

UNIVERSITY OF COLORADO SCHOOL OF MEDICINE

CURRICULUM VITAE

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Education

1991 B.A., University of Chicago, Chicago, IL
2002 M.D., University of Illinois at Urbana-Champaign, Urbana, IL
2002-2003 Internship, Internal Medicine, University of Colorado School of Medicine (SOM),
Denver, CO
2003-2006 Residency, Neurology, University of Colorado SOM, Denver, CO
2006-2009 Postdoctoral NIH Fellowship (Neurovirology), Instructor, University of Colorado
SOM, Denver, CO

Academic Appointments

2009-2015 Assistant Professor, Department of Neurology, University of Colorado SOM,
Denver, CO
2015-2020 Associate Professor, Department of Neurology, University of Colorado SOM,
Denver, CO
2017-2020 Associate Professor, Department of Ophthalmology, University of Colorado
SOM, Denver, CO
2020-present Professor, Department of Neurology, University of Colorado SOM, Denver, CO
2020-present Professor, Department of Ophthalmology, University of Colorado SOM, Denver,
CO

Hospital, Government or Other Professional Positions

2009-2015 Assistant Professor, Department of Neurology, University of Colorado SOM,
Denver, CO
2015-2020 Associate Professor, Department of Neurology, University of Colorado SOM,
Denver, CO
2017-2020 Associate Professor, Department of Ophthalmology, University of Colorado
SOM, Denver, CO
2020-present Professor, Department of Neurology, University of Colorado SOM, Denver, CO
2020-present Professor, Department of Ophthalmology, University of Colorado SOM, Denver,
CO

Honors, Special Recognitions and Awards

1987-1991 University of Chicago Scholar, Chicago, IL
1987-1991 George M. Pullman Educational Foundation Scholar, Chicago, IL
1991 Sigma Xi Award for Excellence in Science, University of Chicago, Chicago, IL
1991 Special Honors in Biological Sciences, University of Chicago, Chicago, IL

1993, 1998	Outstanding Teaching Award, Biochemistry, University of Illinois, Urbana, IL
2001	Johnson Endowment Fellowship, Medical Scholars Program, University of Illinois, Urbana, IL
2006	Award for Most Outstanding Research by a Neurology Resident, Neurology, University of Colorado SOM, Denver, CO
2006	MBA Oldstone Pioneer Lectureship Award for an Investigator in Training, International Society for Neurovirology
2011	Grateful Patient and Family Award, University of Colorado Hospital, Denver
2013	Fellow (elected), American Neurological Association
2018	Induction into the Hall of Fame, Bloom Trail High School, Chicago Heights, IL
2019	Recognized as an Expertscape World Expert in Herpes Zoster (Expertise in Herpes Zoster: Worldwide), http://www.expertscape.com/ex/herpes+zoster

Membership in Professional Organizations

American Academy of Neurology
 American Heart Association
 American Neurological Association
 American Society of Microbiology
 International Society for NeuroVirology
 Rocky Mountain Virology Club
 Royal Society of Medicine

Major Committee and Service Responsibilities

2010-2014	Admissions Committee, Medical School, University of Colorado SOM
2010-2014	Mentor, NIH LABCOATS Program, University of Colorado SOM
2012-present	Neurology Grand Round Committee, University of Colorado SOM
2012-present	Mentor, Denver STARS Program, Office of Inclusion and Outreach, University of Colorado SOM
2013-present	Co-organizer, Odyssey Elementary School Health Visit Day, Office of Inclusion and Outreach, University of Colorado SOM
2015	Founder, Young Entrepreneurs Club, Odyssey Elementary School, Denver, CO
2016-present	Data Safety Monitoring Committee Member, Zoster in Eye Disease Multi-Center Clinical Trial, National Eye Institute
2016-present	Editorial Board, <i>Journal of Neurovirology</i>
2017-2019	Mentor, Graduate Experiences for Multicultural Students (GEMS) Program, University of Colorado SOM
2017-present	Member, Data Safety Monitoring Committee, Zoster Eye Disease Study (ZEDS), National Eye Institute, National Institutes of Health
2017-present	Vice President, Colorado Alphaherpesvirus Latency Society
2018	Panel Chair, CNS Herpes Infections Panel, American Academy of Neurology, Los Angeles, CA
2018	Session Chair, Keynote & Symposium VI: Immunity & Pathogenesis, International Herpesvirus Workshop, Vancouver, British Columbia
2019-present	Member, Board of Directors, Clean Production Action
2019	Mentor, Masters in Modern Human Anatomy Capstone Project, Department of Cell and Developmental Biology, University of Colorado SOM
2019	Reviewer, preK Grant Program, Colorado Clinical and Translational Sciences Institute (CCTSI), University of Colorado Denver Anschutz Medical Campus
2019	Member, VZV Vasculopathy Advisory Board, GlaxoSmithKline (GSK)
2019	Member, Panel Discussion, Junior Scientist Event "Work/Life Balance", 16 th International Symposium on NeuroVirology, Atlanta, GA

