Nikolay S. Markov

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updated August 2025

Education

Ph.D. in Computation Biology, Northwestern University, Chicago, USA — 2022–2025 (expected in December)
Driskill Graduate Program in Life Sciences
Advisors:
— Alexander Misharin, Associate Professor at Northwestern University;
— Rosemary Braun, Associate Professor at Northwestern University.

M.S. in Bioinformatics, Newcastle University, Newcastle upon Tyne, UK — 2017–2018
With distinction
Advisors:
— Jaume Bacardit, Reader at Newcastle University;
— Alexander Misharin, Assistant Professor at Northwestern University.

Undergraduate coursework in Biology, Moscow State University, Moscow, Russia — 2003–2006
Genetics major

Publications

(* denotes equal contribution)

1. Research articles under peer-review

Markov NS*, Esposito AJ*, Senkow KJ, Schleck M, Cusick L, Yu Z, Sokolenko YV, Diaz E, Jonasson E, Swaminathan S, Lu Z, Nafikova R, Fenske S, […], Perlman H, Lam AP, Gottardi CJ, Budinger GRS, Misharin AV, Hinchcliff ME. — 2025

Profibrotic monocyte-derived alveolar macrophages as a biomarker and therapeutic target in systemic sclerosis-associated interstitial lung disease. *bioRxiv*. https://doi.org/10.1101/2025.08.07.669006

Amagai S, Chaudhari V, Chhikara K, Ingraham NE, Hochberg CH, Barker AK, Mao C, Ortiz AC, Weissman GE, Schmid BE, Schwinne M, Bhavani SV, Guleria S, Liao Z, **Markov N**, Lyons PG, Park-Egan B, CLIF Consortium, Parker WF, Luo Y, Rojas JC, Gao CA. — 2025

The Epidemiology of Intensive Care Unit Readmissions Across Ten Health Systems. *medRxiv*. https://doi.org/10.1101/2025.03.10.25323672

Grudzinski KM, Fenske S, Peltekian A, **Markov NS**, Pawlowski A, Kang M, Walter JM, Pickens CI, Nadig NR, Agrawal A, Singer BD, Wunderink RG, Gao CA. — 2024

Neutrophil percentages in bronchoalveolar lavage fluid: Implications for diagnosing bacterial pneumonia in patients with immunocompromise and neutropenia. *medRxiv*. https://doi.org/10.1101/2024.05.04.24306709

Luo L, Możejko M, **Markov N**, Peltekian A, Mohsin S, Carns M, Cooper P, Lysne J, Joudi A, Betensley A, Bemiss BC, Myers C, Bharat A, Tomic R, Arunachalam A, Szczurek E, Budinger GS, Misharin AV, Subramani MV. — 2024

Machine learning analysis of the UNOS database fails to predict lung transplant outcomes. *medRxiv*. https://doi.org/10.1101/2024.10.19.24315817v1

2. Peer-reviewed research articles

Fenske SW, Peltekian A, Kang M, **Markov NS**, Zhu M, Grudzinski K, Bak MJ, Pawlowski A, Gupta V, Mao Y, Bratchikov S, Stoeger T, Rasmussen LV, Choudhary AN, Misharin AV, Singer BD, Budinger GS, Wunderink RG, Agrawal A, Gao CA, NU SCRIPT Study Investigators. — 2025

Developing and validating machine learning models to predict next-day extubation. *Scientific Reports*. https://doi.org/10.1038/s41598-025-12264-4

Zhu M, Pickens CI, **Markov NS**, Pawlowski A, Kang M, Rasmussen LV, Walter JM, Nadig NR, Singer BD, Wunderink RG, Gao CA, NU SCRIPT Study Investigators. — 2025

Antibiotic de-escalation patterns and outcomes in critically ill patients with suspected pneumonia as informed by bronchoalveolar lavage results. *European Journal of Clinical Microbiology & Infectious Diseases*. https://doi.org/10.1007/s10096-025-05144-2

Luecken MD, Gigante S, Burkhardt DB, Cannoodt R, Strobl DC, **Markov NS**, Zappia L, Palla G, Lewis W, Dimitrov D, Vinyard ME, Magruder DS, Mueller MF, Andersson A, Dann E, Qin Q, Otto DJ, Klein M, […], Bloom JM, Pisco AO, Saez-Rodriguez J, Wulsin D, Pinello L, Saeys Y, Theis FJ, Krishnaswamy S. — 2025

