

Per Augustsson  
Department of Biomedical Engineering  
Acoustofluidics group  
NanoLund: Centre for Nanoscience  
LTH Profile Area: Engineering Health  
LTH Profile Area: Nanoscience and Semiconductor Technology  
LTH Profile Area: Photon Science and Technology  
LU Profile Area: Light and Materials



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## Research

Sound carries energy that can exert forces on suspended microscopic objects such as blood cells and biological nanoparticles. My group studies the physics of ultrasonic waves that interacts with fluids and suspended objects. In collaboration with biologists and biomedical researchers we build instruments to separate cells and nanoparticles by ultrasound.

## Employment

**Senior lecturer**

Department of Biomedical Engineering  
Lund University  
Lund, Sweden  
2015 Sept 21 → present

**Senior lecturer**

Acoustofluidics group  
Lund University  
Sweden  
2017 Jun 12 → present

**Principal investigator**

NanoLund: Centre for Nanoscience  
Lund University  
Lund, Sweden  
2022 Mar 30 → present

**Profile area member**

LTH Profile Area: Engineering Health

Lund University  
Sweden  
2022 Jun 28 → present

**Profile area member**

LTH Profile Area: Nanoscience and Semiconductor Technology  
Lund University  
Sweden  
2022 Aug 30 → present

**Profile area member**

LTH Profile Area: Photon Science and Technology  
Lund University  
Sweden  
2022 Sept 13 → present

**Profile area member**

LU Profile Area: Light and Materials  
Lund University  
Sweden  
2023 Jan 1 → present

## Research outputs

**Label-free separation of peripheral blood mononuclear cells from whole blood by gradient acoustic focusing**

Alsved, J., Rezayati Charan, M., Ohlsson, P., Urbansky, A. & Augustsson, P., 2024 Apr 16, In: *Scientific Reports*. 14, 1, 12 p., 8748.

**Acoustic enrichment of heterogenous circulating tumor cells and clusters from patients with metastatic prostate cancer**  
Magnusson, C., Augustsson, P., Undvall Anand, E., Lenshof, A., Josefsson, A., Welén, K., Bjartell, A., Ceder, Y., Lilja, H. & Laurell, T., 2023 Dec 4, *medRxiv*.

**Acoustophoretic Characterization and Separation of Blood Cells in Acoustic Impedance Gradients**

Rezayati Charan, M. & Augustsson, P., 2023 Aug 25, In: *Physical Review Applied*. 20, 2, 16 p., 024066.

**Acoustofluidic Three-Dimensional Motion of Suspended Cells at Near-Zero Acoustic Contrast in Homogeneous Media**  
Rezayati Charan, M., Berg, F. & Augustsson, P., 2023, In: *Physical Review Applied*. 19, 1, 014046.

**Acoustophoresis enriches tumor cell clusters in blood of patients with prostate cancer**

Magnusson, C., Augustsson, P., Undvall Anand, E., Lenshof, A., Josefsson, A., Welén, K., Bjartell, A., Olsson, A. Y., Lilja, H. G. & Laurell, T., 2023.

**Acoustophoresis enrichment of tumor cell clusters in blood of patients with metastatic prostate cancer**

Magnusson, C., Augustsson, P., Undvall Anand, E., Lenshof, A., Josefsson, A., Bjartell, A., Olsson, A. Y., Lilja, H. G. & Laurell, T., 2023, (Unpublished).

**Freeze Frame Imaging- a new imaging technique for fast dynamics particle tracking**

Jakobsson, O., Rossi, M., Cierpka, C. & Augustsson, P., 2023, (Unpublished).

**High-power acoustofluidics driven by line double-parabolic-reflectors wave-guided high-power ultrasonic transducer**

Corato, E., Qiu, W., Morita, T. & Augustsson, P., 2023.

**High-power bulk wave acoustofluidics**

Corato, E., Jakobsson, O., Qiu, W., Morita, T. & Augustsson, P., 2023.

**Rare cell enrichment by cell self-organization in acoustic fields**

Soller, R., Jakobsson, O. & Augustsson, P., 2023.

**The acoustophoretic migration and separation of suspended cells in acoustic impedance gradients**

Rezayati Charan, M. & Augustsson, P., 2023.

**Transient behavior and acoustic streaming effects in acoustically packed blood**

Soller, R., Jakobsson, O., Qiu, W. & Augustsson, P., 2023.