Licensure and Board Certification

2006-present State of Colorado

Inventions, Intellectual Property and Patents Held or Pending

Treatment and Prevention of Alpha Herpes Virus Infection with Neurokinin-1 Receptor Antagonists, International patent filed 3-28-2019 (PCT/US19/24521)

NK-1R Antagonists Block Exosome Transmission, Invention Disclosure Form Stage (patent in review)

Inhibitors of c-Myc Block VZV Infection, Invention Disclosure Form Stage (patent in review)

Review and Referee Work

Ad hoc reviewer for journals: *Archives of Medical Research*, *BMC Infectious Diseases*, *International Journal of STD & AIDS*, *Journal of Medical Virology*, *Journal of Neuroimmunology*, *Journal of Neurosciences in Rural Practice*, *Neurology*, *PLOS ONE*, and *The Journal of Infectious Diseases*

Ad hoc reviewer for the Medical Research Council (U.K.)

Ad hoc reviewer for the Wellcome Trust (U.K.)

Ad hoc reviewer for Clinical Research and Development Committee (University College of London)

Ad hoc reviewer for the National Eye Institute

Invited Extramural Lectures, Presentations, Visiting Professorships, and Major Presentations to Medical and Undergraduate Students and House Officers

2008 "VZV transcription in latently-infected human ganglia", International Herpes Virus Workshop, Estoril, Portugal

2010 "Varicella zoster virus vasculopathy: pathological and immunological analysis of virus-infected arteries", International Herpesvirus Workshop, Salt Lake City, UT

2010 "VZV transcription in latently-infected human ganglia", International Herpesvirus Workshop, Salt Lake City, UT

2010 "Varicella zoster virus vasculopathy", Grand Rounds, Neurology, National Jewish Medical Center, Denver, CO

2011 "Neurological complications of varicella zoster virus", Grand Rounds, Infectious Disease, National Jewish Medical Center, Denver, CO

2011 "Neurological complications of varicella zoster virus" and "Diagnosis of VZV vasculopathy", 100th Anniversary of the Dutch Microbiology Society, Arnhem, The Netherlands

2012 "VZV pain – it's all the same", Grand Rounds, Neurology, University of Colorado School of Medicine, Aurora, CO

2012 "VZV and ischemic optic neuropathy", Grand Rounds, Ophthalmology, University of Colorado School of Medicine, Aurora, CO

2012 "Purinergic signaling and matrix metalloproteases in VZV vasculopathy", Infectious Disease Research Seminar, University of Colorado School of Medicine, Aurora, CO

2012 "VZV Vasculopathy", International Stroke Conference, New Orleans, LA

2012 "Purinergic signaling in VZV vasculopathy", Colorado Alphaherpesvirus Latency Symposium, Vail CO

2013 "Purinergic signaling in VZV-infected brain vascular adventitial fibroblasts", International Herpesvirus Workshop, Grand Rapids, MI

2013 "Neurological complications of varicella zoster virus", Grand Rounds, Rose Medical Center, Denver, CO

2013 "Shingles and postherpetic neuralgia", Grand Rounds, Geriatrics, University of Colorado School of Medicine, Aurora, CO

2014 "Neurovirology", Student Interest Group in Neurology, University of Colorado School of Medicine, Aurora, CO

