Curriculum vitae Johannes Gijsbrecht Kuenen (J.Gijs Kuenen)

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A) Overview

Prof dr J.G. Kuenen studied chemistry and majored in biochemistry at the University of Groningen, the Netherlands. In 1972 he finished his Ph.D. in microbiology at the same University. After a post-doc at the University of California in Los Angeles, USA, he returned as a senior lecturer to Groningen University. In 1980 he was appointed as professor of general and applied microbiology at the Delft University of Technology. He participated in building up the Biotechnology group in the Faculty of Chemical Engineering and Materials Science in Delft, which in 1982 joined forces with the University of Leiden to form the Research Centre of Biotechnology Delft-Leiden (BDL). Today the School includes also some biotechnology groups at the Wageningen Agriculture University (BSDL). This joint venture is now the Graduate Research School Biotechnological Sciences Delft Leiden (BSDL).
Prof. Kuenen has been head of the department of Microbiology & Enzymology from 1980-1987, and from 1993 to 1998. In 1998 he became the chairman of the new Department of Biotechnology which includes Biocatalysis & Organic Chemistry, Enzymology, Bioprocess Technology, Microbiology, Bioseparation Technology, Analytical Biotechnology and Theory of Complex Liquids. He is member of the Board of B(S)DL since 1982, and has been the Dean of the Faculty of Chemical Technology and Materials Science from 1987-1990. From 1995-1998 he was chairman of the Netherlands Society of Microbiology. From 2003-2005 he was also scientific director of the Delft Research Centre for Life Science & Technology and from 2004-2005 business director of the Kluyver Centre of Genomics of Industrial Fermentation. Prof Kuenen teaches general and applied microbiology in the BSc and MSc of the Chemical and Biochemical Engineering curriculum of Delft and in joint the Life Science & Technology curriculum of Delft/Leiden.
He has become Emeritus Professor since 2006 and is now part time Professor in General and Applied Microbiology at the Delft University of Technology

Prof Kuenen has published over 190 articles in international journals, textbooks and proceedings. He has been supervising the completion of 43 PhD thesis and 60 MSc thesis.

B) Research

The research interest of Kuenen's group is on nitrogen and sulfur cycling by bacteria, with a main focus on their ecophysiology including competition and on their application in the treatment of industrial waste water, and microbial leaching. Important contributions have been made on the physiology of sulfur oxidizing bacteria such as *Thiobacillus* and *Thiomicrospira* species, and the importance of mixotrophic potential in the metabolism and competition between obligate and facultative sulfur oxidizing bacteria. Recent investigations on the oxidation of hydrogen sulfide have shown the competitive advantage of bacteria capable of producing elemental sulfur, rather than sulfide. This property can also be exploited in the removal of hydrogen sulfide from waste water in the form of soluble sulfur.Pilot and full-scale plants have been developed and are successfully operated in practice. In combination with sulfate reducing

bacteria these organisms are also applied for the removal of sulfate and heavy metals from waste- and polluted groundwater.
A new branch of the research is the (eco)physiology of (halo)alkaliphic sulfide oxidation. A spectrum of more than 100 different species isolated from different soda lakes all of the world have been isolated. They belong primarily to two new genera, *Thi(o)alkalimicrobium* and *Thi(o)alkalivibrio*, which each occupy their own ecological niche. The first genus is most successful at low salt and relatively high substrate concentrations while the latter are dominating at lower substrate availability and higher salt concentrations. Thes organisms are also exploited for sulfur removal from waste.

Aerobic denitrification as well as heterotrophic nitrification has been revealed and studied in detail in *Thiosphaera pantotropha* (now *Paracoccus pantotrophus*). Artificial enrichments of *Thioploca* species isolated from natural marine sediment off the coast of Chili have revealed that these organisms are very slowly growing, facultatively chemolithoautotrophic, sulfur oxidizers, capable of reducing stored nitrate to ammonium under anoxic conditions.

