CURRICULUM VITAE

May 20, 2015

Mercy P. Mascreen Davidson, Ph.D.
70 Haven Ave, #3G,
New York, NY 10032
Birthplace: Madras, India
Citizenship: USA

Academic appointments:

May 2010 to present: Senior Research Scientist, Department of Radiation Oncology, Columbia University Medical Center, New York.

July 2005 to June 2009: Senior Research Scientist, Department of Neurology, Columbia University Medical Center, New York.

July 1997 to June 2005: Research Scientist, Department of Neurology, Columbia University Medical Center, New York.

Jan 1985 to June 1997: Associate Research Scientist, Department of Neurology, Columbia University Medical Center, New York.

May 1981 to December 1984: Postdoctoral Research Scientist, Department of Neurology, Columbia University Medical Center, New York.

July 1977 to April 1981: Lecturer in Neurochemistry, National Institute of Mental Health & Neurosciences, Bangalore, India.

Education

July 1974 to June 1979: Ph.D. - Biochemistry.
Madras Medical College, Madras, India.

July 1968 to June 1970: M.Sc. - Biochemistry
University of Madras, India.

July 1965 to June 1968: B.Sc. - Chemistry
Queen Mary's College, Madras, India.

Postdoctoral Training

May 1981 to December 1984: Postdoctoral Research Scientist, Department of Pediatrics/Neurology, Columbia University Medical Center, New York.

Honors and Awards:

1968: B.Sc. Chemistry graduated with Honors.
1970: M.Sc. Biochemistry graduated with Honors.
1972: Indian Council of Medical Research (ICMR) Merit Scholarship.
1974: University Grants Commission (UGC) Merit Scholarship.
1981: Muscular Dystrophy Association, USA, Jerry Lewis Postdoctoral Fellowship.

Invited Lectureships: *past three years only*

2014: 4th Annual Conference of the Society for Mitochondrial Research and Medicine (SMRM): CSIR-Indian Institute of Chemical Biology, Kolkata
"Mitochondria mediate genomic instability by cytoplasmic irradiation".

2013: 3rd Annual Conference of the SMRM, National Institute of Mental Health and Neurosciences, Bangalore, India
"Targeting the BBB in MELAS".
Chair of session on "Mitochondria and Aging"

2012: 1st Indo-US Workshop on Mitochondrial Research and Medicine, Center for Cellular and Molecular Biology, Hyderabad India
"The integrity of the BBB is compromised in MELAS".
Chair of session on "Cell Biology, Cancer and Apoptosis".

2011: Visiting Professor, Soochow University, Suzhou, China
i. Mitochondria in health and Disease.
ii. Cell culture models in the study of mitochondrial diseases.
iii. Mitochondria and environmental toxins

Academic service:

- **University Committees:**

2003 to 2015 Columbia University Senator- Elected six terms: Research Officers Constituency 2003 to 2015 University Senate Committee for Research Officers
2004 to 2005 University Senate Committee for Online learning
2005 to 2015 Commission for the Status of Women, 2009 Co-chair

- **Ad-hoc committees:** Salary Equity Study of Research Officers
  - Committee for Effort reporting
  - Subcommittee on Conflict of Interest
  - Sexual Harassment Hearing Panel
  - Consensual Relationship policy

Professional Organizations/Societies:

Memberships: American Society for Cell Biology
American Society for Human Genetics
American Heart Association
American Medical Writers Association

Journal Reviewer: American J. of Human Genetics, American J. of Pathology, Genetics, BBA, Biochemical and Biophysical Research Communication, PLOSOne, J. Neurological Sciences, Internal Medicine J., Mitochondrion, Muscle and Nerve, Cellular and Molecular Biology, Human Molecular Genetics, Advances in Space Research, Human Mutation, Neurobiology of Disease, Laboratory Investigations.

Grant Applications Reviewer:

Ad hoc study section reviewer for NIEHS, Research Triangle NC.
Muscular Dystrophy Association, USA. Telethon, Italy
Department of Environmental Health Sciences, CUMC, Internal grant reviewer.

