American Thyroid Association Grant Recipients: PUBLICATIONS

2003

KNAUF, J. "Tyrosine kinase receptor oncogenes and prostanoid biosynthesis: Role of RET/PTC-induced activation of PGE2 synthase in thyroid tumorigenesis**"**

1. Puxeddu E, Mitsutake N, **Knauf JA**, Moretti S, Kim HW, Seta KA, Brockman D, Myatt L, Millhorn DE, Fagin JA 2003. Microsomal prostaglandin E2 synthase-1 is induced by conditional expression of RET/PTC in thyroid PCCL3 cells through the activation of the MEK-ERK pathway. J Biol Chem **278**:52131-52138.

2. **Knauf JA**, Ouyang B, Croyle M, Kimura E, Fagin JA 2003. Acute expression of RET/PTC induces isozyme-specific activation and subsequent downregulation of PKCepsilon in PCCL3 thyroid cells. Oncogene **22**:6830-6838.

3. **Knauf JA**, Kuroda H, Basu S, Fagin JA 2003. RET/PTC-induced dedifferentiation of thyroid cells is mediated through Y1062 signaling through SHC-RAS-MAP kinase. Oncogene **22**:4406-4412.

4. Wang J, **Knauf JA**, Basu S, Puxeddu E, Kuroda H, Santoro M, Fusco A, Fagin JA 2003. Conditional expression of RET/PTC induces a weak oncogenic drive in thyroid PCCL3 cells and inhibits thyrotropin action at multiple levels. Mol Endocrinol **17**:1425-1436.

JACOBSON, E. "Molecular determinants of the presentation of immunogenic thyroglobulin peptides by HLA-DR3"

New to the thyroid field; no prior thyroid publications

XU, XIULONG* "BRAF gene mutation and oncogenesis of papillary thyroid carcinomas"
* ThyCa award

1. **Xu X**, Quiros RM, Maxhimer JB, Jiang P, Marcinek R, Ain KB, Platt JL, Shen J, Gattuso P, Prinz RA 2003. Inverse correlation between heparan sulfate composition and heparanase-1 gene expression in thyroid papillary carcinomas: a potential role in tumor metastasis. Clin Cancer Res **9**:5968-5979.

2. **Xu X**, Quiros RM, Gattuso P, Ain KB, Prinz RA 2003. High prevalence of BRAF gene mutation in papillary thyroid carcinomas and thyroid tumor cell lines. Cancer Res **63**:4561-4567.

2002

A.C. BIANCO "Type 2 deiodinase-mediated intra-cellular thyrotoxicosis in brown adipocytes is critical for energy homeostasis and adaptive thermogenesis in small mammals"

1. Christoffolete MA, Linardi CC, de Jesus L, Ebina KN, Carvalho SD, Ribeiro MO, Rabelo R, Curcio C, Martins L, Kimura ET, **Bianco AC** 2004. Mice with targeted disruption of the Dio2 gene have cold-induced overexpression of the uncoupling protein 1 gene but fail to increase brown adipose tissue lipogenesis and adaptive thermogenesis. Diabetes **53**:577-584.

2. Nakayama A, **Bianco AC**, Zhang CY, Lowell BB, Frangioni JV 2003. Quantitation of brown adipose tissue perfusion in transgenic mice using near-infrared fluorescence imaging. Mol Imaging **2**:37-49.

2. Baqui M, Botero D, Gereben B, Curcio C, Harney JW, Salvatore D, Sorimachi K, Larsen PR, **Bianco AC** 2003. Human type 3 iodothyronine selenodeiodinase is located in the plasma membrane and undergoes rapid internalization to endosomes. J Biol Chem **278**:1206-1211.

4. Curcio-Morelli C, Zavacki AM, Christofollete M, Gereben B, de Freitas BC, Harney JW, Li Z, Wu G, **Bianco AC** 2003. Deubiquitination of type 2 iodothyronine deiodinase by von Hippel-Lindau protein-interacting deubiquitinating enzymes regulates thyroid hormone activation. J Clin Invest **112**:189-196.

5. Freitas FR, Moriscot AS, Jorgetti V, Soares AG, Passarelli M, Scanlan TS, Brent GA, **Bianco AC**, Gouveia CH 2003. Spared bone mass in rats treated with thyroid hormone receptor TR beta-selective compound GC-1. Am J Physiol Endocrinol Metab **285**:E1135-E1141.

