

References

- Abdu, U., Davis, C., Khalaila, L. and Sagi, A. 2002. The vitellogenin cDNA of *Cherax quadricarinatus* encodes a lipoprotein with calcium binding ability, and its expression is induced following the removal of the androgenic gland in a sexually plastic system. *Gen. Comp. Endocr.* 127, 263-272.
- Adams, M.D., Celniker, S.E., Holt, R.A., Evans, C.A., *et al.* 2000. The genome sequence of *Drosophila melanogaster*. *Science* 287, 2185-2195.
- Adiyodi, R.G. and Subramoniam, T. 1983. Arthropoda-Crustacean. In: Adiyodi, K.G., Adiyodi, R.G. (eds.), *Reproductive Biology of Invertebrates, Oogenesis, oviposition and oosorption*, pp. 443-495. Chichester: Wiley.
- Alfaroa, J., Zunigaa, G. and Komenb, J. 2004. Induction of ovarian maturation and spawning by combined treatment of serotonin and a dopamine antagonist, spiperone in *Litopenaeus stylirostris* and *Litopenaeus vannamei*. *Aquaculture* 236, 511 –522.
- Alonso, J. and Santaren, J.F. 2005. Proteomic analysis of the wing imaginal discs of *Drosophila melanogaster*. *Proteomics* 5, 474-489.
- Altschul, S.F., Madden, T.L., Schaffer, A.A., Zhang, J., Zhang, Z., Miller, W. and Lipman, D.J. 1997. Gapped BLAST and PSI-BLAST: a new generation of protein database search programs. *Nucleic Acids Res.* 25, 3389-3402.
- Amdam, G.V., Norberg, K., Hagen, A. and Omholt, S.W. 2003. Social exploitation of vitellogenin. *PNAS*. 100, 1799-1802.
- Anderson, T.A., Levitt, D.G. and Banaszak, L.J. 1998. The structural basis of lipid interactions in lipovitellin, a soluble lipoprotein. *Structure* 6, 895-909.
- Australia Institute of Marine Science (AIMS), 2006. **Manual for the determination of egg fertility in *Penaeus monodon*, Section I: Breeding biology of *Penaeus monodon*** (Online). Available:<http://www.aims.gov.au/pages/research/mdef/mdef-00.html> (2006, October 10).

- Attarat, J., Phiriyangkul, P. and Utarabhand, P. 2006. Characterization of vitellin from the ovaries of the banana shrimp *Litopenaeus merguensis*. *Comp. Biochem. Physiol.* 143B, 27-36.
- Avarre, J.C., Michelis, R., Tietz, A. and Lubzens, E. 2003. Relationship between vitellogenin and vitellin in a marine shrimp (*Penaeus semisulcatus*) and molecular characterization of vitellogenin complementary DNAs. *Biol. Reprod.* 69, 355-364.
- Ayub, Z. and Ahmed, M. 2002. A description of the ovarian development stages of penaeid shrimps from the coast of Pakistan. *Aquaculture Research* 33, 767-776.
- Babin, P.J., Bogerd, J., Kooiman, F.P., Van Marrewijk, W.J.A. and Van der Horst, D.J. 1999. Apolipoprotein II/I, apolipoprotein B, vitellogenin, and microsomal triglyceride transfer protein genes are derived from a common ancestor. *J. Mol. Evol.* 49, 150-160.
- Baily-Brock, J.H. and Moss, S.M. 1992. Penaeid taxonomy, biology and zoogeography. In: Fast, A.W., Lester, L.J. (eds.), *Marine shrimp culture: principles and practices*, pp. 9-28. Amsterdam: Elsevier Science Publishers.
- Baker, M.E. 1988. Is vitellogenin an ancestor of apolipoprotein B-100 of human low-density lipoprotein and human lipoprotein lipase? *Biochem. J.* 255, 1057-1060.
- Barr, P.J. 1991. Mammalian subtilisins: the long-sought dibasic processing endoproteases. *Cell* 66, 1-3.
- Bates, P.A., Kelley, L.A., MacCallum, R.M. and Sternberg, M.J.E. 2001. Enhancement of Protein Modelling by Human Intervention in Applying the Automatic Programs 3D-JIGSAW and 3D-PSSM. *Proteins: Structure, Function and Genetics, Suppl.* 5, 39-46.
- Bell, T.A. and Lightner, D.V. 1988. *A handbook of normal penaeid shrimp histology*, pp. 114. The World Aquaculture Society, Baton Rouge.
- Bendtsen, J.D., Nielsen, H., Heijne, G.V. and Brunak, S. 2004. Improved prediction of signal peptides-Signal P 3.0. *J. Mol. Biol.* 340, 783-795.
- Berleth, T., Burri, M., Thoma, G., Bopp, D., Richstein, S., Frigerio, G., Noll, M. and Nusslein-Volhard, C. 1988. The role of localization of bicoid RNA in organizing the anterior pattern of the *Drosophila embryo*. *EMBO J.* 7, 1749-1756.

- Birnboim, H.C. and Doly, J. 1979. A rapid alkaline lysis procedure for screening recombinant plasmid DNA. *Nucl. Acids Res.* 7, 1513-1522.
- Blom, N., Gammeltoft, S. and Brunak, S. 1999. Sequence - and structure-based prediction of eukaryotic protein phosphorylation sites. *J. Mol. Biol.* 294, 1351-1362.
- Bouvet, P., Matsumoto, K. and Wolffe, A.P. 1995. Sequence-specific RNA recognition by the *Xenopus* Y-box proteins: An essential role for the cold shock domain. *J. Biol. Chem.* 270, 28297-28303.
- Bradford, M.M. 1976. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Anal. Biochem.* 72, 248-254.
- Brock, M. L. and Shapiro, D. J. 1982. Estrogen Regulates the Absolute Rate of Transcription of the *Xenopus Zaeuis* Vitellogenin Genes. *J. Biol. Chem.* 258, 5449-5455.
- Brock, M. L. and Shapiro, D. J. 1983. Estrogen stabilizes vitellogenin mRNA against cytoplasmic degradation. *Cell* 34, 207-214.
- Browdy, C.L., Fainzilber, M., Tom, M., Loya, Y. and Lubzens, E. 1990. Vitellin synthesis in relation to oogenesis in in vitro-incubated ovaries of *Penaeus semisulcatus* (Crustacea, Decapoda, Penaeidae). *J. Exp. Zool.* 255, 205-215.
- Bujo, H., Hermann, M., Kaderli, O., Jakobsen, L., Sugawara, S., Nimpf, J., Yamamoto, T. and Schneider, W.J. 1994. Chicken oocyte growth is mediated by an eight ligand binding repeat member of the LDL receptor family. *EMBO J.* 13, 5165-5175.
- Byrne, B.M., Gruber, M. and Ab, G. 1989. The evolution of egg yolk proteins. *Prog. Biophys. Mol. Biol.* 53, 33-69.
- Chan, S.M., Mak, A.S.C., Choi, C.L., Ma, T.H., Hui, J.H. and Tiu, S.H. 2005. Vitellogenesis in the red crab, *Charybdis feriatus*: contributions from small vitellogenin transcripts (CfVg) and farnesoic acid stimulation of CfVg expression. *Ann. N. Y. Acad. Sci.* 1040:74-79.
- Chandumpai, A. 1998. Development of techniques for intensive farming of banana prawn, Seminar in Biotech Forum, National Science and Technology Development Agency, March 9th, Bangkok, Thailand.