The recent work on anoxic ammonium oxidation (Anammox) has drawn attention to a totally novel group of nitrifying/denitrifying bacteria belonging to the Planctomycetes. These obligately chemolithoautotrophic bacteria generate energy from the oxidation of ammonium with nitrite as the electron acceptor (with nitrogen gas as the product) and CO_2 as the carbon source. Thus far three new *candidate* families and four different species have been proposed by our international team: Brocadia, Kuenenia and Scalindua. The enzymology of the nitrogen conversion, in which hydroxylamine and hydrazine are probable intermediates, is also studied. It is now clear that the energy conversion takes place in a membrane bound, separate compartment (the anamoxosome) in these Planctomycetes. Spectacular is their substantial presence in the marine environments near the aerobic anaerobic interface (i.e. the Black Sea). Based on these observations and as yet unpublished work it is estimated that anammox makes a major contribution (10-20% of total ammonium turnover) to the nitrogen cycle in the marine environment. Anammox has also been detected in many wastewater treatment plants. Particularly interesting are the options for combining the anoxic ammonium oxidation with partial aerobic nitrification. A full scale operation of 80 m3 has just been started up in Rotterdam at a wastewater treatment plant treating 300.0000 inhabitant equivalents.
The combination of basic and application oriented research offers a continuing challenge for the research and provides an inspiring basis for fruitful collaboration with industry.

C) Further CV data

Born: December 9, 1940, Heemstede, The Netherlands.
Married to Vibeke Boumeester, 3 children.

1959	: Gymnasium, Leiden
1966	: M.Sc Chemistry, Groningen University
1967-1972	: Lecturer Dept. of Microbiology, Groningen
1972	: Doctorate thesis: Colourless sulphur bacteria from Dutch tidal mudflats (in Dutch). Supervisor: Prof.Dr. H. Veldkamp.
1972-1973	: Z.W.O. (Netherlands Foundation for the Advancement of pure research)-fellowship 12 months sabbatical at the Dept. Bacteriology, UCLA, Los Angeles, U.S.A.
1973-1980	: Senior Lecturer Dept. Microbiology Groningen Projectleader research on ecology and physiology of colourless sulfur bacteria
1980-present	: Professor of general and applied Microbiology, Delft University of Technology

1980-1985	: Chairman of the Dept of Microbiology
1985-1987	: Chairman of the Dept. of Microbiology and Enzymology
1988-1990	: Dean of the Faculty of Chemical Technology and Materials Science, Delft University of Technology
1993-1998	: Chairman of the Dept. of Microbiology and Enzymology
1998-present	: Chairman of the Section Industrial and Environmental Microbiology
1997-1998	: Vice-Chairman of the Kluyver Department of Biotechnology
1998 – 2005	: Chairman of the Kluyver Department of Biotechnology
1998-2005	: Research Director of the Graduate Research School Biotechnological Sciences Delft-Leiden (BSDL)
	: Director of the Advanced Biotechnology Studies (BODL)
1998-2005	: Member of the Management Team of the Faculty of Applied Sciences
2001-2005	: Part-time Professor of Microbiology at Leiden University
2003-2005	: Director of the Centre for Life Science & Technology of the University of Delft
2003-2005	: Business director of the Netherlands Kluyver Centre for Genomics of Industrial Fermentation
2004	: Sabbatical leave (5 months) at the Geobiology, Earth Sciences , USC, L.A. ,USA (professor K.N.Nealson)
2006-present	: Emeritus professor, and part time Professor of general & applied Microbiology at the Delft University of Technology
2006	: Visiting scientist (scholar), the Geobiology, Earth Sciences , USC, L.A
2007	: Visiting scientist (scholar), the Geobiology, Earth Sciences , USC, L.A

D) Other activities

1977 - 1981	: Member Scientific Committee Limnological Institute
1980	: Member Peer Review Committee Microbial Ecology, Sweden
1980 - 1988	: Member Scientific Committee Central Bureau for Fungal Cultures (CBS)
1981 - 1986	: Member Peer Review Committee for the Dutch Biological Sciences (Ministry of Education)
1982 - 2005	: Member BSDL Steering Committee/Member Board BSDL-research school and BODL
1982 - 2004	: Consultant DSM Chemical industries
1987 – 2000	: Member of EERO (European Environmental Research Organisation)
1988 - present	: Member of the Institute of Biotechnology (GB)
1988 - 1990	: Member Peer Review Committee Biotechnology in the Netherlands
1986 - 1990	: Member Scientific Committee Freshwater Biological Association
1989 - present	: Start-up and Consultant of Biotechnology Integrated Research and Development (BIRD) Engineering
1990.-.1991	: Member Peer Review Committee Biotechnology, KNAW
1990 - 1997	: Member Board of the Netherlands Institute for Sea Research (NIOZ)
1994	: Member Peer Review Committee Biotechnology, Denmark
1994 - 2005	: Member Scientific Board of the Max Planck Institute for Marine Microbiology Bremen
1992 - June 1998	: Chairman Working Party on Education of the European Federation of Biotechnology
1993 - 1998	: Member Committee of Ethics and Science Delft University of Technology
1995	: Chairman Organizing and Scientific Committee Beijerinck Centennial, The Hague, December 1995
1995 - 1999	: Member Board of the EDBT (European Doctorate in Biotechnology)
1995 - 1998	: Chairman of the Netherlands Society of Microbiology
1997 - 2002	: Member/Vice Chairman Advisory Council Technology (ARTD) Delft University of Technology
1997 - 2001	: Chairman of the EERO (European Environmental Research

