Axel Loewe's Publications

1 Peer-reviewed Journal Articles[1]

Forthcoming

[j95] Giardini, F., Olianti, C., Marchal, G., Campos, F., Steyer, J., Madl, J., Piersanti, R., Arecchi, G., Perumal Vanaja, I., Biasci, V., Nesi, G., Loew, L., Cerbai, E., Chelko, S. P., Regazzoni, F., **Loewe, A.**, Bishop, M. J., Mongillo, M., Kohl, P., T. Z., Zgierski-Johnston, C. M., and Sacconi, L. "Cardiac fibrosis affects electrical conduction and arrhythmogenesis in a pacing-rate-dependent manner", under review. Preprint available. DOI: 10.21203/rs.3.rs-5804800/v1.

[j94] Houillon, M., Klar, J., Boutanios, Z., Stary, T., Cojean, T., Anzt, H., and **Loewe, A.** "FACILE-RS: archival and long term preservation of research software repositories made easy", under review. Preprint available. URL: https://github.com/openjournals/joss-papers/blob/joss.07330/joss.07330/10.21105.joss.07330.pdf.

2025

[j93] Barrios Espinosa, C., Sánchez, J., Appel, S., Becker, S., Krauß, J., Martínez Díaz, P., Unger, L., Houillon, M., and **Loewe, A.** "A Cyclical Fast Iterative Method for Simulating Reentries in Cardiac Electrophysiology Using an Eikonal-Based Model". *Engineering with Computers* 2025, epub ahead. DOI: 10.1007/s00366-024-02094-9.

[j92] **Loewe, A.**, Hunter, P. J., and Kohl, P. "Computational modelling of biological systems now and then: revisiting tools and visions from the beginning of the century". *Philosophical Transactions A of the Royal Society* 2025;383(2296):20230384. DOI: 10.1098/rsta.2023.0384.

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[j90] Sánchez Arciniegas, J., Llorente-Lipe, I., Barrios Espinosa, C., **Loewe, A.**, Hernández-Romero, I., Vicente-Puig, J., Ros, S., Atienza, F., Carta-Bergaz, A., M Climent, A., and S Guillem, M. "Enhancing Premature Ventricular Contraction Localization through Electrocardiographic Imaging and Cardiac Digital Twins". *Computers in Biology and Medicine* 2025, epub ahead. DOI: 10.1016/j.compbiomed.2025.109994.

[j89] Linder, M., Stary, T., Bitay, G., Nagy, N., and **Loewe, A.** "Sympathetic Stimulation Can Compensate for Hypocalcaemia-Induced Bradycardia in Human and Rabbit Sinoatrial Node Cells". *The Journal of Physiology* 2025, epub ahead. DOI: 10.1113/JP287557.

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[j87] Mehari, T., Sundar, A., Bosnjakovic, A., Harris, P., Williams, S. E., **Loewe, A.**, Doessel, O., Nagel, C., Strodthoff, C., and Aston, P. J. "ECG Feature Importance Rankings: Cardiologists vs. Algorithms". *IEEE Journal of Biomedical and Health Informatics* 2024;28(4):2014–2194. DOI: 10.1109/JBHI.2024.3354301.

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[1] Equal contributions by several authors are denoted by *.

[j83] Fröhlich, J., Gerach, T., Krauß, J., **Loewe, A.**, Stengel, L., and Wieners, C. "Numerical evaluation of elasto-mechanical and visco-elastic electro-mechanical models of the human heart". *GAMM Mitteilungen - Surveys for Applied Mathematics and Mechanics* 2024;46(3–4):e202370010. DOI: 10.1002/gamm.202370010.

[j82] Martínez Díaz, P., Sánchez, J., Fitzen, N. A., Ravens, U., Dössel, O., and **Loewe, A.** "The Right Atrium Affects in silico Arrhythmia Vulnerability in Both Atria". *Heart Rhythm* 2024;21(6):799–805. DOI: 10.1016/j.hrthm.2024.01.047.

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[j80] Rinné, S., Oertli, A., Nagel, C., Tomsits, P., Jenewin, T., Kääb, S., Kauferstein, S., **Loewe, A.**, Beckmann, B. M., and Decher, N. "Characterization of a Spectrum of Novel Disease-Associated KCNQ1 Variants Identified in Romano-Ward Syndrome". *International Journal of Molecular Sciences* 2023;24(2):1350. DOI: 10.3390/ijms24021350.

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2016 [a12] Shin, E., Poremba, E., Dössel, O., and **Loewe, A.** "Automated Initiation of Fibrillatory Excitation in Monodomain Simulations". In: *Kentucky Academy of Science*. 2016. Louisville.

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2015 [a8] **Loewe, A.**, Lutz, Y., Wilhelms, M., Sinnecker, D., Barthel, P., Scholz, E. P., Dössel, O., Schmidt, G., and Seeman, G. "In-silico Assessment of the Dynamic Effects of Amiodarone and Dronedarone on Human Atrial Patho-Electrophysiology". In: *Atrial Signals*. 2015. Karlsruhe.

[a7] **Loewe, A.**, Lutz, Y., Wilhelms, M., Sinnecker, D., Barthel, P., Scholz, E. P., Dössel, O., Schmidt, G., and Seemann, G. "In-silico Assessment of the Dynamic Effects of Amiodarone and Dronedarone on Human Atrial Patho-Electrophysiology". In: *Cardiac Physiome Workshop*. 2015. April 8-10, 2015, Auckland, New Zealand.