- Chang, C.F., Jeng, S.R., Lin, M.N. and Tin, Y.Y. 1996. Purification and characterization of vitellin from the mature ovaries of prawn, *Penaeus chinensis*. *Invertbr. Reprod. Dev.* 29, 87-93.
- Chang, C.F., Lee, F.Y. and Huang, Y.S., 1993. Purification and characterization of vitellin from the mature ovaries of prawn, *Penaeus monodon*. *Comp. Biochem. Physiol.* 105B, 409-414.
- Chao, Y.C., Donahue, K. M., Pokrywka, N.J. and Stephenson, E. C. 1991. Sequence of swallow, a gene required for the localization of bicoid message in *Drosophila* eggs. *Developmental Genetics* 12, 333-341.
- Charniack-Cotton, C.H. 1985. Vitellogenesis and its control in malacostracan crustacea. *Am. Zool.* 25, 197-206.
- Cheesman, D.F., Lee, W.L. and Zagalsky, P.F. 1967. Carotenoproteins in invertebrates. *Biol. Rev.* 42, 131-160.
- Chen, J., God, D., Gunsalus, K., Kiss, I., Goldberg, M. and Laski, F.A. 2001. Cofilin/ADF is required for cell motility during *Drosophila* ovary development and oogenesis. *Nature Cell Biology* 3, 204-209.
- Chen, J.S., Sappington, T.W. and Raikhel, A.S. 1997. Extensive sequence conservation among insect, nematode and vertebrate vitellogenins reveals ancient common ancestry. *J. Mol. Evol.* 44, 440-451.
- Chin, G.J. and Goldman, S.A. 1992. Purification of squid synaptic vesicles and characterization of the vesicle associated proteins synaptobrevin and Rab3A. *Brain Res.* 571, 89-96.
- Crocos, P.J. and Kerr, J.D. 1983. Maturation and spawning of the banana prawn *Penaeus merguensis* de Man (Crustacea: Penaeidea) in the Gulf of Carpentaria, Australia. *J. Exp. Mar. Biol. Ecol.* 69, 37-59.
- Cuevas, M.D., Lee, J.K. and Spradling, A.C. 1996. Alpha-spectrin is required for germline cell division and differentiation in the *Drosophila* ovary. *Development* 122, 3959-3968.
- Dall, W., Hill, J., Rothlisbera, P.C. and Shaples, D.J. 1990. *The biology of the penaeidae*, pp 489. Academic Press, San Diego, CA.

- Davis, B.J. 1964. Disc electrophoresis II: Method and application to human serum protein. *Ann. N.Y. Acad. Sci.* 121, 404-427.
- De-Bruin. B.G.H.P., Russell, B.C. and Bogusch, A. 1995. *FAO species identification field guide for fishery purposes: the marine fishery resources of Sri Lanka*, pp. 1-400. Rome, FAO.
- Dehn, P.F., Aiken, D.E. and Waddy, S.L. 1983. Aspects of vitellogenesis in the lobster *Homarus americanus*. *Can. Tech. Rep. Fish. Aquat. Sci.* 1161, 1-24.
- Deng, W. and Lin, H. 1997. Spectrosomes and fusomes anchor mitotic spindles during asymmetric germ cell divisions and facilitate the formation of a polarized microtubule array for oocyte specification in *Drosophila*. *Dev. Biol.* 189, 79-94.
- Deschamps, S., Viel, A., Garrigos, M., Denis, H. and Maire, M.L. 1992. mRNP4, a major mRNA-binding protein from *Xenopus* oocytes is identical to transcription factor FRG Y2. *J. Biol. Chem.* 267, 13799-13802.
- De Vlaming, V.L., Wiley, H.S., Dehahunty, G. and Wallace, R.A. 1980. Goldfish (*Carassius auratus*) vitellogenin: Induction, isolation, properties, and relationship to yolk proteins. *Comp. Biochem. Physiol.* 67B, 613-623.
- Dodson, R.E. and Shapiro, D.J. 1997. Vigilin, a ubiquitous protein with 14 K homology domains, is the estrogen-inducible vitellogenin mRNA 3'-untranslated region-binding protein. *J. Biol. Chem.* 272, 12249-12252.
- Doolittle, R.F. 1995. The multiplicity of domains in proteins. *Annu. Rev. Biochem.* 64, 287-314.
- Driever, W. and Nusslein-Volhard, C. 1988. A gradient of bicoid protein in *Drosophila* embryos. *Cell* 54, 83-93.
- Driever, W. and Nusslein-Volhard, C. 1989. The bicoid protein is a positive regulator of hunchback transcription in the early *Drosophila* embryo. *Nature* 337, 138-143.
- Eastman-Reks, S.B., Fingerman, M. 1985. In vitro synthesis of vitellin by the ovary of the fiddler crab *Uca pugilator*. *J. Exp. Zool.* 233, 111-116.
- Edgar, R.C. 2004. MUSCLE: multiple sequence alignment with high accuracy and high throughput. *Nucleic Acids Research* 32, 1792-1797.
- Edman, P., 1950. Method for determination of the amino acid sequence in peptides. *Acta Chimica Scandinavica* 4, 283 -293.