Organization) - Committee of the European Science Foundation (ESF)

1998 – 2006 : Member of the Advisory Committee of the Biological Sciences (ALW)of the Netherlands Research Foundation (NWO)

1999 : Member of the Peer Review Committee Biotechnology Centre, University of Tokyo

2002 : Member of the Peer Review Committee of the Department of Biology of the ETH, Zuerich (CH).

2002- 2006 : Scientific Director of the interfaculty Delft Research Centre for Life Science & Technology ($1.000.000/year)

2003- 2006 : Business Director of the Kluyver Centre for Genomics of Industrial Fermentation ($10.000.000/year)

E) Prizes/Awards

1987 : Member of EERO (European Environmental Research Organisation)

1988 : Member of the Institute of Biotechnology

1997 : Medal of the Delft University of Technology on the occasion of the 25th Ph.D. thesis prepared under his supervision

1999 : University Award for Excellent Research (BEO)

2002 : Machevo Technology Prize 2002

2004 : Knighthood of the Order of the Dutch Lion, on behalf of Her Majesty Queen Beatrix, for excellence in science

2005 : Elected member of the AAM (American Academy for Microbiology)

2006 : Jim Tiedje award from the International Society for Microbial Ecology(ISME)

2007 : Procter & Gamble award of the American Society of Microbiology for lifetime contributions to Applied Microbiology

F) PhD-students

1980 : J.C.Gottschal

1981 : R.F.Beudeker

1982 : H.Y. Steensma

1984 : Y.A. Holthuyzen

1985 : P.M. Bruinenberg, J.A. Duine

1987 : P.J.F. Gommers, B.J. van Schie, M.L.F. Giuseppin

1988 : L.A. Robertson, G.M.H. Suylen

1989 : H. van Urk

1990 : E. Postma, R.J. Rouwenhorst

1991 : E.W.J. van Niel, J.T. Pronk

1992 : C. Verduyn

1993 : R. Meulenberg, G.C. Stefess

1994 : R.A. Weusthuis

1995 : P.A.M. Arts, M.C.M. Hensing, W. Visser

1996 : B.H.A. van Kleeff

1997 : J.M.M. de Zwart, M.A. van den Berg, J.M. Visser, A.A. van de Graaf

1998 : N. Vriezen, P. de Jong-Gubbels

1999 : M.T. Flikweert

2000 : W.P.M. van Hoek, M. Strous, J. Schalk, S. Schalk-Otte, A.M. Zeeman

2003 : A.O.Sliekers

2004 : H.Banciu

2005 : R.Kumaraswamy

2007 : S.A.Dar, M.Foti

2008 : L.van Niftrik, A.C. Toes

List of publications 1972-present (G-J)

G) Publications in double referee international journals

1. J.G. Kuenen and H. Veldkamp. *Thiomicrospira pelophila*, gen.n., sp.n., a new obligately chemolithotrophic colourless sulfur bacterium. Antonie van Leeuwenhoek 38 (1972) 241-256

2. J.G. Kuenen and H. Veldkamp. Effects of organic compounds on growth of chemostat cultures of *Thiomicrospira pelophila*, *Thiobacillis thioparus*, *Thiobacillus neapolitanus*. Arch. Mikrobiol. 94 (1973) 173-190

2a. W. Harder, K. Visser and J.G. Kuenen. Laboratory Fermentor with an improved magnetic drive. Laboratory practice. (1974) 644-645

2b. J.G. Kuenen, P. Cuperus and W. Harder. Low cost multichannel scanning pH-stat. (1973) 36-38

3. Matin, W.N. Konings, J.G. Kuenen and M. Emmens. Active transport of amino acids by membrane vesicles of *Thiobacillus neapolitanus*. J.Gen. Microbiol. 83 (1974) 311-318