[a6] Rottmann, M., Unger, L., Kaltenbacher, W., **Loewe, A.**, Krueger, M. W., Seemann, G., Arentz, T., Jadidi, A. S., and Doessel, O. "Methods for analyzing signal characteristics of stable and unstable rotors in a realistic heart model". In: *Atrial Signals Conference*. 2015.

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2013 [a4] **Loewe, A.**, Wilhelms, M., Schmid, J., Krause, M. J., Fischer, F., Scholz, E. P., Dössel, O., and Seemann, G. "A Hybrid Optimization Approach for the Adaptation of Cardiac Ion Current Formulations to Voltage and Patch Clamp Data". In: *Cardiac Physiome Workshop*. 2013.

[a3] Liu, J., **Loewe, A.**, Zenge, M., Lefebvre, A., Mueller, E., and Nadar, M. S. "Elora: Enforcing Low Rank for Parallel MR Reconstruction". In: *International Society for Magnetic Resonance in Medicine*. 2013. P. 2652.

[a2] **Loewe, A.**, Poremba, E., Krueger, M. W., Dössel, O., and Seemann, G. "Fast Marching Simulation of Atrial Excitation: Towards Personalized Ablation Planning". In: *TRM Forum*. 2013. Lugano, Switzerland, on 13 December 2013.

[a1] Seemann, G., **Loewe, A.**, Lutz, Y., Wilhelms, M., and Dössel, O. "Simulating the Effects of Drugs and Genetic Defects on Atrial Electrophysiology". In: *TRM Forum*. 2013.

5   Invited Talks

2024 [t29] **Loewe, A.** "Computational Modeling and Simulation of the ECG as an Enabling Technology for

Machine Learning". In: International Congress on Electrocardiology 2024. Lund, Sweden.

[t28] **Loewe, A.** "Computational models of the human heart: linking information across species and scales". In: 5th Translational Workshop of the German Cardiac Society 2024. Hamburg, Germany.

[t27] **Loewe, A.** "Computermodelle des Herzens". In: Arbeitskreis Digitale Medizin 2024. Heidelberg, Germany.

[t26] **Loewe, A.** "Digital chimeras to enable in silico clinical trials of ablation strategies to terminate atrial fibrillation and prevent recurrence". In: Computational Modelling in Medicine 2024. University of Nottingham, UK.

[t25] **Loewe, A.** "Digital chimeras to enable in silico trials at scale". In: Fickle Heart: The intersection of UQ, AI and Digital Twins 2024. Cambridge, UK.

[t24] **Loewe, A.** "Mechanistic Modeling and Simulation of the ECG as an Enabling Technology for Machine Learning: Concepts, Datasets, and Real-World Performance". In: BMT 2024 - 58th Annual Conference of the German Society for Biomedical Engineering (VDE|DGBMT) 2024. Stuttgart, Germany.

[t23] **Loewe, A.** "Modeling & Simulation of Cardiac Function: Combining Mechanistic Models and Artificial Intelligence". In: Medical Information Sciences Seminar 2024. University of Augsburg.

[t22] **Loewe, A.** "Modeling & simulation of cardiac function: combining mechanistic models and artificial intelligence". In: 2024. Tampere University, Finnland.

[t21] **Loewe, A.** "Modeling & simulation of cardiac function: combining mechanistic models and artificial intelligence". In: Edwards Life Sciences Seminar 2024.

[t20] **Loewe, A.** "Real-world and synthetic ECG data for prediction models: synergistic combination of mechanistic and data-driven models". In: Atrial Signals 2024. Maastricht, The Netherlands.

[t19] **Loewe, A.** "Supervised & unsupervised machine learning". In: Artificial Intelligence for Life Scientists 2024. online.

[t18] **Loewe, A.** "Synergies between mechanistic and data-driven models in medical research". In: Helmholtz Information & Data Science Academy (HIDA) Lectures 2024. online. URL: `https://www.youtube.com/watch?v=gw22xAaTKyQ`.

2023 [t17] **Loewe, A.** "Digital chimeras to enable in silico clinical trials of ablation strategies to terminate atrial fibrillation and prevent recurrence". In: Special Semester on Mathematical Methods in Medicine, Johann Radon Institute for Computational and Applied Mathematics 2023. Linz, Austria.

[t16] **Loewe, A.** "Health Technologies at KIT". In: VDI Carl-Benz-Kreis 2023. Karlsruhe, Germany.

[t15] **Loewe, A.** "Modeling & Simulation of the Human Atria – Statistical Shape Models & Electrograms". In: NumeriCor Cardiac Modeling Summit 2023. Graz, Austria.

2022 [t14] **Loewe, A.** and Jadidi, A. "Computational Cardiac Modeling – Synergies with Machine Learning and Clinical Translation". In: Oxford Symposium on the Future of Therapy Discovery and Development 2022. Oxford, UK.

[t13] **Loewe, A.** "Computermodellierung und maschinelles Lernen in der kardiovaskulären Medizin". In: *Clinical Research in Cardiology*. 88th Annual Meeting of the German Cardiac Society (DGK) 2022. Mannheim, Germany. P. V1272. DOI: `10.1007/s00392-022-02002-5`.

[t12] **Loewe, A.** "Contemporary ECGI Research". In: ECG Imaging Symposium 2022. Tampere, Finland.

