

too quickly for evolution by *natural selection [*time].

Another key issue for terrestrial physics was to determine the Earth's exact dimensions and shape. It had been widely assumed the Earth was egg-shaped. Newton (1642–1727) amongst others argued it was an oblate spheroid (flattened at the poles like an orange). The geodetic expeditions of Maupertuis (1698–1759) to Lapland and La Condamine (1701–74) to Peru in 1735–36 effectively established the correctness of Newton's views.

The self-conscious attempt to build up a comprehensive physics of the Earth dates from Alexander von Humboldt (1769–1859). He aimed to collect and collate systematic data concerning the whole range of terrestrial forces (*tides, winds, thermal gradients, *magnetism etc.) and to integrate them into a single scientific discipline.

See also declination and dip; exploration.

RSP

germ. In biology a label for the material of *heredity, popular in the 18th and 19th centuries and sufficiently ambiguous to cover a wide range of ideas. For example, the *egg and *sperm were sometimes called germs, as were the contents of the *cell nucleus. Frequently, it was an abstract unit supposed to be passed on to offspring regulating their *development. There is no modern equivalent, although the concept of *germ plasm eventually led to the theory of the *gene.

See also encapsulation; morphology; mosaic theory; ovism.

germ layer theory. Christian Heinrich Pander (1794–1865) and Karl Ernst von Baer (1792–1876) first maintained that an embryo has heterogeneous structural layers, called germ layers, which always give rise to the same physiologically differentiated adult *tissues. *Development occurs *epigenetically rather than by preformation. Robert Remak (1815–65) later revised the theory in accordance with the *cell theory, emphasizing that the formation of the germ layers occurs by cell division.

*Evolution theory greatly expanded the importance of germ layers. Evolutionists such as Alexandr Kovalevski (1840–1901) and Ernst Haeckel (1834–1919) thought understanding the germ-layer origins of adult structure would uncover *homologies between adult parts, reveal-

ing evolutionary relations. As, however, *cell lineage researchers in the late 19th century traced the origin of the germ layers back to the original egg cell, they found that the germ layers did not originate similarly in all related organisms. Modern biologists still believe that embryos have three germ layers, (endoderm, mesoderm, ectoderm) but they now recognize that the origin and destiny of these layers is exceedingly complex.

See also gastraea theory.

JM

germ plasm. Improved microscopic techniques and *evolutionary theory focused interest on problems of *development and *heredity at the end of the 19th century. Predominantly *materialistic theories emerged to explain inheritance, the most famous being August Weismann's (1834–1914) theory of the germ plasm. Germ plasm comprised the *protoplasmic material of heredity and contained a complex of material units, or determinants, to direct development of physical characteristics. In *Das Keimplasm* (The Germ Plasm, 1892), Weismann provided a unified account for inheritance and development. Biologists had trouble explaining how offspring resemble, yet also differ from, their parents, which raised questions about the way inherited material works. Weismann denied that material which the offspring would inherit was affected by changes in the life of the parent. The germ plasm is immutable, remaining set aside in the germ cells from the time of the parent's own development.

JM

germ theory of disease. See contagion.

Gestalt. Key concept of *Gestaltpsychologie*, a holistic movement founded around 1910 by M. Wertheimer (1880–1943), K. Koffka (1886–1941) and W. Köhler (1887–1967). Its history must be treated as an opposition to the movements of atomistic structural *psychology [*mental atomism] and atomistic *behaviourism. Gestalt in general is any configuration resulting from interaction of its components in an organizing field. In particular, it refers to complex *perceptual experience. Through the hypothesis of 'isomorphism' between experiential and cortical processes, *brain physiology was influenced by experimental perception research whose findings were condensed to Gestalt laws; yet unanimity about

their number and c Gestalt concept was to motivation, *me developmental and ology].

giants (astronomy) diagram.

glaciers. Glaciers scientific attention Naturalists were whether the physical rivers of ice were the Venetz (1788–1859 (1786–1855) hypot had once been mo successfully accour puzzling phenome and vast quantities.

Extending such (1807–73) developo thesis that most o covered, more than in periods of inter Ages would accoun boulders and other matrices, but also : creatures, like the r

Agassiz's ideas m particular because h plain why his Ice / because alternativ water-borne ice exi Agassiz's ideas wo geologists began to dence of moving ic valleys, moraines, polished surfaces c that there have bee episodes in the past may be caused by v. or perhaps by luminosity.

glands. See digest gland; sexuality (h)

globular clusters. sorption; stellar dis

globule theory. Se

glycogen. See live