4. J.G. Kuenen. Colourless sulfur bacteria and their role in the sulfur cycle. Plant and Soil 43 (1975) 49-76

5. J.G. Kuenen and S.C. Rittenberg. Incorporation of long chain fatty acids of the substrate organism by *Bdellovibrio bacteriovorus* during intraperiplasmic growth. J. Bacteriol. 121 (1975) 1145-1157

6. J.G. Kuenen, J. Boonstra, H.G.J. Schröder and H. Veldkamp. Competition for inorganic substrates among chemoorganotrophic and chemlithotrophic bacteria. Microbial Ecol. 3 (1977) 119-130

7. W. Harder, J.G. Kuenen and A. Matin. Microbial selection in continuous culture. J. Appl. Bacteriol. 43 (1977) 1-24

8. J.C. Gottschal, S.C. de Vries and J.G. Kuenen. Competition between the facultatively chemolithotrophic *Thiobacillus* A2, an obligately chemolithotrophic Thiobacillus and a heterotrophic Spirillum for inorganic and organic substrates. Arch.Microbiol. 121 (1979) 241-249

9. Jørgensen, B.B., Kuenen, J.G. and Cohen, Y. Microbial transformations of sulfur compounds in a stratified lake (Solar Lake, Sinai). Limnology and Oceanography, 24 (1979) 799-822

10. D.P. Kelly, J.C. Gottschal, A.P. Wood and J.G. Kuenen. Autotrophic metabolism of formate by *Thiobacillus* strain A2. J. Gen. Microbiol. 114 (1979) 1-13

11. J.G. Kuenen. Growth yields and maintenance energy requirement in *Thiobacillus* species under energy limitation. Arch. Microbiol. 122 (1979) 183-188

12. Y. Cohen, I. de Jonge and J.G. Kuenen. Excretion of glycolate by *Thiobacillus neapolitanus* grown in continuous culture. Arch. Microbiol. 122 (1979) 189-194

13. R.F. Beudeker, G.C. Cannon, J.G. Kuenen and J.M. Shively. Relations between d-ribulose-1,5-bisphosphate carboxylase, carboxylase, carboxysomes and CO_2, fixing capacity in the obligate chemolithotroph *Thiobacillus neapolitanus* grown under different limitations on the chemostat. Archives of Microbiology 124 (1980) 185-189.

13a. Jan C. Gottschal and J. Gijs Kuenen. Selective Enrichment of Facultatively Chemolithotraphic Thiobacilli and related organisms in continuous culture FEMS Microbiology Letters. 7 (1980) 241-247

14. J.C. Gottschal and J.G. Kuenen. Mixotrophic growth of *Thiobacillus* A2 on acetate and thiosulfate as growth limiting substrates in the chemostat. Archives of Microbiology 126 (1980) 33- 42.

14a.J.G.Kuenen Mixed substrates and mixed cultures Antonie van Leeuwenhoek 47 (1981), 188-189

15. R.F. Beudeker and J.G. Kuenen. Carboxysomes: "Calvinosomes"? FEBS Letter 131 (1981) 269-274.

16. R.F. Beudeker, W. de Boer and J.G. Kuenen. Heterolactic fermentation of intracellular polyglucose by the obligate chemolithotroph *Thiobacillus neapolitanus* under anaerobic conditions. FEMS Microbiology Letters 12 (1981) 337-342.

17. R.F. Beudeker, G.A. Codd and J.G. Kuenen. Quantification and intracellular distribution of ribulose-l,5-bisphosphate carboxylase in *Thiobacillus neapolitanus* as related to possible functions of carboxysomes. Archives of Microbiology 129 (1981) 361-367.

18. R.F. Beudeker, M. Veenhuis and J.G. Kuenen. Cytochemical localization of fructose-1,6-bisphospatase in *Thiobacillus neapolitanus* carboxysomes. FEMS Microbiology letters 12 (1981) 343-346.

19. J.C. Gottschal, A. Pol and J.G. Kuenen. Metabolic flexibility of *Thiobacillus* A2 during substrate transitions in the chemostat. Archives of Microbiology 129 (1981) 23-28.

20. R.F. Beudeker, J.G. Kuenen and G.A. Codd. Glycollate metabolism in the obligate chemolithotroph *Thiobacillus neapolitanus* grown in continuous culture. Journa1 of General Microbiology 126 (1981) 337-346.

