

## *Curriculum Vitae, Iris Lindberg, Ph.D.*

**Date:** September 15, 2022

### **Contact Information:**

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Website: [www.thelindberglab.com](http://www.thelindberglab.com)

### **Education**

June 1975 A.B. Biochemistry University of California at Berkeley, CA

Dec 1980 Ph.D. Pharmacology University of Wisconsin Medical School, Madison, WI

### **Post-Graduate Education and Training**

1981 - 1984 Staff Fellow, NRSA Postdoctoral Fellow,  
and Pharmacology Research Associate Trainee (PRAT program)  
Laboratory of Preclinical Pharmacology,  
NIMH, St. Elizabeth's Hospital, Washington D.C.

### **Employment**

1984 - 1989 Assistant Professor, Dept. of Biochemistry and Molecular Biology  
Louisiana State University Medical School  
New Orleans, LA

1989 - 1994 Associate Professor (tenured), Dept. of Biochemistry and Molecular Biology,  
Louisiana State University Health Sciences Center (name changed)  
New Orleans, LA

1994 - 2007 Professor, Dept. of Biochemistry and Molecular Biology  
Louisiana State University Health Sciences Center  
New Orleans, LA

2006 - 2007 LSUHSC Cancer Center Member

2007 - present Professor, Department of Anatomy and Neurobiology  
University of Maryland School of Medicine  
Baltimore, MD  
*Secondary Appointment:* Department of Biochemistry  
*Member:* Greenebaum Cancer Center

### **Professional Society Memberships**

1978 - present Society for Neuroscience

1982- present Winter Conference on Brain Research

1985 - 2005; 2011-pres. American Society for Biochemistry and Molecular Biology  
 2013- 2014 American Society for Bone and Mineral Research  
 2001 - present The Endocrine Society

### Career Development Awards and Honors

1981 NIH Individual Postdoctoral Fellowship (switched to PRAT)  
 1981-1983 Pharmacology Research Associate Traineeship (PRAT)  
 1988-1993 Research Career Development Award (NIDDK)  
 1993-1998 Research Scientist Development Award (NIDA)  
 1998-2003 Research Scientist Development Award (NIDA)  
 2018 Elected AAAS Fellow (Biological Sciences)

### Administrative Service

#### *Institutional Service (Committees)*

#### *Louisiana State University Health Sciences Center*

1985-2007 LSUHSC Neuroscience Center Executive Steering Committee  
 1986-1988 Biochemistry Dept. Graduate Recruitment Committee  
 1992-1997 LSUHSC Graduate Council  
 1996-2000 LSUHSC Neuroscience Center Faculty Recruitment Committee  
 1997-2002 Neuroscience Center Graduate Program Recruitment Committee  
 2001 LSU School of Medicine Research Retreat Committee  
 2003-2004 Emergency Preparedness Faculty Committee, LSUHSC  
 2003-2005 LSUHSC Research Council  
 2004 Biochemistry Dept. Graduate Recruitment Committee  
 2004-2005 Faculty Search Committee, Biochemistry Department  
 2004-2005 Graduate Advisor, Biochemistry Department  
 2004-2005 LSUHSC Graduate Council  
 2005-2007 Faculty Assembly, LSUHSC

#### *University of Maryland-Baltimore*

2007- 2015 Program in Neuroscience Seminar Committee, University of Maryland  
 2007- 2012 Program in Neuroscience Training Committee, University of Maryland  
 2008-2013 Dept. Anatomy & Neurobiology Faculty Search Committee  
 2008- 2011 Proteomics Core Steering Committee, University of Maryland  
 2009- 2010 Pharmacology Head Search Committee, University of Maryland  
 2009- 2016 Departmental Representative or Alternate, School of Medicine Council  
 2010, 2012 Qualifying Exam Committee, Program in Neuroscience  
 2010- 2014 **Chair**, Program in Neuroscience Retreat Committee  
 2012- 2015 Univ. of Maryland Program in Neurosciences Postdoctoral Training Grant  
 Steering Committee  
 2011 Univ. of Maryland Strategic Plan Subcommittee (Research)  
 2010- 2015 Junior faculty mentoring committees, Drs. Elizabeth Powell; Marta Lipinski  
 2007- present Dept. Anatomy & Neurobiology APT Committee; **Chair, 2010- 2014; Chair,**  
 2021- present