6. Kim BW, Zavacki AM, Curcio-Morelli C, Dentice M, Harney JW, Larsen PR, **Bianco AC** 2003. Endoplasmic reticulum-associated degradation of the human type 2 iodothyronine deiodinase (D2) is mediated via an association between mammalian UBC7 and the carboxyl region of D2. Mol Endocrinol **17**:2603-2612.

KOPP, P. "Targeted overexpression of a dominant negative insulin growth factor I (IGFI) in thyroid cells"

1. Gillam MP, Sidhaye AR, Lee EJ, Rutishauser J, Stephan CW, **Kopp P** 2004. Functional characterization of pendrin in a polarized cell system. Evidence for pendrin-mediated apical iodide efflux. J Biol Chem **279**:13004-13010.

2. **Kopp P** 2002. Perspective: genetic defects in the etiology of congenital hypothyroidism. Endocrinology **143**:2019-2024.

2001

CATUREGLI, P. "Interleukin-12 and autoimmune thyroiditis"

1. **Caturegli P**, Rose NR, Kimura M, Kimura H, Tzou SC 2003. Studies on murine thyroiditis: new insights from organ flow cytometry. Thyroid **13**:419-426.

2. Barin JG, Afanasyeva M, Talor MV, Rose NR, Burek CL, **Caturegli P** 2003. Thyroid-specific expression of IFN-gamma limits experimental autoimmune thyroiditis by suppressing lymphocyte activation in cervical lymph nodes. J Immunol **170**:5523-5529.

3. Bonita RE, Rose NR, Rasooly L, **Caturegli P**, Burek CL 2003. Kinetics of mononuclear cell infiltration and cytokine expression in iodine-induced thyroiditis in the NOD-H2h4 mouse. Exp Mol Pathol **74**:1-12.

4. Bonita RE, Rose NR, Rasooly L, **Caturegli P**, Burek CL 2002. Adhesion molecules as susceptibility factors in spontaneous autoimmune thyroiditis in the NOD-H2h4 mouse. Exp Mol Pathol **73**:155-163.

PHILIBERT R. "Role of thyroid hormone and TRAP230 in dopaminergic cell survival and differentiation"

1. **Philibert RA**, Sandhu HK, Hutton AM, Wang Z, Arndt S, Andreasen NC, Crowe R, Wassink TH 2001. Population-based association analyses of the HOPA12bp polymorphism for schizophrenia and hypothyroidism. Am J Med Genet. **105**:130-134.

American Thyroid Association Grant Recipients: PUBLICATIONS

2000

LIU, Y-Y. (2000) "Thyroid hormone regulation of neural differentiation"

1. **Liu YY**, Schultz JJ, Brent GA 2003. A thyroid hormone receptor alpha gene mutation (P398H) is associated with visceral adiposity and impaired catecholamine-stimulated lipolysis in mice. J Biol Chem **278**:38913-38920.

2. **Liu YY**, Brent GA 2002. A complex deoxyribonucleic acid response element in the rat Ca(2+)/calmodulin-dependent protein kinase IV gene 5'-flanking region mediates thyroid hormone induction and chicken ovalbumin upstream promoter transcription factor 1 repression. Mol Endocrinol **16**:2439-2451.

3. **Liu YY**, Tachiki KH, Brent GA 2002. A targeted thyroid hormone receptor alpha gene dominant-negative mutation (P398H) selectively impairs gene expression in differentiated embryonic stem cells. Endocrinology **143**:2664-2672.

RINGEL, M. "The role of AKT in thyroid tumorigenesis"

1. **Ringel MD** 2004. Molecular detection of thyroid cancer: differentiating "signal" and "noise" in clinical assays. J Clin Endocrinol Metab **89**:29-32.

2. **Ringel MD**, Hayre N, Saito J, Saunier B, Schuppert F, Burch H, Bernet V, Burman KD, Kohn LD, Saji M 2001. Overexpression and overactivation of Akt in thyroid carcinoma. Cancer Res **61**:6105-6111.