Defining and benchmarking open problems in single-cell analysis. *Nature Biotechnilogy*. https://doi.org/10.1038/s41587-025-02694-w

Cannoodt R*, Deconinck L*, Couckuyt A*, **Markov NS***, Zappia L, Luecken MD, Interlandi M, Saeys Y, Saelens W. — 2025

funkyheatmap: Visualising data frames with mixed data types. *Journal of Open Source Software*. https://doi.org/10.21105/joss.07698

Gao CA, **Markov NS**, Pickens C, Pawlowski A, Kang M, Walter JM, Singer BD, Wunderink RG. 2025

An observational cohort study of bronchoalveolar lavage fluid galactomannan and Aspergillus culture positivity in patients requiring mechanical ventilation. *Open Forum Infectious Diseases*. https://doi.org/10.1093/ofid/ofaf090

Markov NS, Ren Z, Senkow KJ, Grant RA, Gao CA, Malsin ES, Sichizya L, Kihshen H, […], Nwaezeapu J, Kang M, Rasmussen L, Ozer EA, Lorenzo-Redondo R, Hultquist JF, Simons LM, Rios-Guzman E, Misharin AV, Wunderink RG, Budinger GRS, Singer BD, Morales-Nebreda L; NU SCRIPT Study Investigators. 2024

A distinctive evolution of alveolar T cell responses is associated with clinical outcomes in unvaccinated patients with SARS-CoV-2 pneumonia. *Nature Immunology*. https://doi.org/10.1038/s41590-024-01914-w

Bailey JI, Puritz CH, Senkow KJ, **Markov NS**, Diaz E, Jonasson E, Yu Z, Swaminathan S, Lu Z, Fenske S, Grant RA, Abdala-Valencia H, […], Jain M, Bharat A, Kurihara C, Estepar Ruben SJ, Estepar Raul SJ, Washko GR, Shilatifard A, Sznajder JI, Ridge KM, Budinger GRS, Braun R, Misharin AV, Sala MA. 2024

Profibrotic monocyte-derived alveolar macrophages are expanded in patients with persistent respiratory symptoms and radiographic abnormalities after COVID-19. *Nature Immunology*. https://doi.org/10.1038/s41590-024-01975-x.

Gao CA*, **Markov NS***, Stoeger T*, Pawlowski A, Kang M, Nannapaneni P, Grant RA, Pickens C, Walter JM, Kruser JM, Rasmussen L, Schneider D, Starren J, Donnelly HK, Donayre A, Luo Y, Budinger GRS, Wunderink RG, Misharin AV, Singer BD, NU SCRIPT Study Investigators. 2023

Machine learning links unresolving secondary pneumonia to mortality in patients with severe pneumonia, including COVID-19. *The Journal of Clinical Investigation (JCI)*, 133(12). https://doi.org/10.1172/JCI170682

Sikkema L, Ramírez-Suástegui C, Strobl DC, Gillett TE, Zappia L, Madissoon E, **Markov NS**, Zaragosi LE, Ji Y, Ansari M, Arguel MJ, Apperloo L, Banchero M, Bécavin C, Berg M, […], Falk CS, Meyer KB, Kropski JA, Pe'er D, Schiller HB, Tata PR, Schultze JL, Teichmann SA, Misharin AV, Nawijn MC, Luecken MD, Theis FJ. 2023

An integrated cell atlas of the lung in health and disease. *Nature Medicine*. 29, 1563–1577. https://doi.org/10.1038/s41591-023-02327-2

Gao CA, Howard FM, **Markov NS**, Dyer EC, Ramesh S, Luo Y, Pearson AT. 2023

Comparing scientific abstracts generated by ChatGPT to real abstracts with detectors and blinded human reviewers. *npj Digital Medicine*, 6(1):1–5. https://doi.org/10.1038/s41746-023-00819-6

Villéger R, Chulkina M, Mifflin RC, **Markov NS**, Trieu J, Sinha M, Johnson P, Saada JI, Adegboyega PA, Luxon BA, Beswick EJ, Powell DW, Pinchuk IV. 2023

Loss of alcohol dehydrogenase 1B in cancer-associated fibroblasts: contribution to the increase of tumor-promoting IL-6 in colon cancer. *British Journal of Cancer*, 128(4):537–548. https://doi.org/10.1038/s41416-022-02066-0

Sala MA*, **Markov NS***, Politanska Y, Abdala-Valencia H, Misharin AV, Jain M. 2022