- 2009- present            Biomedical Research Radiation Safety Committee, University of Maryland;  
**Chair, 2016 – present**
- 2009- present            **Organizer**, Departmental “Second Monday” Work-in-Progress seminar series

#### ***Other Institutional Service***

- 1990, 1992, 1995, 1997    LSUHSC Design & production of Biochemistry Dept. recruitment brochure
- 1997-2002                LSUHSC Neuroscience Center brochure production
- 2004- 2006                LSUHSC Grantsmanship presentations to faculty and students
- 2008                        Presentation to UMB graduate students: “How to Succeed in Grad School”
- 2010                        “Getting an RSDA” (Wendy Sanders’ Professional Skills program)
- 2018                        Women in Science and Medicine Chapter Organizer

#### ***Ph.D. Thesis Committees***

##### **Louisiana State University Health Sciences Center:**

Minetta Gardinier, Jeremy Springhorn, Richard Shen, Yi Zhou, John Mathis, Tamim Shaikh, Erik Pakarinen, Joomyeong Kim, Virginia Strand, Astrid Roy, Ping Wei, Mary Breslin, Neva West, Yolanda Fortenberry, Mike Serou, Changning Gong, Bin Tu, Peimin Zhu, Yuri Peterson, Faramarz Taheri, Eleanor Park, and Tanya Roy

##### **University of Maryland-Baltimore:**

Amanda Elson, Zhongping Liu, Akina Hoshino, Adam Clark, Erik Martin, Patricia Cunfer (Young), Alexandra Winters, and Julia Peters (Thayer)

#### ***Other Local Service***

- 1985-86, 1988-89            *Secretary*, Greater New Orleans Society for Neuroscience
- 2005-2006                *President*, Greater New Orleans Society for Neuroscience  
 In 2005-06, my major duty was to organize the distribution of \$100,000 in Katrina relief funds from the national Society for Neuroscience to local neuroscience graduate students.
- 2012- 2013                *President*, Greater Baltimore Society for Neuroscience
- 2014- 2019                *Treasurer*, Greater Baltimore Society for Neuroscience
- 2021                        Centennial High School, MD (gave career talk on success in science)

#### ***National Service***

##### ***Journal Manuscript Review***

- 1990- present            *Ad hoc* reviewer, *J. Biol. Chem.*, *J. Neurochem.*, *Peptides*, *J. Neurosci.*,  
*Analyt. Biochem.*, *FEBS Lett.*, *Protein Eng.*, *Design and Selection*, *Proc. Natl. Acad. Sci.*,  
*Endocrine Rev.*, *Diabetes*, *Molecular Medicine and Metabolism*, *Mol. Cell. Endocrinol.*, *J. Endocrinol.*, *Endocrinol*, *PLoS One*, *Mol. Biol. Cell*, *Eur. J. Cell Biol.*, and many others
- 2000-2005                Editorial Board Member, *Journal of Biological Chemistry*
- 2012-2017                Editorial Board Member, *Journal of Biological Chemistry*

***Gordon Conference Service***

- 1998, 2000      Advisory Committee Member, Gordon Conference:  
*Hormonal and Neural Peptide Synthesis*
- 2002              Vice-Chair, Gordon Conference: *Hormonal and Neural Peptide Synthesis*
- 2004              **Chair, Gordon Conference: *Proprotein Processing, Trafficking, and Secretion***
- 2006-2020      Advisory Committee Member, Gordon Conference: *Proprotein Processing, Trafficking, and Secretion*

***National Society Service***

- 2008-2011      Winter Conference on Brain Research, *Scientific Board*
- 2017-present    Society for Neuroscience travel application AND trainee professional development awards review committees
- 2019              AAAS If/Then Ambassador reviewer

