

Rune Aaslid

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Education and Degrees

1988: Privatdozent (PD) in Neurosurgical Research, University of Berne, Berne, Switzerland.

1975: Dr Philos (PhD) in Cardiovascular Physiology, Medical Faculty, University of Oslo, Oslo, Norway.

1968: Sivilingenieur (MS) in Engineering Cybernetics and Electrical Engineering, The Norwegian Institute of Technology (NTH), Trondheim, Norway.

Career Positions 1998 – present: Director of Research, Hemodynamics AG, Berne, Switzerland.
(<http://www.hemodynamic.com/>)

1989 – present: Privatdozent, (Affiliate Associate Professor), Department of Neurosurgery and Neurovascular Laboratory, University of Berne, Berne, Switzerland.

1991 – present: Affiliate Associate Professor of Neurosurgical Research, University of Washington, Seattle, Washington, USA.

1988 – 91: Director of Neurosurgical Research, Inselspital, University of Berne, Berne, Switzerland.

1985 – 87: Director of Cardiovascular Research, Institute of Applied Physiology and Medicine (IAPM) Seattle, Washington, USA.

1983 – 84: Senior Research Fellow, Department of Neurosurgery, Rikshospitalet, Oslo, Norway.

1981 – 83: Senior Research Fellow (Wissenschaftlicher Beamter), Department of Neurosurgery, Inselspital, University of Berne, Berne, Switzerland

1976 – 79: Adjunct Associate Professor of Biocybernetics, Division of Engineering Cybernetics, Department of Electrical Engineering, the Norwegian Institute of Technology (NTH), Trondheim, Norway.

1969 – 75: Research assistant, Institute of Surgical Research, Rikshospitalet, University of Oslo, Oslo, Norway; and Division of Engineering Cybernetics, Department of Electrical Engineering, the Norwegian Institute of Technology (NTH), Trondheim, Norway. Some Research Milestones

1998-2009: Developed the first transcranial Doppler method capable of portable ambulatory monitoring for cerebral emboli. [80,82].

1998-2008: Created the first interactive computer program for teaching cerebral hemodynamics and the principles and clinical use of transcranial Doppler. The i-book format integrates educational text with a comprehensive model of the cerebral circulation and a realistic rendering of pulsed Doppler and other instruments. Three-D simulation of anatomy and ultrasound insonation is also included in the newest version [<http://www.transcranial.com>].

1989-2007: Introduced and developed the use of transcranial Doppler for quantitative assessment of dynamic cerebral autoregulation. [42, 49, 60, 61, 63, 65, 66, 68, 83]. Publication [42] is currently ranked 17th among the 50 most cited papers in Stroke.

1987: Introduced functional transcranial Doppler for study and quantification of evoked flow responses and the dynamic relationship between brain function and blood flow. [38]

1984: Introduced cerebral vasospasm evaluation by transcranial Doppler. [18, 19, 20, 26, 69, 70] Publication [18] is ranked 43rd among the most cited in neurosurgical journals according to a recent paper (J Neurosurg 112:223-232, 2010)

1982: Developed and introduced the transcranial Doppler method [17]. This publication is the second most cited in neurosurgical journals (J Neurosurg 112:223-232, 2010)

1981: Invented and evaluated a new noninvasive blood pressure measurement method. [15] This technique permits recording of instantaneous and mean blood pressure with accuracy and resolution comparable to invasive methods.

1976: Cooperated on the first study describing a method for noninvasive assessment of pressure gradient in mitral valve stenosis. [5] Dr. Holen was the main contributor to this achievement.

1975: Described a new and accurate method of quantifying the efficiency of prosthetic heart valves. [3]

Editorial Appointments

1990 – 92: Member of the Editorial Board of Stroke.

1989 – present: Member of the Editorial Board of Neurosonology.

