generally abandoned, along with of positivist *reductive analysis.

JRR

:ope. *See* diagnosis; vision.

? *Ad hoc* hypotheses; anaesthesia; m; quality.

les. *See* double stars.

ers. *See* isomerism.

electricity and magnetism; light;

continuity.

urvey. *See* maps.

etal.

sed metaphorically to describe in- ems having properties transcending parts. Historically it was applied to ns which, because they exhibited operties (such as the ability to were considered irreducibly n inanimate or 'inorganic' species rreducibility was challenged when (1596–1650) construed animals as es [*man-machine]. But not until ntury did the science of organic evelop. As organic *analysis was ecially by J. von Liebig (1803–73), constituents of 'organic' substances ed. The apparently universal pre- on, together with the laboratory of carbon *compounds bearing h those derived from organisms, y the early 1840s, organic chemis- e chemistry, not of living systems, compounds.

s between organic and inorganic ly eroded, not only by artificial ut by the establishment of com- d *structural analogies between norganic compounds, as displayed nd *type theories. In *biology, evolution, culminating in that of vin (1809–82), suggested organic ultimately, derived from inorganic neous generation].

JHB

organismic analogy. *See* community; evolutionism in mind and society; functionalism; microcosm/macrocosm.

organization. In the late 18th century, naturalists including Johann Blumenbach (1752–1840), L.-J.-M. Daubenton (1716–1800), Antoine-Laurent de Jussieu (1748–1836) and Félix Vicq d'Azyr (1748–94) concluded the major feature distinguishing living from inanimate things was *organization*, possessed by only the former. They also believed this difference more fundamental than the *animal/vegetable distinction, thus negating the division of *Nature into three comparable kingdoms. Emphasis on the organizational similarity of plants and animals led early 19th-century naturalists to a generalized concept of *life, the study of which was called *biology.

Although anatomical investigations did not reveal the same organizational complexity for plants as for animals, botanical functions such as nutrition, growth, and reproduction seemed to *mechanists in particular to demand some complexity of organization in plants. Plants as well as animals were presumed to have organs suitable for different functions.

From the late 18th century organization was seen as the key to the *natural order of *classification. De Jussieu used the idea of the *subordination of characters for classifying plants as did Georges Cuvier (1769–1832) for animals. Jean-Baptiste Lamarck (1744–1829) made organization the key to his classificatory work, maintaining the natural order of both plants and animals was in each case best represented by a series of increasing complexity of organization. Cuvier's major systematic treatise, his *Le Règne Animal distribué d'après son Organisation* (The Animal Kingdom Arranged by its Organization, 1817), denied animals could be arranged in series, identifying instead four separate and basic plans of animal organization.

RWB

organizer. Around 1900 embryologists asked whether individual *development depends only on factors inside the *fertilized *egg cell or also on external factors. Within *developmental mechanics, this question became: is the organism self-differentiating or dependently differentiating, and is development *epigenetic or predetermined?

Hans Spemann's (1869–1941) classic experiments resolved these questions. Transplanting pigmented tissues from one embryo to another he traced the relative contributions of each. In 1924, with Hilde Mangold, he discovered that the dorsal lip of the blastopore transforms the material it touches, serving as an organizer for development. Each stage of development is thus necessary to direct the next.

JM

orogenesis. *See* mountains.

Ørsted's effect. *See* electricity and magnetism.

orthogenesis. An evolutionary term coined by Wilhelm Haacke (1855–1912) and used by T. G. H. Eimer (1843–98) to describe and account for rectilinear trends in *evolution over long periods of time. Such trends, exemplified in cases like the hypertrophy of antlers of the *extinct 'Irish elk', were variously explained as due to the steady interaction of the organism with the *environment, the effect of *natural selection on spontaneous *mutations, or the existence of an internal, perfecting principle [*teleology]. The idea of steady progressions in the *fossil record explicable by orthogenesis was criticized by George Gaylord Simpson (*b* 1902) and now has little support.

RWB

osmosis. The passage of solvent into a *solution through a barrier impermeable to *molecules of the solute. This phenomenon, though previously noted, was first investigated scientifically by Jean Nollet (1700–70) in 1748. More systematic experiments by René Dutrochet (1776–1847) in the 1820s and 1830s, and by Thomas Graham (1805–69) and Justus Liebig (1803–73) in the 1840s and 1850s did not lead to a satisfactory theory. In 1877 Friedrich Pfeffer (1845–1920) published measurements of osmotic pressure, showing it directly proportional to *concentration (and hence inversely to volume) and also directly proportional to absolute temperature, i.e. $PV = kT$. In 1885, Jacobus van't Hoff (1852–1911) related this constant, k, to the universal *gas constant R, and further demonstrated other gas *laws were quantitatively applicable to dissolved substances after allowing for their tendency to *dissociate into *ions, as suggested by Svante Arrhenius (1859–1927) in 1887. Osmosis could now be explained by a general physicochemical theory of solutions, while its crucial role in animal and plant physiology became better understood

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Debate continued around 1 serious c