PRESS RELEASE

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INEQUALITY MAKES A HEAD

SINGAPORE, December 15, 2005 – Scientists at Temasek Life Sciences Laboratory (TLL) have identified an important mechanism that may control patterning of the body. This discovery was made by Mr Aniket Gore, who is currently pursuing his PhD with Dr Karuna Sampath, group leader of the Vertebrate Development Group at TLL. Their results are published in the December 15 issue of Nature.

In many organisms, the development of the egg to a multicellular creature requires the function of gene products that are deposited by the mother into the egg. This is well understood in simple animals such as fruit flies (Drosophila melanogaster) and worms, where not only does the mother deposit various products, but also puts them in specific locations within the egg, which will later define where the head, tail or back forms. The unequal or "asymmetric" distribution of these "maternal determinants" as they are sometimes called, is an important step in the correct placement of various body parts. For instance, if a "head" determinant is put in the wrong location of the egg, the resulting animal could have two heads, but no abdomen or tail. Conversely, if it is absent in its correct location, the resulting animal may have no head. While experimental manipulations in frog and fish eggs have suggested that maternal determinants might exist in these animals as well, their identity has been largely unknown, and only earlier this year, the first bona fide determinant was identified in frogs.

The studies by Mr Gore and his colleagues in the Vertebrate Development Group have identified the asymmetric distribution of a molecule, called "squint", and showed that it functions in determining the correct formation of the back and head structures in the zebrafish. They also identified a sequence tag in the gene that is required for the unequal distribution of its product. Interestingly, the zebrafish gene has counterparts in mammals including humans, a finding that has broad implications in our understanding of how an egg develops to form a complete organism.

The zebrafish, used in these studies, is an excellent animal model system for studying asymmetric distribution of factors and their role in development of complex animals such as humans. The zebrafish has also become one of the preferred model systems for studying the basis of many human diseases. Zebrafish are easy to maintain and produce many eggs in each mating. Since the fish develops very rapidly, rudiments of most organs such as the heart, brain, and kidneys are present within a day of egg-laying. Furthermore, many experimental manipulations are possible in fish embryos as they develop outside the mother's body, unlike mouse or human embryos, and its growth and development can be easily observed in water.

Mr Aniket Gore said “The transparent eggs of the zebrafish also allowed us to “see” every developmental process/change as it happens in the live animal. This is an advantage that zebrafish offers over other model organisms such as the mouse.” Taking advantage of this property, Gore and his colleagues injected and saw the unequal distribution of the molecule in live fish embryos. They identified the sequence tag that is essential for the unequal distribution of the molecule, and found that similar motifs exist in the mammalian counterparts, including humans. Strikingly, they also found that the human sequence can bestow unequal distribution in fish eggs as well. Thus, this mechanism may be used in many animals, including humans.

Dr Karuna Sampath added, “Aniket's work describes a novel and important mechanism for axis formation in vertebrates, and is likely stimulate a lot of work in this area of developmental biology. The work will hopefully also shed some light on how human embryos develop to form various tissues and organs.”

Encl.
Annex 1: Nature paper “The zebrafish dorsal axis is apparent at the four-cell stage”

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