**Determination of the Complex-Valued Elastic Moduli of Polymers by Electrical-Impedance Spectroscopy for Ultrasound Applications**

Bodé, W. N., Lickert, F., Augustsson, P. & Bruus, H., 2022 Dec, In: *Physical Review Applied*. 18, 6, 064078.

**Electrical impedance spectroscopy for acoustofluidic applications**

Bodé, W. N., Lickert, F., Augustsson, P. & Bruus, H., 2022, p. 110-111.

**Thermoacoustic streaming in a linear temperature gradient for perpendicular and parallel ultrasound fields**

Corato, E., H. Jørgensen, J., Jakobsson, O., Qiu, W., Bruus, H. & Augustsson, P., 2022, p. 190-191.

**Thermoacoustic Streaming Induced by Asymmetric Laser Heating**

Martens, F., Qiu, W. & Augustsson, P., 2022, p. 128-129.

**Towards high-throughput microfluidic compressibility cytometry using gradient acoustic focusing integrated with density centrifugation**

Rezayati Charan, M., Andersson, O., Jakobsson, O. & Augustsson, P., 2022.

**Fast Microscale Acoustic Streaming Driven by a Temperature-Gradient-Induced Nondissipative Acoustic Body Force**

Qiu, W., Joergensen, J., Corato, E., Bruus, H. & Augustsson, P., 2021 Aug 3, In: *Physical Review Letters*. 127, 6, 6 p., 064501.

**Effects of a Laser-induced Thermal Gradient on the Acoustic Streaming Field**

Martens, F., Qiu, W., Ehn, A. & Augustsson, P., 2021.

**Self-organization by acoustic contrast factor in acoustically packed beds of whole blood and in-line removal of red blood cells**

Augustsson, P., Soller, R. & Jakobsson, O., 2021.

**Particle-size-dependent acoustophoretic motion and depletion of micro- and nano-particles at long timescales**

Qiu, W., Bruus, H. & Augustsson, P., 2020 Jul 21, In: *Physical Review E*. 102, 1, 11 p., 013108.

**Gradient acoustic focusing of sub-micron particles for separation of bacteria from blood lysate**

Van Assche, D., Reithuber, E., Qiu, W., Laurell, T., Henriques-Normark, B., Mellroth, P., Ohlsson, P. & Augustsson, P., 2020 Feb 28, In: *Scientific Reports*. 10, 1, 3670.

**Charting cell properties through their acoustophoretic migration in a gradient of density and compressibility**

Rezayati Charan, M. & Augustsson, P., 2020.

**Thermal-gradient-induced fast convection in acoustofluidic devices**

Qiu, W., H. Jørgensen, J., Corato, E., Bruus, H. & Augustsson, P., 2020.

**Experimental Characterization of Acoustic Streaming in Gradients of Density and Compressibility**

Qiu, W., Karlsen, J. T., Bruus, H. & Augustsson, P., 2019 Feb 7, In: *Physical Review Applied*. 11, 2, 11 p., 024018.

**Acoustic patterning of concentration fields and its real-time imaging**

Qiu, W., Beech, J., Tegenfeldt, J., Bruus, H. & Augustsson, P., 2019, (Unpublished).

**Plasma generation and label-free mononuclear cell separation from whole blood by one-step acoustic focusing**

Alsved, J., Urbansky, A., Ohlsson, P., Petersson, K., Nielsen, E., Michanek, A. & Augustsson, P., 2019, *23rd International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2019*. Chemical and Biological Microsystems Society, p. 140-141 2 p. (23rd International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2019).

**Acoustic impedance matched buffers enable separation of bacteria from blood cells at high cell concentrations**

Ohlsson, P., Petersson, K., Augustsson, P. & Laurell, T., 2018 Dec 1, In: *Scientific Reports*. 8, 1, 9156.

**Acoustic Streaming and Its Suppression in Inhomogeneous Fluids**

Karlsen, J. T., Qiu, W., Augustsson, P. & Bruus, H., 2018 Jan 30, In: *Physical Review Letters*. 120, 5, 6 p., 054501.

**Acoustofluidic hematocrit determination**

Petersson, K., Jakobsson, O., Ohlsson, P., Augustsson, P., Scheding, S., Malm, J. & Laurell, T., 2018, In: *Analytica Chimica Acta*. 1000, p. 199-204

**ACouWash: A standalone instrument for the washing, separation and enrichment of cells.**

Mallinson, J., Linander, O., Magnusson, C., Pircs, K. & Augustsson, P., 2018, *22nd International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2018*. Chemical and Biological Microsystems Society, p. 279-281 3 p. (22nd International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2018; vol. 1).