3. Ringel MD, Hardy E, Bernet VJ, Burch HB, Schuppert F, Burman KD, Saji M 2002. Metastin receptor is overexpressed in papillary thyroid cancer and activates MAP kinase in thyroid cancer cells. J Clin Endocrinol Metab **87**:2399-

4. Saito J, Kohn AD, Roth RA, Noguchi Y, Tatsumo I, Hirai A, Suzuki K, Kohn LD, Saji M, **Ringel MD** 2001. Regulation of FRTL-5 thyroid cell growth by phosphatidylinositol (OH) 3 kinase-dependent Akt-mediated signaling. Thyroid **11**:339-351.

1999

MARINO, M. "Megalin (gp330) in thyroid physiology and pathology"

1. Lisi S, Chiovato L, Pinchera A, Marcocci C, Menconi F, Morabito E, Altea MA, McCluskey RT, **Marino M** 2003. Impaired thyroglobulin (Tg) secretion by FRTL-5 cells transfected with soluble receptor associated protein (RAP): evidence for a role of RAP in the Tg biosynthetic pathway. J Endocrinol Invest **26**:1105-1110. ? OMIT

2. **Marino M**, Lisi S, Pinchera A, Chiovato L, McCluskey RT 2003. Targeting of thyroglobulin to transcytosis following megalin-mediated endocytosis: evidence for a preferential pH-independent pathway. J Endocrinol Invest **26**:222-229.

3. **Marino M**, McCluskey RT 2000. Role of thyroglobulin endocytic pathways in the control of thyroid hormone release. Am J Physiol Cell Physiol **279**:C1295-C1306.

4. **Marino M**, Chiovato L, Mitsiades N, Latrofa F, Andrews D, Tseleni-Balafouta S, Collins AB, Pinchera A, McCluskey RT 2000. Circulating thyroglobulin transcytosed by thyroid cells in complexed with secretory components of its endocytic receptor megalin. J Clin Endocrinol Metab **85**:3458-3467.

5. **Marino M**, McCluskey RT 2000. Megalin-mediated transcytosis of thyroglobulin by thyroid cells is a calmodulin-dependent process. Thyroid **10**:461-469.

6. **Marino M**, Zheng G, Chiovato L, Pinchera A, Brown D, Andrews D, McCluskey RT 2000. Role of megalin (gp330) in transcytosis of thyroglobulin by thyroid cells. A novel function in the control of thyroid hormone release. J Biol Chem **275**:7125-7137.

ZAVACHI, A.M. "Regulation of thyroid hormone responsive genes by the nuclear receptor RIP 14"

1. Kim BW, **Zavacki AM**, Curcio-Morelli C, Dentice M, Harney JW, Larsen PR, Bianco AC 2003. Endoplasmic reticulum-associated degradation of the human type 2 iodothyronine deiodinase (D2) is mediated via an association between mammalian UBC7 and the carboxyl region of D2. Mol Endocrinol **17**:2603-2612.

2. Curcio-Morelli C, **Zavacki AM**, Christofollete M, Gereben B, de Freitas BC, Harney JW, Li Z, Wu G, Bianco AC 2003. Deubiquitination of type 2 iodothyronine deiodinase by von Hippel-Lindau protein-interacting deubiquitinating enzymes regulates thyroid hormone activation. J Clin Invest **112**:189-196.

3. Curcio-Morelli C, Gereben B, **Zavacki AM**, Kim BW, Huang S, Harney JW, Larsen PR, Bianco AC 2003. In vivo dimerization of types 1, 2, and 3 iodothyronine selenodeiodinases. Endocrinology **144**:937-946.

1998

TOMER, Y. (1998) "Mutational and functional analysis of candidate susceptibility Genes in Graves' disease"

1. Ban Y, Greenberg DA, Concepcion E, Skrabanek L, Villanueva R, **Tomer Y** 2003. Amino acid substitutions in the thyroglobulin gene are associated with susceptibility to human and murine autoimmune thyroid disease. Proc Natl Acad Sci U S A **100**:15119-15124.

2. Ban Y, Davies TF, Greenberg DA, Kissin A, Marder B, Murphy B, Concepcion ES, Villanueva RB, Barbesino G, Ling V, **Tomer Y** 2003. Analysis of the CTLA-4, CD28, and inducible costimulator (ICOS) genes in autoimmune thyroid disease. Genes Immun **4**:586-593.

3. **Tomer Y**, Ban Y, Concepcion E, Barbesino G, Villanueva R, Greenberg DA, Davies TF 2003. Common and unique susceptibility loci in Graves and Hashimoto diseases: results of whole-genome screening in a data set of 102 multiplex families. Am J Hum Genet **73**:736-747.