21. R.F. Beudeker, J.W.M. Kerver and J.G. Kuenen. Occurrence, structure and function of intracellular polylucose in the obligate chemolithotroph *Thiobacillus neapolitanus*. Archives of Microbiology 129 (1981) 221-226.

22. J.C. Gottschal, H.J. Nanninga and J.G. Kuenen. Growth of *Thiobacillus* A2 under alternating growth conditions in the chemostat. Journal of General Microbiology 126 (1981) 85-96

23. R.F. Beudeker J.C. Gottschal and J.G. Kuenen. Reactivity versus flexibility in thiobacilli. Antonie van Leeuwenhoek 48 (1982) 39-51.

24. R.F. Beudeker, R. Riegman and J.G. Kuenen. Regulation of nitrogen assimilation by the obligate chemolithotroph *Thiobacillus neapolitanus*. Journal of General Microbiology 128 (1982) 39-47.

25. J.G. Kuenen and R.F. Beudeker. Microbiology of Thiobacilli and other sulphur-oxidizing autotrophs, mixotrophs and heterotrophs. Philosophical Transactions Royal Society of London 298 (1982) 473-497.

25a. Lesley A. Robertson and J. Gijs Kuenen. *Thiosphaera pantotropha* Gen. Nov. Sp. Nov. A Facultatively Anaerobic, Facultatively Autotrophic Sulphur Bacterium. 129 (1983) 2847-2855

26. J.A.M. de Bont, P. Dokter, B.J. van Schie, J.P. van Dijken, J. Frank Jzn., J.A. Duine and J.G. Kuenen. Role of quinoprotein glucose dehydrogenase in gluconic acid production by *Acinetobacter calcoaceticus.* Antonie van Leeuwenhoek 50 (1984) 76-77.

27. L.A. Robertson and J.G. Kuenen. Aerobic denitrification: a controversy revived. Archives of Microbiology 139 (1984) 351-354.

28. L.A. Robertson and J.G. Kuenen. Aerobic denitrification-old wine in new bottles? Antonie van Leeuwenhoek 50 (1984) 525-544.

29. B.J. van Schie, J.P. van Dijken and J.G. Kuenen. Non-coordinated synthesis of glucose dehydrogenase and its prosthetic group PQQ in acinetobacter and pseudomonas species. FEMS Microbiology Letters 24 (1984) 133-138

29a. Knut Yngve Børsheim, J. Gijs Kuenen, Jan Gottschal and Ian Dundas. Microbial activities and chemical gradients in the chemocline of a meromictic lake in relation to the precision of the sampling procedure. (1985) 337-341

30. P.M. Bruinenberg, J.P. van Dijken, J.G. Kuenen and. W.A. Scheffers. Critical parameters in the isolation of mitochondria from *Candida utilis* grown in continuous culture. Journal of General Microbiology 131 (1985) 1035-1042.

31. P.M. Bruinenberg, J.P. van Dijken, J.G. Kuenen and W.A. Scheffers. Oxidation of NADH and NADPH by mitochondria from the yeast *Candida utilis*. Journal of General Microbiology 13l (1985) 1043-1051

32. B.J. van Schie, K.J. Hellingwerf, J.P. van Dijken, M.G.L. Elferink, J.M. van Dijl, J.G. Kuenen and W.N. Konings. Energy transduction by electron transfer via pyrrolo-quinoline quinone-dependent glucose dehydrogenase in *Escherichia coli*, *Pseudomonas aeruginosa*, and *Acinetobacter calcoaceticus* (var. Iwoffi). Journal of Bacteriology 163 (1985) 493-499

32a. L.A. Robertson, B.H.A. van Kleeff and J.G. Kuenen. A microcomputer based method for semicontinuous monitoring in biological activities. J. Microbiology Methods. 5 (1986) 237-242

33. P.J.F. Gommers, L.P. Christoffels, J.G. Kuenen and K.Ch.A.M. Luyben. Gas-phase influence on the mixing in a fluidized bed bio-reactor. Applied Microbiology Biotechnology 25 (1986) 1-7.

33a. Yolande A. Holthuijzen, Jan van Breemen, J. Gijs Kuenen and Wil N. Konings. Protein composition of the carboxysomes of *Thiobacillus neapolitanus*. 144 (1986) 398-404

34. W. Hazeu, W. Bijleveld, J.T.C. Grotenhuis, E. Kakes and J.G. Kuenen. Kinetics and energetics of reduced sulphur oxidation by chemostat cultures of *Thiobacillus ferrooxidans*. Antonie van Leeuwenhoek 52 (1986) 507-518.