[t11] **Loewe, A.** "Mein digitaler Zwilling: Welche Möglichkeiten eröffnen mathematische Computermodelle des Herzens für die Diagnose und Therapie von Herzkrankheiten?" In: KIT im Rathaus (KIT in the city hall) 2022. Karlsruhe, Germany.

2021 [t10] **Loewe, A.** "Computational Cardiac Modeling - Synergies with Machine Learning". In: Cardiac Electromechanics Research Group (Prof. Niederer / Bishop), King's College London 2021. London, UK.

[t9] **Loewe, A.** "Predicting potential AFlut patterns using computational modeling". In: Atrial Signals Workshop 2021. Karlsruhe, Germany.

2019 [t8] **Loewe, A.** "The inverse problem of cardiac mechanics - estimation of cardiac active stress distribution through imaging-driven computational modeling". In: 9th International Congress on Industrial and Applied Mathemarics 2019. Valencia, Spain.

	[t7]	**Loewe, A.** "The inverse problem of cardiac mechanics - estimation of cardiac active stress from endocardial motion tracking". In: 6th International Conference on Computational and Mathematical Biomedical Engineering 2019. Sendai City, Japan.
2017	[t6]	**Loewe, A.** "Multiscale modeling of cardiac electrophysiology". In: School of Science and Engineering, Reykjavik University / Háskólann í Reykjavík 2017. Reykjavik, Iceland.
	[t5]	**Loewe, A.** "Validation upside down - In-silico models to sound the potential and limitations of diagnostic tools". In: TRM Forum 2017. Lugano, Switzerland.
2016	[t4]	**Loewe, A.** "Multiscale computational cardiology". In: Computational Physiopathology Unit (Prof. Stefano Severi), University of Bologna 2016. Bologna, Italy.
2015	[t3]	**Loewe, A.** "In-silico Assessment of the Dynamic Effects of Amiodarone and Dronedarone on Human Atrial Patho-Electrophysiology". In: Emerging Mathematical Topics in Biology and Life Sciences 2015. Graz, Austria.
2014	[t2]	**Loewe, A.** "Modeling human atrial patho-electrophysiology: genetic defects and pharmacological agents". In: Simula Cardiac Modeling Workshop 2014. Oslo, Norway.
	[t1]	**Loewe, A.** "Multiscale in silico modeling of human atrial electrophysiology". In: Computational Cardiology Lab (Prof. Natalia Trayanova), Johns Hopkins University 2014. Baltimore, USA.

6 Patents

2022	[pa5]	Azzolin, L., **Loewe, A.**, Dössel, O., Nairn, D., Nagel, C., Sánchez, J., Unger, L., and Zheng, T. *Automated pipeline to generate augmented anatomical and functional atrial digital twins*. European Patent Application.
2021	[pa4]	Müller-Edenborn, B., Jadidi, A., **Loewe, A.**, and Luongo, G. *Algorithm to identify patients with atrial fibrillation-induced heart failure*. German Patent Application.
2019	[pa3]	Oesterlein, T., Dössel, O., Frisch, D., **Loewe, A.**, Lenis, G., and Pilia, N. *Method and system for determining ventricular far field contribution in atrial electrograms*. United States Patent Application 20190059765, 16/111092.
2015	[pa2]	Liu, J., Yang, Z., Nadar, M. S., Janardhanan, N., Wang, Q., and **Loewe, A.** *Multi-stage Magnetic Resonance Reconstruction for Parallel Imaging Applications*. United States Patent 9097780.
2014	[pa1]	Lefebvre, A., **Loewe, A.**, Nadar, M. S., and Liu, J. *Zero communication block partitioning*. United States Patent 9286648B2.

7 Public Outreach / Popular Science

2025	[o12]	Grävemeyer, A. "Digitale Zwillinge – Mit hoch skalierbaren Algorithmen simulieren Supercomputer Patientenherzen". *c't – Magazin für Computertechnik* 2025;(7), 124–127. URL: `https://www.heise.de/select/ct/2025/7/2504311301389077742`.
	[o11]	**Loewe, A.**, Neic, A., Seemann, G., Vigmond, E., and Plank, G. "openCARP: Personalized Computational Model of the Heart Examines Cardiac Rhythm". *SIAM News* 2025;58(2):7–8. URL: `https://www.siam.org/publications/siam-news/articles/opencarp-personalized-computational-model-of-the-heart-examines-cardiac-rhythm/`.
2024	[o10]	Marburger, H. "Computermodelle und Maschinelles Lernen verbessern die Herzdiagnostik". *lookKIT* 2024;(2), 10–13. URL: `https://www.sts.kit.edu/downloads/lookkit-202402.pdf`.
	[o9]	Junger Kulturkanal. "Medizin der Zukunft". *Radio Interview* 2024.
2023	[o8]	ZEISS Innovation Hub@KIT. "Unveiling the Digital Heart Twin". *Podcast - A coffee with...* 2023. URL: `https://open.spotify.com/episode/6OctAEO6nGQx2asbRa3V7D?si=c41b2bd6d1184005`.
	[o7]	KIT Campus Report. "Zentimetergenaue Lokalisierung durch Künstliche Intelligenz" – KIT-Forschungsprojekt will Diagnose von Herzrhythmusstörungen erleichtern". *Podcast* 2023. URL: `https://medienportal.bibliothek.kit.edu/details/DIVA-2023-269`.
2022	[o6]	**Loewe, A.** and Anzt, H. "Es ist Zeit über Forschungssoftware zu reden". *Wissenschaftsmanagement* 2022;2021:56–61. URL: `https://www.wissenschaftsmanagement.de/news/es-ist-zeit-ueber-forschungssoftware-zu-reden`.

