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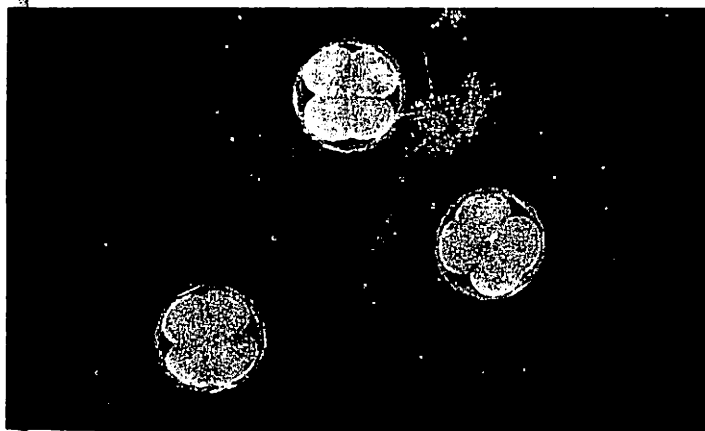
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perature of about 160°C. sulfur changes from a comparatively fluid, straw-colored, 8-membered ring to a dark, viscous, high polymer having thousands of atoms in a linear chain. Lubricants likewise are made relatively temperature independent by adding high polymers which are soluble only with difficulty and which unfold with temperature rise, thus counteracting the usual decrease of viscosity of liquids with temperature rise.

When linear high polymers change their state, they introduce holes only in directions normal to the length of the chain. Thus a linear polymer melts in two directions but retains its solid-like properties along the chain length. The result is that high polymers progress by wriggling a segment at a time, as shown by the fact that they exhibit the expected pressure and temperature coefficients of a molecule the size of a segment. The viscosity is much higher for a high polymer because of a negative entropy of activation corresponding to correlation of segment motion. Extensive quantitative correlations of rheological properties are available. See POLYMER.

[H.E.Y.]
Bibliography: F. R. Eirich (ed.), *Rheology: Theory and Applications*, 3 vols., 1956-1958 (vol. 3 prep.); M. Reiner, The flow of matter, *Sci. American*, 201(6):122-138, 1959.

Rheostat

A variable resistor constructed so that its resistance value may be changed without interrupting the circuit to which it is connected. It is used to vary the current in a circuit. The resistive element of a rheostat may be a metal wire or ribbon, carbon disks, or a conducting liquid. See RESISTOR; see also POTENTIOMETER (VARIABLE RESISTOR).

The metallic type is the most common. The wire or ribbon is constructed in a coil or a grid, and taps are brought out from different sections of the element to a multicontact switch which can short circuit any desired section of the resistor or switch it out of the circuit. For more continuous control, as needed for laboratory rheostats, a sliding-contact wiper bears directly on closely wound coils of resistive wire.

The carbon-disk type is used only for small currents. The resistive element is varied by changing the pressure on the carbon disks. The advantage of this type is its capacity for fine adjustment.

The electrolytic type is ideally suited to large currents. This type consists of a tank of conducting liquid in which electrodes are placed. The variation of resistance is obtained by changing the distance between the electrodes, the depth of immersion of the electrodes, or the resistivity of the solution. This type, also called water rheostat, has practically continuous adjustment.

Rheostats are used whenever it is desired to vary resistance or adjust current. Typical applications are for starting or controlling the speed of motors, for adjusting generator characteristics, for controlling storage-battery charging, for dimming lights, and for imposing artificial loads on electrical equipment during test.

Rheumatic fever

A childhood illness which follows an infection by *Streptococcus hemolyticus*, group A, by about 3 weeks. It is characterized by arthritis (redness and swelling of joints) and carditis (inflammation of heart tissue). Typically the polyarthritis is migratory with involvement of two or more larger joints. Other symptoms include nose bleeds and chorea, also known as St. Vitus dance. Fever, rapid pulse, paleness, and indisposition are present. Rheumatic fever is important because it can cause heart disease. The likelihood of this occurring and of permanent heart damage are increased by rheumatic fever's natural tendency to recur. Heart damage can show up later, though the active illness was decidedly mild.

Rheumatic fever, not in itself an infectious disease, follows 2-3% of untreated streptococcal infections. There is agreement as to its cause, but its mechanism is not known. The illness is not related to severity of infection nor the serologic type (Lancefield) of hemolytic streptococcus. Heredity and environment are difficult to evaluate separately as factors. Rheumatic fever does not appear after penicillin treatment of the streptococcal infection. Continuous, that is, prophylactic, use of penicillin in smaller dosage will prevent later attacks. Therapy in active rheumatic fever includes penicillin and salicylates (aspirin). Aspirin produces prompt subsidence of fever and arthritis. Bed rest is usual. Cortisone, a hormone, is administered when there is carditis. Badly scarred heart valves are corrected surgically. See LANCEFIELD DIFFERENTIATION SCHEME; SCARLET FEVER; STREPTOCOCCUS. [P.L.B.]

Rheumatism

A term used to denote any combination of muscle or joint pain, stiffness, or discomfort arising from nonspecific disorders. It is generally used as a lay expression to indicate a chronic or recurrent condition affecting a certain area and precipitated by cold, dampness, or strain.