2015 "Shingles and stroke", Cafe Scientifique, Sigma Xi Society, Boulder, CO

2015 "VZV vasculopathy", Grand Rounds, Neurology, University of New Mexico

2016 "Multisystem disease caused by VZV", Grand Rounds, NASA, Houston, TX

- 2016 "Space weather and human health", Grand Rounds, NASA, Houston, TX
- 2016 "VZV – the new great pretender", Grand Rounds, Immunology and Microbiology, University of Colorado School of Medicine, Aurora, CO
- 2017 "Mechanisms of VZV vasculopathy", Grand Rounds, Neurology, University of Colorado School of Medicine, Aurora, CO
- 2017 "VZV vasculopathy", Grand Rounds, Neurology, Temple University, Philadelphia, PA
- 2017 "Varicella zoster virus vasculopathy", Neurology Research Retreat, University of Colorado School of Medicine, Aurora, CO
- 2017 "Pathophysiology of varicella zoster virus related vascular disease", Advances and Controversies in Our Understanding of Herpes Zoster, Royal Society of Medicine, London
- 2017 "VZV vasculopathy: past, present and future", 42nd Annual International Herpesvirus Workshop, Ghent, Belgium
- 2018 "Clinical manifestations of varicella zoster virus", Pathfinders, Evergreen, CO
- 2018 "Life as a brain detective", 21st Expanding Your Horizons Workshop, American Association of University Women (Boulder Branch), Boulder, CO
- 2018 "VZV disruption of perineurial cells via IL-6", Neurology Research Retreat, University of Colorado School of Medicine, Aurora, CO
- 2018 "Nuclear neurokinin-1 receptor promotes varicella zoster virus spread in human spinal astrocytes", American Society for Neurochemistry, Riverside, CA
- 2018 "VZV-induced disruption of perineurial cells via IL-6: implications in neurotropic viral infections and peripheral nerve injury", Colorado Alphaherpesvirus Latency Symposium, Vail, CO
- 2018 "VZV-induced disruption of perineurial cells via IL-6: implications in neurotropic viral infections and peripheral nerve injury", Translational Neuroimmunology, FASEB Science Research Conference, Snowmass, CO
- 2019 "The link between varicella zoster virus infection and Alzheimer's disease", Grand Rounds, Neurology, Temple University, Philadelphia, PA
- 2019 "Life as a brain detective", 22nd Expanding Your Horizons Workshop, American Association of University Women (Boulder Branch), Boulder, CO
- 2019 "The link between varicella zoster virus infection and Alzheimer's disease", Grand Rounds, Neurology, University of Colorado School of Medicine, Aurora, CO
- 2019 "Proviral amylin and amyloidogenic viral peptides link VZV with Alzheimer's disease", Colorado Alphaherpesvirus Latency Symposium, Vail, CO
- 2019 "Zoster, amyloid and animal models", Neurology Research Retreat, University of Colorado School of Medicine, Aurora, CO
- 2019 "Proviral amylin and amyloidogenic viral peptides link VZV with Alzheimer's disease", 43rd Annual International Herpesvirus Workshop, Knoxville, TN
- 2019 "Varicella zoster virus vasculopathy", Grand Rounds, Neurology, Albert Einstein College of Medicine and Montefiore Medical Center, New York, NY
- 2019 "Proviral amylin and amyloidogenic viral peptides link VZV with Alzheimer's disease", 19th Annual Rocky Mountain Virology Meeting, Ft. Collins, CO
- 2019 "Varicella zoster virus reactivation from cranial nerves", Otolaryngology T32 Research Seminar Series, Department of Otolaryngology, University of Colorado School of Medicine, Aurora, CO
- 2019 "Varicella zoster virus and amyloid-associated diseases", 2019 Audrey Gilden Lectureship, 16th International Symposium on NeuroVirology, Atlanta, GA
- 2019 "Proviral amylin and amyloidogenic viral peptides link VZV with Alzheimer's disease", Don Gilden Memorial Lecture, INDOUS 2019 Symposium/Workshop, Port Blair, India
- 2020 "VZV and amyloid-associated diseases", Distinguished Speakers in Microbiology and Infectious Disease (seminar series), University of Florida, Gainesville, FL
- 2020 "Neurological sequelae of COVID-19", Bilateral Indo-US Webinar on COVID Biology

Graduate Students and Postdoctoral Fellows Trained

Since 2006, I have served as a career advisor and research mentor to 20 mentees, including 6 postdoctoral fellows, 3 neurology residents, 4 medical students, 4 post-baccalaureate students, 13 undergraduates and 8 high school students. This mentoring has been research oriented in the neurovirology laboratories in the Department of Neurology. My mentees have multiple peer-reviewed publications in journals such as *Neurology*, *Journal of Neurological Sciences*, *Journal of Infectious Diseases*, *Archives of Neurology* and *Journal of Virology*; and they have given presentations at local and regional scientific meetings hosted by the International Society of Neurovirology, American Society of Microbiology, Colorado Alphaherpesvirus Latency Society and Rocky Mountain Virology Club; have received 7 awards; and have obtained 5 grants, including an Undergraduate Research Opportunities Grant from both University of Colorado Denver and Metropolitan State College of Denver, salary support for students from the Office of Inclusion and Outreach, and 3 funded research supplements from the National Institute on Aging to promote diversity.

