

- Sakaguchi, S Kimura, M Nonak, A Kimura. 1988. Growth-promoting activity of tuna growth hormone and expression of tuna growth hormone cDNA in *Escherichia coli*. *Bio-technol. Appl. Biochem.* **10**: 385-392.
- Schulte PM, NE Down, EM Donaldson, LM Souza. 1989. Experimental administration of recombinant bovine growth hormone to juvenile rainbow trout (*Salmo gairdneri*) by injection or immersion. *Aquaculture* **76**: 145-152.
- Sekine S, T Miizukzmi, T Nishi, Y Kuwana, A Saito, M Sato, H Itoh, H Kawauchi. 1985. Cloning and expression of cDNA for salmon growth hormone in *E. coli*. *Proc. Natl. Acad. Sci. USA* **82**: 4306-4310.
- Shamblott MJ, TT Chen. 1992. Identification of a second insulin-like growth factor in a fish species. *Proc. Natl. Acad. Sci. USA* **89**: 8913-8917.
- Shamblott MJ, TT Chen. 1993. Age-related and tissue-specific levels of five forms of insulin-like growth factor mRNA in a teleost. *Mol. Mar. Biol. Biotechnol.* **2**: 351-361.
- Shamblott MJ, C Cheng, D Bolt, TT Chen. 1995. Insulin-like growth factor (IGF) mRNA is accumulated in the liver and pyloric caeca of a teleost in a growth hormone-dependent manner. *Proc. Natl. Acad. Sci. USA*. (in press).
- Shears MA, GL Fletcher, CL Hew, S Gauthier, PL Davies. 1991. Transfer, expression, and stable inheritance of antifreeze protein genes in Atlantic salmon (*Salmo salar*). *Mol. Mar. Biol. Biotechnol.* **1**: 58-63.
- Stinchcomb DT, JE Shaw, SH Carr, D Hirsh. 1985. Extrachromosomal DNA transformation of *Caenorhabditis elegans*. *Mol. Cell Biol.* **5**: 3484-3496.
- Stuart GW, JV McMurry, M Westerfield. 1988. Replication, integration, and stable germ-line transmission of foreign sequence injected into early zebrafish embryos. *Development* **109**: 403-412.
- Stuart GW, JV Vielkind, JV McMurray, M Westerfield. 1990. Stable lines of transgenic zebrafish exhibit reproduction patterns of transgene expression. *Development* **109**: 293-296.
- Swanson ME, MJ Martin, JK O'Donnell, K Hoover, W Lago, V Huntress, CT Parsons, CA Pinkert, S Pilder, JS Logan. 1992. Production of functional human hemoglobin in transgenic swine. *Bio/Technol.* **10**: 557-559.
- Symonds JE, SP Walker, FYT Sin. 1994. Development of mass gene transfer method in chinook salmon: optimization of gene transfer by electroporated sperm. *Mol. Mar. Biol. Biotechnol.* **3**: 104-111.
- Tseng FS, IC Lio, HJ Tsai. 1994. Introducing the exogenous growth hormone cDNA into lach (*Misgurnus anguillicaudatus*) eggs via electroporated sperms as carrier. 3rd International Marine Biotechnology Conference, Tromsø, Norway. Abstract pp. 71.
- Wallis AE, RH Devlin. 1993. Duplicate insulin-like growth factor I gene in salmon display alternative splicing pathways. *Mol. Endocrinol.* **7**: 409-422.
- Wright G, A Garver, D Cottom, D Reeves, A Scott, P Simons, I Wilmut, I Garner, A Colman. 1991. High level expression of active human α -antitrypsin in the milk of transgenic sheep. *Bio/Technol.* **9**: 830-834.
- Zhang P, M Hayat, C Joyce, LI Gonzales-Villasenor, CM Lin, RA Dunham, TT Chen, DA Powers. 1990. Gene transfer, expression and inheritance of pRSV-Rainbow Trout-GH-cDNA in the carp, *Cyprinus carpio* (Linnaeus). *Mol. Reproduc. Develop.* **25**: 3-13.
- Zhu Z, G Li, L He, SZ Chen. 1985. Novel gene transfer into the goldfish (*Carassius auratus* L. 1758). *Angew Ichthyol.* **1**: 31-34.

轉殖基因魚：基礎科學研究及生物科技應用之理想模式

陳鐵雄¹ 陸振岡¹ Mike J. Shamblott¹ 鄭美潔¹

林純民¹ Jane C. Burns² Renate Reimschuessel³

Nagaraj Chatakondi⁴ Rex A. Dunham⁴

用人工方法將外來之基因轉殖入生物原有之基因體者稱為轉基因生物。自1985年來，顯微注射法及電破法已廣泛被使用生產各種不同之轉基因魚類。這些轉基因魚類可用為基礎科學研究及生物科技應用之模型。使用近年來本實驗室及其他實驗室所得之研究結果為例，本文將闡釋轉殖基因魚之利用價值。

關鍵詞：基因轉殖技術，生長激素，類胰島素生長因子，顯微注射法，電破法。

¹ Center of Marine Biotechnology, University of Maryland Biotechnology Institute and Department of Biological Sciences, University of Maryland, Baltimore County, Baltimore, MD, USA

² Department of Pediatrics, School of Medicine, University of California, San Diego, CA, USA

³ Aquatic Pathobiology Group, Department of Pathology, University of Maryland at Baltimore, MD, USA

⁴ Department of Fisheries Science and Allied Aquaculture, Auburn University, Auburn, AL, USA