4. Ban Y, **Tomer Y** 2003. The contribution of immune regulatory and thyroid specific genes to the etiology of Graves' and Hashimoto's diseases. Autoimmunity **36**:367-379.

5. **Tomer Y**, Concepcion E, Greenberg DA 2002. A C/T single-nucleotide polymorphism in the region of the CD40 gene is associated with Graves' disease. Thyroid **12**:1129-1135.

MARIASH, C. "Thyroid hormone deficiency during fetal and early childhood development"

1. Campbell MC, Anderson GW, **Mariash CN** 2003. Human spot 14 glucose and thyroid hormone response: characterization and thyroid hormone response element identification. Endocrinology **144**:5242-5248.

2. Ota Y, **Mariash CN** 2003. Paradoxical triiodothyronine suppression of S14 transcription in permanent hepatic cell lines. Thyroid **13**:437-445.

3. Jones SA, Jolson DM, Cuta KK, **Mariash CN**, Anderson GW 2003. Triiodothyronine is a survival factor for developing oligodendrocytes. Mol Cell Endocrinol **199**:49-60.

4. Zhu XG, Park KS, Kaneshige M, Bhat MK, Zhu Q, **Mariash CN**, McPhie P, Cheng SY 2000. The orphan nuclear receptor Ear-2 is a negative coregulator for thyroid hormone nuclear receptor function. Mol Cell Biol **20**:2604-2618.

5. Liu B, Li W, **Mariash CN**. 1999. Two different gene elements are required for glucose regulation of S14 transcription. Mol Cell Endocrinol. **148**:11-19.

6. Anderson GW, Larson RJ, Oas DR, Sandhofer CR, Schwartz HL, **Mariash CN**, Oppenheimer JH. 1998 Chicken ovalbumin upstream promoter-transcription factor (COUP-TF) modulates expression of the Purkinje cell protein-2 gene. A potential role for COUP-TF in repressing premature thyroid hormone action in the developing brain. 1998 J Biol Chem. **273**:16391-16399.

WOODMANSEE, W. (1998) “Thyroid hormone regulation of mouse somatostatin 5 receptor promoter”

1. Gordon DF, **Woodmansee WW**, Black JN, Dowding JM, Bendrick-Peart J, Wood WM, Ridgway EC 2002. Domains of Pit-1 required for transcriptional synergy with GATA-2 on the TSH beta gene. Mol Cell Endocrinol **196**:53-66.

2. **Woodmansee WW**, Mouser RL, Gordon DF, Dowding JM, Wood WM, Ridgway EC 2002. Mutational analysis of the mouse somatostatin receptor type 5 gene promoter. Endocrinology **143**:2268-2276.

3. Wood WM, Sarapura VD, Dowding JM, **Woodmansee WW**, Haakinson DJ, Gordon DF, Ridgway EC 2002. Early gene expression changes preceding thyroid hormone-induced involution of a thyrotrope tumor. Endocrinology **143**:347-359.

KIM, S.-W. “Exploring the mechanism of thyroid hormone dependent gene regulation”

1. de Jesus LA, Carvalho SD, Ribeiro MO, Schneider M, **Kim SW**, Harney JW, Larsen PR, Bianco AC. 2001. The type 2 iodothyronine deiodinase is essential for adaptive thermogenesis in brown adipose tissue. J Clin Invest. 2001. **108**:1379-1385.

2. Bartha T, **Kim SW**, Salvatore D, Gereben B, Tu HM, Harney JW, Rudas P, Larsen PR. 2000. Characterization of the 5'-flanking and 5'-untranslated regions of the cyclic adenosine 3',5'-monophosphate-responsive human type 2 iodothyronine deiodinase gene. Endocrinology. 2000. 141:229-237.

3. **Kim SW**, Harney JW, Larsen PR 1998. Studies of the hormonal regulation of type 2 5'-iodothyronine deiodinase messenger ribonucleic acid in pituitary tumor cells using semiquantitative reverse transcription-polymerase chain reaction. Endocrinology **139**:4895-4905.

BIESIADA, E. “Molecular mechanisms for thyroid hormone regulation of motor neuronal process growth”

1. Gianino S, Stein SA, Li H, Lu X, **Biesiada E**, Ulas J, Xu XM. 1999. Postnatal growth of corticospinal axons in the spinal cord of developing mice. Brain Res Dev Brain Res **112**:189-204.