Trainees (most recent)

April Rempel, 2010-2014, Postbaccalaureate NIH Fellow to Support Diversity in the Health Sciences; Undergraduate Research Intern

Current Position: Medical Student, University of Oklahoma, Oklahoma City, OK

Ann Wyborny, DO, 2011-2013, Research Fellow; 2016-2018, Undergraduate Research Intern

Current Position: Resident, Sky Ridge Medical Center, Lone Tree, CO

Stephanie James, PhD, 2011-2014, Postdoctoral Fellow

Current Position: Assistant Professor, Rueckert-Hartman College of Health Professions, Regis University, Denver, CO

Emily Forbes, MD, 2013-2017, Neurology Resident

Current Position: Movement Disorder Fellowship, Department of Neurology, University of Pennsylvania, Philadelphia, PA

Badani Hussain, PhD, 2014-2016, Postdoctoral Fellow

Current Position: Senior Scientific Director, PRI Healthcare Solutions, New York City, NY

Anna (Blackmon) Burnet, 2014-2019, Postbaccalaureate NIH Fellow to Support Diversity in the Health Sciences; Senior Professional Research Assistant

Current Position: Graduate Student at the University of Colorado Anschutz Medical Campus, Microbiology Program

Dallas Jones, PhD, 2016-2019, Postdoctoral Fellow

Current Position: Postdoctoral Fellow, Department of Pediatrics, Section of Hematology/Genops, University of Colorado Anschutz Medical Campus, School of Medicine

Andrew Bubak, PhD, 2017-2019, Postdoctoral Fellow

Current Position: Research Instructor, Department of Neurology, University of Colorado Anschutz Medical Campus, School of Medicine

Christy Niemeyer, PhD, 2018-present, Postdoctoral Fellow

James E. Hassell, Jr., PhD, 2019-present, Postdoctoral Fellow

Grant Awards and Additional Support

Active/Current Funding

1. Federal NIH/NIA P01, AG032958
A Major Contributor of Serious Multisystem Disease in the Elderly: Varicella Zoster Virus-induced Inflammation
Project 1: Characterizing the VZV-induced Inflammatory Response in Temporal Arteries from Patients with Giant Cell Arteritis
Program Director, 15% effort (Administrative and Scientific Cores)
Project Leader, Project 1, 30% effort
03-01-2009 to 12-31-2023
\$11,330,711 (total direct and indirect costs/5 years)
\$2,182,418, Project 1 (total direct and indirect costs/5 years)
2. Federal NIH/NINDS R01, NS093716
Neurobiology of Varicella Zoster Virus
Co-Investigator (Randall Cohrs, PI), 10% effort
07-01-2015 to 06-30-2021
\$2,228,285 (total direct and indirect costs/5 years)
3. Federal NIH/NIDCD R01, DC00566
Complex Odor Recognition of the Main Olfactory Bulb
Administrative Supplement
Co-Investigator (Diego Restrepo, PI), 10% effort
05-01-2020 to 04-30-2021
\$170,612 (total direct costs/1 year)
4. Federal NIH/NIDCD R01, DC014253
Olfactory Receptors for Semiochemical Detection in the Main Olfactory Epithelium,
Administrative Supplement
Co-Investigator (Diego Restrepo, PI), 5% effort
07-01-2020 to 06-30-2021
\$194,375 (total direct costs/1 year)
5. Skaggs School of Pharmacy and Pharmaceutical Sciences Therapeutic Innovation Grant
Nucleic Acid-based Therapies for Blood-Borne Viruses
Co-Principal Investigator (Thomas Anchordoquy, PI), 5% effort
02-01-2017 to 01-31-2021
\$750,000 (total costs/3 years)
6. NASA/Lyndon B Johnson Space Center, NSPIRES 17-OMNI_2-0018
VZV Shedding after Antiviral Drug (Valacyclovir) Treatment in Antarctic Expeditioners
Consultant (Satish Mehta, PI)
10-01-2019 to 09-30-2021
\$99,915 (total direct and indirect costs/1 year)
7. SPARK/REACH Program, University of Colorado Anschutz Medical Campus
Repositioning Neurokin-1 Receptor (NK-1R Antagonists as Antiviral Agents against Human Herpesviruses
Principal Investigator, 10% effort
07-01-2020 to 06-30-2022
\$100,000 (total costs/2 years)