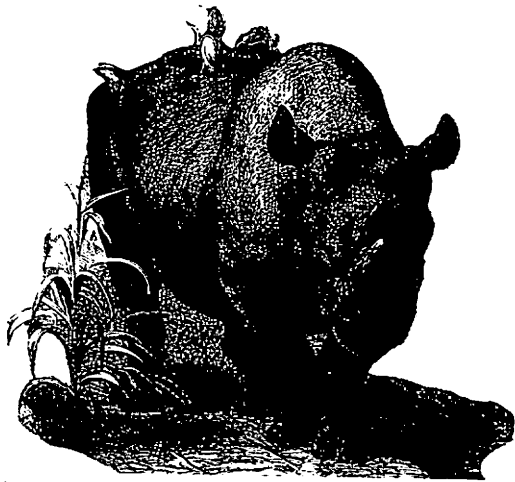
Fibromyositis refers to acute or chronic symptoms of tenderness, stiffness, and pain in a joint and related structures which follows exposure, strain, trauma, or infection. Myositis denotes an inflammation of a muscle; myalgia refers to muscle pain or tenderness without inflammation. Fibrositis is an inflammation of fibrous connective tissue, usually that of a joint region.

Rheumatism includes all of the above nonspecific disorders and is best reserved for complaints not related to a specific disease such as arthritis, rheumatic fever, trichinosis, or others that may cause the same or similar symptoms.

Lumbago, wryneck, charleyhorse and shinsplint are commonly used expressions included under the catch-all category of rheumatism. [E.G.ST.]

Rhinoceros

Any of five species of odd-toed, hoofed, massive mammals of the family Rhinocerotidae, order Perissodactyla, found in Africa, Asia, and the East

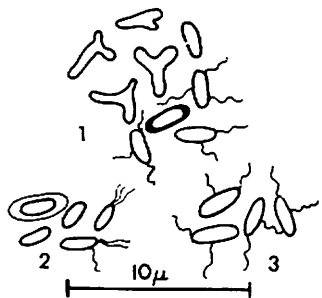


The rhinoceros, *Rhinoceros bicornis*; length to $8\frac{1}{2}$ ft. (From P. M. Duncan, ed., Cassell's Natural History, Cassell)

Indies. Rhinoceroses have three toes on each foot, and unusually thick, nearly naked skins, often laid in deep folds over the body. They have small ears and small eyes. The African and one Asian species have two horns located on the median portion of the snout, the posterior one usually smaller than the other. Two of the Asian species have a single, large, anterior horn. These horns are solid and are made up of a mass of cornified fibers which are modified hairs: they have no bony connection to the skull. Both sexes have horns of similar size. The record horn, 53 in. long, grew on a female African rhinoceros. All of the species are becoming increasingly rare and appear destined for extinction. See PERISSODACTYLA. [J.D.B.]

Rhizobiaceae

A family of bacteria of the order Eubacteriales. Some species are effective in the soil for nitrogen fixation, and others are plant pathogens. The bacteria comprising the three genera are heterotrophic, rod-shaped, gram-negative, and aerobic. Carbohydrates are utilized by all strains without appreciable acid formation; gas is not produced. Isolation and cultivation of all strains within the genera



1—*Rhizobium* 2—*Agrobacterium*
3—*Chromobacterium*

Some genera of Rhizobiaceae. (V. B. D. Skerman)

Rhizobium and *Agrobacterium* are accomplished with ease; species in the genus *Chromobacterium* are difficult to maintain in culture collections.

Rhizobium, the type genus of the family, comprises organisms generally known as the root nodule bacteria, or rhizobia. These bacteria are short, motile rods in early stages of growth on ordinary culture media; pleomorphic, x-, y-, star- and club-shaped bacteroid forms are commonly found in cultures grown in acid media or in the presence of glucosides or alkaloids as well as within the nodules.

The rhizobia are best known for their abilities to invade the root hairs of leguminous plants and cause the formation of cortical hypertrophies known as root nodules. Free atmospheric nitrogen is fixed by the plant and bacteria in symbiosis. The six species now recognized, *R. meliloti*, *R. trifolii*, *R. leguminosarum*, *R. phaseoli*, *R. japonicum*, and *R. lupini*, are defined by their reactions in litmus milk and their respective abilities to produce nodules on certain leguminous plants contained within cross-inoculation plant groups. Strains of each species show marked host specificities in their abilities to symbiose with the plants within each group. The amount of nitrogen fixed by different leguminous plants varies within a wide range. No correlation exists between the cultural, physiological, and biochemical characteristics of the rhizobia and their abilities to symbiose with their host plants. The treatment of leguminous seeds with bulk preparations of effective rhizobia is widely practiced throughout the world for the purpose of preventing nitrogen starvation, lessening plant demand for soil nitrogen, and for improving the yield and quality of leguminous plants used in agriculture and soil conservation. See NITROGEN CYCLE; RHIZOSPHERE; SOIL MICROBIOLOGY.

Agrobacterium is a genus of seven species, of which five are plant pathogens. *A. tumefaciens* causes root and stem galls on plants contained in over 40 families of angiosperms. *A. gypsophila* produces galls on *Gypsophila paniculata* L. and related plants. *A. pseudotsugae* is pathogenic on the Douglas fir. *Pseudotsuga taxifolia* Britton. *A. zogenes* causes a hairy-root condition of apple and other plants, and *A. rubi* is pathogenic on various species of raspberries and blackberries. *A. radiobacter* and *A. stellulatum* are nonpathogenic; the former is commonly found on the roots of plants and as a contaminant within leguminous nodules. The latter has marine habitats. None of the agrobacteria fixes atmospheric nitrogen.

Chromobacterium is a genus of four species of saprophytic soil and fresh-water bacteria which produce moist to rugose colonies on agar media and form ring or surface membranous pellicles on gelatin and liquid media. One of the best known characteristics of the chromobacteria is the production of a violet-blue pigment which is soluble in alcohol, but not in water or chloroform. The best known pigment type, violacein, is presumably related chemically to indigo.