Expression of *ACE2*–A Key SARS-CoV-2 Entry Factor–Is Not Increased in the Nasal Mucosa of People with Cystic Fibrosis. *American Journal of Respiratory Cell and Molecular Biology (AJRCMB)*, 67(1):132–137. https://doi.org/10.1165/rcmb.2021-0341LE

Yoshida M, Worlock KB, Huang N, Lindeboom RGH, Butler CR, […], **NU SCRIPT Study Investigators**†, Reynolds G, Haniffa M, Bowyer GS, Coates M, Clatworthy MR, Calero-Nieto FJ, Göttgens B, O'Callaghan C, Sebire NJ, Jolly C, De Coppi P, Smith CM, Misharin AV, Janes SM, Teichmann SA, Nikolić MZ, Meyer KB. 2022

Local and systemic responses to SARS-CoV-2 infection in children and adults. *Nature*, 602, 321–327. https://doi.org/10.1038/s41586-021-04345-x
† **Markov NS** among NU SCRIPT Study Investigators.

Koch CM, Prigge AD, Anekalla KR, Shukla A, Do Umehara HC, Setar L, Chavez J, Abdala-Valencia H, Politanska Y, **Markov NS**, Hahn GR, Heald-Sargent T, Sanchez- Pinto LN, Muller WJ, Singer BD, Misharin AV, Ridge KM, Coates BM. 2022

Age-related Differences in the Nasal Mucosal Immune Response to SARS-CoV-2. *American Journal of Respiratory Cell and Molecular Biology (AJRCMB)*, 66(2):206–222. https://doi.org/10.1165/rcmb.2021-0292OC

Speir ML, Bhaduri A, **Markov NS**, Moreno P, Nowakowski TJ, Papatheodorou I, Pollen AA, Raney BJ, Seninge L, Kent WJ, Haeussler M. 2021

UCSC Cell Browser: visualize your single-cell data. *Bioinformatics*, 37(23):4578–4580. https://doi.org/10.1093/bioinformatics/btab503

Watanabe S, **Markov NS**, Lu Z, Piseaux Aillon R, Soberanes S, Runyan CE, Ren Z, Grant RA, Maciel M, Abdala-Valencia H, Politanska Y, Nam K, Sichizya L, Kihshen HG, Joshi N, McQuattie-Pimentel AC, Gruner KA, Jain M, Sznajder JI, Morimoto RI, Reyfman PA, Gottardi CJ, Budinger GRS, Misharin AV. 2021

Resetting proteostasis with ISRIB promotes epithelial differentiation to attenuate pulmonary fibrosis. *Proceedings of the National Academy of Sciences (PNAS)*, 118(20):e2101100118. https://doi.org/10.1073/pnas.2101100118

Morales-Nebreda L, Helmin KA, Acosta MAT, **Markov NS**, Hu JYS, Joudi AM, Piseaux-Aillon R, Abdala-Valencia H, Politanska Y, Singer BD. Available from: https://insight.jci.org/articles/view/141690 PMID: 0 2021

Aging imparts cell-autonomous dysfunction to regulatory T cells during recovery from influenza pneumonia. *JCI Insight*, 6(6): e141690. https://doi.org/10.1172/jci.insight.141690

Grant RA*, Morales-Nebreda L*, **Markov NS***, Swaminathan S, Querrey M, Guzman ER, Abbott DA, […], Malsin ES, Pickens CO, Smith SB, Walter JM, Pawlowski AE, Schneider D, Nannapaneni P, Abdala-Valencia H, Bharat A, Gottardi CJ, Budinger GRS, Misharin AV, Singer BD, Wunderink RG. 2021

Circuits between infected macrophages and T cells in SARS-CoV-2 pneumonia. *Nature*, 590, 635–641. https://doi.org/10.1038/s41586-020-03148-w

Bharat A, Querrey M, **Markov NS**, Kim S, Kurihara C, Garza-Castillon R, Manerikar A, Shilatifard A, Tomic R, Politanska Y, Abdala-Valencia H, Yeldandi AV, Lomasney JW, Misharin AV, Budinger GRS. 2020

Lung transplantation for pulmonary fibrosis secondary to severe COVID-19. *Science Translational Medicine*, 12, eabe4282. https://doi.org/10.1126/scitranslmed.abe4282

Runyan CE, Welch LC, Lecuona E, Shigemura M, Amarelle L, Abdala-Valencia H, Joshi N, Lu Z, Nam K, **Markov NS**, McQuattie-Pimentel AC, Piseaux-Aillon R, Politanska Y, Sichizya L, Watanabe S, Williams KJN, Budinger GRS, Sznajder JI, Misharin AV. 2020