Fellowship and grant support:

FUNDING AGENCY/ NUMBER	PERIOD	ROLE ON GRANT	DIRECT SUPPORT FUNDS	TITLE
CURRENT SUPPORT				
5RO1-ES 012888 -06 NIEHS/NIH	04-01-2012 to 03-31-2017	Co-Investigator PI:Tom Hei, Ph.D.	$33,450 current year	Cytoplasmic Damage and Genotoxicity.
Major goals: 1) To characterize the induction of genomic instability in human small airway epithelial cells by targeted cytoplasmic irradiation with a defined number of alpha particles. 2) To characterize the induction of mitochondrial damage by cytoplasmic irradiation and its role in modulating the biological response including bystander effects and genomic instability. 3) To determine the signaling pathway induced by cytoplasmic irradiation resulting in the biological response				
PENDING SUPPORT				
R21-A1 NINDS/NIH	09-01-2015 to 08-31-2017	PI	Requested $275,000/ 2yr	Vascular pathology in MELAS
Major goals: To test the hypothesis that altered myogenic tone leading to impairment in autoregulation in the cerebral arterioles is the pathogenic cause for recurrent strokelike episodes in MELAS using a in vitro dynamic flow model of the BBB.				
RO1-A1 NCI	09-01-2015 to 08-31-2020	PI	Requested $1,750,000/ 5yr	Mechanism of arsenic induced neurotoxicity
Major goals: To study the contribution of arsenic induced oxidative stress signaling at the BBB and its neuronal components in modulating arsenic induced neurotoxicity.				

PAST SUPPORT

PO1HD03262/ 19 NICHD/NIH	05-01-20 10 to 02-28- 2015	PI, Project #3 Director: Salvatore DiMauro, MD	$1,000,000/5 yr	Pathogenic Mechanisms and Therapeutic Strategies in MELAS.
Major goals: 1) Study the integrity of the BBB in MELAS using in vitro models of the normal and MELAS BBB by analysis of TEER, paracellular permeability and junctional proteins. 2) Validate cell culture data with human brain tissue. 3) Investigate the mechanism of BBB disruption in MELAS.				
PO1 HD03262-10 NICHD/NIH	12-01-2004 to 11-30- 2009	PI, Project #3 ector: Director: Salvatore DiMauro, MD	$829,200/5 yr	Pathogenic Mechanisms and Therapeutic Strategies in cellular models with mtDNA mutations.
Major goals: 1) To generate cell culture model of MELAS endothelial cells and astrocytes. 2) To construct an i vitro normal and MELAS BBB. 3) Study the integrity of the BBB in MELAS using in vitro models of the norm and MELAS BBB.				
PO1 HD03262-5 NICHD/NIH	02-15-99 to11-30-04	PI, Project #5 Director: Salvatore DiMauro, MD	$565,760/5 yr	Pathogenesis of MERRF and MELAS in transmitochondrial muscle cultures.
Major goals: To study intermitochondrial interaction between two different populations of mtDNA, one containing the MELAS mutation and the other containing the MERRF mutation in postmitotic muscle cultures to determine if genetic complementation can restore normal respiratory chain function.				
AHA Grant-in Aid Ref: 9951061	07-01-99 to 06-30-02	PI	$180,000/3 yr	Analysis of pathogenic mtDNA mutations in human cardiomyopathies
Major goals: 1) Morphological, biochemical, molecular and immunochemical analysis of a human cardiomyocyte harboring two mitochondrial cardiomyopathy specific mutations, A4300G and A1555G mutations. 2) Study nuclear mitochondrial interaction of these two mutations using transnuclear fibroblast cultures.				
P42 ES10349-10 NIEHS/NIH	4-01-2006 to 03-31-201 1	Co-Investigat or Director: Joseph Graziano, Ph.D. Subproject PI: Tom Hei Ph.D.	$61,500/5 yr	Genotoxic mechanism od arsenic in mammalian cells.
Major goals: The overall goal of this project is to examine the role of mitochondria damage in mediating the in vitro genotoxicity of arsenic in mammalian cells.				

NS11766 NINDS/NIH Center Grant	02-1-2002 to 11-30-200 7	Co-Investigat or Director: Salvatore DiMauro MD Subproject PI:	$254,000/5 yr	Nuclear gene involvement in cytochrome *c* oxidase deficiency.