- Fainzilber, M., Tom, M., Shafir, S., Applebaum, S.W. and Lubzens, E., 1992. Is there extraovarian synthesis of vitellogenin in penaeid shrimp? *Biol. Bull.* 183, 233-271.
- Fisheries global information system. 2006. **Food and Agriculture Organization of the United Nations (FAO) Fishery Statistic** (Online). Available: <http://www.fao.org/figis/servlet/species?fid=2583> (2006, October 10).
- Fei, Y.-J., Fujita, T., Lapp, D.F., Ganapathy, V. and Leibach, F.H. 1998. Two oligopeptide transporters from *Caenorhabditis elegans*: molecular cloning and functional expression. *Biochem. J.* 332, 565-572.
- Fingerman, M. 1997. Roles of neurotransmitters in regulating reproductive hormone release and gonadal maturation in decapod crustaceans. *Invertebr. Reprod. Dev.* 31, 47– 54.
- Finn, R.D., Mistry, J., Schuster-Bockler, B., Griffiths-Jones, S., Hollich, V., Lassmann, T., Moxon, S., Marshall, M., Khanna, A., Durbin, R., Eddy, S.R., Sonnhammer, E.L.L. and Bateman, A. 2006. Pfam: clans, web tools and services. *Nucleic Acids Research*, Database Issue 34, D247-D251.
- Fitch, W.M. 1970. Distinguishing homologous from analogous proteins. *Syst. Zool.* 19, 99–113.
- Garcia-Orozco, K.D., Vargas-Albores, F., Sotelo-Mundo, R.R. and Yepiz-Plascencia, G. 2002. Molecular characterization of vitellin from the ovaries of the white shrimp *Penaeus (Litopenaeus) vannamei*. *Comp. Biochem. Physiol.* 133B, 361-369.
- Gasteiger E., Hoogland C., Gattiker A., Duvaud S., Wilkins M.R., Appel R.D. and Bairoch A. 2005. *Protein Identification and Analysis Tools on the ExPASy Server*. In: John M. Walker (eds.), *The Proteomics Protocols Handbook*. pp. 571-607. Humana Press.
- Gelfand, M.S., Koonin, E.V. and Mironov, A.A. 2000. Prediction of transcription regulatory sites in archaea by a comparative genomic approach. *Nucleic Acids Res.* 28, 695–705.
- Gerber-Huber, S., Nardelli, D., Haefliger, J.A., Cooper, D.N., Givel, F. and Germond, J.E. 1987. Precursor-product relationship between vitellogenin and the yolk proteins as derived from the complete sequence of a *Xenopus* vitellogenin gene. *Nucleic Acids Res.* 15, 4737-4760.
- Gilchirst, B.M. 1968. Distribution and relative abundance of carotenoid pigments in Anostraca (Crustacea: Branchiopoda). *Comp. Biochem. Physiol.* 24, 123-147.

- Gorman, M.J. and Paskewitz, S.M. 2001. Serine protease as mediators of mosquito immune responses. *Insect Biochem. Mol. Biol.* 31, 257-262.
- Guex, N. and Peitsch, M.C. 1997. SWISS-MODEL and the Swiss-PdbViewer: An environment for comparative protein modeling. *Electrophoresis* 18, 2714-2723.
- Gupta, R., Jung, E., Gooley, A.A., Williams, K.L., Brunak, S. and Hansen., J. 1999. Scanning the available *Dictyostelium discoideum* proteome for O-linked GlcNAc glycosylation sites using neural networks. *Glycobiology* 9, 1009-1022.
- Hagedorn, H.H., Maddison, D.R. and Tu, Z. 1998. The evolution of vitellogenins, cyclorrhaphan yolk proteins and related molecules. *Adv. Insect Physiol.* 27, 335-384.
- Hall, T.A., 1999b. BioEdit: a user-friendly biological sequence alignment editor and analysis program for window 95/98/NT. *Nucl. Acids. Symp. Ser.* 41, 95-98.
- Hall, M., Wang, R., Antwerpen, R.V., Sottrup-Jensen, L. and Soderhall, K. 1999a. The crayfish plasma clotting protein: A vitellogenin-related protein responsible for clot formation in crustacean blood. *PNAS.* 96, 1965-1970.
- Hegde, J. and Stephenson, E.C. 1993. Distribution of swallow protein in egg chambers and embryos of *Drosophila melanogaster*. *Development* 119, 457-470.
- Henikoff, S. and Henikoff, J.G. 1992. Amino acid substitution matrices from protein blocks. *PNAS.* 89, 10915-10919.
- Hickey, E.D. and Wallace, R.A. 1974. A study of the vitellogenic protein in the serum of estrogen-treated *Ictalurus nebulosus*. *Biol. Bull.* 147, 281-293.
- Holder, M. and Lewis, P.O. 2003. Phylogeny estimation: traditional and Bayesian approaches. *Nature Reviews* 4, 275-284.
- Holthuis, L.B. 1980. FAO species catalogue-Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. *FAO Fish Synop*, Roma 125, 1-271.
- Huelsenbeck, J.P. and Ronquist, F. 2001. MRBAYES: Bayesian inference of phylogenetic trees. *Bioinformatics Applications Note* 17, 754-755.
- Huelsenbeck, J.P., Ronquist, F., Nielsen, R. and Bollback, J.P. 2001. Bayesian inference of phylogeny and its impact on evolutionary biology. *Sciences compass* 294, 2310-2314.