[o5] KIT im Rathaus. "Mein digitaler Zwilling: Welche Möglichkeiten eröffnen mathematische Computermodelle des Herzens für die Diagnose und Therapie von Herzkrankheiten?" *YouTube* 2022. URL: `https://www.youtube.com/watch?v=iLL1XTmFFMc&list=PL0TmH52ybqIfnLU0b1TKz8qFCuEJyRNJk&index=3`.

[o4] Renal Research Institute, Frontiers in Kidney Medicine and Biology. "What ECG can tell us about the events on a molecular scale". *YouTube* 2022. URL: `https://www.youtube.com/watch?v=g75nZOwISMI`.

2021   [o3] Anzt, H. and **Loewe, A.** "Forschungssoftware – Nachhaltige Entwicklung und Bereitstellung". *Forschung & Lehre* 2021;28(5):380–381. URL: `https://www.wissenschaftsmanagement-online.de/beitrag/forschungssoftware-nachhaltige-entwicklung-und-bereitstellung-12233`.

[o2] Appel, F. and **Loewe, A.** "Forschungssoftware – Nachhaltige Entwicklung und Unterstützung". *IAMO Policy Briefs* 2021;42. URL: `https://www.iamo.de/fileadmin/documents/IAMOPolicyBrief42_de.pdf`.

[o1] Luik, A., Unger, L., and **Loewe, A.** "Fortschritt - erst technisch dann klinisch". *Cardio News* 2021;24(11/12):24.

[o0] **Loewe, A.** "KIT Forscher simulieren Herzen". *Badische Neueste Nachrichten* 2021.

[o-1] Appel, F. and **Loewe, A.** "Research Software–Sustainable Development and Support". *IAMO Policy Briefs* 2021;42. URL: `https://www.iamo.de/fileadmin/documents/IAMOPolicyBrief42_en.pdf`.

[o-2] Fakultät für Elektrotechnik und Informationstechnik. "Studieren am KIT: Elektrotechnik und Informationstechnik (ETIT)". *YouTube* 2021. URL: `https://www.youtube.com/watch?v=m7q0o1KqVcE`.

2020   [o-3] **Loewe, A.** "Ein digitales Herz". *Spektrum der Wissenschaft* 2020;20(10):44–48.

[o-4] Lohrer, M. and **Loewe, A.** "Herzsimulator 1.0". *dotnetpro* 2020;2020(1):13–19.

[o-5] **Loewe, A.** "Mit Computerherz zum Therapieerfolg". *KIT NEULAND* 2020, 36–43. URL: `https://kit-neuland.de/de/magazin/projekte/mit-computerherz-zum-therapieerfolg#site-contents-568`.

2019   [o-6] Hallensleben, S. and **Loewe, A.** "Wie wirken Arzt und digitale Technik im Jahr 2035 zusammen?" *VDE DGBMT* 2019.

2018   [o-7] KIT Campus Report. "Ein Schritt zur individualisierten Medizin - Computersimulationen des Vorhofflimmerns ermöglichen wirksamere Therapien". *Podcast* 2018. URL: `https://medienportal.bibliothek.kit.edu/details/DIVA-2018-664`.

[o-8] **Loewe, A.** "Mit Vortests zur besten Therapie - KIT-Forscher simuliert am PC Behandlungsmethoden bei Vorhofflimmern". *Badische Neueste Nachrichten* 2018.

See CV for further dissemination and outreach activities.

8   Book Chapters and Monographs

2024   [b13] Viceconti, M., Geris, L., Emili, L., **Loewe, A.**, Staumont, B., Morales-Orcajo, E., Horner, M., De Cunha Maluf-Burgman, M., and Lesage, R. "Introduction". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 1–8. ISBN: 9783031482847. DOI: `10.1007/978-3-031-48284-7_1`.

[b12] Kulesza, A., **Loewe, A.**, Stenti, A., Nicolò, C., Morales-Orcajo, E., Courcelles, E., Sips, F., Pappalardo, F., Russo, G., Horner, M., Viceconti, M., De Cunha Maluf-Burgman, M., Lesage, R., and Kreuzer, S. "Model Development". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 25–42. ISBN: 9783031482847. DOI: `10.1007/978-3-031-48284-7_3`.

[b11] Lesage, R., **Loewe, A.**, Morales-Orcajo, E., and Viceconti, M. "The Investigator: Modellers and Analysts". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 115–122. ISBN: 9783031482847. DOI: `10.1007/978-3-031-48284-7_9`.

[b10] Viceconti, M., Juárez, M., **Loewe, A.**, Calvetti, D., Somersalo, E., Geris, L., Horner, M., and De Cunha Maluf-Burgman, M. "Theoretical Foundations of Good Simulation Practice". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 9–23. ISBN: 9783031482847. DOI: `10.1007/978-3-031-48284-7_2`.

2022 [b9] Matas, J. F. R., Berenfeld, O., **Loewe, A.**, Corino, V., and Martínez, J. P., eds. *Atrial Fibrillation: Technology for Diagnosis, Monitoring, and Treatment, Volume II*. 2022. Frontiers Media SA. DOI: `10.3389/978-2-8325-2466-4`.

