Gewebelehre' published 1859 (copy left). Authenticated and signed by K Bassford*

2.3. COMPOSITION OF BLOOD.....white cells & immunology

The role of T & B lymphocyte cells (type of white cells) in the blood is an essential component of the immune system



Pages from GB 1999 prestige booklet and a complete booklet.

The role of T &B cells in the immune response is described below

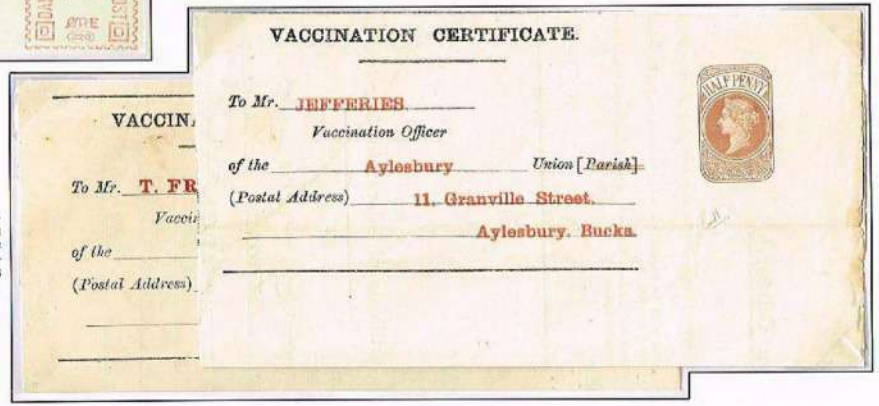
Scanning electron micrograph of a white cell (lymphocyte) ▶
cross section of a white cell under the electron microscope ▼

It is the role of these cells in the immune response that produce antibodies in the plasma against infectious diseases.

The serum/plasma antibodies are purified by specialised laboratories for further use and research.

meter: Francotyp "C"

Postal Stationery issued 1875 with Medical Certificate of successful vaccination dated 1875. The Vaccinations Act of 1867 and 1871 permitted all Boards of Guardians to appoint an officer to enforce the law of vaccination.
Type I and type II - different print of Queen Victoria's hair ribbon



Vaccines can be manufactured which can trigger the immune response against diseases such as as smallpox and others.

2.4. EXAMINATION OF THE HEART AND BLOOD.....technology helps us to understand and diagnose diseases

Many of the components of the circulatory system can be examined in great detail...

Chromalin proof by Walsall Security Printers in which full color proofs are produced directly from the colour separations prior to final production of the printing plates.

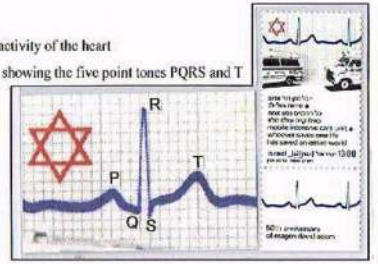
Taking the pulse is the simplest procedure, an increased pulse rate of 238 can occur after strenuous exercise

Normal stamp and reverse of imperf with control number 238

The stethoscope invented by Rene Laennec in 1816, enabled him to hear and correlate the different sounds of the heart

The Electrocardiograph (ECG) monitor records the electrical activity of the heart

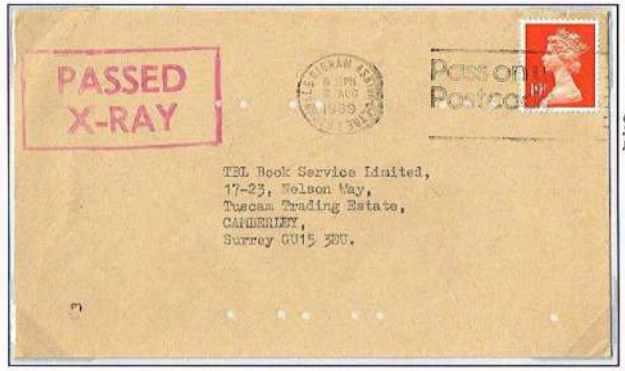
ECG tracing showing the five point tones PQRS and T



Enlarged section

ATM (Automatic variable stamp) label, 2006

Black print - ungummed imperforated proof printed in black from the original printing plates and affixed to Government information folder.



Cachet applied by Royal Mail Security Mail Screening Services following X-ray examination

X-rays are an important tool for the diagnosis of heart disease, but can also be used for the detection of HIV contaminated needles and explosive devices inserted into envelopes and packages.

Other techniques such as computed tomography (CT scan) can show the heart in 3D

Blood analysis is an essential part of a doctors examination

Meter: Pitney Bowes R series

Taking blood for analysis,

even from small babies and foetus *reverse of stamp (not reduced)*

...with special blood sampling devices

Meter: Francotyp Cc

Meter: Francotyp-Postalia, digital ultimail 30

The examination of blood cells under the microscope may indicate the presence of certain diseases such as...

Reverse of stamp (not reduced)

leukaemia cells

presence of sickle cells in sickle cell anaemia .

The reverse printing has made the instructions for preparing a blood slide for microscopic analysis difficult to understand, but the diagram although a mirror image of the original can still be understood.

Reverse printing error on inland letter card - scan of reverse

Staining the cells with special dyes (Fields stain)may show malaria parasites

Analysis of the blood constituents

Issued stamp and reverse of imperf with control number 453

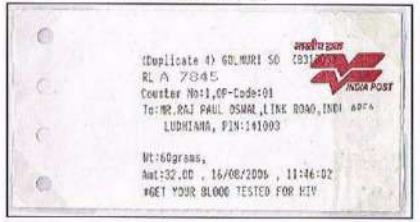
Blood glucose levels were orinally measured by a method devised by Folin and Wu, blood glucose can detect diabetes.