		Eric Schon Ph.D		
Major goals: The aim of this project was to identify nuclear gene mutations that cause cytochrome *c* oxidase deficiency by complementation of COX deficiency with rodent-human monochromosomal hybrids followed by exclusion mapping and candidate gene approaches.				
RO1 ES05786-14 NIEHS/NIH	05-01-2002 to 06-31-2007	Co-Investigator PI:Tom Hei Ph.D.	$51,500/5 yr	Mutagenicity of mineral fibers
Major goals: The overall goals of the proposed study are to examine the mechanism(s) of fiber mutagenesis. a) determine if nucleus is the direct and immediate target in asbestos induced mutagenesis in mammalian cells. b). to ascertain the functional role of mitochondria in fiber mutagenesis. c). the role of lipid peroxidation and peroxynitrite anions in fiber mutagenesis.				
P42 ES10349 NIEHS/EPA	06-01-2000 to 03-31-2005	Co-Investigator Director: Joseph Graziano, Ph.D. Subproject PI: Tom Hei Ph.D.	$77,250/5 yr	Genotoxic mechanism of Arsenic in mammalian cells.
Major goals: The overall goal of this project is to examine the role of genotoxic mechanism of arsenic in mammalian cells.				
NHLBI/NIH	12-01-1996 to 11-30-2001	Co-Investigator PI:Michio Hirano MD	$75,000/5 yr	Mitochondrial DNA mutations in human cardiomyopathies.
Major goals: 1) To study cardiomyopoathy specific mtDNA mutations and analyze the pathogenesis of these mutations in cybrids harboring the specific mtDNA mutation. 2) To analyze the molecular defect in Autosomal Recessive Cardiomyopathy Ophthalmoplegia syndrome associated with multiple mtDNA deletions.				
PO1 HD03262-10 NICHD/NIH	2-1-95 to 11-30-99	Principal Investigator/ Project #3	$750,000/5 yr	Studies of MERRF and MELAS in nerve-muscle coculture.
Major goals: To study mtDNA point mutations associated with MELAS and MERRF in myoblasts and differentiated myotubes using innervated muscle cultures to understand the pathogenesis of the clinical symptoms of the two maternally inherited diseases.				
MDA	01-01-94 to 12-31-96	PI	$390,000/5 yr	Kearne-Sayre Syndrome: Studies in Innervated muscle culture.
Major goals: To analyze the pathogenesis of mtDNA deletions associated with KSS in innervated muscle cultures.				

MDA Postdoctoral Fellowship	05-15-19 81 to 04-30-1983	Postdoctoral Fellow PI: Shobhana Vora MD	$60,000/3 yr	Studies of human muscle phosphofructokinase.
Major goals: 1) to elucidate the molecular basis of muscle PFK deficiency using muscle cultures. 2) analyze ontogenic development of PFK isozymes in vivo and in muscle cultures. 3) Biochemical and immunochemical characterization of fetal muscle PFK .4) To study subunit structures of heart, brain and muscle PFK.				

Educational Contributions:

- **Teaching:**

  Radiation Oncology residents training program:
  Radiobiology lecture series: Fall and Spring sessions
  "Cancer biology and oxidative metabolism"- Fall 2013 and Spring 2014

- **Coursework Lectures:** D.M. (Neurology), and D.P.M. (Psychiatry) Class, National Institute of Mental Health & Neurosciences, Bangalore, India. 1977 to 1981.
  i. Biochemistry of Neurological Disorders.
  ii. Biochemistry of Neuromuscular Diseases.

- **Mentored Independent Research Senior Thesis:**
- Department of Biological Sciences, Columbia University, New York.
  The effect of dichloroacetate on lactate levels in cybrids harboring a mitochondrial DNA mutation associated with myoclonic epilepsy with ragged red fibers (MERRF). Angela Richardson, Fall 2001.

- Department of Biological Sciences, Columbia University, New York.
  Identification of the nuclear gene mutation that causes cytochrome c oxidase deficiency. Susie Ko, Fall 2008.

- Department of Biochemistry, Columbia University, New York.
  Nuclear-mitochondrial genome interaction causing mitochondrial cardiomyopathy. Stefan Vutescu, Fall 2008.

- **Advising /Supervising and Mentorship**

  Doctoral students
  Sarah Huang 2007-CUMC
  Ying Ying Tang 2001- CUMC
  Judy Masucci 1995- CUMC
  Claudia Sobreira 1990 University of Sao Paolo, Brazil

- **Postdoctoral fellows:**
  Uli Walker, MD, Freiburg, Germany, 1993-1995
  Studies of mtDNA complementation of the MELAS and MERRF point mutations in post-mitotic cells

  Claudia Sobreira, MD, Sao Paolo, Brazil, 1993-1996
  Studies of mtDNA complementation of non-overlapping deletions in post-mitotic cells.