1997

BURMEISTER, L. "Thyroid hormone dependent modulation of brain function: A PET Study"

1. **Burmeister LA**, Ganguli M, Dodge HH, Toczek T, DeKosky ST, Nebes RD 2001. Hypothyroidism and cognition: preliminary evidence for a specific defect in memory. Thyroid **11**:1177-1185.

2. Lee E, Chen P, Rao H, Lee J, **Burmeister LA** 1999. Effect of acute high dose dobutamine administration on serum thyrotrophin (TSH). Clin Endocrinol (Oxf) **50**:487-492.

3. Zou L, **Burmeister LA**, Styren SD, Kochanek PM, DeKosky ST 1998. Up-regulation of type 2 iodothyronine deiodinase mRNA in reactive astrocytes following traumatic brain injury in the rat. J Neurochem **71**:887-890.

4. **Burmeister LA**, Pachucki J, St Germain DL 1997. Thyroid hormones inhibit type 2 iodothyronine deiodinase in the rat cerebral cortex by both pre- and posttranslational mechanisms. Endocrinology

KOIBUCHI, N. "Thyroid hormone receptor and RORalpha action on neurotrophin gene expression in the developing cerebellum"

1. Miyazaki W, Iwasaki T, Takeshita A, Kuroda Y, **Koibuchi N** 2004. Polychlorinated biphenyls (PCBs) suppress thyroid hormone (TH) receptor (TR)-mediated transcription through a novel mechanism. J Biol Chem (In press)

2. Vasudevan N, **Koibuchi N**, Chin WW, Pfaff DW 2001. Differential crosstalk between estrogen receptor (ER)alpha and ERbeta and the thyroid hormone receptor isoforms results in flexible regulation of the consensus ERE. Brain Res Mol Brain Res **95**:9-17.

3. Kia HK, Krebs CJ, **Koibuchi N**, Chin WW, Pfaff DW 2001. Co-expression of estrogen and thyroid hormone receptors in individual hypothalamic neurons. J Comp Neurol **437**:286-295.

4. **Koibuchi N**, Yamaoka S, Chin WW 2001. Effect of altered thyroid status on neurotrophin gene expression during postnatal development of the mouse cerebellum. Thyroid **11**:205-210.

5. Martinez dA, **Koibuchi N**, Chin WW 2000. Coactivator and corepressor gene expression in rat cerebellum during postnatal development and the effect of altered thyroid status. Endocrinology **141**:1693-1698.

6. **Koibuchi N**, Fukuda H, Chin WW 1999. Promoter-specific regulation of the brain-derived neurotropic factor gene by thyroid hormone in the developing rat cerebellum. Endocrinology **140**:3955-3961.

7. **Koibuchi N**, Liu Y, Fukuda H, Takeshita A, Yen PM, Chin WW 1999. ROR alpha augments thyroid hormone receptor-mediated transcriptional activation. Endocrinology **140**:1356-1364.

LEE, S.L. (1997) "Novel and multi-disciplinary approach to understanding the physiological regulation by thyroid hormone of the TRH neurones in the paraventricular nucleus of the hypothalamus"

1. Fragner P, **Lee SL**, Aratan dL 2001. Differential regulation of the TRH gene promoter by triiodothyronine and dexamethasone in pancreatic islets. J Endocrinol **170**:91-98.

2. Luo LG, **Lee SL**, Lechan RM, Jackson IM 2001. Effect of preproTRH antisense on thyrotropin-releasing hormone synthesis and viability of cultured rat diencephalic neurons. Endocrine **15**:79-85.

PUYMIRAT, J. "Physiopathology of brain dysfunctions in congenital hypothyroidism"

1. Martel J, Cayrou C, **Puymirat J** 2002. Identification of new thyroid hormone-regulated genes in rat brain neuronal cultures. Neuroreport **13**:1849-1851.

2. Cayrou C, Denver RJ, **Puymirat J** 2002. Suppression of the basic transcription element-binding protein in brain neuronal cultures inhibits thyroid hormone-induced neurite branching. Endocrinology **143**:2242-2249.

3. Baas D, **Puymirat J**, Sarlieve LL 1998. Posttranscriptional regulation of oligodendroglial thyroid hormone (T3) receptor beta 1 by T3. Int J Dev Neurosci **16**:461-467.

