

## VITELLOGENESIS

**VITELLOGENESIS** is the process through which food is progressively stored in the growing oocytes of oviparous animals, making up the yolk of the mature egg. The process is remarkably similar in all animals analyzed so far. There are many common points during the vitellogenesis of worms, insects and vertebrates (amphibians, reptiles and birds):

- Most of the food reserves are produced outside the oocytes and transported through the body fluids (pseudocoelomic fluid in nematodes, hemolymph in insects or blood in vertebrates) by soluble proteins.
- The uptake of these proteins by the oocytes is mediated by specific receptors.
- The synthesis of these proteins is controlled by hormones (except in nematodes).
- The main proteins involved in the process are called **VITELLOGENINS**. They are large proteins (> 500

*kDa ie 500,000 times the mass of a Hydrogen atom!) and have lipids, carbohydrates and phosphate associated to them*

- *Yolk stored in larger amounts provides raw materials for more extensive embryonic development to occur before a hatchling has to find its own food.*
- *A yolky egg has substantial stored products in its cytoplasm which transcend the needs of the embryo for survival through early cleavage.*
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### *VITELLOGENIN LIPIDS*

*Lipids are integral to all vitellogenins (Vg), and vitellins (Vt) characterized either by lipid-specific staining of polyacrylamide gels or by various quantitative techniques.*

*Table- Lipid compositions of lipophorins,*

*Presented as percentage of total lipid*

<i>Genus, species</i>	<i>% lipid</i>	<i>diglyceride</i>	<i>cholesterol</i>	<i>phospholipid</i>
<i>Periplaneta americana</i>	50	15	5	43
<i>Locusta migratoria</i>	31	42	7	38
<i>Manduca sexta</i>	37	34	5	38
<i>Philosamia cynthia</i>	44	58	14	27
<i>Philosamia cynthia</i>	10	15	6	71

Considerable similarities exist among the phospholipids, diacylglycerols and cholesterol which comprise the bulk lipid components. A role of Vg as a carrier of diacylglycerol molecules into

the egg for conversion to triacylglycerol is possible. **LIPOPHORM**  
**LIPID**

- Since Lp's main function is diacylglycerol transport
- the mammalian lipoproteins contain a high percentage of triglycerides and cholesterol ester.
- The lipid difference is a clue that the physiological mechanism of insect lipid transport proteins is different from their mammalian counterparts, reflecting different physiological environments.
- mammalian carrier lipoproteins are endocytosed and degraded when yielding their lipid to accepting tissues.
- The observed rapid exchange of lipid between the various protein forms suggests that the polar diglyceride is probably carried on the outer surface of the proteins.
- Its isolation from yolk and its uptake into oocytes indicate it may also serve as a yolk precursor.

**Hormonal induction of vitellogenin**

- 20-hydroxyecdysone was the first hormone to be shown to interact rapidly with certain "sensor" genes in the regulation of molting. It's debatable role in vitellogenesis of some species is not understood mechanistically.
- A number of exciting challenges regarding the incorporation of lipids into Vg and their possible roles in egg development are awaiting the field of insect biochemistry

### VITELLOGENIN LIPID BIOSYNTHESIS

Lipid constituents of Vg are presumably intercalated into the hydrophobic core or bound to its surface prior to release into the hemolymph. This is one aspect of post-translational modification of Vg which has not been explored. It has been found to stimulate the incorporation of acetate and choline into lipid but it is not clear if this function is associated with supplying the lipid moiety of Vg or the lipids involved with the membranes of the protein synthetic and secretory apparatus. It is also unclear where and how conjugated ecdysteroid is bound to Vt.

*Certainly, more information is needed regarding the possible functions of egg-bound Vt as a vehicle for transporting lipid (diglyceride, cholesterol, ecdysteroid) to the developing embryo.*

*A number of exciting challenges regarding the incorporation of lipids into Vg and their possible roles in egg development are awaiting the field of Egg biochemistry*

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