Carla Giordano, MD, Rome, Italy, 1998-2001
Cybrid analysis of the A1555T and the A4300G mutation.

Claudia Nesti, Ph. D., Pisa, Italy, 2002-2004
Studies of the A4300G mtDNA mutation using human cardiomyocyte cell lines.

Leonardo Salviati, MD, Padua, Italy. 2001-2003
Copper supplementation in myoblasts from patients with the SCO2 mutation.
Pathogenesis of a functionally dominant mtDNA mutation.

Sabrina Sacconi, MD, Milan, Italy. 2001- 2003
Analysis of a novel dominant mtDNA mutation G5545A in fibroblasts and cybrids.

Michael Partridge, Ph.D, Sydney, Australia. 2007-2009
Arsenic induces mitochondrial DNA damage and dysfunction in mammalian cells.

Bo Zhang, Ph.D., Bejing, China 2011 - 2013
Alpha particle irradiation causes mitochondrial fusion-fission changes in SAE cells.

Xuezhong Gong, MD., Shanghai, China 2012-2013
Tetramethylpyrazine (TMP) protects against sodium arsenite-induced nephrotoxicity

Research highlights:

1. Cybrid technology
Created cybrid cell lines with a wide range of mtDNA mutations in a neutral nuclear background to study pathogenesis.

2. ρ^0 *cell lines*
Successfully established mtDNA-less cell lines from human, hamster and mouse fibroblasts, human cardiomyocytes, human small airway epithelial cells, using DNA intercalating drug ditercalinium (Clark et al 2002).

3. Human ventricular cardiomyocyte cell line
Generated a unique proliferating human ventricular cardiomyocyte cell line by a novel mitochondrial function-based approach, which can be used generically to virtually transform all postmitotic cells and force them to reenter the cell cycle. Both the technique of immortalization and the cardiomyocyte cell line are covered under a United States Patent #7223599.

4. Nuclear swap technology
Developed the nuclear swap technique to generate transnuclear fibroblasts. By this technique, it is possible to generate reconstituted cells containing various combinations of virtually any nuclear and cytoplasmic background. These models are used to test the nuclear contribution in patients with homoplasmic mtDNA mutations associated with expression of tissue-specific phenotypes (Giordano et al 2002, Davidson et al 2009a).

5. A4300G mtDNA mutation

Established proliferating cardiomyocyte cultures harboring a cardiomyopathy-specific mtDNA mutation, A4300G. Data reveal that a homoplasmic mtDNA mutation acts synergistically with a nuclear modifier to cause mitochondrial cardiomyopathy (Davidson et al 2009b).

6. In vitro model of the blood-brain barrier

Developed an *in vitro* co-culture model of the normal blood brain barrier comprised of brain capillary endothelial cells on one side and astrocytes and neuronal cells on the other side of the membrane. Also developed a unique model of the MELAS BBB by repopulating astrocytes and endothelial cells with the m.3243A>G mtDNA mutation associated with MELAS. Using this model we determined that the permeability alterations in the BBB in MELAS cause stroke-like episodes and vasogenic edema (Davidson et al 2009a). This model is currently used to study potential therapy for MELAS using BBB stabilizers and evaluate BBB protection on molecular target levels of MELAS phenotypic biomarkers.

7. Intermitochondrial complementation

Demonstrated for the first time that mitochondria can interact resulting in functional complementation of non-overlapping deletions and point mutations in both proliferating cells as well as in postmitotic muscle. These data contribute to our understanding of mtDNA interactions and have implications in therapeutic intervention of mitochondrial diseases (Gilkerson et al 2008).

Patents & Inventions:

Immortalization of human postmitotic cells: Novel proliferating human ventricular cardiomyocyte cell lines. Sole inventor.
United States Patent #7223599

Publications:

A: Original peer-reviewed research papers (selected from more than110)

1. Winsome F. Walker, Kurenai Tanji, Huabin Huang and **Mercy M. Davidson**, Molecular analysis of BBB disruption in MELAS. (2015) *submitted.*

2. Xuezhong Gong, Vladimir N. Ivanov, **Mercy Davidson** and Tom K. Hei. Tetramethylpyrazine (TMP) protects against sodium arsenite-induced nephrotoxicity by suppressing programmed cell death, ROS production, mitochondrial dysfunction and pro-inflammatory signal pathways. (2014) Arch. Toxicol. June 25 [Epub ahead of print]

3. Bo Zhang, **Mercy M. Davidson**, and Tom K. Hei. Mitochondria regulate DNA damage and genomic instability induced by high LET radiation. (2014). Life Sciences in Space Research : 1: 80-88.