Impaired phagocytic function in CX3CR1^{+} tissue-resident skeletal muscle macrophages prevents muscle recovery after influenza A virus-induced pneumonia in old mice. *Aging Cell*, 19(9):e13180. https://doi.org/10.1111/acel.13180

Joshi N, Watanabe S, Verma R, Jablonski RP, Chen CI, Cheresh P, **Markov NS**, Reyfman PA, McQuattie-Pimentel AC, Sichizya L, Lu Z, Piseaux R, Kirchenbuechler D, Flozak AS, Gottardi CJ, Cuda CM, Perlman H, Jain M, Kamp DW, Scott Budinger GR, Misharin AV. 2019

A spatially restricted fibrotic niche in pulmonary fibrosis is sustained by M-CSF/M-CSFR signalling in monocyte-derived alveolar macrophages. *European Respiratory Journal (ERJ)*, 55 (1) 1900646. https://doi.org/10.1183/13993003.00646-2019

Invited Talks

Distinct pathogen-specific host responses in patients with severe pneumonia. March 2025
Systems Biology Consortium for Infectious Diseases Lecture Series.

Host response in severe pneumonia is pathogen-specific. September 2024
Systems Biology for Infectious Diseases Annual Meeting.

Cellular and molecular biomarkers of successful responses to therapy in severe pneumonia, including COVID-19. November 2022
CZI Single-Cell Biology 2022 Annual meeting. Recording

Circuits between infected macrophages and T cells in SARS-CoV-2 pneumonia. June 2021
American Thoracic Society Allergy, Immunology and Inflammation (AII) assembly journal club. Recording

Awards and Grant

American Heart Association Predoctoral Fellowship 2024–2026
Machine learning approaches to predict outcomes and complications in ICU patients.
24PRE1196998 ($67000)
https://doi.org/10.58275/AHA.24PRE1196998.pc.gr.190609

Northwestern Institute on Complex Systems Data Science Fellow ($12500) 2022

Work Experience

Post-Baccalaureate Research Fellow, Division of Pulmonary and Critical Care Medicine, Feinberg School of Medicine, Northwestern University, Chicago, USA 2019–2022
Analyse transcriptomic data from human samples and mouse experiments to gain insights into COVID-19, pulmonary fibrosis, systemic sclerosis and other pulmonary diseases. Analyse clinical data to correlate -omics data to clinical states and effects of treatment. Write manuscripts, support and organize data exchange, data management infrastructure, survey and apply new tools to RNA-seq analysis, develop in-house algorithms, design biological experiments to test hypothesis generated from analysis of transcriptomic data.

Head of maintenance tools development group, Yandex, Moscow, Russia 2014–2017
Manage a team of developers: mentoring, resolving conflicts, improving performance, code review.
Develop, design and support tools for system administrators and other employees.

Full-stack software engineer, Yandex, Moscow, Russia 2007–2014
Develop, design and support web-services and console tools for improving employees' workflows.

Software engineer, Art. Lebedev Studio, Moscow, Russia 2006–2007
Develop and support web-sites and a content management system.

Teaching Experience

Summer Students Program 2022 at Division of Pulmonary and Critical Care Medicine 2022
Co-mentored 1 college student in automated image analysis. Helped develop project goals, methodology and results interpretation.

Summer Students Program 2020 at Division of Pulmonary and Critical Care Medicine 2020
Co-mentored a group of 4 college students on a bioinformatics project. Contributed to project's design, teaching R programming environment, single-cell RNA-seq experimental technology and analysis.

Introduction to Python, Introduction to Pandas and Matplotlib 2020
Small introductory lecture series during Data Science Nights at NICO, Northwestern University.

Introduction to Programming, Newcastle University, Newcastle upon Tyne, UK 2017
Unofficial 5-lecture course for fellow students.

Introduction to Computer Science with Python 3, Yandex, Moscow, Russia 2013
High-school students.

Miscalleneous

Open Problems for Single-Cell Analysis Jamboree March 2021
https://openproblems.bio/jamboree/

Contributor to open-source software: 2018–present
`Seurat`, `CellBrowser`, `biopython`, `funkyheatmap`, `statannotations`, `scanpy`, `CellBender`.

Programming languages:
Python, R, Java, C++, Ruby, Perl. Linux. Latex. HTML, JavaScript.
Github: https://github.com/mxposed