

計畫編號：04

計畫名稱：餌料生物豐年蝦轉殖生長基因品系的產業化應用

計畫主持人：蔡懷楨

計畫中文摘要：

在水產養殖業中，早期種苗幼生的營養供給是大量生產的瓶頸。剛孵化的魚、蝦、貝類幼苗由於消化系統分化不全，大多數無法消化及代謝配方飼料，因此選用適當的餌料生物活體，將有助於提供種苗充足的營養與提高育成率。節肢動物中甲殼類豐年蝦 (*Artemia* sp.) 又名鹵蟲 (brine shrimp) 是一般水產動物種苗最常用的餌料生物，也是魚、蝦、蟹苗後期必要的餌料生物。應用基因轉殖技術可豐年蝦攜帶有用的外來基因(如生長蛋白基因)。若魚、蝦、蟹之種苗經攝食後，這些具有經濟價值的養殖物種就會增加特質(如促進快速生長等)。近幾年來，本實驗室已發展出了一種電穿孔法大量轉殖基因的方法，能有效地將外源性的構築質體 DNA 導入豐年蝦的染色體內，並能利用外來啟動子驅動生長蛋白基因，且能表現重組生長蛋白。藉由餵養這些豐年蝦轉殖品系到魚類幼苗內，可以促進生長等。更重要的，轉殖品系透過這樣自然的食物鏈方式，增加養殖魚類的經濟價值，但是消費者卻不必直接食用基因轉殖魚，可以大大降低直接使用基因轉殖生物 (genetically modified organisms, GMO) 對人體食用及環境污染的潛在風險。所以，本實驗室擬提出這個促進產學合作先導型研究計畫，希望能與水產生物科技公司合作，先進行這個特殊 *artemia* 轉殖品系能工業化的初期工作，例如將之前得到的轉殖品系，把具有半套 transgene 的 heterozyotic strain 繁育成具有双套 transgene 的 homozygotic strain，然後大量生產，遺傳穩定篩選，進而在實際養殖場評估促進幼苗成長的效果及經濟效益，然後產量標準化及產品規格化等。另一方面，我們也會建立好轉殖豐年蝦基因標記鑑定的重要工作，例如進行染色体 Southern blot 分析，以便瞭解作外來基因片段嵌入轉殖豐年蝦染色體的 copy 數目，位置，兩側序列以及 transgene 排列方式。又為了確保所篩選出來的優良品系能永久留下來，我們也需要研發適合這種轉殖豐年蝦品系的冷凍休眠卵技術，以能長期保留這些優良品種，已備推廣到將來可能產業化之用。

計畫英文摘要：

The crustacean *Artemia*, also named brine shrimp (*Artemia* sp.), has been commonly used to study in many fields as an experimental organism,

such as the toxicology, evolutionary and comparative developmental biology. More importantly, the nauplii of brine shrimp are the most widely used as a live zooplankton bait for feeding larvae of many aquaculture finfish and shellfish because it is an essential nutrient for marine fish larvae. By taking advantages of genetically transformed *Artemia*, which carry the foreign gene (such as growth hormone gene), some traits of the fish that feed the transgenic artemia enable to improve (such as fast-growing). Due to GMO is employed through the relatively low level of food chain, the potential risk of consuming the GMO by people might decrease greatly, compared to people directly consume the GMO fish. Recently, my lab has successfully developed a more effective approach for transferring exogenous DNA fragment into the fertilized eggs of artemia (*A. sinica*) through electroporation. And, we demonstrated that the transgenic *A. sinica* enables to express the introduced fish growth hormone cDNA. The exogenous DNA fragment is proven to be transmitted stably to the following generations of the transgenic founders. In the sense, the transgenic line of artemia which produces a functional fish growth hormone is generated. We believe that the germ-line transmitted transgenic artemia may be highly potentially for being a new bioreactor for aquaculture, especially for fish-larval industry. Therefore, we propose this project to collaborate with a partner from aquaculture industry. Through this project, we will continue to carry out some researches prior to this transgenic artemia can be industrialized. We will screen and breed the transgenic homozygotic strain derived from the present heterozygotic strain that carries the transferred growth hormone gene. We will make a large-scale production of the homozygotic strain of this transgenic artemia line. Many works will also be scheduled to perform before we can industrialize this precious material, including breeding standardization, quality control, genetic marker, gene stabilization, and high survival rate of eggs after frozen preservation. In addition, Southern blot analysis will be performed to identify the insertion sites, copy number of inserted gene fragment and the type of array in the genome. After these works are well done, we will go further to develop a platform technology to evaluate the economically impact of growth faster of fish after eating this transgenic artemia containing growth hormone gene.