***Grant Reviewer, NIH***

- 1987              Study section reviewer, NLS1
- 1989, 1997      Study section reviewer, NIDA Biochemistry
- 1989, 1990      Special emphasis panel member, NIDDK
- 1991              Study section reviewer, NIMH career awards
- 1994              Special emphasis panel member, NINDS
- 1995              Study section reviewer, NLS1
- 1995, 1996, 1998 Study section and special emphasis panel reviewer, END/NIDDK
- 1996, 1997, 2002 Study section reviewer, NLS1
- 1996-2000      **Standing member, Endocrinology study section**
- 1999              Study section reviewer, ACS
- 2000              NIMH Career Awards study section reviewer
- 2000-2005      Endocrinology study section reviewer ( about 1 panel per year)
- 2007-2010      **Standing member, Molecular and Cellular Endocrinology study section**
- 2010              Special Emphasis Panel reviewer, NIDDK 2/2010
- 2011              EUREKA NIH review panel member 12/2011
- 2013              SBIR study section, 3/2013
- 2015              MCE study section reviewer 6/2015
- 2015              SBIR reviewer 10/2015
- 2016              Special Emphasis Panel 6/2016
- 2018              NIH internal review site visit 5/2018
- 2018              NIDA internal review site visit, 12/2018
- 2020              NIH F05 Fellowship review panel 3/2020
- 2022              R16 SURE award review panel, 11/2022

***International Review Service***

- 2002              Finnish National Academy of Sciences Review Panel, Helsinki, Finland
- 2002-2016      Canada College of Reviewers
- 2003              Chair, Finnish National Academy of Sciences Review Panel
- 2005-present    Various European granting agencies (about one grant per year)

*Teaching Service***LSUHSC**

1985- 1986	Dental Biochemistry (17 lecture h per year) - 85 students
1985-2005	One lecture in "Methods in Neuroscience" - 15 students (course given at Tulane University in alternate years on protein expression methods) (2 h)
1987 -1999	Medical Biochemistry (17 h) -150 students
1991, fall	Graduate seminar in the cell biology of protein targeting (20 h) 8 students
1995 - 2001	Neuroscience Survey (2 h) 8 students
1997	Endocrinology (on radioimmunoassay and opioid peptides) (2 h) 10 students
1998- 2004	Molecular Neuroscience (on neurotransmitters) (4 h) 8 students
2000	Nursing Biochemistry (20 h) 80 students
2001	Graduate Seminar in Protein Motifs (20 h) 7 students
2001, 2002	Special Topics Graduate Seminar in Methods in Biochemistry; (Protein Expression and Purification) (2 h); 8 students
2003, 2006,2007	Endocrinology - Bioactive peptides and radioimmunoassay (4 h and 2h); 12 students
2003-2005	Graduate Seminar- "Professional Skills". Graduate student mentoring: giving talks, preparing grants, manuscripts, career choices (30 h); 12 students
2006	Dental Biochemistry (4 h); 85 students
2006	Molecular Neuroscience - Neuropeptides (4 h) and Grantsmanship (1 h)

**University of Maryland-Baltimore**

2008- 2010	Professional Skills course in Molecular Medicine "How to Write/Review Grants" (1 h) 20 students
2008- present	GPILS Core Course "Posttranslational Modifications" (2 h); 50 students
2009- present	Ethics Class, Discussion Leader (1.5 h) twice a year (small group of 10-15)
2010 -2020	Systems Neuroscience (GPILS 641) "Neuropeptides" (2 h); "Special Topics in Neurodegeneration" in 2020; 10-12 students
2010- 2020	Structure and Development "Thyroid, Parathyroid, and Adrenal" (1 h); 180 students
2015- 2020	Medical Neuroscience "Monoamines" and "Peptide Neuromodulators" (1-2 h); 180 students
2021	Advanced Neuroscience Investigation "Parkinson's Disease" (1 h; student-led; 11 students).

**Students and postdoctoral fellows supervised***Graduate Students supervised (rotation students not listed)*

1. Fu-Sheng Shen (1986- 1988) (Ph.D. 1990, from Institute of Physiology, Beijing)
2. John Mathis (1988- 1994) Ph.D. 1994
3. Yi Zhou (1990- 1994) Ph.D. 1994
4. Yolanda Fortenberry (1997- 2001) Ph.D. 2001
5. Maria Sayah (3/00- 12/00) (Master's thesis; French practical training)

6. Valery Iattignon (1/04- 4/04) (Master's thesis; French practical training)
7. Akina Hoshino (11/07- 4/2012) Ph.D. 2012
8. Alexandra Winters (2013-2016) (co-mentor with Dr. Toni Pollin) Ph.D. 2016