[b8] Matas, J. F. R., Berenfeld, O., **Loewe, A.**, Corino, V., and Martínez, J. P., eds. *Atrial Fibrillation: Technology for Diagnosis, Monitoring, and Treatment*. 2022. Frontiers Media SA. DOI: `10.3389/978-2-88974-690-3`.

[b7] **Loewe, A.**, Martínez Díaz, P., Nagel, C., and Sánchez, J. "Cardiac Digital Twin Modeling". In: *Innovative treatment strategies for clinical electrophysiology*. Ed. by T. Jadczyk, A. Loewe, G. Caluori, and K. S. Golba. 2022. Springer. DOI: `10.1007/978-981-19-6649-1_7`.

[b6] Jadczyk, T., **Loewe, A.**, Caluori, G., and Golba, K. S., eds. *Innovative Treatment Strategies for Clinical Electrophysiology*. Lecture Notes in Bioengineering 2022. Springer. ISBN: 978-981-19-6648-4. DOI: `10.1007/978-981-19-6649-1`.

[b5] **Loewe, A.**, Luongo, G., and Sánchez, J. "Machine Learning for Clinical Electrophyisology". In: *Innovative treatment strategies for clinical electrophysiology*. Ed. by T. Jadczyk, A. Loewe, G. Caluori, and K. S. Golba. 2022. Springer. DOI: `10.1007/978-981-19-6649-1_6`.

2021 [b4] **Loewe, A.** "Simulation of Cardiac Electrophysiology and Biomechanics: from Model Development to Clinical Translation". Habilitation Thesis. Karlsruhe Institute of Technology (KIT).

2016 [b3] **Loewe, A.** "Modeling human atrial patho-electrophysiology from ion channels to ECG : substrates, pharmacology, vulnerability, and P-waves". PhD thesis. Karlsruhe Institute of Technology (KIT). DOI: `10.5445/KSP/1000054615`.

2013 [b2] **Loewe, A.** "Arrhythmic potency of human electrophysiological models adapted to chronic and familial atrial fibrillation". Master Thesis. Karlsruhe Institute of Technology (KIT).

2010 [b1] **Loewe, A.** "Comparison of cardiac simulation tools regarding the modeling of acute ischemia". Bachelor Thesis. Karlsruhe Institute of Technology (KIT).

9 Reviewer Activity

9.1 Funding Agencies

- *Association of Collaborating Health Foundations (SGF)*
- *Bayerisches Staatsministerium für Wissenschaft und Kunst*
- *Bayerische Forschungsstiftung*
- *Belgian Physical Society*
- *British Heart Foundation*
- *Czech Academy of Sciences, member of evaluation panel "Engineering and Technology"*
- *Deutsche Forschungsgemeinschaft (DFG)*
- *Deutsche Gesellschaft für Kardiologie (DGK)*
- *Dutch Heart Foundation*
- *Dutch Research Council (NWO)*
- *ETH Zurich*
- *European Research Council (ERC)*
- *Fondazione Leonardo*
- *Heart Research UK*
- *Heidelberger Akademie der Wissenschaften*
- *Medical Research Council, UK*
- *Medical Research Foundation, UK*
- *National Science Center, Poland*

- *Research Council of Norway (Forskningsrådet)*
- *Swiss National Science Foundation (SNSF)*
- *UKRI Engineering and Physical Sciences Research Council*
- *Wellcome Trust*

9.2   Scientific Journals and Conferences

- *American Journal of Physiology - Heart and Circulatory Physiology* (2023-24)
- *Annals of Biomedical Engineering* (2019-20, 2025)
- *Annals of Noninvasive Electrocardiology* (2024)
- *Artificial Intelligence in Medicine* (2024)
- *Biomechanics and Modeling in Mechanobiology* (2020, 2023-24)
- *Biomedizinische Technik Conference (Annual Meeting of the German Society for Biomedical Engineernig)* (2022-24)
- *Biophysical Journal* (2019, 2022)
- *BMC Medical Research Methodology* (2023)
- *BMC Nephrology* (2021)
- *Cardiology Research and Practice* (2021)
- *Cardiovascular Engineering and Technology* (2021)
- *Cardiovascular Research* (2018, 2022-24)
- *Chaos, Solitions and Fractals* (2024-25)
- *Circulation: Arrhythmia and Electrophyisology* (2021)
- *Clinical Medicine Insights Cardiology* (2019)
- *Communications Medicine* (2025)
- *Computers in Biology and Medicine* (2018-21)
- *Computers Methods and Programs in Biomedicine* (2024-25)
- *Computing in Cardiology Conference* (2017-23,2025)
- *eLIFE* (2021)
- *Engineering with Computers* (2022)
- *Europace* (2016-21, 2023-24)
- *European Heart Journal* (2022)
- *European Heart Journal - Digital Health* (2023)
- *Expert Systems with Applications* (2022, 2024)
- *Frontiers in Cardiovascular Medicine* (2020, 2022)
- *Frontiers in Physiology* (2017, 2019-23)
- *Functional Imaging and Modeling of the Heart Conference* (2023, 2025)
- *Heart Rhythm Journal* (2017-19, 2022-24)
- *Heart Rhythm Society Annual Meeting* (2023-24)
- *Heliyon* (2023)
- *IEEE Journal of Biomedical and Health Informatics* (2023-24)
- *IEEE Transactions on Automation Science and Engineering* (2022)
- *IEEE Transactions on Biomedical Engineering* (2016, 2019-21, 2023)