**Suppression of acoustic streaming by the inhomogeneity-induced acoustic body force**

Qiu, W., Karlsen, J., Bruus, H. & Augustsson, P., 2018, In: *Proceedings of Meetings on Acoustics*. 34, 1, 045023.

**Clinical-Scale Cell-Surface-Marker Independent Acoustic Microfluidic Enrichment of Tumor Cells from Blood**

Magnusson, C., Augustsson, P., Lenshof, A., Ceder, Y., Laurell, T. & Lilja, H., 2017 Nov 21, In: *Analytical Chemistry*. 89, 22, p. 11954-11961 8 p.

**Shaping acoustofluidic landscapes to profile and separate cells and sub-micron particles**

Augustsson, P., 2017 Oct 31, *2017 IEEE International Ultrasonics Symposium, IUS 2017*. IEEE Computer Society, 8091549

**Acoustic Force Density Acting on Inhomogeneous Fluids in Acoustic Fields**

Karlsen, J. T., Augustsson, P. & Bruus, H., 2016 Sept 9, In: *Physical Review Letters*. 117, 11, p. 114504 6 p.

**Iso-acoustic focusing of cells for size-insensitive acousto-mechanical phenotyping**

Augustsson, P., Karlsen, J. T., Su, H-W., Bruus, H. & Voldman, J., 2016 May 16, In: *Nature Communications*. 7, 11556.

**Acoustophoretic manipulation of sub-micron objects enabled by density gradients**

Augustsson, P., Karlsen, J. T. & Bruus, H., 2016, *20th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2016*. Chemical and Biological Microsystems Society, p. 158-159 2 p.

**Label-free concentration of viable neurons, hESCs and cancer cells by means of acoustophoresis.**

Castro Zalis, M., Reyes, J. F., Augustsson, P., Holmqvist, S., Roybon, L., Laurell, T. & Deierborg, T., 2016, In: *Integrative Biology*. 8, 3, p. 332-340 9 p.

**Theory of the acoustic force density acting on inhomogeneous fluids**

Karlsen, J. T., Augustsson, P. & Bruus, H., 2016, *20th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2016*. Chemical and Biological Microsystems Society, p. 721-722 2 p.

**Twenty second acoustofluidic whole blood hematocrit assay**

Petersson, K., Jakobsson, O., Ohlsson, P., Augustsson, P. & Laurell, T., 2016, *20th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2016*. Chemical and Biological Microsystems Society, p. 635-636 2 p.

**Acoustofluidic, label-free separation and simultaneous concentration of rare tumor cells from white blood cells**

Antfolk, M., Magnusson, C., Augustsson, P., Lilja, H. & Laurell, T., 2015, In: *Analytical Chemistry*. 87, 18, p. 9322-9328

**Applications in continuous flow acoustophoresis**

Lenshof, A., Augustsson, P. & Laurell, T., 2015, *Microscale Acoustophoresis*. Laurell, T. & Lenshof, A. (eds.). Royal Society of Chemistry, p. 148-188

**A single inlet two-stage acoustophoresis chip enabling tumor cell enrichment from white blood cells**

Antfolk, M., Antfolk, C., Lilja, H., Laurell, T. & Augustsson, P., 2015, In: *Lab on a Chip*. 15, 9, p. 2102-2109

**Iso-acoustic focusing for size-insensitive cell separation based on acoustic properties**

Augustsson, P. & Voldman, J., 2015, *MicroTAS 2015 - 19th International Conference on Miniaturized Systems for Chemistry and Life Sciences*. Chemical and Biological Microsystems Society, p. 14-16 3 p.

**Acoustic radiation forces at liquid interfaces impact the performance of acoustophoresis.**

Deshmukh, S., Brzozka, Z., Laurell, T. & Augustsson, P., 2014, In: *Lab on a Chip*. 14, 17, p. 3394-3400

**Acoustophoresis for label-free separation and concentration of cancer cells**

Antfolk, M., Augustsson, P., Magnusson, C., Lilja, H. & Laurell, T., 2014, *18th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2014*. Chemical and Biological Microsystems Society, p. 2508-2509 (18th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2014).