35. P.J.F. Gommers, B.J. van Schie, J.P. van Dijken and J.G. Kuenen. Biochemical limits to microbial growth yields: an analysis of mixed substrate utilization. Biotechnology and Bioengineering 32 (1986) 86-94.

35a. Yolande A. Holthuijzen, Jan F.L. van Breemen, Wil N. Konings and Ernst F.J. van Bruggen.
Electron microscopic studies of carboxysomes of *Thiobacillus neapolitanus*. Arch Microbiol. 144 (1986) 258-262

36. Y.A. Holthuyzen, F.J.M. Maathuis, J.G. Kuenen, R.N.H. Konings and W.N. Konings. Carboxysomes of *Thiobacillus neapolitanus* do not contain extrachromosomal DNA. FEMS Microbiol. Lett. 35 (1986) 193-198.

36a. G.M.M.Suylen and J.G.Kuenen. Chemostat enrichment and isolation of *Hyphomicrobium* EG, a dimethyl sulphide oxidizing methylotroph and a re-evaluation of *Thiobacillu*s MSI. Antonie van Leeuwenhoek. 52
(1986) 281 293

37. G.M.H. Suylen, G.C. Stefess and J.G. Kuenen. Chemolithotrophic potential of a *Hyphomicrobium* species, capable of growth on methylated sulphur compounds. Arch. Microbiology 146 (1986) 192-198.

37a. J.G. Kuenen, B.B. Jørgensen and N.P. Revsbech. Oxygen microprofiles of trickling filter Biofilms. Water Research 20 (1986) 1589-1598

38. Y.A. Holthuijzen, F.F.M. van Dissel-Emiliani, J.G. Kuenen, and W.N. Konings. Energetic aspects of CO_2, uptake in *Thiobacillus neapolitanus*. Archives of. Microbiology 147 (1987) 285-290.

39. G. Muyzer, A.C. de Bruyn, D.J.M. Schmedding, P. Bos, and P. Westbroek and J.G. Kuenen. A combined immunofluorescence-DNA-fluorescense staining technique for enumeration of *Thiobacillus ferrooxidans* in a population of acidophilic bacteria. Applied and Environmental Microbiology 53 (1987) 660-664.

40. B.J. van Schie, O.H. de Mooy, J.D. Linton, J.P. van Dijken, and J.G. Kuenen. PQQ-dependent production of gluconic acid by *Acinetobacter*, *Agrobacterium* and *Rhizobium* species. Journal of General Microbiology 133 (1987) 867-875.

41. Y.A. Holthuijzen, J.G. Kuenen and W.N. Konings. Activity of ribulose-1, 5-biphosphate carboxylase in intact and disrupted carboxysomes *Thiobacillus neapolitanus*. FEMS Microbiology Letters 42 (1987) 121-124.

42. B.J. van Schie, J.T. Pronk, K.J. Hellingwerf, J.P. van Dijken and J.G. Kuenen. Glucose-dehydrogenase-mediated solute transport and ATP synthesis in *Acinetobacter calcoaceticus*. Journal of General Microbiology 133 (1987) 3427-3435.

43. B.J. van Schie, R.J. Rouwenhorst, J.A.M. de Bont, J.P. van Dijken and J.G. Kuenen. An in vivo analysis of the energetics of aldose oxidation by *Acinetobacter calcoaceticus*. Applied Microbiology and Biotechnology 26 (1987) 560-567.

44. G.M.H. Suylen, P.J. Large, J.P.van Dijken and J.G. Kuenen. Methyl mercaptan oxidase, a key enzyme in the metabolism of methylated sulphur compounds by *Hyphomicrobium* EG. Journal of General Microbiology 133 (1987) 2989-2997.

44a. P.J.F. Gommers, B.J. van Schie, J.P. van Dijken and J.G. Kuenen. Biochemical limits to microbial Growth Yields: An analysis of mixed substrate utilization.Biotechnology and Bioengineering. 32 (1988) 86-94

45. L.A. Robertson and J.G. Kuenen. Heterotrophic nitrification in *Thiosphaera pantotropha* oxygen uptake and enzyme studies. Journal of General Microbiology 134 (1988) 857-863.