- *IEEE Transactions on Medical Imaging* (2022)
- *Interface Focus* (2023)
- *International Journal of Cardiology* (2024)
- *International Journal of Clinical Cardiology* (2017)
- *International Journal for Numerical Methods in Biomedical Engineering* (2022)
- *JACC Clinical Electrophysiology* (2021-22)
- *Journal of Cardiovascular Electrophysiology* (2021-22)
- *Journal of Computational Physics* (2021)
- *Journal of Electrocardiology* (2024)
- *Journal of Open Source Software* (2021-22)
- *Journal of the American Heart Association* (2023-24)
- *Mathematics* (2022)
- *Medical and Biological Engineering and Computing* (2016-17, 2019)
- *Medical Image Analysis* (2020-21, 2023-24)
- *Nature Cardiovascular Research* (2023-24)
- *Nature Communications* (2025)
- *Neural Networks* (2024)
- *Pflügers Archiv - European Journal of Physiology* (2023)
- *Platform for Advanced Scientific Computing (PASC) Conference* (2021)
- *Philosophical Transactions of the Royal Society A* (2019-20)
- *Physiological Reports* (2022)
- *PLOS Computational Biology* (2017, 2019, 2025)
- *PLOS ONE* (2019)
- *Scientific Data* (2025)
- *Scientific Reports* (2023, 2025)
- *Simulation: Transactions of the Society for Modeling and Simulation* (2018)
- *The Journal of Physiology* (2024-25)
- *Wellcome Open Research* (2022)
- *Workshop Biosignale* (2022, 2024)

9.3   Universities

- *Freiburg University* (2024)
- *Ghent University* (2021)
- *KIT Department of Mathematics* (2022, 2024)
- *KIT Department of Electrical Engineering and Information Technology* (2020-2024)
- *Maastricht University* (2025)
- *Politecnico di Milano* (2021)
- *Tampere University* (2024)
- *Università degli Studi di Milano* (2022)

- *Università di Bologna* (2024)
- *Universitat Politècnica de València* (2024)
- *University of Auckland* (2023-24)

Axel Loewe's Supervisions

10 Supervised Doctoral Candidates

[14] Barrios Espinosa, C A. 2025. *"Extending Eikonal-based Models in Cardiac Electrophysiology Research: Balancing Accuracy and Speed"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI:

[13] Martínez Díaz, L P. 2024. *"Personalization of Computer Models for the Assessment of Atrial Fibrillation Vulnerability"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000174866

[12] Martínez Anton, C. 2024. *"Local Impedance Characterization for Scar and Fibrosis Detection: Towards a New Substrate Assessment for Atrial Mapping"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/KSP/1000171038

[11] Brenneisen, J. 2023. *"Interaction of elastomechanics and fluid dynamics in the human heart: Opportunities and challenges of light coupling strategies"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000158111

[10] Nagel, C. 2022. *"Multiscale Cohort Modeling of Atrial Electrophysiology: Risk Stratification for Atrial Fibrillation through Machine Learning on Electrocardiograms"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/KSP/1000155927

[9] Gerach, T. 2022. *"Personalized Electromechanical Modeling of the Human Heart: Challenges and Opportunities for the Simulation of Pathophysiological Scenarios"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000147806

[8] Nairn, D. 2022. *"Multi-Modality Correspondence to Enhance Arrhythmogenic Atrial Substrate Identification: Guiding Persistent Atrial Fibrillation Ablation Therapy"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000144762

[7] Azzolin, L. 2021. *"Atrial Digital Twins to Assess Arrhythmia Vulnerability and Guide Ablation Therapy: Leverage Patient-Specific Atrial Models to Understand Atria Fibrillation Mechanisms and Provide Personalized Treatments"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000142101

[6] Luongo, G. 2021. *"Non-Invasive Atrial Arrhythmia Diagnosis Using the 12-Lead ECG: Machine Learning Leveraging in-silico and Clinical Signals"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000141417

[5] Nothstein, M. 2021. *"Characterizing Atrial Fibrillation Substrate by Electrogram and Restitution Analysis"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000140821

[4] Schuler, S. 2021. *"Novel Methods to Incorporate Physiological Prior Knowledge into the Inverse Problem of Electrocardiography: Application to Localization of Ventricular Excitation Origins"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000141624

[3] Kovacheva, E. 2021. *"Model Based Estimation of the Elastomechanical Properties of the Human Heart"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000135416

[2] Sánchez Arciniegas, J P. 2021. *"A Multiscale In Silico Study to Characterize the Atrial Electrical Activity of Patients With Atrial Fibrillation: A Translational Study to Guide Ablation Therapy"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/KSP/1000143481

[1] Lutz, Y. 2020. *"Modeling of the Human Brain to Predict Spatial and Temporal Temperature Profiles for the Selective Hypothermia Treatment of an Ischemic Stroke"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000122124

- Krauß, J., expected 2026
- Steyer, J.F., expected 2026
- Tenbrink, L., expected 2026
- Götz, C., expected 2026

- Linder, M. expected 2026
- Appel, S. expected 2027
- Becker, S. expected 2027
- Mierisch, J. expected 2027
- Maierhofer, P.H. expected 2027

11   Supervised and Refereed Student Theses

[87] Kruthoff, C. 2025. *"Evaluating Cardiac Resynchronization Therapy Strategies in an Electromechanical Heart Model"*. Master Thesis.

[86] Bender, J. 2025. *"Optimizing Electrode Placement for Atrial Cardiomyopathy Diagnosis Using in Silico Modeling"*. Master Thesis.