**Focusing of sub-micrometer particles and bacteria enabled by two-dimensional acoustophoresis.**

Antfolk, M., Muller, P. B., Augustsson, P., Bruus, H. & Laurell, T., 2014, In: *Lab on a Chip*. 14, 15, p. 2791-2799

**Improved acoustophoretic circulating tumor cell (CTC) separation for low target cell numbers in clinical volumes**

Lenshof, A., Magnusson, C., Augustsson, P., Hafliadottir, B., Lilja, H. & Laurell, T., 2014, *18th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2014*. Chemical and Biological Microsystems Society , p. 594-596 (18th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2014).

**Acoustophoresis separation of bacteria from blood cells for rapid sepsis diagnostics**

Ohlsson, P. D., Petersson, K., Augustsson, P. & Laurell, T., 2013, *17th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2013*. Chemical and Biological Microsystems Society, Vol. 2. p. 1320-1322 3 p.

**Microchannel Acoustophoresis does not Impact Survival or Function of Microglia, Leukocytes or Tumor Cells.**

Burguillos Garcia, M., Magnusson, C., Nordin, M., Lenshof, A., Augustsson, P., Hansson, M., Elmer, E., Lilja, H., Brundin, P., Laurell, T. & Deierborg, T., 2013, In: *PLoS ONE*. 8, 5, e64233.

**Ultrasound-induced acoustophoretic motion of microparticles in three dimensions**

Muller, P. B., Rossi, M., Marin, A. G., Barnkob, R., Augustsson, P., Laurell, T., Kaehler, C. J. & Bruus, H., 2013, In: *Physical Review E (Statistical, Nonlinear, and Soft Matter Physics)*. 88, 2, 023006.

**Acoustic radiation- and streaming-induced microparticle velocities determined by microparticle image velocimetry in an ultrasound symmetry plane**

Barnkob, R., Augustsson, P., Laurell, T. & Bruus, H., 2012, In: Physical Review E (Statistical, Nonlinear, and Soft Matter Physics). 86, 5, 056307.

**Acoustofluidics 11: Affinity specific extraction and sample decomplexing using continuous flow acoustophoresis.**

Augustsson, P. & Laurell, T., 2012, In: Lab on a Chip. 12, 10, p. 1742-1752

**Acoustophoretic microfluidic chip for sequential elution of surface bound molecules from beads or cells**

Augustsson, P., Malm, J. & Ekström, S., 2012, In: Biomicrofluidics. 6, 3, 034115.

**Label-free somatic cell cytometry in raw milk using acoustophoresis.**

Grenvall, C., Folkenberg, J. R., Augustsson, P. & Laurell, T., 2012, In: Cytometry Part A. 81A, 12, p. 1076-1083

**Microfluidic, Label-Free Enrichment of Prostate Cancer Cells in Blood Based on Acoustophoresis**

Augustsson, P., Magnusson, C., Nordin, M., Lilja, H. & Laurell, T., 2012, In: Analytical Chemistry. 84, 18, p. 7954-7962

**Automated and temperature-controlled micro-PIV measurements enabling long-term-stable microchannel acoustophoresis characterization.**

Augustsson, P., Barnkob, R., Wereley, S. T., Bruus, H. & Laurell, T., 2011, In: Lab on a Chip. 11, 24, p. 4152-4164

**Measuring density and compressibility of white blood cells and prostate cancer cells by microchannel acoustophoresis**

Barnkob, R., Augustsson, P., Magnusson, C., Lilja, H., Laurell, T. & Bruus, H., 2011, *15th International Conference on Miniaturized Systems for Chemistry and Life Sciences 2011, MicroTAS 2011*. p. 127-129 (15th International Conference on Miniaturized Systems for Chemistry and Life Sciences 2011, MicroTAS 2011; vol. 1).

**On microchannel acoustophoresis - Experimental considerations and life science applications**

Augustsson, P., 2011, 72 p.

**Cell separation based on acoustophoresis and applications in health care**

Lenshof, A., Petersson, F., Augustsson, P., Grenvall, C., Ekström, S., Persson, J., Swärd, A-M., Åberg, L., Ohlin, M. & Laurell, T., 2010.

**Extraction of circulating tumor cells from blood using acoustophoresis**

Augustsson, P., Magnusson, C., Grenvall, C., Lilja, H. & Laurell, T., 2010, *14th International Conference on Miniaturized Systems for Chemistry and Life Sciences 2010, MicroTAS 2010*. p. 1592-1594 (14th International Conference on Miniaturized Systems for Chemistry and Life Sciences 2010, MicroTAS 2010; vol. 3).

