

## Abstract

### *“How to celebrate 80 years of science. Glutamate and beyond”*

As a student in 1960 I was [recruited](#) by my teacher Per Andersen to demonstrate neuromuscular synapses by staining for acetylcholinesterase, which at that time was the only way to visualize a synaptic transmitter (acetylcholine, although indirectly). Theodor Blackstad had me stain the hippocampus, putting me on the path of neurotransmitter localization in the brain, which I have pursued since. During the 1960ies fluorescence methods for showing monoamines were devised (by the Swedes), providing the first direct demonstration of neurotransmitters in the microscope, but it became clear that neither acetylcholine, nor monoamines carry the main transmission of signals between nerve cells in the brain. In the 1970ies, with F Fonnum, I did microbiochemistry showing for the first time that  $\gamma$ -aminobutyric acid (GABA) is synthesized selectively in inhibitory nerve endings (1970 Brain Res), and that glutamate is selectively taken up in excitatory nerve endings (1977 Nature). I devised immunocytochemical localization of amino acids (1983 Nature, 1986 Nature), and showed with OP Ottersen and V Gundersen that glutamate and GABA are highly concentrated in the synaptic vesicles of excitatory and inhibitory neurons, respectively. Work with NC Danbolt and the groups of E Seeberg and BI Kanner discovered the first glutamate transporter protein (1992 Nature). Studies with FA Chaudhry and the group of RH Edwards showed the vesicular transporters of GABA (1998 J Neurosci) and glutamate (2001 Neuron, 2002 PNAS, 2004 Science), and identified a ‘new’ family of transporter proteins carrying amino acids into and out of cells (1999 Cell, 2001 EMBO J), including glutamine, the raw material for forming glutamate and GABA (2020 Cells). Lately, I have had the luck to participate in work by the group of LH Bergersen showing that lactate, in addition to its role as brain fuel, transmits beneficial effects to the brain from exercising muscle via a receptor protein (2017 Nat Commun, 2020 Acta Physiol). – To enjoy 80 years of age, it helps to work hard and long with hands and brains, but it is essential also to physically exercise the body, engage in interesting cultural hobbies, and keep good personal relations.

## Biography

Jon Storm-Mathisen is Professor (emeritus) at the University of Oslo (UiO), where he also earned his MD 1965 and PhD (Dr med) 1976. He provided early proof of where in the brain and in which cells and parts of cells the main neurotransmitters of inhibition (GABA and glycine) and excitation (glutamate) are localized, and how they are synthesized. His works are highly [cited](#). He received the UiO Researcher Prize 2004, the Lundbeck Nordic Prize 2005 and the Jahre Prize 2006, and is elected member of Norwegian Academies (DNVA, DKNVS). He was director of two EU projects, co-founder and co-chair of the Centre for Molecular Biology and Neuroscience ([CMBN](#), a CoE), inaugural committee chairman of the Kavli Prize in Neuroscience, and a founding member of the Norwegian Centre on Healthy Ageing [Network](#).