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Reference:

- (1) Ibba, M.; Soll, D. Aminoacyl-tRNA synthesis. *Annu Rev Biochem* 2000, 69, 617-650.
- (2) de Pouplana, L. R.; Schimmel, P. A view into the origin of life: aminoacyl-tRNA synthetases. *Cell Mol Life Sci* 2000, 57, 865-870.
- (3) Woese, C. R.; Olsen, G. J.; Ibba, M.; Soll, D. Aminoacyl-tRNA synthetases, the genetic code, and the evolutionary process. *Microbiol Mol Biol Rev* 2000, 64, 202-236.
- (4) Ribas de Pouplana, L.; Schimmel, P. A view into the origin of life: aminoacyl-tRNA synthetases. *Cell Mol Life Sci* 2000, 57, 865-870.
- (5) Zhang, Y.; Baranov, P. V.; Atkins, J. F.; Gladyshev, V. N. Pyrrolysine and selenocysteine use dissimilar decoding strategies. *J Biol Chem* 2005, 280, 20740-20751.
- (6) Soares, J. A.; Zhang, L.; Pitsch, R. L.; Kleinholz, N. M.; Jones, R. B. et al. The residue mass of L-pyrrolysine in three distinct methylamine methyltransferases. *J Biol Chem* 2005, 280, 36962-36969.
- (7) O'Donoghue, P.; Sethi, A.; Woese, C. R.; Luthey-Schulten, Z. A. The evolutionary history of Cys-tRNACys formation. *Proc Natl Acad Sci U S A* 2005, 102, 19003-19008.
- (8) Leibundgut, M.; Frick, C.; Thanbichler, M.; Bock, A.; Ban, N. Selenocysteine tRNA-specific elongation factor SelB is a structural chimaera of elongation and initiation factors. *Embo J* 2005, 24, 11-22.
- (9) Feng, L.; Sheppard, K.; Tumbula-Hansen, D.; Soll, D. Gln-tRNAGln formation from Glu-tRNAGln requires cooperation of an asparaginase and a Glu-tRNAGln kinase. *J Biol Chem* 2005, 280, 8150-8155.
- (10) Feng, L.; Yuan, J.; Toogood, H.; Tumbula-Hansen, D.; Soll, D. Aspartyl-tRNA synthetase requires a conserved proline in the anticodon-binding loop for tRNA(Asn) recognition in vivo. *J Biol Chem* 2005, 280, 20638-20641.
- (11) Theobald-Dietrich, A.; Giege, R.; Rudinger-Thirion, J. Evidence for the existence in mRNAs of a hairpin element responsible for ribosome dependent pyrrolysine insertion into proteins. *Biochimie* 2005, 87, 813-817.
- (12) Theobald-Dietrich, A.; Frugier, M.; Giege, R.; Rudinger-Thirion, J. Atypical archaeal tRNA pyrrolysine transcript behaves towards EF-Tu as a typical elongator tRNA. *Nucleic Acids Res* 2004, 32, 1091-1096.
- (13) Schimmel, P.; Beebe, K. Molecular biology: genetic code seizes pyrrolysine. *Nature* 2004, 431, 257-258.
- (14) Polycarpo, C.; Ambrogelly, A.; Berube, A.; Winbush, S. M.; McCloskey, J. A. et al. An aminoacyl-tRNA synthetase that specifically activates pyrrolysine. *Proc Natl Acad Sci U S A* 2004, 101, 12450-12454.