- Jasmani, S., Ohira, T., Jayasankar, V., Tsutsui, N., Aida, K. and Wilder, M.N. 2004. Localization of vitellogenin mRNA expression and vitellogenin uptake during ovarian maturation in the giant freshwater prawn, *Macrobrachium rosenbergii*. *J. Exp. Zool.* 301, 334-343.
- Jayasankar, V., Jasmani, S., Tsutsui, N., Aida, K. and Wilder, M.N. 2006. Dynamics of vitellogenin synthesis in juvenile giant freshwater prawn *Macrobrachium rosenbergii*. *J. Exp. Zool.* 305A, 440-448.
- Jayasankar, V., Tsutsui, N., Jasmani, S., Saïdo-Sakanako, H., Yang, W.J., Okuno, A., Hien, T.T.T., Aida, K. and Wilder, M.N. 2002. Dynamics of vitellogenin mRNA expression and changes in hemolymph vitellogenin levels during ovarian maturation in the giant freshwater prawn *Macrobrachium rosenbergii*. *J. Exp. Zool.* 293, 675-682.
- Johnson, P.T. 1980. Histology of the blue crab, *Callinectes sapidus*. *A model for the Decapoda*. Praeger, pp. 440. New York.
- Johnstone, O. and Lasko, P. 2004. Interaction with eIF5B is essential for Vasa function during development. *Development* 131, 4167-4178.
- Jones DT, Taylor WR and Thornton JM. 1992. The rapid generation of mutation data matrices from protein sequences. *Comput. Appl. Biosci.* 8, 275-282.
- Kao, H.C., Chan, T.Y. and Yu, H.P. 1999. Ovary development of the deep-water shrimp *Aristaeomorpha foliacea* (Risso, 1826) (Crustacea: Decapoda: Aristeidae) from Taiwan. *Zool. Stud.* 38, 373-378.
- Kato, Y., Tokishita, S., Ohta, T. and Yamagata, H. 2004. A vitellogenin chain containing a superoxide dismutase-like domain is the major component of yolk proteins in cladoceran crustacean *Daphnia magna*. *Gene* 334, 157-165.
- Kawazoe, I., Jasmani, S., Shih, T.-W., Suzuki, Y. and Aida, K., 2000. Purification and characterization of vitellin from the ovary of kuruma prawn, *Penaeus japonicus*. *Fish. Sci.* 66, 390-396.

- Khalaila, I., Peter-Katalinic, J., Tsang, C., Radcliffe, C.M., Aflalo, E.D., Harvey, D.J., Dwek, R.A., Rudd, P.M. and Sagi, A. 2004. Structural characterization of the *N-glycan* moiety and site of glycosylation in vitellogenin from the decapod crustacean *Cherax quadricarinatus*. *Glycobiology* 14, 767-774.
- Khayat, M., Lubzens, E., Tietz, A. and Funkenstein, B. 1994a. Cell-free synthesis of vitellin in the shrimp *Penaeus semisulcatus*. *Gen. Comp. Endocrinol.* 93, 204-213.
- Khayat, M., Lubzens, E., Tietz, A. and Funkenstein, B. 1994b. Are vitellin and vitellogenin coded by one gene in the marine shrimp *Penaeus semisulcatus*? *Gen. Comp. Endocrinol.* 93, 204-213.
- Khayat, M., Yang, W.J., Aida, K., Nagasawa, H., Tietz, A., Funkenstein, B. and Lubzens, E. 1998. Hyperglycaemic hormones inhibit protein and mRNA synthesis in in-vitro incubated ovarian fragments of the marine shrimp *Penaeus semisulcatus*. *Gen. Comp. Endocrinol.* 110, 307-318.
- Khoo, H.W., Goh, P.Y. and Tong, P.H. 1990. Possible extra-ovarian sites of yolk protein synthesis in the Riceland shrimp, *Macrobrachium lanchesteri* (De Man). *Occ. Papers Singapore Inst. Biol.* 7, 1-7.
- Komatsu, M. and Ando, S. 1992. A novel low-density lipoprotein with large amounts of phospholipids found in the egg yolk of crustacea sand crayfish *Ibacus ciliatus*: Its function as vitellogenin-grading proteinase. *Biochem. Biophys. Res. Comm.* 186, 498-502.
- Komatsu, M., Matsumoto, W. and Hayashi, S. 1996. Protease activity appeared after trypsin treatment of the purified vitellogenin from eel *Angilla japonica*. *Comp. Biochem. Physiol.* 113B, 561-571.
- Koonin, E.V. 2001. An apology for orthologs - or brave new memes. *Genome Biol.* 2, 1005.
- Kuenzel, E.A., Mulligan, J.A., Sommercorn, J. and Krebs, E.G. 1987. Substrate specificity determinants for casein kinase II as deduced from studies with synthetic peptides. *J. Biol. Chem.* 262, 9136-9140.
- Kumar, S., Tamura, K. and Nei, M. 2004. MEGA3: Integrated software for molecular evolutionary genetics analysis and sequence alignment. *Brief Bioinform.* 5, 150-163.

- Kung, S.Y., Chan, S.M., Hui, J.H.L., Tsang, W.S., Mak, A. and He, J.G. 2004. Vitellogenesis in the sand shrimp, *Metapenaeus ensis*: the contribution from the hepatopancreas-specific vitellogenin gene (MeVg2). *Biol. Reprod.* 71, 863-870.
- Laemmli, U.K., 1970. Cleavage of structural protein during assembly of the head of bacteria phage T. *Nature* 227, 680-695.
- Lambert, C., Leonard, N., De Bolle, X. and Depiereux, E. 2002. ESyPred3D: Prediction of proteins 3D structures. *Bioinformatics* 18, 1250-1256.
- Lasko, P.F. and Ashburner, M. 1988. The product of the *Drosophila* gene *vasa* is very similar to eukaryotic initiation factor-4A. *Nature* 335, 611-617.
- Lee, C.Y. and Watson, R.D. 1995. In vitro study of vitellogenesis in the blue crab (*Callinectes sapidus*): Site and control of vitellin synthesis. *J. Exp. Zool.* 271, 364-372.
- Lee, F.Y. and Chang, C.F. 1997. The concentrations of vitellogenin (vitellin) and protein in hemolymph, ovary and hepatopancreas in different ovarian stages of the fresh water prawn, *Macrobrachium rosenbergii*. *Comp. Biochem. Physiol.* 117A, 443-439.
- Lee, F.Y., Shin, T.W. and Chang, C.F. 1997b. Isolation and characterization of female-specific protein (vitellogenin) in mature female hemolymph of the freshwater prawn, *Macrobrachium rosenbergii*: comparison with ovarian vitellin. *Gen. Comp. Endocrinol.* 108, 406-415.
- Lee, J.K., Brandin, E., Branton, D. and Goldstein, L.S. 1997a. Alpha-spectrin is required for ovarian follicle monolayer integrity in *Drosophila melanogaster*. *Development* 124, 353-362.
- Lee, R.F. and Walker, A. 1995. Lipovitellin and lipid droplet accumulation in oocytes during ovarian maturation in the blue crab, *Callinectes sapidus*. *J. Exp. Zool.* 271, 401-412.
- Li, M-G., Mcgrail, M., Serr, M. and Heys, T.S. 1994. *Drosophila* cytoplasmic dynein, a microtubule motor that is asymmetrically localized in the oocyte. *J. Cell Biol.* 126, 1475-1494.