**Measuring the local pressure amplitude in microchannel acoustophoresis**

Barnkob, R., Augustsson, P., Laurell, T. & Bruus, H., 2010, In: Lab on a Chip. 10, 5, p. 563-570

**Buffer medium exchange in continuous cell and particle streams using ultrasonic standing wave focusing**

Augustsson, P., Åberg, L. B., Sward-Nilsson, A-M. K. & Laurell, T., 2009, In: Microchimica Acta. 164, 3-4, p. 269-277

**Decomplexing biofluids using microchip based acoustophoresis**

Augustsson, P., Persson, J., Ekström, S., Ohlin, M. & Laurell, T., 2009, In: Lab on a Chip. 9, 6, p. 810-818

**Harmonic microchip acoustophoresis: a route to online raw milk sample precondition in protein and lipid content quality control**

Grenvall, C., Augustsson, P., Folkenberg, J. R. & Laurell, T., 2009, In: Analytical Chemistry. 81, 15, p. 6195-6200

**Acoustic microfluidic chip technology to facilitate automation of phage display selection**

Persson, J., Augustsson, P., Laurell, T. & Ohlin, M., 2008, In: The FEBS Journal. 275, 22, p. 5657-5666

**Decomplexing biofluids using microchip based acoustophoresis**  
Augustsson, P., Persson, J., Ekström, S., Ohlin, M. & Laurell, T., 2008.

**On chip affinity selection of antibodies using ultrasonic standing waves**  
Augustsson, P., Persson, J., Ohlin, M. & Laurell, T., 2008.

**Fluorescent Activated Cell Sorter using Ultrasound Standing Waves in Micro Channels**  
Grenvall, C., Carlsson, M., Augustsson, P., Petersson, F. & Laurell, T., 2007, *Micro Total Analysis Systems 2007. Proceedings of μTAS 2007. 11th International Conference on Miniaturized Systems for Chemistry and Life Sciences*. Viovy, J-L., Tabeling, P., Descroix, S. & Malaquin, L. (eds.). Chemical and Biological Microsystems Society, Vol. 2. p. 1813-1815 3 p.

**On-chip affinity selection of antibodies using ultrasonic standing waves.**  
Augustsson, P., Persson, J., Ohlin, M. & Laurell, T., 2007, *Micro Total Analysis Systems 2007. Proceedings of μTAS 2007. 11th International Conference on Miniaturized Systems for Chemistry and Life Sciences*. Viovy, J-L., Tabeling, P., Descroix, S. & Malaquin, L. (eds.). Chemical and Biological Microsystems Society, Vol. 2. p. 1810-1812

**Ultrahydrophobic properties of porous silicon for surface based bioanalysis**  
Ressine, A., Augustsson, P., Marko-Varga, G. & Laurell, T., 2007, *Micro Total Analysis Systems 2007. Proceedings of μTAS 2007 Conference*. Jean-Louis, V., Tabeling, P., Descroix, S. & Malaquin, L. (eds.). Chemical and Biological Microsystems Society, Vol. 2. p. 1046-1047 3 p.

**Improved Carrier Medium Exchange Efficiency in Acoustic Standing Wave Particle Washing**  
Augustsson, P., Petersson, F. & Laurell, T., 2006, *Micro Total Analysis Systems 2006. Proceedings of μTAS 2006 Conference*. Kitamori, T., Fujita, H. & Hasebe, S. (eds.). Society for Chemistry and Micro-Nano Systems, Vol. 1. p. 627-629 3 p.

**Separation of escherichia coli bacteria from raw milk using resonant ultrasound in a microfluidic channel**  
Augustsson, P., Matsuoka, H. & Laurell, T., 2006.

## Prizes and Distinctions

**Ingvar Carlsson Award 2017**  
Augustsson, Per (Recipient), 2017 Apr 10

**PhD-thesis of the year 2011 at the Faculty of Engineering at Lund University**  
Augustsson, Per (Recipient), 2012 May 23

**The Phabian Award 20013**  
Augustsson, Per (Recipient), 2014 Feb 11

## Awards

**Acoustic separation of blood components**  
Augustsson, P.  
Mats Paulssons stiftelse: SEK2,000,000.00  
2023/01/01 → 2024/03/01