[85] Gschwind, B. 2025. *"Implementation of Cholinergic Sinoatrial Cell Reaction"*. Bachelor Thesis.

[84] Winkler, F. 2025. *"Parameter Optimization of an Electrophysiological Sinoatrial Node Cell Model"*. Master Thesis.

[83] Maierhofer, P. 2024. *"Explainable Machine Learning for the Prediction of Arrhythmia Vulnerability"*. Master Thesis.

[82] Müller, E. 2024. *"Evaluation of the Suitability of Invertible Neural Networks for ECG-based Non-invasive Localization of Extrasystoles"*. Master Thesis.

[81] Ladner, A. 2024. *"Influence of Atrial Electrophysiological, Anatomical and Substrate Characteristics on Atrial Fibrillation Vulnerability Assessment"*. Master Thesis.

[80] Merkel, C. 2024. *"Using Variational Autoencoders to Encode and Augment Vectorcardiographic Signals"*. Master Thesis.

[79] Becker, S. 2023. *"Influence of Conduction Velocity Restitution on Vulnerability to and Maintenance of Atrial Fibrillation"*. Master Thesis.

[78] Krapp, K.-N. 2023. *"Evaluating the Effect of Federated Learning on Explainable Artificial Intelligence"*. Bachelor Thesis.

[77] Schicketanz, L. 2023. *"Modeling and Simulation of the Fetal ECG"*. Master Thesis.

[76] Lorenz, N. 2023. *"Design and Development of a Multichannel Fast-Scan Cyclic Voltammetry System for Neurotransmitter Detection Using Boron Doped Diamond Microelectrode Arrays and Machine Learning"*. Master Thesis.

[75] Raval, H. 2023. *"The eikonal based method to analyze the regional changes of patient with atrial fibrillation"*. Master Thesis.

[74] Duhme, J.-E. 2023. *"Effect of Increased Heart Rate on Active Tension Development"*. Bachelor Thesis.

[73] Keller, L. 2023. *"Influence of Electrical Propagation Patterns on Diffusion Currents"*. Bachelor Thesis.

[72] Caslli, N. 2023. *"EGMs vs. LI in Non Fully Transmural Scar Configurations"*. Bachelor Thesis.

[71] Fitzen, N. 2023. *"Impact of the Right Atrium on Arrhythmia Vulnerability Assessment and Fitting of a Statistical Shape Model for Augmentation of Missing Right Atria"*. Bachelor Thesis.

[70] Wörnle, C. 2023. *"Evaluation of Transcranial Magnetic Stimulation - Motor Mapping Methods"*. Master Thesis.

[69] Krnjaca, D. 2022. *"Generation of a Statistical Shape Model for the Liver"*. Bachelor Thesis.

[68] Prüßmeier, E. 2022. *"Entwicklung eines Teststandes für Handprothesen mit automatischer Fehlerdetektion durch Bilderkennung"*. Master Thesis.

[67] Götz, C. 2022. *"Atrial Segment Division Method for Regional and Quantitative Analysis"*. Master Thesis.

[66] Liu, H. 2022. *"Detection of Anxiety Using Non-Invasive Biosignals"*. Master Thesis.

[65] Reiß, M. 2022. *"Termination Prediction in Atrial Fibrillation via Intracardiac Electrograms using Signal Processing and Machine Learning"*. Master Thesis.

[64] Bender, J. 2022. *"Classification of Interatrial Conduction Block Based on P waves of the 12-lead ECG"*. Bachelor Thesis.

[63] Vu, M A. 2022. *"Analyse und Korrektur der Verzerrungseffekte an der Cornea in OCT Bildern"*. Master Thesis.

[62] Oberschulte, E. 2022. *"A novel low-energy pacing approach to control Atrial Fibrillation induced by a phase singularity distribution"*. Master Thesis.

[61] Miao, Y. 2022. *"Study of the intra-cardiac electrogram signals using in-silico experiments to asses the impact of the atrial geometry"*. Master Thesis.

[60] Shen, T. 2021. *"Comparison of Intra-Cardiac Mapping Modalities by Analysing the Amplitude of Electrogram Signals"*. Master Thesis.

[59] Osypka, J. 2021. *"Application of Deep Neural Networks for Clinical ECG-based Identification of Atrial Fibrosis"*. Master Thesis.

[58] Skupien, N. 2021. *"Refining the Eikonal Model to reproduce the Influnece of Geometrical Factors on Conduction Velocity"*. Master Thesis.

[57] Shoykhet, A. 2021. *"Analysis of Most Significant EEG Signals Associated with Motion Sickness Using Machine Learning"*. Bachelor Thesis.

[56] Huhn, O. 2021. *"Investigation of the Influence of Pole Geometries on Mapping and the Generation of Lesions by Pulsed Field Ablation"*. Master Thesis.

[55] Tejero Cervera, P. 2021. *"Source Estimation in Cardiac Fibrotic Substrate from Intracardiac Signals"*. Master Thesis.

[54] Sachs, M. 2021. *"Investigating the use of machine learning for classifying atrial diseases based on P-wave simulations on a biatrial shape model"*. Master Thesis.

[53] Zheng, T. 2021. *"Automatic patient-specific atrial model generation to study arrhythmia vulnerability"*. Master Thesis.

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[49] Dzindo, H. 2020. *"Behavior and Transformation of Restitution Curves of Different Stimulation Protocols under Atrial Fibrillation Conditions"*. Bachelor Thesis.