***Postdoctoral Fellows Supervised***

1. Dr. Nympha D'Souza (1987-1988)
2. Dr. Steven Roberts (1988- 1991)
3. Dr. Joseph Irvine (1989- 1991)
4. Dr. Fu-Sheng Shen (1991- 1992)
5. Dr. Osvaldo Vindrola (1991- 1993)
6. Dr. Nazarius Lamango (1994- 1996)
7. Dr. Xiaorong Zhu (1994- 1997) **NRSA Fellowship**
8. Dr. Karla Johanning (1994- 1998)
9. Dr. Laurent Muller (1996- 1999)
10. Dr. Ekaterina Apletalina (1997- 2000)
11. Dr. Jae-Ryoung Hwang (1998- 2001)
12. Dr. Angus Cameron (1999- 2000)
13. Dr. Virginie Laurent (1999-2002)
14. Dr. Ashok Dubey (2000- 2001)
15. Dr. Miroslav Sarac (2000- 2003)
16. Dr. Emmanuel Prodhomme (2001-2002)
17. Dr. Weidong Liu (2001-2002)
18. Dr. Sang-Nam Lee (2002- 2007)
19. Dr. Juan Ramon Peinado (2003-2004)(2013)(2019-2020), **Visiting Assistant/Associate Professor, Ciudad Real University, Spain**
20. Dr. Magdalena Kacprzak (2003- 2005)
21. Dr. Bainan Liu (2004- 2005)
22. Dr. Dorota Kowalska (2005) and (2008-2009)
23. Dr. Wagner Judice (2006- 2007) **NIDA INVEST Fellow**
24. Dr. Jin Liu (2006- 2008)
25. Dr. Akihiko Ozawa (2006- 2011)
26. Dr. Michael Helwig (2009- 2012) **Leopoldina Fellowship**
27. Dr. Mirella Vivoli (2010- 2012)
28. Dr. Indrani Dasgupta (2011-2013)
29. Dr. Laura Sanglas (2011-2012) **Danish Academy Fellowship**
30. Dr. Hiroyuki Yamamoto (2013; **Visiting Assistant Professor, Shizuoka University, Japan**)
31. Dr. Elias Blanco (2013- 2015) **Chilean Government Fellowship 2014-2105**
32. Dr. Yogikala Prabhu (2011; 2013)
33. Dr. Bruno Ramos-Molina (2014- 2015)
34. Dr. Timothy Jarvela (2015-2020) **UMB SOM Diabetes Training Grant Fellow 2016-2019**
35. Dr. Tomas Bachor (2017- 2018)
36. Dr. Manita Shakya (2018-2022)
37. Dr. Kriti Chaplot (2019-2022)
38. Dr. Tripti Joshi (2022-present)

## Grant Support

### Ongoing Research Support

#### **ProSAAS-mediated neuroprotective mechanisms in Alzheimer's and Parkinson's diseases: the role of secretory chaperones in neurodegeneration**

R01 AG062222-04 I. Lindberg and N. Maidment, Co-PIs (33% effort) 12/01/18 - 11/30/23  
NIH/NIA

This grant is to investigate the ability of the neural secretory chaperone proSAAS to influence the deposition of amyloid into plaques, and synuclein into Lewy bodies, and the functional sequelae.

A supplement was awarded in November 2020 to study a possible role for cyto-proSAAS in encapsulating TDP-43 in frontotemporal dementia.

#### **Opioid Peptide Synthesizing Enzymes**

6/01/17 - 5/30/22 (NCE to 5/2023)

R01 DA042351-06 I. Lindberg (PI) (32% effort)  
NIH/NIDA

This grant is to investigate the role of human *PCSK1* mutations and polymorphisms in peptide-mediated hypothalamic obesity mechanisms.

### **Completed Research Support (Competing NIH applications and other grants; these and current NIH grants total over \$18.5 million as of 3/2021 according to NIH Reporter)**