4. Palomer X, Capdevila-Busquets E, Botteri G, Salvadó L, Barroso E, **Davidson MM**, Michalik L, Wahli W, Vazquez-Carrera M. PPARβ/δ attenuates palmitate-induced endoplasmic reticulum stress and induces autophagic markers in human cardiac cells. (2014). Int. J. Cardiol. 174: 110-118.

5. Palomer X, Capdevila-Busquets E, Garreta G, **Davidson MM**, Vázquez-Carrera M. PPARa attenuates palmitate induced endoplasmic reticulum stress in human cardiac cells by enhancing AMPK activity. (2014). Clin Investig Arterioscler.26: 255-267.

6. Dworatzek E, Mahmoodzadeh S, Schubert C, Westphal C, Leber J, Kusch A, Kararigas G, Fliegner D, Moulin M, Ventura-Clapier R, Gustafsson JA, Davidson MM, Dragun D, Regitz-Zagrosek V. Cardiovasc. Res. 102: 418-428.

7. Bo Zhang, **Mercy M. Davidson**, Hongning Zhou, Winsome F. Walker and Tom K. Hei. Cytoplasmic irradiation results in mitochondrial dysfunction and DRP1-dependent mitochondrial fission. (2013). Cancer Res. 73: 6700-6710

8. Palomer X, Capdevila-Busquets E, Alvarez-Guardia D, Barroso E, Pallàs M, Camins A, **Davidson MM**, Planavila A, Villarroya F, Vázquez-Carrera M. Resveratrol induces nuclear factor-κB activity in human cardiac cells. Int J Cardiol. 2012 Jun 27. [Epub ahead of print]

9. Mahmoodzadeh S, Pham TH, Kuehne A, Fielitz B, Dworatzek E, Kararigas G, Petrov G, **Davidson MM**, Regitz-Zagrosek V. 17β-Estradiol-induced interaction of ERα with NPPA regulates gene expression in cardiomyocytes. Cardiovasc Res. (2012) Epub 2012 Sep 7.

10. Wan X, Gupta S, Zago MP, **Davidson MM**, Dousset P, Amoroso A, Garg NJ. Defects of mtDNA replication impaired mitochondrial biogenesis during Trypanosoma cruzi infection in human cardiomyocytes and chagasic patients: the role of Nrf1/2 and antioxidant response. J Am Heart Assoc. (2012) Epub 2012 Dec 19.

11. Casarin A, Giorgi G, Pertegato V, Siviero R, Cerqua C, Doimo M, Basso G, Sacconi S, Cassina M, Rizzuto R, Brosel S, Davidson MM, Dimauro S, Schon EA, Clementi M, Trevisson E, Salviati L. Copper and bezafibrate cooperate to rescue cytochrome c oxidase deficiency in cells of patients with *SCO2* mutations. (2012) Orphanet J Rare Dis. 7(1):21

12. Lee SY, Kim JR, Hu Y, Khan R, Kim SJ, Bharadwaj KG, Davidson MM, Choi CS, Shin KO, Lee YM, Park WJ, Park IS, Jiang XC, Goldberg IJ, Park TS. Cardiomyocyte specific deficiency of serine palmitoyltransferase subunit 2 reduces ceramide but leads to cardiac dysfunction. (2012) J. Biol Chem. 287, 18429-39.

13. Huang SX, Partridge MA, Ghandhi SA, **Davidson MM**, Amundson SA, Hei TK. Mitochondria-derived reactive intermediate species mediate asbestos-induced genotoxicity and oxidative stress-responsive signaling pathways. (2012) Environ Health Perspect. 120, 840-847.

14. Jinyao Mo, Yajuan Xia, Timothy J. Wade, David M. DeMarini, **Mercy Davidson** and Judy Mumford. Altered Gene Expression by Low-Dose Arsenic Exposure in Humans and Cultured Cardiomyocytes: Assessment by Real-Time PCR Arrays (2011) Int. J. Environ. Res. Public Health, 8: 2090-2108.