46. P.J.F. Gommers and J.G. Kuenen. *Thiobacillus* strain Q, a chemolithoheterothophic sulphur bacterium. Archives of Microbiology 150 (1988) 117-125.

47. E.M. Bonnet-Smits, L.A. Robertson, J.P. van Dijken, E. Senior and J.G. Kuenen. Carbon dioxide fixation as the initial step in the metabolism of acetone by *Thiosphaera pantotropha*. Journal of General Microbiology 134 (1988) 2281-2289.

48. P.J.F. Gommers, W. Bijleveld and J.G. Kuenen. Simultaneous sulfide and acetate oxidation in a denitrifying fluidized bed reactor-I; start- up and reactor performance. Water Research 22 (1988) 1075-1083.

49. P.J.F. Gommers, W. Bijleveld, F.J.M. Zuijderwijk and J.G. Kuenen. Simultaneous sulfide and acetate oxidation in a denitrifying fluidized bed-reactor-II; measurements of activities and conversion. Water Research 22 (1988) 1085-1092.

50. W. Hazeu, W.H. Batenburg-van der Vegte, P. Bos, R.K. van der Pas and J.G. Kuenen. The production and utilization of intermediary elemental sulfur during the oxidation of reduced sulphur compounds by *Thiobacillus ferrooxidans*. Archives of Microbiology 150 (1988) 574-579.

51. L.A. Robertson, E.W,J. van Niel, R.A.M. Torremans and J.G. Kuenen. Simultaneous nitrification and denitrification in aerobic chemostat cultures of *Thiosphaera pantotropha*. Applied and Environmental Microbiology 54 (1988) 2812-2818

51a . P.Bos and J.G.Kuenen (1988). Microbiële ijzervreters. Intermediair, *23*, 71-79

52. B.J. van Schie, R.J. Rouwenhorst, J.P. van Dijken and J.G. Kuenen. Selection of glucose-assimilating variants of *Acinetobacter calcoaceticus* LMD 79.41 in chemostat culture. Antonie van Leeuwenhoek 55 (1989) 39-52.

52a.K.C.A.M. Luyben, J.G.Kuenen, L.A.Robertson. Biotechnology education in the Netherlands Chimicaggi (1989) 31-32

53. L.A. Robertson, R. Cornelisse, P. de Vos, R. Hadioetomo and J.G. Kuenen. Aerobic denitrification in various heterotrophic nitrifiers. Antonie van Leeuwenhoek (1989) 56, 289-299.

54. B.J. van Schie, J.P. van Dijken and J.G. Kuenen. Effects of growth rate and oxygen tension on glucose dehydrogenase activity in *Acinetobacter calcoaceticus*.. Antonie van Leeuwenhoek 55 (1989) 53-65.

55. L.A. Robertson, R. Cornelisse, P. de Vos, R. Hadioetomo and J.G. Kuenen. Aerobic denitrification in various heterotrophic nitrifiers. Antonie van Leeuwenhoek 56 (1989) 289-299.

56. L.A. Robertson, R. Cornelisse, Rong Zeng and J.G. Kuenen. The effect of thiosulfate and other inhibitors of autotrophic nitrification on heterotrophic nitrifiers. Antonie van Leeuwenhoek 56 (1989) 301-309

57. F.C. Boogerd, P. Bos and J.G. Kuenen. Oxygen and carbon dioxide mass transfer and the aerobic autotrophic cultivation of moderate and extreme thermophiles: a case study related to the microbial desulfurization of coal. Biotechnology and Bioengineering 35 (1990) 1111-1119.

57a. J.T. Pronk, P. de Bruin, J.P. van Dijken, P. Bos and J.G. Kuenen. Energetics of mixotrophic and autotrophic C1-metabolism by *Thiobacillus acidophilus*. Arch Microbiology. 154 (1990) 576-583

58. J.T. Pronk, R. Meulenberg, W. Hazeu, P. Bos and J.G. Kuenen. Oxidation of reduced inorganic sulphur compounds by acidophillic thiobacilli. FEMS Microbiology Reviews 75 (1990) 293-306.

58a. J.T. Pronk, R. Meulenberg, D.J.C. van den Berg, W. Batenburg van der Vegte, P. Bos and J.G. Kuenen. Mixotrophic and Autotrophic Growth of *Thiobacillus acidophilus* on Glucose and Thiosulfate. (1990) 3395-3401

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VERSION AUGUST 2008