1/85 - 12/86	I. Lindberg, PI "Pharmacologic control of opioid peptide biosynthesis." Pharmaceutical Manufacturer's Association Starter Grant
4/85 - 11/88	I. Lindberg, PI (30% effort) "Biosynthesis of enkephalin in the adrenal medulla." R01 DK35199-01
4/88 - 3/91	I. Lindberg, PI (30% effort) "Opioid peptide-synthesizing enzymes" R01 DA05084-01
7/88 - 6/93	I. Lindberg, PI (90% salary) Research Career Development Award K04 DK 01868 (salary award)
12/88 - 11/91	I. Lindberg, PI (30% effort) "Biosynthesis of enkephalin in the adrenal medulla." R01 DK35199-04
4/91 - 3/94	I. Lindberg, PI (30% effort) "Opioid peptide-synthesizing enzymes" R01 DA 05084-04
10/93- 9/98	I. Lindberg, PI (75% salary) Research Scientist Development Award K02 DA00204-01 (salary award)
4/94 - 3/99	I. Lindberg, PI (30% effort) "Opioid peptide-synthesizing enzymes" R01 DA 05084-07
7/96- 3/02	I. Lindberg, PI (30% effort) "Control of peptide hormone biosynthesis by PC2 and 7B2"

R01 DK49703-01

10/98- 9/03 I. Lindberg, PI (75%)  
Research Scientist Development Award  
K02 DA 00204-06 (salary award renewal)

4/99- 3/04 I. Lindberg, PI (30% effort)  
"Opioid peptide-synthesizing enzymes"  
R01 DA005084-12

4/02- 3/07 I. Lindberg, PI (30% effort)  
"Control of peptide hormone biosynthesis by PC2 and 7B2"  
R01 DK49703-06

2004 I. Lindberg, PI Gordon Conference support grant  
"Proprotein processing, trafficking and secretion"  
5R13 DK061936

2004 I. Lindberg, PI NSF Conference Support: received \$2,000 for a poster award  
program for the same Gordon Conference cited above

4/04-3/09 I. Lindberg, PI (30% effort)  
"Opioid peptide-synthesizing enzymes"  
R01 DA005084-17

9/02-8/05 I. Lindberg, PI (20% effort)  
"Blockade of anthrax toxin cytotoxicity using furin inhibitors"  
R21 AI053517-01

8/03-8/06 P. Sunkara, PI (5% effort)  
"Hexa-D-Arg: a furin inhibitor for anthrax biodefense"  
Subcontract, Molecular Therapeutics  
SBIR R43 AI 056850

9/04-3/06 S. Pincus, PI (5% effort)  
"Furin Inhibition in HIV Disease"  
R21 AI058714-01

3/06-6/06 I. Lindberg, PI (10% effort)  
"Furin as an Anti-Cancer Target"  
Louisiana Cancer Research Consortium

6/09- 5/11 I. Lindberg, PI (20% effort)  
"Identification of Novel Peptide Hormones"  
R21 DK084481-01

9/09- 3/14 I. Lindberg (P.I.) (30% effort)  
"Control of peptide hormone biosynthesis by PC2 and 7B2"  
R01 DK49703-12

7/09-6/14 I. Lindberg and B. Roth (co-P.I.s) (30% effort)  
"De-orphanizing the peptidome"  
R01 DA027170-01

4/09-3/14 I. Lindberg, PI (30% effort)  
"Opioid peptide-synthesizing enzymes"



	R01 DA005084-22
4/15-6/17	I. Lindberg (P.I) (20% effort) (bridge support) "Opioid Peptide Synthesizing Enzymes" R56 DA005084-28A1
9/14-4/18	I. Lindberg (P.I.) (20% effort) "The Secretary Chaperone 7B2 as an Endogenous Regulator of Amyloid Pathology" R21 AG045741-02

**ARRA Supplement** received in 2010 for purchase of AKTA FPLC (\$70,000)

Also contributed sections to several **COBREs** and **equipment grants** awarded to LSUHSC faculty; and contributed to various **ARRA Equipment Supplement** and many **Multi-User Equipment** applications at the University of Maryland), most recently (2021) a scanning electron microscope.

#### *Research Support as Mentor*

07/95-06/98	Mentor to Dr. Xiaorong Zhu, NRSA postdoctoral fellowship
10/97-08/00	Mentor to Ms. Yolanda Fortenberry, NRSA predoctoral fellowship
12/06-12/07	Mentor to Dr. Wagner Judice, NIDA INVEST fellowship
08/10-08/12	Mentor to Dr. Michael Helwig, Leopoldina fellowship
06/11-06/12	Co-mentor to Dr. Laura Sanglas, Danish Academy fellowship
05/16-04/19	Mentor to Dr. Timothy Jarvela, UMSOM Diabetes and Obesity Training Grant

#### **Patents**

1. Patent # 6,548,736 on the 7B2 null mouse as a model for pituitary Cushing's was granted in 1999 to C.H. Westphal, **I. Lindberg**, and P. Leder.
2. Patent # 7,033,991 on polyarginine furin inhibitors in inhibiting bacterial disease and cancer was granted on April 25, 2006 to **I. Lindberg**, A. Cameron, J. Appel, and R.A. Houghten.