- Lida, T. and Lilly, M.A. 2004. *missing oocyte* encodes a highly conserved nuclear protein required for the maintenance of the meiotic cycle and oocyte identity in *Drosophila*. *Development* 131, 1029-1039.
- Link, V., Shevchenko, A. and Heisenberg, C.P. In press. Proteomics of early zebrafish embryos. *BMC Developmental Biology*.
- Lui, C.W. and O'Conner, J.D. 1976. Biosynthesis of lipovitellin by the crustacean ovary. II. Characterization of and in vitro incorporation of amino acids into the purified subunits. *J. Exp. Zool.* 195, 41-52.
- Lui, C.W., Sage, B.A. and O'Conner, J.D. 1974. Biosynthesis of lipovitellin by the crustacean ovary. *J. Exp. Zool.* 188, 289-296.
- Mak, A.S.C., Choi, C.L., Tiu, S.H.K., Hui, J.H.L., He, J.G., Tobe, S.S. and Chan, S.M. 2005. Vitellogenesis in the red crab *Charybdis feriatus*: hepatopancreas-specific expression and farnesoic acid stimulation of vitellogenin gene expression. *Mol. Reprod. Dev.* 70, 288-300.
- Mann, C.J., Anderson, T.A., Read, J., Chester, S.A., Harrison, G.B., Kochl, S., Ritchie, P.J., Bradbury, P., Hussain, F.S., Amey, J., Vanloo, B., Rosseneu, M., Infante, R., Hancock, J.M., Levitt, D.G., Banaszak, L.J., Scott, J. and Shoulders, C.C. 1999. The structure of vitellogenin provides a molecular model for the assembly and secretion of atherogenic lipoproteins. *J. Mol. Biol.* 285, 391-408.
- Meggio, F. and Pinna, L.A. 1988. Phosphorylation of phosphovitin by casein kinase-2 provides the evidence that phosphoserines can replace carboxylic amino acids as specificity determinants. *Biochem. Biophys. Acta.* 971, 227-231.
- Meusy, J.J. 1980. Vitellogenin, the extraovarian precursor of the protein yolk in crustacean, a review. *Reprod. Nutr. Dev.* 201A, 1-21.
- Meusy, J.J. and Charniix-Cotton, H. 1984. Endocrine control of vitellogenesis in malacostraca crustaceans. In: Engles, W. (Eds.), *Advances in Invertebrate Reproduction*, pp. 231-242. Amsterdam: Elsevier.
- Meusy, J.J. and Payen, G.G. 1988. Female reproduction in malacostracan crustacean. *Zool. Sci.* 5, 217-265.

- Michalak, M., Corbett, E.F., Mesaeli, N., Nakamura, K. and Opas, M. 1999. Calreticulin : one protein, one gene, many functions (Review). *Biochem. J.* 344, 281-292.
- Monigatti, F., Gasteiger E., Bairoch A. and Jung E. 2002. The Sulfinator: predicting tyrosine sulfation sites in protein sequences. *Bioinformatics* 18, 769-770.
- Montozzi, M., Falchuk, K.H. and Vallee, B.L. 1995. Vitellogenin and lipovitellin: zinc proteins of *Xenopus laevis* oocytes. *Biochemistry* 34, 10851-10858.
- Motoh, H. 1984. Biology and ecology of *Penaeus monodon*. Proceedings of the first international conference on the culture of Penaeid prawns/shrimp. SEAFDEC Aquaculture Department, pp. 27-36, Iloilo City.
- Murray, M.T., Schiller, D.L., and Franke, W.W. 1992. Sequence analysis of cytoplasmic mRNA-binding proteins of *Xenopus* oocytes identifies a family of RNA-binding proteins. *PNAS.* 89, 11-15.
- Nardelli, D., Gerber-Huber, S., Van het Schip, F.D., Gruber, M., Ab, G. and Wahli, W. 1987. Vertebrate and nematode genes coding for yolk proteins are derived from a common ancestor. *Biochemistry* 26, 6397-6402.
- Norberg, B. and Haux, C. 1985. Induction, isolation, and characterisation of the lipid content of plasma vitellogenin from two *Salmo* species: Rainbow trout (*Salmo gairdneri*) and sea trout (*Salmo trutta*). *Comp. Biochem. Physiol.* 81B, 869-876.
- Okumura, T. and Aida, K. 2000. Hemolymph vitellogenin levels and ovarian development during the reproductive and non-reproductive molt cycles in the giant freshwater prawn *Macrobrachium rosenbergii*. *Fish. Sci.* 66, 678-685.
- Okuno, A., Yang, W.J., Jayasankar, V., Saido-Sakanaka, H., Huong, D.T.T., Jasmani, S., Atmomarsono, M., Subramoniam, T., Tsutsui, N., Ohira, T., Kawazoe, I., Aida, K. and Wilder, M.N., 2002. Deduced primary structure of vitellogenin in the giant freshwater prawn, *Macrobrachium rosenbergii*, and yolk processing during ovarian maturation. *J. Exp. Zool.* 292, 417-429.
- Paulus, J.E. and Laufer, H. 1987. Vitellogenocytes in the hepatopancreas of *Carcinus maenas* and *Libinia emarginata* (Decapoda Brachyura). *Int. J. Invert. Reprod.* 11, 29-44.