- (15) Lee, J.; Hendrickson, T. L. Divergent anticodon recognition in contrasting glutamyl-tRNA synthetases. *J Mol Biol* 2004, 344, 1167-1174.
- (16) Krzycki, J. A. Function of genetically encoded pyrrolysine in corrinoid-dependent methylamine methyltransferases. *Curr Opin Chem Biol* 2004, 8, 484-491.
- (17) Hao, B.; Zhao, G.; Kang, P. T.; Soares, J. A.; Ferguson, T. K. et al. Reactivity and chemical synthesis of L-pyrrolysine- the 22(nd) genetically encoded amino acid. *Chem Biol* 2004, 11, 1317-1324.
- (18) Blight, S. K.; Larue, R. C.; Mahapatra, A.; Longstaff, D. G.; Chang, E. et al. Direct charging of tRNA(CUA) with pyrrolysine in vitro and in vivo. *Nature* 2004, 431, 333-335.
- (19) Tumbula-Hansen, D.; Feng, L.; Toogood, H.; Stetter, K. O.; Soll, D. Evolutionary divergence of the archaeal aspartyl-tRNA synthetases into discriminating and nondiscriminating forms. *J Biol Chem* 2002, 277, 37184-37190.
- (20) Charron, C.; Roy, H.; Blaise, M.; Giege, R.; Kern, D. Non-discriminating and discriminating aspartyl-tRNA synthetases differ in the anticodon-binding domain. *Embo J* 2003, 22, 1632-1643.
- (21) Srinivasan, G.; James, C. M.; Krzycki, J. A. Pyrrolysine encoded by UAG in Archaea: charging of a UAG-decoding specialized tRNA. *Science* 2002, 296, 1459-1462.
- (22) Ibba, M.; Soll, D. Genetic code: introducing pyrrolysine. *Curr Biol* 2002, 12, R464-466.
- (23) Salazar, J. C.; Zuniga, R.; Racznik, G.; Becker, H.; Soll, D. et al. A dual-specific Glu-tRNA(Gln) and Asp-tRNA(Asn) amidotransferase is involved in decoding glutamine and asparagine codons in Acidithiobacillus ferrooxidans. *FEBS Lett* 2001, 500, 129-131.
- (24) Berry, M. J.; Tujebajeva, R. M.; Copeland, P. R.; Xu, X. M.; Carlson, B. A. et al. Selenocysteine incorporation directed from the 3'UTR: characterization of eukaryotic EFsec and mechanistic implications. *Biofactors* 2001, 14, 17-24.
- (25) Low, S. C.; Grundner-Culemann, E.; Harney, J. W.; Berry, M. J. SECIS-SBP2 interactions dictate selenocysteine incorporation efficiency and selenoprotein hierarchy. *Embo J* 2000, 19, 6882-6890.
- (26) Commans, S.; Bock, A. Selenocysteine inserting tRNAs: an overview. *FEMS Microbiol Rev* 1999, 23, 335-351.
- (27) Mizutani, T.; Kanaya, K.; Ikeda, S.; Fujiwara, T.; Yamada, K. et al. The dual identities of mammalian tRNA(Sec) for SerRS and selenocysteine synthase. *Mol Biol Rep* 1998, 25, 211-216.
- (28) Curnow, A. W.; Hong, K.; Yuan, R.; Kim, S.; Martins, O. et al. Glu-tRNAGln amidotransferase: a novel heterotrimeric enzyme required for correct decoding of glutamine codons during translation. *Proc Natl Acad Sci U S A* 1997, 94, 11819-11826.

- (29) Becker, H. D.; Reinbolt, J.; Kreutzer, R.; Giege, R.; Kern, D. Existence of two distinct aspartyl-tRNA synthetases in *Thermus thermophilus*. Structural and biochemical properties of the two enzymes. *Biochemistry* 1997, 36, 8785-8797.
- (30) Forchhammer, K.; Bock, A. Selenocysteine synthase from *Escherichia coli*. Analysis of the reaction sequence. *J Biol Chem* 1991, 266, 6324-6328.
- (31) Wilcox, M. Gamma-glutamyl phosphate attached to glutamine-specific tRNA. A precursor of glutaminyl-tRNA in *Bacillus subtilis*. *Eur J Biochem* 1969, 11, 405-412.
- (32) Wilcox, M.; Nirenberg, M. Transfer RNA as a cofactor coupling amino acid synthesis with that of protein. *Proc Natl Acad Sci U S A* 1968, 61, 229-236.
- (33) Kovaleski, B. J.; Kennedy, R.; Khorchid, A.; Kleiman, L.; Matsuo, H. et al. Critical role of helix 4 of HIV-1 capsid C-terminal domain in interactions with human Lysyl-tRNA synthetase. *J Biol Chem* 2007.
- (34) Kovaleski, B. J.; Kennedy, R.; Hong, M. K.; Datta, S. A.; Kleiman, L. et al. In vitro characterization of the interaction between HIV-1 Gag and human lysyl-tRNA synthetase. *J Biol Chem* 2006, 281, 19449-19456.
- (35) Rho, S. B.; Lee, K. H.; Kim, J. W.; Shiba, K.; Jo, Y. J. et al. Interaction between human tRNA synthetases involves repeated sequence elements. *Proc Natl Acad Sci U S A* 1996, 93, 10128-10133.
- (36) Rho, S. B.; Kim, M. J.; Lee, J. S.; Seol, W.; Motegi, H. et al. Genetic dissection of protein-protein interactions in multi-tRNA synthetase complex. *Proc Natl Acad Sci U S A* 1999, 96, 4488-4493.
- (37) Park, S. G.; Kim, H. J.; Min, Y. H.; Choi, E. C.; Shin, Y. K. et al. Human lysyl-tRNA synthetase is secreted to trigger proinflammatory response. *Proc Natl Acad Sci U S A* 2005, 102, 6356-6361.
- (38) Rock, F. L.; Mao, W.; Yaremchuk, A.; Tukalo, M.; Crepin, T. et al. An antifungal agent inhibits an aminoacyl-tRNA synthetase by trapping tRNA in the editing site. *Science* 2007, 316, 1759-1761.
- (39) Baker, S. J.; Zhang, Y. K.; Akama, T.; Lau, A.; Zhou, H. et al. Discovery of a new boron-containing antifungal agent, 5-fluoro-1,3-dihydro-1-hydroxy-2,1-benzoxaborole (AN2690), for the potential treatment of onychomycosis. *J Med Chem* 2006, 49, 4447-4450.
- (40) Foundation, N. Nobel Prize in Physiology or Medicine, 2005.
- (41) Tomb, J. F.; White, O.; Kerlavage, A. R.; Clayton, R. A.; Sutton, G. G. et al. The complete genome sequence of the gastric pathogen *Helicobacter pylori*. *Nature* 1997, 388, 539-547.
- (42) Skouloubris, S.; Ribas de Pouplana, L.; De Reuse, H.; Hendrickson, T. L. A noncognate aminoacyl-tRNA synthetase that may resolve a missing link in protein evolution. *Proc Natl Acad Sci U S A* 2003, 100, 11297-11302.