8. IUSSTF, Indo-UC Science and Technology Forum, New Delhi
Indo-U.S. Virtual Network for COVID-19
Leveraging Reverse Genetics Strategies to Study Structure-Function Interplay of Virus Host Attachment Spike Protein to Design Therapies for COVID-19
Co-Principal Investigator/Consultant (Jayasri Das Sarma, PI)
10-26-2020 to 4-25-2022
\$64,500 (total costs/18 months)

Inactive/Prior Funding

1. Federal NIH/NINDS K08, NS067070
Mechanisms by which VZV IE Proteins Interact with Cell Antiviral Proteins
PI
09-30-2009 to 08-31-2014
\$866,700 (total direct and indirect costs)
2. CCTSI/CNS Junior Faculty Pilot Award
The Role of Purinergic Signaling in VZV Vasculopathy
PI
01-1-2012 to 12-31-2012
\$30,000
3. University of Colorado Department of Neurology AEF Research Support
Purinergic Signaling in VZV Vasculopathy
01-01-2012 to 12-31-2012
PI
\$30,000
4. Federal NIH/NINDS R01, NS094758
Purinergic Signaling in Varicella Zoster Virus Vasculopathy
Principal Investigator, 37.5% effort
09-1-2015 to 08-31-2020
\$1,360,624 (total direct and indirect costs/4 years)
5. NASA, Department of Microbiology Intramural Support
Development of a Multiplex PCR Assay for Human Herpesviruses
PI
10-30-2015 to 01-31-2017
\$40,000 (total direct costs/year)
6. Contrafect Corporation Industry Grant
Characterization of Human Pulmonary Arterial Adventitial and Aortic Adventitial Fibroblasts
Response of CF-301 Treatment *In Vitro*
PI and Project Manager, CVP Research Lab (Kurt Stenmark, PI)
05-6-2016 to 05-31-2019
\$139,283 (total direct and indirect costs/1 year)
7. University of Colorado Department of Neurology Intramural Grant for Assistant Professors
The Role of Alphaherpesvirus Infection in Head and Face Pain
Mentor for PI Marius Birlea
07-1-2016 to 06-30-2017
\$40,000 (direct costs/1 year)

8. Research to Prevent Blindness, Challenge Grant (pilot grant), University of Colorado
Department of Ophthalmology
Varicella Zoster Virus Infection of the Cornea
Co-PI (Niklaus Mueller, PI)
02-22-2017 to 10-31-2017
\$10,000 (direct costs/1 year)
9. Colorado Clinical and Translational Sciences Institute (CCTSI)
Novel Method Development (NMD) Grant, NIH-NCATS CTSA
Induced Pluripotent Stem Cell-derived Human Motor Neurons for Modeling and Treatment of
Amyotrophic Lateral Sclerosis and Other Human Motor Neuron Diseases
Co-PI (Holger Russ, PI)
05-01-2018 to 04-30-2019
\$20,000 (total direct costs/1 year)
10. University of Colorado, Department of Ophthalmology
Research to Prevent Blindness, Challenge Grant (pilot grant)
Varicella Zoster Virus Infection in Age-Related Macular Degeneration
Principal Investigator, 1% effort
01-23-2019 to 01-22-2020
\$5,000 (total direct costs/1year)
11. Federal NIH/NIDCD R01, DC014253
Olfactory Receptors for Semiochemical Detection in the Main Olfactory Epithelium,
Administrative Supplement
Co-Investigator (Diego Restrepo, PI), 5% effort
08-01-2019 to 07-31-2020
\$358,225 (total direct and indirect costs/1 year)