15. Palomer X, Alvarez-Guardia D, Davidson MM, Chan TO, Feldman AM, Vázquez-Carrera M. The Interplay between NF-kappaB and E2F1 Coordinately Regulates Inflammation and Metabolism in Human Cardiac Cells. PLoS One. 2011;6(5):e19724. Epub 2011 May 23.

16. Alvarez-Guardia D, Palomer X, Coll T, Serrano L, Rodríguez-Calvo R, **Davidson MM**, Merlos M, El Kochairi I, Michalik L, Wahli W, Vázquez-Carrera M. PPARβ/δ activation blocks lipid-induced inflammatory pathways in mouse heart and human cardiac cells. Biochim Biophys Acta. (2011) 2: 59-67

17. Akman HO, Davidzon G, Tanji K, Macdermott EJ, Larsen L, **Davidson MM,** Haller RG, Szczepaniak LS, Lehan TJ, Hirano M and DiMauro S. Neutral lipid storage disease with subclinical myopathy due to a retrotransposal insertion into the PNPLA gene. (2010) Neuromusc. Disord. 20, 397-402

18. M. D'Aurelio, C. Vives-Bauza, **M.M. Davidson** and G. Manfredi. Mitochondrial DNA background modifies the bioenergetics of NARP/MILS ATP6 mutant cells. Hum. Mol. Gen. (2010). 19: 374–386.

19. Ba X, Gupta S, **Davidson M**, Garg NJ. Trypanosoma cruzi induces ROS (reactive oxygen species)- PARP (polyADP Ribose polymerase)-1-RelA pathway for upregulation of cytokine expression in cardiomyocytes. J Biol Chem. (2010) 285, 11596-11606

20. Alvarez-Guardia D, Palomer X, Coll T, **Davidson MM**, Chan TO, Feldman AM, Laguna JC, Vázquez Carrera M. The p65 subunit of NF-{kappa}B binds to PGC-1{alpha} linking inflammation and metabolic disturbances in cardiac cells. Cardiovasc Res. (2010) Mar 7. [Epub ahead of print].

21. **Mercy M. Davidson**, Winsome F. Walker and Evelyn Hernandez-Rosa. The m.3243A>G mtDNA mutation is pathogenic in an *in vitro* model of the human blood brain barrier. (2009). Mitochondrion, 9: 463-470.

22. Shokoufeh Mahmoodzadeh, Stephan Fritschka, Elke Dworatzek, Thi H. Pham, Eva Becher, Arne Kühne, **Mercy M. Davidson** and Vera Regitz-Zagrosek. Nuclear Factor-Kappa B Regulates Estrogen Receptor-alpha Transcription in the Human Heart. (2009). J. Biol. Chem. 284:24705-24714

23. Gregori Casals, Josefa Ros, Alessandro Sionis, **Mercy M. Davidson**, Morales-Ruiz and Wladimiro Jiménez. Hypoxia induces B-type natriuretic peptide release in cell lines derived from human cardiomyocytes. (2009). Am J Physiol Heart Circ Physiol 297:550-555.

24. **Mercy M. Davidson,** Winsome F. Walker, Evelyn Hernandez-Rosa and Claudia Nesti. Evidence for nuclear modifier gene in mitochondrial cardiomyopathy. (2009) J, Mol, Cell, Cardiol. 46: 936-942.

25. Partridge, Michael A., Huang, Sarah X. L., Kibriya, Muhammad G., Ahsan, Habibul, **Davidson, Mercy M.** and Hei, Tom K. Environmental Mutagens Induced Transversions but not Transitions in Regulatory Region of Mitochondrial DNA. (2009). J of Toxicol Environ Health, Part A, 72:5301-5304

26. Xavier Palomer, David Álvarez-Guardia, Ricardo Rodríguez-Calvo, Teresa Coll, Juan C. Laguna, **Mercy M. Davidson,** Tung O. Chan, Arthur M. Feldman and Manuel Vázquez-Carrera. TNF-a reduces PGC-1a expression through NF-kB and p38 MAPK leading to increased glucose oxidation in a human cardiac cell model. (2009). Cardiovasc Res. 81:703-12.