- Peixoto, S., Coman, G., Arnold, S., Crocos, P. and Preston, N. 2005. Histological examination of final oocyte maturation and atresia in wild and domesticated *Penaeus monodon* (Fabricius) broodstock. *Aquac. Res.* 36, 666-673.
- Perez-Farfante, I and Kensley, B. 1997. Penaeoid and Sergestoid shrimps and prawns of the world: Keys and diagnoses for the families and genera. *Memoirs du museum nationale d'histoire naturelle*, tome. 175, 233.
- Pokrywka, N.J., Fishbein, L. and Frederick, J. 2000. New phenotypes associated with the swallow gene of *Drosophila*: evidence for a general role in oocyte cytoskeletal organization. *Dev. Genes. Evol.* 210, 426-435.
- Pollastri, G. and McLysaght, A. 2005. Porter: a new, accurate server for protein secondary structure prediction. *Bioinformatics* 21, 1719-1720.
- Polzonetti-Magni, A.M., Mosconi, G., Soverchia, L., Kikuyama, S. and Carnevali, O. 2004. Multihormonal control of vitellogenesis in lower vertebrates. *Int. Rev. Cytol.* 239, 1-46.
- Porter, M.L., Losada, M.P. and Crandall, K.A. 2005. Model-based multi-locus estimation of decapod phylogeny and divergence times. *Mol. Phylogenet. Evol.* 37, 355-369.
- Primavera, J.H. 1990. External and internal anatomy of adult penaeid prawns/shrimps. SEAFDEC, Aquaculture Department, The Philippines, Poster.
- Quackenbush, L.S., 1992. Yolk synthesis in the marine shrimp, *Penaeus vannamei*. *Comp. Biochem. Physiol.* 103A, 711-714.
- Quackenbush, L.S. 2001. Yolk synthesis in the marine shrimp, *Penaeus vannamei*. *Amer. Zool.* 41, 458- 464.
- Quackenbush, L.S. and Keeley, L.L. 1988. Regulation of vitellogenesis in the fiddler crab, *Uca pugilator*. *Biol. Bull.* 175, 321-331.
- Qui, Y.W., Ng, T.B. and Chu, K.H. 1997. Purification and characterization of vitellin from the ovaries of the shrimp *Metapenaeus ensis* (Crustacea: Decapoda: Penaeidae). *Invertbr. Reprod. Dev.* 31, 217-223.
- Quinitio, E.T., Hara, A., Yamaguchi, K. and Fuji, A. 1990. Isolation and characterization of vitellin from the ovary of *Penaeus monodon*. *Invertbr. Reprod. Dev.* 17, 221-227.

- Raag, R., Appelt, K., Xoung, H. H., and Banaszak, L. 1988. Structure of the lamprey yolk lipid-protein complex lipovitellin-phosvitin at 2.8 Å resolution. *J. Mol. Biol.* 200, 553-569
- Raikhel, A.S. and Dhadialla, T.S. 1992. Accumulation of yolk proteins in insect oocytes. *Ann. Rev. Entomol.* 37, 217-251.
- Rani, K. and Subramoniam, T. 1997. Vitellogenesis in the mud crab *Scylla serrata* an in vivo isotope study. *J. Crust. Biol.* 17, 659-665.
- Ranjan, M., Tafuri, S.R. and Wolffe, A.P. 1993. Masking mRNA from translation in somatic cells. *Genes Dev.* 7, 1725-1736.
- Raviv, S., Parnes, S., Segall, C., Davis, C. and Sagi, A. 2006. Complete sequence of *Litopenaeus vannamei* (Crustacea: Decapoda) vitellogenin cDNA and its expression in endocrinologically induced sub-adult females. *Gen. Comp. Endocrinol.* 145, 39-50.
- Retzek, H., Steyrer, E., Sanders, E.J. Nimpf, J. and Schneider, W.J. 1992. Molecular cloning and functional characterization of chicken cathepsin D, a key enzyme for yolk formation. *DNA Cell Biol.* 11, 661-672.
- Rime, H., Guitton, N., Pineau, C., Bonnet, E., Bobe, J. and Jalabert, B. 2004. Post-ovulatory ageing and egg quality: A proteomic analysis of rainbow trout coelomic fluid. *Reprod. Biol. Endocrinol.* 2, 26-36.
- Rodriguez, E.M., Medesani, D.A., Lopez Greco, L.S. and Fingerman, M. 2002. Effects of some steroids and other compounds on ovarian growth of the red swamp crayfish, *Procambarus clarkii*, during early vitellogenesis. *J. Exp. Zool.* 292, 82-87.
- Sagi, A., Soroka, Y., Snir, E., Chomsky, O., Calderon, J. and Milner, Y. 1995. Ovarian protein synthesis in the prawn *Macrobrachium rosenbergii*: Does ovarian vitellin synthesis exist? *Invert. Reprod. Develop.* 27, 41-47.
- Saito, N. and Nei, M. 1987. The neighbor-joining method: A new method for reconstructing phylogenetic trees. *Mol. Biol. Evol.* 4, 406-425.
- Sakoyama, Y. and Okubo, S. 1981. Two-Dimensional gel patterns of protein species during development of *Drosophila* embryos. *Dev. Biol.* 81, 361-365.

- Sali, A., Potterton, L., Yuan, F., van Vlijmen, H., and Karplus, M. 1995. Evaluation of comparative protein modelling by MODELLER. *Proteins* 23, 318-326.
- Sanger, F., Nicklen, S. and Coulson, A.R. 1977. DNA sequencing with chain-terminating inhibitors. *PNAS*. 74, 5463-5467.
- Sangpradab, S., Krilrum, S. and Laitim, W. 1987. Pond culture of banana prawn (*Penaeus merguensis* de Man) at various stocking densities. Technical Paper, 4, Dept Fisheries, Thailand.
- Sappington, T.W., Heys and A.R., Raikhel, A.S. 1995. Mosquito vitellogenin receptor: Purification, development and biochemical characterization. *Insect. Biochem. Mol. Biol.* 25, 807-817.
- Sappington, T.W. and Raikhel, A.S. 1998. Molecular characteristics of insect vitellogenins and vitellogenin receptors. *Insect. Biochem. Mol. Biol.* 28, 277-300.
- Sayle, R.A. 1995. RASMOL: biomolecular graphics for all. *Trends Biochem. Sci.* 20, 374-376.
- Schneider, W.J. 1992. Lipoprotein receptors in oocyte growth. *Clin. Invest.* 70, 385-390.
- Seafood Fishing Aquaculture Marine. 2006. **Banana prawn** (Online). Available: <http://www.sea-ex.com/fishphotos/prawn,.htm> (2006,October 10).
- Serrano-Pinto, V., Landais, I., Ogliastro, M.H., Gutierrez-Ayala, M., Mejia- Ruiz, H., Villarreal Colmenares, H., Garcia-Gasca, A. and Vazquez-Boucard, C. 2004. Vitellogenin mRNA expression in *Cherax quadricarinatus* during secondary vitellogenic at first maturation females. *Mol. Reprod. Dev.* 69, 17-21.
- Shafir, S., Tom, M., Ovadia, M. and Lubzens, E. 1992. Protein, vitellogenin and vitellin levels in the hemolymph and ovaries during ovarian development in *Penaeus semisulcatus* (de Haan). *Biol. Bull.* 183, 394-400.
- Sharrock, W.J. 1983. Yolk proteins of *Caenorhabditis elegans*. *Dev. Biol.* 96, 182-188.
- Sharrock, W.J., Rosenwasser, T.A., Gould, J., Knott, J., Hussey, D., Gordon, J.I. and Banaszak, L. 1992. Sequence of lamprey vitellogenin: implication for the lipovitellin crystal structure. *J. Mol. Biol.* 226, 903-907.
- Shi, X., Zhang, S. and Pang, Q. 2006. Vitellogenin is a novel player in defense reactions. *Fish and Shellfish Immunology* 20, 769-772.