Bibliography

1. Singh, S., Ross, S.R., **Acena, M.**, Rowley, D.A., Schreiber, H.: Stroma is critical for preventing or permitting immunological destruction of antigenic cancer cells. *J. Exp. Med.* 175:139-146, 1992.
2. Koeppen, H., **Acena, M.**, Drolet, A., Rowley, D.A., Schreiber, H.: Tumors with reduced expression of a cytotoxic T lymphocyte recognized antigen lack immunogenicity but retain sensitivity to lysis by cytotoxic T lymphocytes. *Eur. J. Immunol.* 23:2770-2776, 1993.
3. Dodson, R.E., **Acena, M.R.**, Shapiro, D.J.: Tissue distribution, hormone regulation and evidence for a human homologue of the estrogen-inducible *Xenopus laevis* vitellogenin mRNA binding protein. *J. Steroid Biochem. Mol. Biol.* 52:505-515, 1995.
4. Cunningham, K.S., Dodson, R.E., **Nagel, M.A.**, Shapiro, D.J., Schoenberg, D.R.: Vigilin binding selectively inhibits cleavage of the vitellogenin mRNA 3'-untranslated region by the mRNA endonuclease polysomal ribonuclease 1. *Proc. Natl. Acad. Sci. U.S.A.* 97:12498-12502, 2000.
5. Dodson, R.E., Goolsby, K.M., **Acena-Nagel, M.**, Mao, C., Shapiro, D.J.: RNA gel shift assays for analysis of hormone control of mRNA stability. *Methods Enzymol.* 364:350-361, 2003.
6. Moses, H., **Nagel, M.A.**, Gilden, D.H.: Acute cerebellar ataxia in a 41-year-old woman. *Lancet Neurol.* 5:984-988, 2006.
7. **Nagel, M.A.**, Forghani, B., Mahalingam, R., Wellish, M.C., Cohrs, R.J., Russman, A.N., Katzan, I., Lin, R., Gardner, C.J., Gilden, D.H.: The value of detecting anti-VZV IgG antibody in CSF to diagnose VZV vasculopathy. *Neurology* 68:1069-1073, 2007.
8. **Nagel, M.A.**, Gilden, D.H.: The protean neurologic manifestations of varicella zoster virus infection. *Cleve. Clin. J. Med.* 74:489-504, 2007.
9. Orme, H.T., Smith, G., **Nagel, M.A.**, Bert, R.J., Mickelson, T.S., Gilden, D.H.: VZV spinal cord infarction identified by diffusion-weighted MRI (DWI). *Neurology* 69:398-400, 2007.
10. **Nagel, M.A.**, Corboy, J.R.: Viral illnesses of the nervous system of the elderly. In: *Clinical Neurology of the Older Adult* (J.I. Sirven, B.L. Malamut, eds.), Lippincott Williams & Wilkins, Philadelphia, pp. 448-456, 2008.
11. **Nagel, M.A.**, Cohrs, R.J., Mahalingam, R., Wellish, M.C., Forghani, F., Schiller, A., Safdieh, J.E., Kamenkovich, E., Ostrow, L.W., Levy, M., Greenberg, B., Russman, A.N., Katzan, I., Gardner, C.J., Häusler, M., Nau, R., Saraya, T., Wada, H., Goto, H., de Martino, M., Ueno, M., Brown, W.D., Terborg, C., Gilden, D.H.: The varicella zoster virus vasculopathies: clinical, CSF, imaging and virological features. *Neurology* 70:853-860, 2008.
12. Mueller, N.H., Gilden, D.H., Cohrs, R.J., Mahalingam, R., **Nagel, M.A.**: VZV infection: clinical features, molecular pathogenesis of disease and latency. *Neurol. Clin.* 26:675-697, 2008.
13. Gilden, D., **Nagel, M.A.**, Ransohoff, R.M., Cohrs, R.J., Mahalingam, R., Tanabe, J.L.: Recurrent varicella zoster virus myelopathy. *J. Neurol. Sci.* 276:196-198, 2009.
14. Gilden, D., **Nagel, M.A.**, Mahalingam, R., Mueller, N.H., Brazeau, E.A., Pugazhenthii, S., Cohrs, R.J.: Clinical and molecular aspects of VZV infection. *Future Neurol.* 4:103-117, 2009.