1987 – present: Ad Hoc reviewer for Stroke and various other journals. Other Editorial

1999: Coeditor, Neurosurgical management of aneurysmal subarachnoid haemorrhage [69, 70]

1992: Coeditor, Transcranial Doppler [53]

1986: Editor, first book on Transcranial Doppler Sonography [28-30]

Publications in Peer Reviewed Journals and Books

1. Aaslid R, Brubakk AO: [Dynamic pressure-flow relationship of the human aorta]. Ver Dtsch Ges Kreislaufrorschg 1973; 40:154-158 2. Aaslid R: Simulation of the individual cardiovascular system: A pilot study. PhD thesis, Medical Faculty, University of Oslo and Report No. 74-51-W Division of Engineering Cybernetics, The Norwegian Institute of Technology 1974 3. Aaslid R, Levang O, Froysaker T, Skagseth E, Hall KV: "In situ" evaluation of the aortic pivoting disc valve prosthesis. Scand J Thor Cardiovasc Surg 1975; 9:81-84 4. Nornes H, Magnes B, Aaslid R: Observations on intracranial pressure plateau waves, in Lundberg N, Ponten U, Brock M: Intracranial Pressure. Springer Verlag, Berlin-Heidelberg- New York 1975 5. Holen J, Aaslid R, Landmark K, Simonsen S: Determination of pressure gradient in mitral stenosis with a noninvasive ultrasound Doppler technique. Acta Med Scand 1976; 199:455- 460 6. Aaslid R, DiStefano III J, Balchen JG: Modeling of the hormonal state of fishes. Report STF48 A76081, SINTEF, Trondheim 1976 7. Aaslid R: [Biocybernetics, textbook in Norwegian] Report no 75-110X, Division of Engineering Cybernetics, University of Trondheim, Trondheim 1975 8. Holen J, Aaslid R, Landmark K, Simonsen S, Ostrem T: Determination of the effective orifice area in mitral stenosis from noninvasive ultrasound Doppler data and mitral flow rate. Acta Med Scand 1977; 201:83-88 9. Nornes H, Aaslid R, Lindegaard KF: Intracranial pulse pressure dynamics in patients with intracranial hypertension. Acta Neurochir 1977; 38:177-186 10. Brubakk AO, Aaslid R: A model approach to studying cardiovascular function in man, in Perkins WJ:

Biomedical Computing. Pitman Medical UK, 1977 11. Brubakk AO, Aaslid R: Use of a model for simulating individual aortic dynamics in man. *Med Biol Eng Comput* 1978; 16:231-242 12. Piene H, Aaslid R, Hansen M, Sund T: Simple system for analog data transmission from the physiological research laboratory to a digital computer. *Ann Biom Eng* 1978; 6:161-166 13. Sudmann E, Aaslid R: A synchronization control unit for super 8 sound recording, editing and sound transfer to magnetic-striped film. *Society of Motion Picture and Television Engineers Journal* 1978; 87:158-162 14. Giltvedt J, Aaslid R: Timesaving method for segmental pressure measurements. *Med Biol End Comput* 1981; 19:775-776 15. Aaslid R, Brubakk AO: Accuracy of an ultrasound Doppler servo method for noninvasive determination of instantaneous and mean arterial blood pressure. *Circulation* 1981; 64:753- 759 16. Hetland O, Warhuus K, Giercksky KE, Aaslid R, Prydz H: Toxicity of phospholipase C in rabbits. *Scand J Clin Lab Invest* 1982; 42:239-244 17. Aaslid R, Markwalder T-M, Nornes H: Noninvasive transcranial Doppler ultrasound recording of flow velocity in basal cerebral arteries. *J Neurosurg* 1982; 57:769-774 18. Aaslid R, Huber P, Nornes H: Evaluation of cerebrovascular spasm with transcranial Doppler ultrasound. *J Neurosurg* 1984; 60:37-41 19. Aaslid R, Nornes H: Musical Murmurs in human cerebral arteries after subarachnoid hemorrhage. *J Neurosurg* 1984; 60:32-36 20. Aaslid R, Huber P, Nornes H: Noninvasive transcranial Doppler ultrasound recording in basal cerebral arteries - A new approach to evaluation of cerebrovascular spasm, in Voth D, Glee P (eds): *Cerebral Vasospasm*. Walter de Gruyter, Berlin-New York, 1984 21. Markwalder T-M, Grolimund P, Seiler RW, Roth F, Aaslid R: Dependency of blood velocity in the middle cerebral artery on en-tidal carbon dioxide partial pressure - A transcranial ultrasound Doppler study. *J Cereb Blood Flow Metab* 1984; 4:368-372 22. Lindegaard K-F, Bakke SJ, Grolimund P, Aaslid R, Huber P, Nornes H: Carotid artery disease: Assessment of intracranial hemodynamic pattern by noninvasive transcranial Doppler. *J Neurosurg* 1985; 63:890-898 23. Lundar T, Lindegaard K-F, Froyssaker T, Aaslid R, Wiberg J, Nornes H: Cerebral perfusion during nonpulsatile cardiopulmonary bypass. *Ann Thorac Surg* 1985; 40:144-150 24. Lundar T, Lindegaard K-F, Froyssaker T, Aaslid R, Wiberg J, Nornes H: Dissociation between cerebral autoregulation and CO₂ reactivity during nonpulsatile cardiopulmonary bypass. *Ann Thorac Surg* 1986; 40:582-588 25. Seiler RW, Aaslid R, Grolimund P: Correlation of the middle cerebral artery flow velocity with the clinical course and CT-visualized subarachnoid blood in patients after aneurysm surgery, in Auer LM (ed): *Timing of aneurysm surgery*. Walter de Gruyter, Berlin-New York, 1985 26. Aaslid R, Huber P, Nornes H: A transcranial Doppler method in the evaluation of cerebrovascular spasm. *Neuroradiology* 1986; 28:11-16 27. Seiler RW, Grolimund P, Aaslid R, Huber P, Nornes H: Cerebral vasospasm evaluated by transcranial ultrasound correlated with clinical grade and CT-visualized subarachnoid hemorrhage. *J Neurosurg* 1986; 64:594-600 28. Aaslid R: Transcranial Doppler examination techniques, in Aaslid R (ed): *Transcranial Doppler sonography*, Springer, Vienna-New York, 1986 29. Aaslid R: The Doppler principle applied to measurement of blood flow velocity in cerebral arteries, in Aaslid R (ed): *Transcranial Doppler sonography*, Springer, Vienna-New York, 1986 30. Aaslid R, Lindegaard K-F: Cerebral Hemodynamics, in Aaslid R (ed): *Transcranial Doppler sonography*, Springer, Vienna-New York, 1986 31. Lindegaard K-F, Aaslid R, Nornes H: Cerebral arteriovenous malformations, in Aaslid R (ed): *Transcranial Doppler sonography*, Springer, Vienna-New York, 1986 32. Seiler RW, Aaslid R: Transcranial Doppler for evaluation of cerebral vasospasm, in Aaslid R (ed): *Transcranial Doppler sonography*, Springer, Vienna-New York, 1986 33. Aaslid R, Lundar T, Lindegaard K-F, Nornes H: Estimation of cerebral perfusion pressure from arterial blood pressure and transcranial Doppler recordings, in Miller JD et al (eds): *Intracranial Pressure VI*. Springer-Verlag, Berlin-Heidelberg-New York, 1986, pp226-229 34. Lindegaard K-F, Grolimund P, Aaslid R, Nornes H: Evaluation of cerebral AVM's using transcranial Doppler ultrasound. *J Neurosurg* 1986; 65:335-344 35. Lindegaard K-F, Bakke SJ, Aaslid R, Nornes H: Doppler diagnosis of intracranial artery occlusive disorders. *J Neurol Neurol Psychiat* 1986; 47:510-518 36. Aaslid R: [Future possibilities in transcranial Doppler sonography - in German], in Widder B (ed): *Transcranielle Doppler-Sonographie bei zerebrovascularen Erkrankungen*. Springer- Verlag, New York-Berlin-Heidelberg, pp 25-29, 1987 37. Aaslid R: Transcranial Doppler diagnosis, in Spencer MP (ed): *Ultrasonic diagnosis of cerebrovascular disease*. Martinus Nijhoff Publishers, Dordrech, 1987, pp 227-240 38. Aaslid R:

Visually evoked dynamic blood flow response of the human cerebral circulation. *Stroke* 1987; 18:771-775 39. Grolimund P, Seiler RW, Aaslid R, Huber P, Zurbrugg M: Evaluation of cerebrovascular disease by combined extracranial and transcranial Doppler sonography: Experience in 1039 patients. *Stroke* 1987; 18:1018-1024 40. Lindegaard K-F, Lundar T, Wiberg J, Sjöberg D, Aaslid R, Nornes H: Variations in middle cerebral artery blood flow investigated with noninvasive transcranial blood velocity measurements. *Stroke* 1987; 18:1024-1030 41. Adams RJ, Aaslid R, el Gammal T, Nichols FT, McKie V: Detection of cerebral vasculopathy in sickle cell disease using transcranial Doppler ultrasonography and magnetic resonance imaging. Case report, *Stroke* 1988; 19:518-520 42. Aaslid R, Lindegaard K-F, Sorteberg W, Nornes H: Cerebral autoregulation dynamics in humans. *Stroke* 1989; 20:45-52 43. Steiger HJ, Aaslid R, Keller S, Reulen HJ: Strength, elasticity and viscoelastic properties of cerebral aneurysms. *Heart Vessels* 1989; 5:41-46 44. Steiger HJ, Aaslid R, Keller S, Reulen HJ: Growth of aneurysms can be understood as passive yield to blood pressure. An experimental study. *Acta Neurochir (Wien)* 1989; 100:74-78 45. Augustyniak E, Swietliczko I, Aaslid R: [Evaluation of blood flow velocity and pulsation curves in the posterior ciliary arteries in glaucoma - in Polish.] *Klin Oczna* 1989; 91:3-6 46. Adams RJ, Nichols FT, Aaslid R, McKie VC, McKie K, Carl E, Stephens S, Thompson WO, Milner P, Figueroa R: Cerebral vessel stenosis in sickle cell disease: Criteria for detection by transcranial Doppler. *Am J Pediatric Hematol Oncol* 1990; 12:277-282 47. Aaslid R, Groger U, Patlak CS, Fenstermacher JD, Huber P, Reulen HJ: Fluid flow rates in human peritumoural Oedema. *Acta Neurochir Suppl (Wien)* 1990; 51:152-154 48. Nornes H, Sorteberg W, Nakstad P, Bakke SJ, Aaslid R, Lindegaard K-F: Haemodynamic aspects of clinical cerebral angiography - concurrent two vessel monitoring using transcranial Doppler ultrasound. *Acta Neurochir (Wien)* 1990; 105:89-97 49. Aaslid R, Newell DW, Stooss R, Sorteberg W, Lindegaard K-F: Assessment of cerebral autoregulation dynamics from simultaneous arterial and venous transcranial Doppler recordings in humans. *Stroke* 1991; 22:1148-1154 50. Aaslid R, Bondar, RL, Kassam MS, Stein F, Dunphy PT. Cerebral autoregulation in microgravity. *Proceedings, Spacebound '91, Ottawa, ON.* 1991; 224-227. 51. Sullivan PJ, Thirsk R, Goodman L, Ackles K, Pecaric M, Bondar R, Kassam MS, Aaslid R, Dunphy PT, Stein F. Evaluation of an experimental antigravity suit for astronauts. *Proceedings, Seventh Conference on Astronautics, Canadian Aeronautics and Space Institute, Ottawa, ON.* 1992; 54-58. 52. Aaslid R: Principles of transcranial Doppler measurements, in Olesen J (ed): *Migraine and other headaches: the vascular mechanisms.* New York: Raven Press 1991; 253-259 53. Aaslid R: Cerebral hemodynamics, in Newell DW, Aaslid R eds. *Transcranial Doppler.* New York: Raven Press 1992; pp49-55 54. Newell DW, Aaslid R: *Transcranial Doppler: clinical and experimental uses.* *Cerebrovasc Brain Metab Rev* 1992; 4:122-143 55. Newell DW, Aaslid R, Stooss R, Reulen HJ: The relationship of blood flow velocity fluctuations to intracranial pressure B waves. *J Neurosurg* 1992; 76:415-421 56. Steiger HJ, Aaslid R, Stooss R: Dynamic computed tomographic imaging of regional cerebral blood flow and blood volume. A clinical pilot study. *Stroke* 1993; 24:591-597 57. Giller CA, Aaslid R: Estimates of pulse wave velocity and measurement of pulse transit time in the human cerebral circulation. *Ultrasound Med Biol* 1994; 20:101-105 58. Newell DW, Aaslid R, Lam A, Mayberg TS, Winn HR: Comparison of Flow and velocity during dynamic autoregulation testing in humans. *Stroke* 1994; 25:793-797 59. Steiger HJ, Aaslid R, Stooss R, Seiler RW: Transcranial Doppler monitoring in head injury: relations between type of injury, flow velocities, vasoreactivity, and outcome. *Neurosurgery* 1994; 34:79-85 60. Tiecks FP, Lam AM, Aaslid R, Newell DW: Comparison of static and dynamic autoregulation measurements. *Stroke* 1995; 26:1014-19 61. Strebel S, Lam AM, Matta B, Mayberg TS, Aaslid R, Newell DW: Dynamic and static autoregulation during Isoflurane, Desflurane and Propofol anaesthesia. *Anesthesiology* 1995; 83:66-76 62. Baumgartner RW, Mattle HP, Aaslid R: Transcranial color-coded duplex sonography, magnetic resonance angiography, and computed tomography angiography: methods, applications, advantages, and limitations. *J Clin Ultrasound* 1995; 23:89-111 63. Newell DW, Weber JP, Watson R, Aaslid R, Winn HR: Effect of transient moderate hyperventilation on dynamic cerebral autoregulation after severe head injury. *Neurosurgery* 1996; 35-43 64. Sturzenegger M, Newell DW, Aaslid R: Visually evoked blood flow response assessed by simultaneous two-channel transcranial Doppler using flow velocity averaging. *Stroke* 1996;