#### **Publications**

##### *Peer-Reviewed Journals*

1. **Lindberg, I.**, Smythe, S., and Dahl, J.L. (1979) Distribution of enkephalin in bovine brain. *Brain Research*, 168, 200-203.
2. **Lindberg, I.**, and Dahl, J.L. (1981) Characterization of enkephalin release from rat striatum. *J. Neurochem.* 36, 506-512.
3. Epstein, M., **Lindberg, I.**, and Dahl, J.L. (1981) Development of enkephalinergic neurons in the gut of the chick. *Peptides* 2, 271-276.
4. **Lindberg, I.**, Yang, H.-Y.T., and Costa, E. (1982) An enkephalin-generating enzyme in bovine adrenal medulla. *Biochem. Biophys. Res. Commun.* 106, 186-1934.
5. Dahl, J.L., Epstein, M.L., Silva, B.W., and **Lindberg, I.** (1982) Multiple forms of met<sup>5</sup>- and leu<sup>5</sup>-enkephalin in fetal and neonatal rat brain and gut. *Life Sci.* 31, 1853-1856.
6. **Lindberg, I.**, Yang, H.-Y.T., and Costa, E. (1982) Characterization of a partially purified trypsin-like enkephalin-generating enzyme in bovine adrenal medulla. *Life Sci.* 31, 1713-1716.

7. **Lindberg, I.**, Yang, H.Y., Costa, E.(1982) Enzymatic production of Met<sup>5</sup>- and Leu<sup>5</sup>-enkephalin in adrenal chromaffin granules. *Adv Biochem Psychopharmacol.* 1982;33:183-91.
8. **Lindberg, I.**, Yang, H.-Y.T., and Costa, E. (1983) A high molecular weight form of met<sup>5</sup>-enk-arg<sup>6</sup>-gly<sup>7</sup>-leu<sup>8</sup> in rat brain and bovine adrenal chromaffin granules. *Life Sciences* 33 Supp. I., 5-8.
9. **Lindberg, I.**, and Yang, H.-Y.T. (1984) Distribution of met<sup>5</sup>-enk-arg<sup>6</sup>-gly<sup>7</sup>-leu<sup>8</sup>-immunoreactive peptides in rat brain: presence of multiple immunoreactive forms. *Brain Research* 299, 73-78.
10. **Lindberg, I.**, Yang, H.-Y.T., and Costa, E. (1984) Further characterization of an enkephalin-generating enzyme from bovine adrenal chromaffin granules. *J. Neurochem.* 42, 1411-1419.
11. **Lindberg, I.**, Yang, H.-Y.T., and Costa, E. (1985) Release of multiple immunoreactive forms of met<sup>5</sup>-enk-arg<sup>6</sup>-gly<sup>7</sup>-leu<sup>8</sup> from rat brain. *Neuropeptides* 5, 541-544.
12. **Lindberg, I.**, and White, L. (1986) Reptilian enkephalins: implications for the evolution of proenkephalin. *Arch. Biochem. Biophys.* 245, 1-7.
13. Wang, Y.N. and **Lindberg, I.** (1986) Distribution and characterization of met-enk-arg-gly-leu in the gastrointestinal tract of the rat. *Cell and Tissue Res.* 244, 77- 85.
14. **Lindberg, I.**, and White, L. (1986) Distribution of immunoreactive Peptide B in the rat brain. *Biochem. Biophys. Res. Commun.* 139, 1024-1032.
15. **Lindberg, I.** (1986) Reserpine-induced alterations in the processing of proenkephalin in cultured chromaffin cells: increased amidation. *J. Biol. Chem.* 261, 16317- 16323.
16. Panula, P., and **Lindberg, I.** (1987) Pituitary enkephalins: biochemical and immunohistochemical observations. *Endocrinology* 121, 48-58.
17. Byrd, J., Naranjo, J., and **Lindberg, I.** (1987) Proenkephalin gene expression in the PC12 cell line: stimulation by sodium butyrate. *Endocrinology* 121, 1299-1305.
18. D'Souza, N. and **Lindberg, I.** (1988) Evidence for the phosphorylation of a proenkephalin-derived peptide, Peptide B. *J. Biol. Chem.* 263, 2548-2552.
19. Shen, F.S. and **Lindberg, I.** (1988) Characterization of enkephalin-immunoreactive peptides generated from plasma proteins by peptic digestion. *Endocrinology* 122, 2905-2910.
20. Shen, F-S., and **Lindberg, I.** (1989) Purification and assay of opioid activity of low molecular weight enkephalin-immunoreactive peptides generated by peptic digestion of rat plasma proteins. *Neuropeptides* 13, 23-28.
21. Shen, F.-S., Roberts, S.F., and **Lindberg, I.** (1989) A putative processing enzyme for proenkephalin in bovine adrenal chromaffin granules- purification and characterization. *J. Biol. Chem.* 264, 15600-15605 (1989).
22. **Lindberg, I.**, and Thomas, G. (1990) Cleavage of proenkephalin by a chromaffin granule processing enzyme. *Endocrinology* 126, 480-487.
23. Irvine, J., Roberts, S.F., and **Lindberg, I.** (1990) Electrophoretic analysis of proteinases in sodium dodecyl sulfate polyacrylamide gels containing copolymerized radiolabelled protein substrates: application to proenkephalin processing enzymes. *Analyt. Biochem.* 190, 141-146.
24. **Lindberg, I.**, Shaw, E., Finley J., Leone, D., and Deininger, P. (1991) Posttranslational modifications of recombinant rat proenkephalin overexpressed in Chinese hamster ovary cells. *Endocrinology* 128, 1849-1856.
25. Irvine, J.W., and **Lindberg, I.** (1991) Partial purification and characterization of a putative prohormone processing enzyme complex from bovine pituitary. *Endocrinology*, 128, 2345- 2352.
26. **Lindberg, I.**, and Shaw, E. (1992) Posttranslational processing of proenkephalin in a human neuroblastoma cell line, SK-N-MC. *J. Neurochem.* 58, 458-453.