Early laboratory equipment for blood glucose estimation Folin & Wu method (blue tubes), a Duboscq colorimeter is also illustrated to measure the amount of blue colour change.

Colour shift, in UL corner block, caused by paper crease on LR stamp occurring after application of yellow, cyan and black but before magenta which is shifted to left. ONLY KNOWN BLOCK OF 4

Modern day measurement of blood glucose

testing for AIDS (HIV)



▲ *Receipt issued to sender of registered letter etc. Slogan in use for only one day at one post office only.*

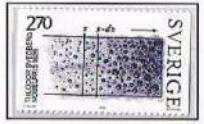
Special blood dilution pipettes used for preparing blood, to count cells under the microscope...

Meter: Postalia, D2/D3

...the method of counting cells under the microscope was automated by machines such as this early Technicon automated analyser (1970's) similar to that used for blood counting...

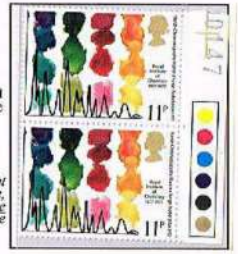
...which have now been replaced by more advanced blood analyser systems.

Meter: Pitney Bowes, 6300



Chromatography & electrophoresis will separate different proteins, amino acids etc, these separated elements can be stained by special dyes as shown on right

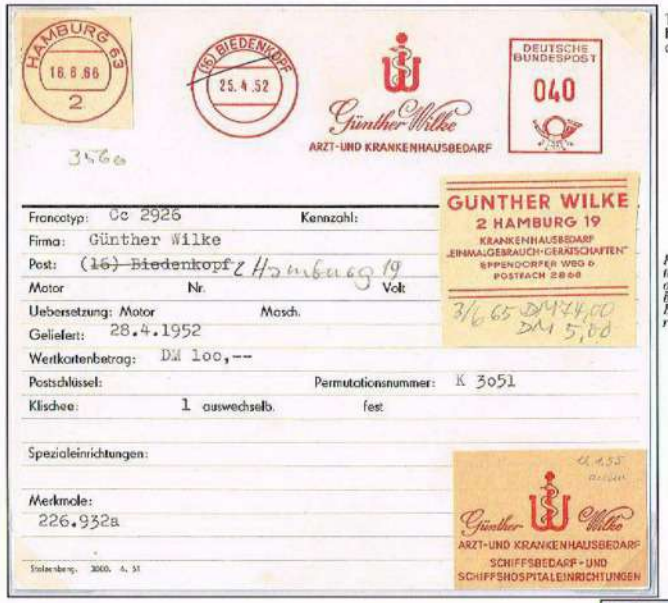
Printers traffic light colour check sequence, shows all the separate colours used in the stamp ▶



Photometry can be used for the chemical analysis of plasma.

Meter: National Postal Meter Co.

The blood tests are carried out in specialised blood testing places or laboratories.



The type of equipment used for analysing blood can be supplied by specialist hospital suppliers such as Günther Wilke in Germany and Health Care Products Ltd. of Hong Kong

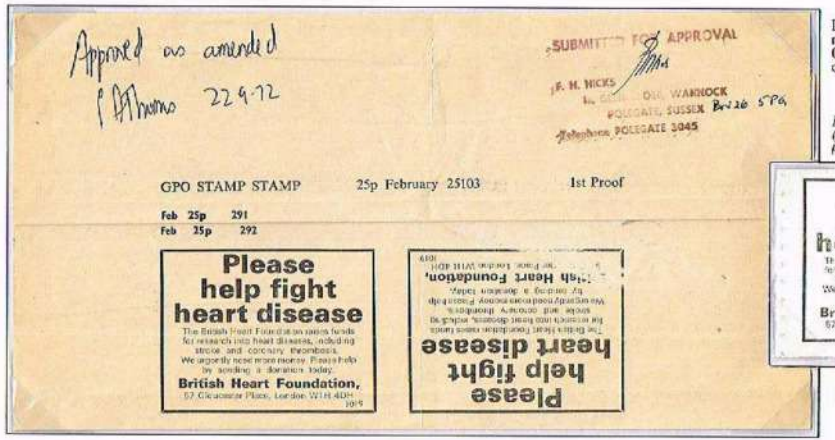
Francotype specimen card (musterkarte, stammkarte) recording the different metermarks for each company, it is a unique record of that specific automatic franking machine. In this case Cc2926 belonged to the company Günther Wilke, originally of Biedenkopf and later of Hamburg, all changes to the meter are recorded.

Blood testing laboratories:

During wartime field blood testing laboratories were established (blutuntersuchungstelle)

Field post facilities used by Red Cross Blutuntersuchungs-

Blood analysis and heart examination can provide essential information for the diagnosis and understanding of numerous diseases...



Diseases of the heart and circulation are two of the most common causes of death, and are on the increase. Coronary thrombosis, a blood clot in the blood vessels of the heart is a major cause of heart disease

First proof of advertising panes for 1973 booklet (folded to show the British Heart Foundation pane only)

Thrombosis or clotting of the blood within the blood vessel can be caused by an abnormality in the haemostatic mechanism, one such abnormality is factor V Leiden or Leyden named after the town were it was first discovered in the population.

The pale area on the error below right is indicative of damage caused by a thrombosis

Colour variation