15. **Nagel, M.A.**, Gilden, D., Shade, T., Gao, B., Cohrs, R.J.: Rapid and sensitive detection of 68 unique VZV gene transcripts in five multiplex reverse transcription-polymerase chain reactions. *J. Virol. Methods* 157:62-68, 2009.
16. Gilden, D., Cohrs, R.J., Mahalingam, R., **Nagel, M.A.**: VZV vasculopathies: diverse clinical manifestations, laboratory features, pathogenesis and treatment. *Lancet Neurol.* 8:731-740, 2009.
17. Umbach, J.L., **Nagel, M.A.**, Cohrs, R.J., Gilden, D.H., Cullen, B.R.: Analysis of human α -herpesvirus microRNA expression in latently infected human trigeminal ganglia. *J. Virol.* 83:10677-10683, 2009.
18. **Nagel, M.A.**, Mahalingam, R., Cohrs, R.J., Gilden, D.: Virus vasculopathy and stroke: an under-recognized cause and treatment target. *Infect. Disord. Drug Targets* 10:105-111, 2010.
19. **Nagel, M.A.**, Gilden, D.: Stroke caused by varicella zoster virus. UpToDate: www.uptodate.com, version 8, May 2010.
20. Gilden, D., Cohrs, R.J., Mahalingam, R., **Nagel, M.A.**: Neurological disease produced by VZV reactivation without rash. *Curr. Top. Microbiol. Immunol.* 342:243-253, 2010.
21. **Nagel, M.A.**, Gilden, D., Mahalingam, R., Cohrs, R.J.: Neurologic manifestations of herpes zoster. *In: Neuroinflammation Insights Series* (A. Minagar, ed.), Elsevier, Chap. 23:497-520, 2010.
22. Blumenthal, D.T., Shacham-Shmueli, E., Bokstein, F., Schmid, D.S., Cohrs, R.J., **Nagel, M.A.**, Mahalingam, R., Gilden, D.: Zoster sine herpete: virological verification by detection of anti-VZV IgG antibody in CSF. *Neurology* 76:484-485, 2011.
23. **Nagel, M.A.**, Choe, A., Traktinskiy, I., Cordery-Cotter, R., Gilden, D., Cohrs, R.J.: Varicella zoster virus transcriptome in latently infected human ganglia. *J. Virol.* 85:2276-2287, 2011.
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25. Pierson, D.L., Mehta, S.K., Gilden, D., Cohrs, R.J., **Nagel, M.A.**, Schmid, D.S., Tyring, S.K.: Varicella zoster virus DNA at inoculation sites and in saliva after Zostavax immunization. *J. Infect. Dis.* 203:1542-1545, 2011.
26. Azarkh, Y., Dölken, L., **Nagel, M.**, Gilden, D., Cohrs, R.J.: Synthesis and decay of varicella zoster virus transcripts. *J. NeuroVirol.* 17:281-287, 2011.
27. Pugazhenthhi, S., Nair, S., Velmurugan, K., Liang, Q., Mahalingam, R., Cohrs, R.J., **Nagel, M.A.**, Gilden, D.: VZV infection of differentiated human neural stem cells. *J. Virol.* 85:6678-6686, 2011.
28. Gilden, D., Mahalingam, R., **Nagel, M.A.**, Pugazhenthhi, S., Cohrs, R.J.: The neurobiology of varicella zoster virus infection. *Neuropathol. Appl. Neurobiol.* 37:441-463, 2011.
29. **Nagel, M.A.**, Traktinskiy, I., Azarkh, Y., Kleinschmidt-DeMasters, B., Hedley-Whyte, T., Russman, A., VanEgmond, E.M., Stenmark, K., Frid, M., Mahalingam, R., Wellish, M., Choe, A., Cordery-Cotter, R., Cohrs, R.J., Gilden, D.: Varicella zoster virus vasculopathy: Analysis of virus-infected arteries. *Neurology* 77:364-370, 2011.

30. **Nagel, M.A.**, Choe, A., Cohrs, R.J., Traktinskiy, I., Sorensen, K., Mehta, S.K., Pierson, D.L., Tyring, S.K., Haitz, K., DiGiorgio, C., LaPolla, W., Gilden, D.: Persistence of VZV DNA in saliva after herpes zoster. *J. Infect. Dis.* 204:820-824, 2011.
31. **Nagel, M.A.**, Gilden, D.: The trigeminal trophic syndrome. *Neurology* 77:1499, 2011.
32. **Nagel, M.A.**, Traktinskiy, I., Choe, A., Rempel, A., Gilden, D.: Varicella-zoster virus expression in the cerebral arteries of diabetic subjects. *Arch. Neurol.* 69:142-144, 2012.
33. Tsai, J., Cohrs, R.J., **Nagel, M.A.**, Mahalingam, R., Schmid, D.S., Choe, A., Gilden, D.: Reactivation of type 1 herpes simplex virus and varicella zoster virus in an immunosuppressed patient with acute peripheral facial weakness. *J. Neurol. Sci.* 313:193-195, 2012.
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