[48] Esnaola Capa, J M. 2020. *"Co-Registration of Multimodal Datasets in Patint-Specific Computational Models to Correlate Fibrotic Area and Electograms' Signals"*. Master Thesis.

[47] Becker, S. 2020. *"Separating ECG changes caused by potassium channel blocks from changes by anormal potassium concentrations"*. Bachelor Thesis.

[46] Meinzer, M. 2020. *"Patientenabhängigkeit von Algorithmen zur Ionenkonzentrationrekonstruktion und deren Überwindung"*. Master Thesis.

[45] Koch, J. 2020. *"Enhancing Conduction Velocity Estimation by Atrial Electrogram Analysis"*. Bachelor Thesis.

[44] Schweda, C. 2020. *"Online Gastransferratenmessung und Performance-Indikation von Hohlfasermembranoxygenatoren"*. Master Thesis.

[43] Schicketanz, L. 2020. *"Erkennung von atrialen Nahfeld und Fernfeld Komponenten in Elektrogrammen bei atrialen Tachykardie"*. Bachelor Thesis.

[42] Sandrock, J. 2020. *"Ermittlung und Analyse einer Optimierungskurve über die Anzahl von Elektroden zur Erfassung von Myosignalen zur Steuerung einer Handprotheseattern Recognition"*. Master Thesis.

[41] Hunyar, D. 2020. *"Identification of how voltage is affected due to changes in electrode size and the use of a Lasso catheter using a computational model"*. Bachelor Thesis.

[40] Bettaieb, F. 2020. *"The Effect of Fibrosis Transmurality on Electrogram Morphology and Atrial Fibrillation Dynamics"*. Bachelor Thesis.

[39] Appel, S. 2020. *"Parameteroptimierung zur Regulierung der calciumabhängigen Kraftentwicklung in Herzmuskelzellen"*. Bachelor Thesis.

[38] Hii, K. 2020. *"Reorientation of an Atrial Model: to Simulate 12-lead ECG Signals: An Overfitting and Data Augmentation Problem"*. Bachelor Thesis.

[37] Andlauer, R. 2020. *"Bidirectional Translation Between Facial Image and 3D Reconstruction for Postoperative Face Prediction"*. Master Thesis.

[36] Reiß, M. 2020. *"Verbesserung der Genauigkeit bei der Bestimmung der Zeitdifferenz zwischen zwei Indikatordilutionskurven in Quantitativer Fluoreszenzangiographiewendung mathematischer Modelle"*. Bachelor Thesis.

[35] Schaufelberger, M. 2019. *"Activation Times Estimation in ECG Imaging: Comparison of Source Models and Estimation Methods"*. Master Thesis.

[34] Stritt, M. 2019. *"High-Density Mapping of Ablation Lesions for the Assessment of Myocardial Scar"*. Master Thesis.

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[21] Meissner, T. 2019. *"Adaption and Partitioning of a Brain Geometry for Spatially Detailed Calculation of Local Cerebral Temperatures"*. Master Thesis.

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[19] Molchanova, O. 2018. *"Devolpment and Characterisation of a SD-OCT system for imaging scattering samples"*. Master Thesis.

[18] Álvarez Guirado, P. 2018. *"Classification of atrial ectopic origins into spatial segments based on the 12-lead ECG"*. Master Thesis.

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[16] Stein, G. 2018. *"Farbraumanpassung zur Optimierung des SNR von physiologisch relevanten Signalen in intraoperativen Systemen"*. Master Thesis.

[15] Wirth, T. 2018. *"Optical Detection of Regions of No Interest in Medical Sceneries"*. Master Thesis.

[14] Debatin, S. 2017. *"Quantifying and Optimizing the Diagnostic Potential of the ECG Regarding the Atria: Contribution of the Left Atrium, Zones of Low Voltage, andnrization"*. Bachelor Thesis.

[13] Kahlmann, W. 2017. *"Development of a Fast Method to Tailor Purkinje Activation Based on QRS Information"*. Master Thesis.

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[11] Hérnandez Mesa, M. 2017. *"Analysis of the Effects of Serum Calcium Changes on the ECG in a Computational Model"*. Bachelor Thesis.

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[9] Pilia, N. 2016. *"Characterization and reconstruction of ionic concentrations in the human ventricles analyzing the action potential and the surface ECG"*. Master Thesis.

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[7] Nguyen, H. 2016. *"Estimation of Local Cardiac Conduction Velocity Based on Intra-cardiac Recordings"*. Bachelor Thesis.

[6] Wachter, A. 2015. *"In-silico Assessment of Arrhythmogenic Potential of Atrial Ablation Patterns: A Sensitivity Analysis"*. Diploma Thesis.

[5] Khalef, A. 2015. *"Comparison of Statistic and Optimization-based Approaches for Parameter Estimation of Ion Current Formulations"*. Bachelor Thesis.

[4] Andlauer, R. 2015. *"Investigation of the Effect of Left Atrial Anatomy Alterations on P-Wave Morphology in a Computational Model"*. Bachelor Thesis.

[3] Xu, Y. 2014. *"In-silico Characterization of the Atrial Mode of Action of Ajmaline and Vernakalant and their Effect on Spiral Waves"*. Bachelor Thesis.

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[1] Lutz, Y. 2013. *"Specific Antiarrhythmic Therapy for Familial Atrial Fibrillation in a Numerical Model of Human Atrial Electrophysiology"*. Bachelor Thesis.