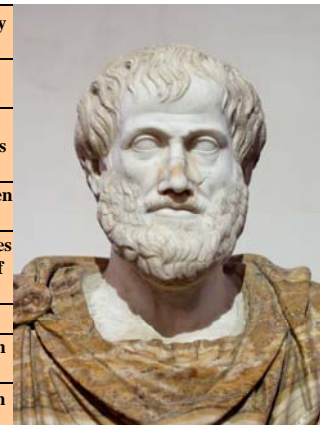
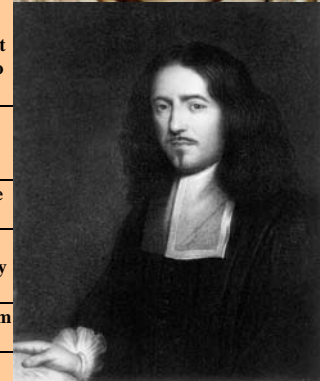


Field Time Discovery

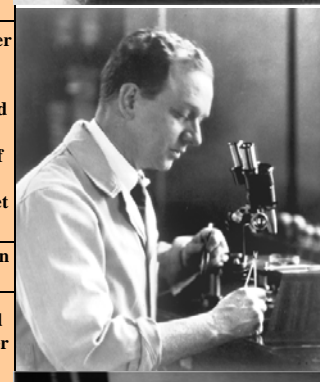
Development	1400 BCE	Egyptians are the first time artificially incubate chicken eggs, during the 18 th dynasty (Carter 1923)
	460 BCE	Hippocrates opens eggs after various times of incubation by hens and compares the embryos (Bellairs 2005)
	350 BCE	Aristotle begins work with chick embryos to study development (leads to major principles and mistakes) (Stern 2005) the first to actually dissect the embryo (Bellairs 2005)
	1400s	Albert Magnus composes treatises on chick embryology that serve as the filler between Aristotle and the Renaissance (Needham 1953)
	1567	Volcher Coiter publishes work on the development of the chick embryo, and compares this development to that of reptiles, humans, and other birds. This makes the field of comparative anatomy take off (Schullian 2008)
	1570	Volcher Coiter identifies blastoderm on chick embryo (Stern 2004)
	1599	Ulysses Aldrovandus opens hen eggs during incubation for scientific study (Needham 1953, M De Felici and G Siracusa 2000)
	1628	William Harvey discovers first blood islands form and then circulation develops with the functional differences between veins and arteries through the use of the chick embryo (Stern 2005), studies heart formation and commencement of beating in ovo using a magnifying lens (Bellairs 2005) Previous to this, it was thought that the heart did not beat until birth/hatching. Identified the yolk as the source of nourishment to the embryo.
	1651	William Harvey publishes findings that the generation of a chick is the result of epigenesis not metamorphosis. Rebukes Aristotles belief that chick eggs can grow without male fertilization (Stern 2004)
	1671	Malpighi, through his studies of frogs and chicks, publishes work describing the role of capillaries. (Stern 2005)
	1672-1675	Malpighi discovers function of neural tubes and somites through the study of chick embryos (Hamburger 1968), describes the chick blastoderm, neural genesis and early heart development (Bellairs 2005)
	1677	Malpighi is the first to try artificially inseminating animals using chick eggs (Needham 1953)
	1749	Beguelin perfects the window in the shell technique for chick observation as the embryo develops (Goodpasture 1938)
	1759	Casper Friedrich Wolff publishes "The Theory of Generation" which is the first paper to suggest body organs do not exist at the beginning of gestation, but instead are formed through a series of steps (Magner 2010) His findings counter the idea of preformation, that the miniature but fully formed individual is present in the egg and grows until hatching. This was what many thought about the development of other organisms, but Wolff's documented findings in the chick egg promoted the theory of epigenesis, which suggested that both growth and differentiation were necessary during embryogenesis. He specifically showed that the gut is formed from a flat sheet of tissue that folds into a tube. (Bellairs 2005)
	1817-1828	Heinz Christian Pander and Karl Ernst von Baer discover and identify germ layers in the forming chick embryo (Needham 1953). Pander was a follower of Wolff.
	1826	Karl Ernst von Baer is the first to identify the mammalian ovum (Magner 2010) and notochord. He used the light microscope to extend Pander and von Baer's germ layer discovery, showing that it is universally present in vertebrates. Before him, it was suspected that changes between species in the stages of development represented progressive evolution. His findings supposedly influenced Darwin's thinking.
1859	Darwin's publishes 'On the Origin of Species'	
1906	Levaditi uses the chick embryo model to study infections (first use of model to study infections) (Goodpasture 1938)	
		Caldwell and Murray graft human tumors onto the CAM and recognize the vascular



Aristotle



Marcello Malpighi



Dr. Francis Peyton Rous



Dr. Ernest

Genetics	1936	Frederick Hutt publishes the first genetic map of the chicken (Hutt 1936, Groenen 2000)
Cancer	1945-1955	Dagg, Karnofsky and Toolan perform routine serial transplantation of human tumors and initiate therapeutic trials on tumor bearing chicks.
Neurology	1952	Rita Levi-Montalcini – nobel prize winner for the discovery of nerve growth factors. Most of her defining work involved nerve development in the chick (she recently turned 101!)
	1967	Michel Abercrombie discovers the cellular process of contact inhibition through his studies on the chick embryo, this process is now used to distinguish between normal and cancerous cells (Guelstein 1973, Stern 2005)
Cancer	1974	Folkman publishes CAM assay as a model to study vascularization.
	1983	Schwartz, Zard and Gilbert determine the 9312 nucleotide sequence for the Rous sarcoma virus (RSV)
	1983	Bishop reviews 25 known oncogenes, 9 are from domestic fowl
	1983	Ossowski, Chambers, and Quigley establish the chick as a model for metastasis.
genetic model for human disease	1991	Tiersch and Wachtel discover that the genome of birds, specifically <i>Gallus gallus</i> , is one third the size of mammals, furthering the case for the use of the chick (Tiersch and Wachtel 1991, Groenen 2000)
	2004	Avian flu moves from chicken to human infection (starting in Vietnam and Thailand) causes a world-wide focus on avian biology and disease Richard Wilson's group at Washington University provide the first full avian genome sequence (of the Red Jungle Fowl, <i>Gallus gallus</i> , which is the ancestor of domestic chickens)
Intravital imaging model	1996	Chambers monitors single-cell behavior in the CAM using In vivo video microscopy
	2006	Lewis implement viral nanoparticles to image CAM and tumor vasculature intravitaly
	2008	Zijlstra uses intravital imaging to demonstrate correlation between cell migration in the primary tumor and metastasis to distant organs



Dr. Rita Levi-Montalcini



Dr. Judah Folkman