27. Witt H, Schubert C, Jaekel J, Fliegner D, Penkalla A, Tiemann K, Stypmann J, Roepcke S, Brokat S, Mahmoodzadeh S, Brozova E, **Davidson MM**, Ruiz Noppinger P, Grohé C, Regitz-Zagrosek V. Sex specific pathways in early cardiac response to pressure overload in mice. (2008). J. Mol. Med. 86, 1013- 1024

28. Robert W. Gilkerson, Eric A. Schon, Evelyn Hernandez, and **Mercy M. Davidson**. Mitochondrial nucleoids maintain genetic autonomy but allow for functional complementation. (2008) J. Cell. Biol. 181, 1117-1128.

29. Honging Zhou, Vladimir N. Ivanov, Yu-Chin Lien, **Mercy Davidson** and Tom K. Hei. Mitochondrial function and nuclear factor-kB-mediated signaling in radiation-induced bystander effects. (2008), Cancer Res., 68, 2233-2240.

30. Helen Swalwell, Emma L. Blakely, Ruth Sutton, Kasia Tonska, Matthias Elstner, Langping He, Tanja Taivassalo, Dennis K. Burns, Douglass M. Turnbull, Ronald G. Haller, **Mercy M. Davidson** and Robert W. Taylor. A homoplasmic mtDNA variant can influence the phenotype of the pathogenic m.7472Cins *MTTS1* mutation: are two mutations better than one? (2008) Eur. J. Hum. Genet, 1-10.

31. Sabrina Sacconi, Leonardo Salviati, Yutaka Nishigaki, Winsome F. Walker, Evelyn Hernandez-Rosa, Eva Trevisson, Severine Delplace, Claude Desnuelle, Sara Shanske, Michio Hirano, Eric A. Schon, Eduardo Bonilla, Darryl C. De Vivo, Salvatore DiMauro, and **Mercy M. Davidson.** A functionally dominant mitochondrial DNA mutation. (2008), Hum. Mol. Genet. 17, 1814-1820.

32. Michael A. Partridge, Sarah X.L. Huang, Evelyn Hernandez-Rosa, **Mercy M. Davidson** and Tom K. Hei. Arsenic induced mitochondrial DNA damage and altered mitochondrial oxidative function: Implications for genotoxic mechanisms in mammalian cells. Cancer Res. (2007) 67, 5239-5247.

33. Michael A. Partridge, **Mercy M. Davidson** and Tom K. Hei. The complete nucleotide sequence of Chinese hamster *(criceulus griseus)* mitochondrial DNA. DNA Sequence, (2007), 18, 341-346.

34. Hiroko P. Indo, **Mercy Davidson**, Hsiu-Chuan Yen, Shigeaki Suenaga, Kazuo Tomita, Takeshi Nishii, Masahiro Higuchi, Yasutoshi Koga, Toshihiko Ozawa, Hideyuki J. Majima. Evidence of ROS generation by mitochondria in cells with impaired electron transport chain and mitochondrial DNA damage. Mitochondrion (2007) 7, 106–118.

35. Su-Xian Liu, **Mercy M. Davidson,** Xiuwei Tang, Mohammad Athar and Tom K. Hei.. Mitochondrial damage mediates genotoxicity of arsenic in mammalian cells. Cancer Res. (2005), 65, 3236-3242.

36. **Mercy M. Davidson**, Claudia Nesti, Winsome F. Walker, Evelyn Hernandez, Lev Protas, Michio Hirano and Nithila D. Isaac. Novel human cell lines derived from adult human ventricular cardiomyocytes. J. Mol. Cell. Cardiol. (2005), 39, 133-147

37. Santra, S, Gilkerson, RW, **Davidson, M** and Schon, EA. Ketogenic treatment reduces deleted mitochondrial DNAs in cultured human cells. Ann. Neurol. (2004), 56, 662-669.

38. Tay, S.K.H. Nesti, C, Mancuso, M, Schon, E.A, Shanske, S, Bonilla, E, **Davidson, M.M** and DiMauro, S. Studies of COX16, COX19, and PET191 in human Cytochrome-c oxidase deficiency. Arch. Neurol.(2004), 61, 1935-1937.

39. F. Pallotti, A. Baracca, E. Hernandez-Rosa, W. F. Walker, G. Solaini, G. Lenaz, G.V. Melzi d'Eril, S. DiMauro, E.A. Schon, and **M. Davidson**. (2004). Biochemical analysis of respiratory function in cybrid cell lines harboring mtDNAmutations. Biochem J. (2004), 384, 287-294.

