

RECAPITULATIONS IN HOLOMETABOLAN MORPHOGENESIS. A.L. Tichomirova, A.P. Rasnitsyn*, Paleontological Institute, Acad. Sci. USSR, 117868 Moscow, USSR.

Study of the late embryonal and postembryonal insect development revealed a general morphogenetic pathway similar in all examined insects (various beetles, *Musca*, *Dolichovespula*, *Acheta*). This basic similarity is obscured, the particular morphogenetic stages being exposed in active ontogenetic phases (larva, nymph, imago) of some insects and concealed in resting phases (egg, prepupa, pupa) of others. For instance, late embryogenesis of *Silpha* (Silphidae) and *Aleochara* (Staphylinidae) recapitulates a bruchid-like larva, an embryo of *Philonthus* (Staphylinidae) recapitulates both bruchid-like and *Silpha*-(*Aleochara*)-like larvae, and embryonal *Pterostichus* (Carabidae) passes through the stages corresponding to larvae of each Bruchidae, *Silpha* and *Philonthus*. Late prepupa and early pupa of *Dolichovespula* (Vespidae) correspond morphologically to an imaginal saw-fly because of sessile abdomen with exposed apical segments and genitalia, two-spurred fore tibia, fore wings with veins SC and 2A, head with true occipital suture (persisted as subocular grooves in imaginal head) and many other ancestral features.

PANBIOGEOGRAPHIC IMPLICATIONS FOR A PRE-CRETACEOUS ORIGIN OF LEPIDOPTERA-ANGIOSPERM HOST-PLANT RELATIONSHIPS. J. R. GREHAN, 47 Dover Road, Wainuiomata, New Zealand.

The evolution of modern Lepidoptera-angiosperm host-plant relationships in space/time is examined from a pan-biogeographic perspective. Lepidopteran and angiosperm distributions conform to standard global biogeographic patterns where the world's ocean basins represent the major natural biogeographic regions. The correlation of tectonic history with Lepidopteran and angiosperm evolution suggests that many of the modern insect and plant lineages (family and genus) were already differentiated by the beginning of the Cretaceous. The co-evolutionary implications of Lepidoptera-angiosperm biogeography are discussed in relation to fossil records.

THE REGULATION OF HORMONE SYNTHESIS IN INSECTS AND CRUSTACEA. Hans Laufer, The Department of Molecular and Cell Biology, The University of Connecticut, Storrs, Connecticut 06268, USA.

The corpus allatum (CA) of insects produces juvenile hormone (JH) which regulates reproductive functions in adults. The production of JH is controlled by allatostatins and allatostatins, neuropeptides from the brain-corporal complex. We investigated the possible existence of JHs in crustacea and have found that crustacea possess methyl farnesoate (MF), an unepoxidated JHIII in their blood. The mandibular organs (MOs), structures homologous to insect CAs, synthesize MF in vitro (Laufer et al., 1987, Science 235:202). The greatest synthesis of MF by adult female MOs from the spider crab *Libinia emarginata* coincided with active vitellogenesis, suggesting that MF may act in crustacea as JH acts in insect reproduction.

MF synthesis and reproduction in crustacea appear to be controlled by the eyestalks. Removal of eyestalks enhances reproduction and doubles MF production by the MOs. Eyestalk extracts inhibit MF synthesis in vitro as does the synthetic peptide, pigment dispersing hormone (PDH) at 10^{-7} M. Red pigment concentrating hormone (RPH), an octapeptide, at 10^{-6} M doubles MF synthesis by the MO. Since analogs to these crustacea hormones exist in insects, it may be possible that these peptides or molecules similar in structure play a role in regulating CA activity.

EVOLUTION OF COMPOSITION & FUNCTION OF INSECT SERUM STORAGE PROTEINS. J.G. Kunkel, Zoology Department, Univ of Massachusetts, Amherst, MA 01003, USA.

The hexameric serum proteins take on several roles in arthropods. Although storage may be one of their most important roles, we must explore the possibility that evolution has used them in other ways. Principal components analysis and tree building with amino acid compositions for 36 insect and 12 other arthropod hexamers allow us to discriminate membership in several distinct clusters of hexamers: one or two Arylphorin (Ap) clusters, a Female Specific Storage Protein (FSP) and Hemocyanin (HbCy). Two distinct Ap like proteins exist in both Dipterans and Dictyopterans with different developmental patterns; they are presumed to have distinct functions. The major correlation that has been observed is with molting in the hemimetabola and metamorphosis in the holometabola. Yet hexamers are known which persist into the adult stage in the hemimetabola. An insectan HbCy has been recognized in a lepidopteran. Is this a relict of the evolutionary relationship to crustacean HbCy? The binding of insecticides observed in lepidopteran Ap may be an indication of a more general role of Ap as a carrier of compounds in the blood particularly during the molting and metamorphic phases of insect development. For instance a potential glycine carrier function for AP may be associated with silk production in Lepidoptera. Lack of FSP in some lepidoptera may force other hexamers to take up the FSP function.

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LIPOPROTEINS AS CHARACTERS FOR THE STUDY OF ARTHROPOD PHYLOGENY

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Lipid transport by lipoproteins is an essential but complex task in all living organisms. Since lipoproteins provide functional rather than morphological information, they seem particularly suited to evolutionary and phylogenetic studies. All insect lipophorins appear to share the same properties. Our recent investigations have focused on the lipoproteins of a wide variety of arthropods. We find that Millipedes (*Orthoporus ornatus*) and centipedes (*Scolopendra heros*), which are classified with insects in the same arthropod subphylum, also possess lipophorins very similar to those of insects. In contrast, a different lipoprotein is found in both terrestrial and aquatic members of the arthropod subphylum Crustacea. Surprisingly, arachnids, which are considered to occupy a phyletic status distant from both insects and crustaceans, use lipoproteins very similar to insect lipophorins. Species investigated include several members of the order Araneae (tarantula, *Eurypelma californicum*, crab spider, *Olios fascicularis*, black widow, *Latrodectus hesperus*), Solpugidae (wind scorpion, *Eremobates* sp.), and Scorpiones (*Hadrurus arizonensis*). Interestingly, we discovered that members of the arachnid order Acari (mites, *Dinotrombium pandorae*) possess a lipoprotein, which appears similar to the crustacean particle. While these data are not in full agreement with current phylogenetic theories, our findings should encourage study of other functional biochemical characters appropriate to the investigation of phylogenetic relationships, perhaps including proteins linked to developmental processes.

ADAPTATIONS OF POST-EMBRYONIC STAGES IN THE EVOLUTION OF MAYFLIES, ESPECIALLY REGARDING THE SUBIMAGO. W.P. McCafferty and G.F. Edmunds Jr. (USA).

No Abstract

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**ABSTRACTS
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