27. Roberts, S.F., Irvine, J.W., and **Lindberg, I.** (1992) Proteolytic activity in bovine adrenal chromaffin granules visualized using [<sup>35</sup>S]methionine-labelled proenkephalin copolymerized into SDS-PAGE. *J. Neurochem.* 58, 593-599.
28. **Lindberg, I.**, Lincoln, B., and Rhodes, C.J. (1992) Fluorometric assay of a calcium-dependent, paired basic processing endopeptidase present in insulinoma granules. *Biochem. Biophys. Res. Commun.* 183, 1-7.
29. Vindrola, O., and **Lindberg, I.** (1992) Biosynthesis of the prohormone convertase mPC1 in AtT-20 cells. *Mol. Endocrinol.* 6, 1088-1094.
30. Mathis, J., and **Lindberg, I.** (1992) Posttranslational processing of proenkephalin in AtT-20 cells: evidence for cleavage at a Lys-Lys site. *Endocrinology* 131, 2287-2296.
31. Zhou, Y., and **Lindberg, I.** (1993) Purification and characterization of the prohormone convertase PC1 (PC3) *J. Biol. Chem.* 268, 5615- 5623.
32. Shen, F.S., Seidah, N.G., and **Lindberg, I.** (1993) Biosynthesis of the prohormone convertase PC2 in Chinese hamster ovary cells and in rat insulinoma cells. *J. Biol. Chem.* 268, 24910-24915.
33. Breslin, M., **Lindberg, I.**, Benjannet, S., Lazure, C., Mathis, J.P., and Seidah, N.G. (1993) Processing of proenkephalin by PC1(PC3), PC2, and furin. *J. Biol. Chem.* 268, 27084-27093.
34. Vindrola, O., and **Lindberg, I.** (1993) Release of the prohormone convertase PC1 from AtT-20 cells. *Neuropeptides* 25, 151-160.
35. Hornby, P.J., Rosenthal, S.D., Mathis, J.P., Vindrola, O., and **Lindberg, I.** (1993) Immunocytochemical analysis of the neuropeptide-synthesizing enzyme PC1 in AtT-20 cells. *Neuroendocrinol.* 58, 555-563.
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