4. Nobrega JN, Raymond R, **Puymirat J**, Belej T, Joffe RT 1997. Regional changes in beta1 thyroid hormone receptor immunoreactivity in rat brain after thyroidectomy. Brain Res **761**:161-164.

1996

HAUSER, P. (1996) "A quantitative study of brain structures in subjects with resistance to thyroid hormone"

1. Phillips SA, Rotman-Pikielny P, Lazar J, Ando S, **Hauser P**, Skarulis MC, Brucker-Davis F, Yen PM 2001. Extreme thyroid hormone resistance in a patient with a novel truncated TR mutant. J Clin Endocrinol Metab **86**:5142-5147.

2. **Hauser P**, McMillin JM, Bhatara VS 1998. Resistance to thyroid hormone: implications for neurodevelopmental research on the effects of thyroid hormone disruptors. Toxicol Ind Health **14**:85-101.

3. **Hauser P**, Soler R, Brucker-Davis F, Weintraub BD 1997. Thyroid hormones correlate with symptoms of hyperactivity but not inattention in attention deficit hyperactivity disorder. Psychoneuroendocrinology **22**:107-114.

ROVET, J. (1996) "Early sequel of abnormal intrauterine and postnatal thyroid hormone exposure"

1. Zoeller RT, Bigelow C, **Rovet J** 2004. Lack of a relation between human neonatal thyroxine and pediatric neurobehavioral disorders: neonatal total thyroxine is not a good proxy measure of maternal thyroid hormone insufficiency. Thyroid **14**:239-241.

2. **Rovet** J 2003. Long-term follow-up of children born with sporadic congenital hypothyroidism. Ann Endocrinol (Paris) **64**:58-61.

3. Till C, Koren G, **Rovet JF** 2002. Agreement between prospective and retrospective reports of maternal exposure to chemicals during pregnancy. J Occup Environ Med **44**:708-713.

4. Song SI, Daneman D, **Rovet J** 2001. The influence of etiology and treatment factors on intellectual outcome in congenital hypothyroidism. J Dev Behav Pediatr **22**:376-384.

6. Mirabella G, Feig D, Astzalos E, Perlman K, **Rovet JF** 2000. The effect of abnormal intrauterine thyroid hormone economies on infant cognitive abilities. J Pediatr Endocrinol Metab **13**:191-194.

10. Magee LA, Nulman I, **Rovet JF**, Koren G 1999. Neurodevelopment after in utero amiodarone exposure. Neurotoxicol Teratol **21**:261-265.

PAVLIDES, C. (1996) "Developmental changes in hippocampal physiology and synaptic plasticity: Effects of altered thyroid state during the perinatal period"

1. Yamada K, McEwen BS, **Pavlides C** 2003. Site and time dependent effects of acute stress on hippocampal long-term potentiation in freely behaving rats. Exp Brain Res **152**:52-59.

2. Ribeiro S, Mello CV, Velho T, Gardner TJ, Jarvis ED, **Pavlides C** 2002. Induction of hippocampal long-term potentiation during waking leads to increased extrahippocampal zif-268 expression during ensuing rapid-eye-movement sleep. J Neurosci **22**:10914-10923.

3. **Pavlides C**, Nivon LG, McEwen BS 2002. Effects of chronic stress on hippocampal long-term potentiation. Hippocampus **12**:245-257.

4. Sarnyai Z, Sibille EL, **Pavlides C**, Fenster RJ, McEwen BS, Toth M 2000. Impaired hippocampal-dependent learning and functional abnormalities in the hippocampus in mice lacking serotonin(1A) receptors. Proc Natl Acad Sci U S A **97**:14731-14736.

5. **Pavlides C**, McEwen BS 1999. Effects of mineralocorticoid and glucocorticoid receptors on long-term potentiation in the CA3 hippocampal field. Brain Res **851**:204-214.

6. Jellinck PH, **Pavlides C**, Sakai RR, McEwen BS 1999. 11beta-hydroxysteroid dehydrogenase functions reversibly as an oxidoreductase in the rat hippocampus in vivo. J Steroid Biochem Mol Biol **71**:139-144.

7. Ribeiro S, Goyal V, Mello CV, **Pavlides C** 1999. Brain gene expression during REM sleep depends on prior waking experience. Learn Mem **6**:500-508.