- (43) Salazar, J. C.; Ahel, I.; Orellana, O.; Tumbula-Hansen, D.; Krieger, R. et al. Coevolution of an aminoacyl-tRNA synthetase with its tRNA substrates. *Proc Natl Acad Sci U S A* 2003, 100, 13863-13868.
- (44) Akochy, P. M.; Bernard, D.; Roy, P. H.; Lapointe, J. Direct glutaminyl-tRNA biosynthesis and indirect asparaginyl-tRNA biosynthesis in *Pseudomonas aeruginosa* PAO1. *J Bacteriol* 2004, 186, 767-776.
- (45) Becker, H. D.; Min, B.; Jacobi, C.; Raczniak, G.; Pelaschier, J. et al. The heterotrimeric *Thermus thermophilus* Asp-tRNA(Asn) amidotransferase can also generate Gln-tRNA(Gln). *FEBS Lett* 2000, 476, 140-144.
- (46) Raczniak, G.; Becker, H. D.; Min, B.; Soll, D. A single amidotransferase forms asparaginyl-tRNA and glutaminyl-tRNA in *Chlamydia trachomatis*. *J Biol Chem* 2001, 276, 45862-45867.

Appendix : Cloning primer sequences

Primer	Sequence (5'→ 3')
Pt#001	ggtaaacacttatagagacacctggaggcggtttattgatthaaggg
Pt#002	cccttaatcaat aaaaaccacgcctccaaggctataagtgttacacc
Pt#003	ggcgtggtagaaaaccctaaacGaaaaacggtaaaattgaaatcg
Pt#004	cgatttcaattttacccgttttCgttaggtttctaaccagcgcc
Pt#005	gttaattattgaaaataaaagcGGTACCCaccgattgaaattggcaac
Pt#006	gttgcattcaatcggtggGGTACCGctttatttcaataattaac
Pt#007	CGCggatccATGCGTACAGAATATTG
Pt#008	cggGGTACCGcggttgatg
Pt#009	cgcGGATCCatgagcggttgcc
Pt#010	cggGGTACCatcttcaaccc



Output จากโครงการวิจัยที่ได้รับทุนจาก สกอ.

1. ผลงานตีพิมพ์ในวารสารวิชาการนานาชาติ

Chuawong, P., Likittrakulwong, W., Fuengfuloy, P., Svasti, J., "The Anticodon-Binding Domain Swapping in the Non-discriminating Aspartyl-tRNA Synthetase from *Helicobacter pylori*: The contribution to the tRNA Specificity and Catalytic Activity", *Biochemistry*, Submitted

2. การนำผลงานวิจัยไปใช้ประโยชน์

-เชิงสาธารณะ (มีเครือข่ายความร่วมมือ/สร้างกระแสความสนใจวงกว้าง)

งานวิจัยชิ้นนี้ ได้ก่อให้เกิดความร่วมมือทางวิชาการ กับ The department of chemistry, Wayne State University ประเทศสหรัฐอเมริกา

-เชิงวิชาการ (มีการพัฒนาการเรียนการสอน/สร้างนักวิจัยใหม่)

งานวิจัยชิ้นนี้ เป็นส่วนหนึ่งในการพัฒนาการเรียนการสอนในระดับปริญญาโท และ ปริญญาเอก ของนิสิต จำนวน 2 ท่าน (นายวิโรจน์ ลิขิตธະกุลวงศ์ ระดับปริญญาเอก และ นางสาวพิชญาดา เพื่องฟุล oy ระดับปริญญาโท)

3. อื่นๆ (เช่น ผลงานตีพิมพ์ในวารสารวิชาการในประเทศ การเสนอผลงานในที่ประชุมวิชาการ หนังสือ การจดสิทธิบัตร)

งานวิจัยชิ้นนี้ ได้ถูกนำเสนอ ณ การประชุมประจำปีของนิสิตนักศึกษาผู้ได้รับทุนใน โครงการเครือข่ายเชิงกลยุทธ์ ของสำนักงานการอุดมศึกษาแห่งชาติ (นายวิโรจน์ ลิขิตธະกุล วงศ์)