- Shoulders, C.C., Brett, D.J., Bayliss, J.D., Narcisi, T.M.E., Jarmuz, A., Grantham, T.T., Leoni, P.R.D., Bhattacharya, S., Pease, R.J., Cullen, P.M., Levi, S., Byfield, P.G.H., Purkiss, P. and Scott, J. 1993. Abetalipoproteinemia is caused by defects of the gene encoding the 97 kDa subunit of a microsomal triglyceride transfer protein. *Hum. Mol. Genet.* 2, 2109-2116.
- Shoulders, C.C., Narcisi, T.M.E., Read, J., Chester, S.A., Brett, D.J., Scott, J., Anderson, T.A., Levitt, D.G. and Banaszak, L.J. 1994. The abetalipoproteinemia gene is a member of the vitellogenin family and encodes an α -helical domain. *Nature Struct. Biol.* 1, 285-286.
- Shyu, A.B., Raff, R.A. and Blumenthal, T. 1986. Expression of the vitellogenin gene in female and male sea urchin. *PNAS.* 83, 3865-3869.
- Snigirevskaya, E.S., Sappington, T.W. and Reikhel, A.S. 1997. Internalization and recycling of vitellogenin receptor in the mosquito oocyte. *Cell Tiss. Res.* 290, 175-183.
- Suzuki, S. 1987. Vitellins and vitellogenins of the terrestrial isopod, *Armadillidium vulgare*. *Biol. Bull.* 173, 345-354.
- Tafurl, S.R. and Wolffe, A.P. 1993. Selective recruitment of masked maternal mRNA from messenger ribonucleoprotein particles containing FRGY2 (mRNP4). *J. Biol. Chem.* 268, 24255-24261.
- Takiya, S., Nishita, Y., Ishikawa, S., Ohno, K., Tamura, T. and Suzuki, Y. 2004. Bombyx Y-Box protein BYB facilitates specific DNA interaction of various DNA binding proteins independently of the Cold Shock Domain. *J. Biochem.* 135, 683-393.
- Tay, T.L., Lin, Q., Seow, T.K., Tan, K.H., Hew, C.L. and Gong, Z. 2006. Proteomic analysis of protein profiles during early development of the zebrafish, *Danio rerio*. *Proteomics* 6, 3176-3188.
- Thellin, O., Zorzi, W., Lakaya, B., Borman, B.D., Coumans, B., Hennen, G., Grisar, T., Igout, A. and Heinen, E. 1999. Housekeeping genes as internal standards: use and limits. *J. Biotechnol.* 75, 291-295.

- Theurkauf, W.E., Smiley, S., Wong, M.L. and Alberts, B. M. 1992. Reorganization of the cytoskeleton during *Drosophila* oogenesis: implications for axis specification and intercellular transport. *Development* 115, 923-936.
- Thompson, J.D., Higgins, D.G. and Gibson, T.J. 1994. Clustal W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acids Res.* 22, 4673-4680.
- Thompson, J.R. and Banaszak, L.J. 2002. Lipid-protein interactions in lipovitellin. *Biochemistry.* 41, 9398-9409.
- Tiu, S.H.K., Hui, J.H.L., Mak, A.S.C., He, J.G. and Chan, S.M. 2006. Equal contribution of hepatopancreas and ovary to the production of vitellogenin (PmVg1) transcripts in the tiger shrimp, *Penaeus monodon*. *Aquaculture* 254, 666-674.
- Tokishita, S.I., Kato, Y., Kobayashi, T., Nakamura, S., Ohta, T. and Yamagata, H. 2006. Organization and repression by juvenile hormone of a vitellogenin gene cluster in the crustacean, *Daphnia magna*. *Biochem. Biophys. Res. Commun.* 345, 362-370.
- Tom, M., Fingerman, M., Hayes, T.K., Johnson, V., Kerner, B. and Lubzens, E. 1992. A comparative study of the ovarian protein from two penaeid shrimps, *Penaeus semisulcatus* de Haan and *Penaeus vannamei* (Boone). *Com. Biochem. Physiol.* 102B, 483-490.
- Trumbly, R.J. and Jarry, B. 1983. Stage-specific protein synthesis during early embryogenesis in *Drosophila melanogaster*. *EMBO. J.* 2, 1281-1290.
- Tsang, W.S., Quackenbush, L.S., Chow, B.K.C. and Tiu, S.H.K. 2003. Organization of the shrimp vitellogenin gene: evidence of multiple genes and tissue specific expression by the ovary and hepatopancreas. *Gene* 303, 99-109.
- Tsukimura, B., 2001. Crustacean vitellogenesis: Its role in oocyte development. *Amer. Zool.* 41, 465-476.
- Tsutsui, N., Jayasankar, V., Saido-Sakanaka, H., Jasmani, S., Ohira, T., Aida, K., Okumura, T. and Wilder, M.N. 2002. Purification and characterization of vitellin in the coonstriped shrimp, *Pandalus hypsinotus*. In: Keller, R., Dirksen, H., Sedlmeier,