40. Robert W. Taylor, Carla Giordano, **Mercy M. Davidson**, Giulia d'Amati, Hugh Bain, Christine M. Hayes, Helen Leonard, Martin J. Barron, Carlo Casali, Filippo M. Santorelli, Michio Hirano, Robert N. Lightowlers, Salvatore DiMauro and Douglass M. Turnbull. A homoplasmic mitochondrial transfer ribonucleic acid mutation as a cause of maternally inherited hypertrophic cardiomyopathy. J. Amer. Coll. Cardiol. (2003), 41, 1786-1796.

41. Sacconi S, Salviati L, Sue CM, Shanske S, **Davidson MM**, Bonilla E, Naini AB, De Vivo DC, DiMauro S. Mutation Screening in Patients With Isolated Cytochrome c Oxidase Deficiency. Pediatr. Res. (2003), 53, 224-230.

42. Kim M. Clark, Timothy A. Brown, **Mercy M. Davidson**, Lefkothea C. Papadopoulou and David A. Clayton. Differences in nuclear gene expression between cells containing monomer and dimer mitochondrial genomes. Gene (2002), 286, 91-104.

43. Leonardo Salviati, Sabrina Sacconi, Minerva M. Raslam, David F. Kronn, Alex Braun, Peter Canoll, **Mercy Davidson**, Sara Shanske, Eduardo Bonilla, Arthur P Hayes, Eric A Schon, and Salvatore DiMauro. Cytochrome oxidase deficiency due to *SCO2* mutations mimicking Werdnig-Hoffmann Disease. Arch. Neurol. (2002), 59, 862-865.

44. Carla Giordano, Francesco Pallotti, Winsome F.Walker, Nicoletta Checcarelli, Olimpia Musumeci ,Filippo Santorelli, Giulia d'Amati, Eric A. Schon, Salvatore DiMauro, Michio Hirano, and **Mercy M. Davidson.** Pathogenesis of the deafness-associated A1555G mitochondrial DNA mutation. Biochim. Biophys. Res. Commun. (2002), 293, 521-529.

45. Leonardo Salviati, Evelyn Hernandez-Rosa, Winsome F. Walker, Sabrina Sacconi, Salvatore DiMauro. Eric A. Schon, and **Mercy M. Davidson**. Copper supplementation restores cytochrome *c* oxidase activity in cultured cells from patients with *SCO2* mutations. Biochem. J. (2002), 363, 321-327.

46. Hirano M, **Davidson M.,** DiMauro S. Mitochondria and the heart. Curr Opin Cardiol. (2001), 16: 201- 210.

47. Karadimas, CL, Greenstein,,P, Sue, CM, Joseph, JT, Tanji, K,Haller, RG,Taivassalo, T, **Davidson**, **MM**, Shanske, S, Bonilla, E, and DiMauro, S. Recurrent Myoglobinuria due to a nonsense mutation in the *COX I* gene of mitochondrial DNA. Neurol, (2000), 55, 644-649.

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ii) Mitochondrial Neurogastrointestinal Encephalomyopathy (MNGIE).
iii) Myoclonic Epilepsy associated with Ragged Red Fibers (MERRF).

Ph.D. Thesis

Mascreen, Mercy (1979). Metabolic Aspects of CNS function: Biochemistry of Neuromuscular Diseases. Madras Medical College, Madras, India.

Personal statement

Since 1995 as PI, my laboratory has been engaged in research in neuromuscular diseases with focus on mitochondrial diseases with independent funding. My area of expertise is in biochemistry and cell biology, particularly in the *in vitro* manipulation of cells in culture. Due to the lack of animal models, I have generated novel cellular models for the study of mitochondrial diseases, including cybrids with mtDNA mutations, a culture model of the MELAS and normal BBB, and proliferating human ventricular cardiomyocyte cell lines with cardiomyopathy specific mtDNA mutations. These models have been used to study pathogenesis of mitochondrial disease, to analyze basic normal and pathogenic cellular mechanisms and to evaluate therapeutic strategies. My research interests are as follows:

- Microbeam irradiation induced mitochondrial damage.
- Genotoxic effects of environmental toxins.
- Mitochondrial dynamics in health and disease.
- Targeting the mitochondria in cancer.
- Blood-brain barrier in MELAS: pathogenesis and therapeutic strategy.
- Nuclear-mitochondrial genome interactions in mitochondrial cardiomyopathy.
- Angiogenesis in MELAS.