27:2256-2261 65. Newell DW, Aaslid R, Stooss R, Seiler RW, Reulen HJ: Evaluation of hemodynamic responses in head injury patients with transcranial Doppler monitoring. *Acta Neurochir (Wien)* 1997; 139:804-817 66. Junger EC, Newell DW, Grant GA, Avellino AM, Ghatan S, Douville CM, Lam AM, Aaslid R, Winn HR: Cerebral autoregulation following minor head injury. *J Neurosurg* 1997; 87:485- 486 67. Seidel G, Beller KD, Aaslid R, Hummel RP, Thibaut U, Vidal-Langwasser M, Kukat B, Kaps M: The influence of different gases on acoustic properties of a spherosome-based ultrasound contrast agent (BY963). A transcranial Doppler sonography study. *J Neuroimaging* 1998; 8:83-87 68. Doering TJ, Aaslid R, Steuernagel B, Brix J, Niederstadt C, Breull A, Schneider B, Fischer GC: Cerebral autoregulation during whole-body hypothermia and hyperthermia stimulus. *Am J Phys Med Rehabil* 1999; 78:33-38 69. Aaslid R: Hemodynamics of cerebrovascular spasm. *Acta Neurochir [Suppl]* 1999;72: 47-57 70. Langmoen IA, Lundar T, Aaslid R, Reulen H-J eds. Neurosurgical management of aneurysmal subarachnoid haemorrhage. *Acta Neurochir [Suppl 72]* 1999 71. Aaslid R: Hemodynamics of cerebrovascular spasm. *Acta Neurochir [Suppl 72]* 1999;72:47-57 72. Newell DW, Eskridge JM, Aaslid R. Current indications and results of cerebral angioplasty. *Acta Neurochir Suppl.* 2001; 77:181-183 73. Aaslid R: Transcranial Doppler assessment of cerebral vasospasm. *Eur J Ultrasound.* 2002;16: 3-10 74. Vavilala MS, Newell DW, Junger E, Douville CM, Aaslid R, Rivara FP, Lam AM. Dynamic cerebral autoregulation in healthy adolescents. *Acta Anaesthesiol Scand.* 2002; 46:393-397. 75. Park CW, Sturzenegger M, Douville CM, Aaslid R, Newell DW. Autoregulatory response and CO₂ reactivity of the basilar artery. *Stroke.* 2003; 34:34-39. 76. Blaha M, Aaslid R, Douville CM, Correra R, Newell DW. Cerebral blood flow and dynamic cerebral autoregulation during ethanol intoxication and hypercapnia. *J Clin Neurosci.* 2003; 10:195-198. 77. Aaslid R, Lash SR, Bardy GH, Gild WH, Newell DW. Dynamic pressure-flow velocity relationships in the human cerebral circulation. *Stroke.* 2003; 34: 1645-1649. 78. Mackinnon AD, Aaslid R, Markus HS. Long-term ambulatory monitoring for cerebral emboli using transcranial Doppler ultrasound. *Stroke.* 2004;35:73-78 79. Aaslid R, Newell DW. Response: Limitations in Estimating Critical Closing Pressure by Noninvasive Blood Pressure Measurements. *Stroke* 2004; 35:e91-e92 80. Mackinnon AD, Aaslid R, Markus HS: Ambulatory transcranial Doppler cerebral embolic signal detection in symptomatic and asymptomatic carotid stenosis. *Stroke* 2005;36:1726- 1730 81. Aaslid R: Cerebral autoregulation and vasomotor reactivity. In Baumgartner RW (ed): *Handbook on neurovascular ultrasound.* Front. Neurol. Neurosci, Basel, Karger 2006;21:1-13 82. Aaslid R, Blaha M, Svirid G, Douville CM, Newell DW. Asymmetric dynamic cerebral autoregulatory response to cyclic stimuli. *Stroke* 2007; 38:1465-69 83. Svirid GE, Aaslid R, Douville CM, Moore A, Newell DW. Time course for autoregulation

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