- D., Vaudry, A. (eds.), Proceedings of the 21st Conference of European Comparative Endocrinologists A, pp 433–436. Monduzzi Editore, Bologna.
- Tsutsui, N., Kawazoe, I., Ohira, T.S.J., Yang, W.-J., Wilder, M. and Aida, K. 2000. Molecular characterization of a cDNA encoding vitellogenin and its expression in the hepatopancreas and ovary during vitellogenesis in the kuruma prawn, *Penaeus japonicus*. *Zool. Sci.* 17, 651-660.
- Tsutsui, N., Kim, Y.K., Jasmani, S., Ohira, T., Wilder, M.N. and Aida, K. 2005. The dynamics of vitellogenin gene expression differs between intact and eyestalk ablated kuruma prawn *Penaeus (Marsupenaeus) japonicus*. *Fish. Sci.* 71, 249-256.
- Tsutsui, N., Saido-Sakanaka, H., Yang, W.J., Jayasankar, V., Jasmani, S., Okuno, A., Ohira, T., Okumura, T., Aida, K. and Wilder, M.N. 2004. Molecular characterization of a cDNA encoding vitellogenin in the coonstriped shrimp, *Pandalus hypsinotus* and site of vitellogenin mRNA expression. *J. Exp. Zool.* 301A, 802-814.
- Tung, H. 2001. Shrimp research at BIARC and the potential of *Penaeus merguensis* culture. *AARM newsletter.* 6, 37-38.
- Utarabhand, P. and Bunlipatanon, P. 1996. Plasma vitellogenin of grouper (*Epinephelus malabaricus*): Isolation and properties. *Comp. Biochem. Physiol.* 115, 101-110.
- Vaca, A. and Alfaro, J. 2000. Ovarian maturation and spawning in the white shrimp, *Penaeus vannamei*, by serotonin injection. *Aquaculture* 182, 373– 385.
- Valoir, T.D., Tucker, M.A., Belikoff, E.J., Camp, L.A., Bolduc, C. and Beckingham, K. 1991. A second maternally expressed *Drosophila* gene encodes a putative RNA helicase of the DEAD box family. *PNAS.* 88, 2113-2117.
- Vazquez-Boucard, C.G. and Ceccaldi, H.H., 1986. Identification, purification, et characterization de la lipovitelline chez un crustace decapode Natantia *Penaeus japonicus*. *J. Exp. Mar. Biol. Ecol.* 97, 37-50.
- Wahli, W. 1988. Evolution and expression of vitellogenin genes. *Trends Genet.* 4, 227-232.
- Warrier, S. and Subramoniam, T. 2003. Instability of crab vitellogenin and its immunological relatedness with mammalian atherogenic lipoproteins. *Mol. Reprod. Dev.* 64, 329-340.

- Warrier, S.R. and Subramoniam, T. 2002. Receptor mediated yolk protein uptake in the crab *Scylla serrata*: Crustacean vitellogenin receptor recognizes related mammalian serum lipoproteins. *Mol. Reprod. Dev.* 61, 536-548.
- Wilder, M.N., Subramoniam, T. and Aida, K. 2002. Yolk proteins of Crustacea. In Reproductive Biology of Invertebrates. Adiyodi, K.G. and Adiyodi, R.G. (series eds.), Volume XII – *Recent Progress in Vitellogenesis*. Raikhel, A.S. and Sappington, T.W. (eds.), 131–174. USA: Science Publishers Inc.
- Wilhelm, J.E., Mansfield, J., Hom-Booher, N., Wang, S., Turck, C.W., Hazelrigg, T., and Vale, R.D. 2000. Isolation of a ribonucleoprotein complex involved in mRNA localization in *Drosophila* oocytes. *J. Cell Biol.* 148, 427–439.
- World Aquaculture Society (WAS). 2006. **Banana shrimp and its prospects as a farmed species** (Online). Available: <http://www.was.org>. (2006, June 26)
- Wuthisuthimethavee, S., Lumubol, P., Vanavichit, A. and Tragoonrung, S. 2005. EST-based identification of genes expressed in the branchiae of black tiger shrimp (*Penaeus monodon* Fabricius). *Science Asia* 31, 137-144.
- Yamano, K. and Unuma, T. 2006. Expressed sequence tags from eyestalk of kuruma prawn, *Marsupenaeus japonicus*. *Comp. Biochem. Physiol.* 143A, 155-161.
- Yamashita, T., Shimada, S., Guo, W., Sato, K., Kohmura, E., Hayakawa, T., Takagi, T. and Tohyama, M. 1997. Cloning and functional expression of a brain peptide/histidine transporter. *J. Biol. Chem.* 272, 10205-10211.
- Yang, F., Xu, H.T., Dai, Z.M. and Yang, W.J. 2005. Molecular characterization and expression analysis of vitellogenin in the marine crab *Portunus trituberculatus*. *Comp. Biochem. Physiol.* 142B, 456-464.
- Yang, W.J., Ohira, T., Tsutsui, N., Subramoniam, T., Huong, D.T.T., Aida, K. and Wilder, M.N. 2000. Determination of amino acid sequence and site of mRNA expression of four vitellins in the giant freshwater prawn, *Macrobrachium rosenbergii*. *J. Exp. Zool.* 287, 413-422.
- Yano, I. 1988. Oocyte development in the kuruma prawn *Penaeus japonicus*. *Mar. Biol.* 99, 547-553.

- Yano, I. and Chinzei, Y., 1987. Ovary is the site of vitellogenin synthesis in kuruma prawn, *Penaeus japonicus*. *Comp. Biochem. Physiol.* 86B, 213-218.
- Yates, J.L. and Nomura, M. 1980. E.coil ribosomal protein L4 is a feedback regulatory protein. *Cell* 21, 517-522.
- Yoshizaki, N. and Yonezawa, S. 1994. Cathepsin D activity in the vitellogenesis of *Xenopus laevis*. *Develop. Growth Differ.* 36, 299-306.
- Yurkova, M.S. and Murray, M.T. 1997. A translation regulatory particle containing the *Xenopus* oocyte Y box protein mRNP3+4. *J. Biol. Chem.* 272, 10870–10876.
- Zacharia, S. and Kakati, V.S. 2002. Growth and survival of *Penaeus merguensis* postlarvae at different salinities. *Israeli J. Aquacult.-Bamidgeh.* 54, 157-162.
- Zhang, P., Talluri, S., Deng, H., Branton, D. and Wagner, G. 1995. Solution structure of the pleckstrin homology domain of Drosophila beta-spectrin. *Structure* 15, 1185-1195.