

prof. Dr J.P. Abrahams

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| Born 28 May 1961, Oslo
| Nationality: Dutch
| married to Alison Sutton
| 2 daughters (Élise & Gwendolyne)

I am a structural biologist, currently at Basel University (prof.) and the Paul Scherrer Institute (head of LBR). I love seeing important molecular structures of life that nobody has seen before, in ways that nobody has tried before. For this purpose, I develop novel methods in high-resolution bioimaging, which include computation, chemistry and physics. I currently focus my efforts on the analysis of protein 3D nano-crystals.

After my Ph. D. in Leiden (cum laude, 1990), I moved to the LMB in Cambridge, where, working in the groups of Andrew Leslie and John Walker, I solved the structure of the F1-ATPase. I could only solve this structure with the novel approaches in X-ray data collection and crystallographic phasing that I developed specifically for this purpose and that have now become part of mainstream crystallography. Together with Robin Carrell, I solved structures of serpins and with Richard Henderson I worked on a giant image plate scanner. In 1997 I returned to Leiden to become a full professor. Here, I studied serpins, viruses, ribosomal complexes, DNA repair proteins, microtubule complexes, enzymes, and amyloid-formation using X-ray crystallography, EM, NMR, AFM and spectroscopic techniques. Between 1997 and 2012, as a PI, I raised in excess of 36 MEuro in competitive funding for this and other work; the majority of these funds were for joint research projects and joint infrastructure. In this period, four companies were spun out of my research group.

Being inspired by the visionary, multidisciplinary approach at the LMB in Cambridge, I decided upon my move to Leiden that I should devote part of my energy to integrating approaches in bioimaging and establishing a joint, top-end infrastructure for structural biology. Hence, I initiated and directed the Cyttron I & II consortia¹, raised the funds for and established NeCEN², and initiated and directed the Leiden Cell Observatory³. In 2015, I moved to Switzerland as professor at the Basel Biozentrum and head of the Laboratory of Biomolecular Research of the Paul Scherrer Institute, in order to advance biomolecular cell research with the anticipated billion Euro SwissFEL X-ray source and a new electron diffraction instrument that will be built under my direction and guidance.

Current and future research

One of the main challenges in structural biology is that many proteins fail to produce (sufficiently large) 3D crystals required for structure solution. In order to meet this challenge, I am now analysing 3D nanocrystals of proteins using electron diffraction. My recent successes include visualising 2D, phased projection structures of single 100 nm protein crystals with a resolution beyond 2 Å using cryo-EM, the collection of large wedges of continuous 3D rotation diffraction data (up to 35 Deg) of similar nano-crystals with a resolution of up to 3Å and phasing of small organic molecules by direct methods. In order to achieve these results, I implemented quantum area detectors for electron diffraction and developed novel concepts, algorithms and software for analysing diffraction and imaging data. In the near future I anticipate adapting and improving these methods, in close

¹ Public-private partnership of 6 universities and 8 commercial enterprises, budget of 38 MEuro (2003-2015): <http://cyttron.org>

² Netherlands Centre for Electron Nanoscopy: joint EM centre of the Netherlands at Leiden University: <http://www.necen.nl>

³ The Leiden University joint facility for bioimaging: <http://cellobservatory.leidenuniv.nl>

collaboration with scientists at the PSI, to allow determining and refining protein structures *ab initio*. This approach is vital for making good use of the novel ultra-high intensity X-ray sources (XFEL, SwissFEL, new synchrotrons with diffraction limited storage rings). It will allow thorough, low-cost optimisation and characterisation of the marginal, but biologically important samples that are destined for such competitive, top-end X-ray sources. As a spin-off of my effort, a novel approach in atomic refinement of 3D cryo-EM single particle reconstructions of large molecular complexes is emerging from my research group.

However, many of the important molecular structures of life probably will not crystallise at all. In order to characterise these structures, I will expand techniques that I am currently developing to include asymmetric structures. I will focus my efforts on diffraction studies, as in both EM and X-ray imaging, the shot-noise of quanta that did not interact with the sample is much higher than the useful elastic signal. Only by collecting diffraction data, these non-interacting quanta (be they photons or electrons) can be discarded: they end up in the direct beam. In order to retrieve the phases of the diffraction patterns, I envisage using ptychography (lensless imaging by overlapped diffraction) and structured beam diffraction (phase retrieval using prior knowledge of the shape of the diffracted beam). I am convinced that these approaches will provide more accurate structures to a higher resolution than is currently feasible.

When establishing a new method, one is allowed to be a bit opportunistic concerning the biological samples are investigated. But new methods are only worth developing if they provide the tools that biologists need. Through collaborations that I will establish with leading biological labs, including the BioZentrum in Basel, I will ensure the methods I develop, are designed for the analysis of important biological molecular systems that cannot be tackled in any other practical way. Separately, I will continue a project I started a few years ago on disease associated nano-crystallisation of misfolded proteins into amyloid, which is associated with important ailments including Alzheimer's and Parkinson's Disease.

International position

In the 2010 national evaluation of all Chemistry groups of the Netherlands, the Abrahams group was awarded a score placing it amongst the top chemistry groups of the Netherlands (5/5 for quality, 5/5 viability, 4/5 productivity, 4/5 relevance). Concerning the scientific quality of the group, the review committee wrote⁴: “*The Biophysical Structural Chemistry group is pioneering in the development of new methodologies for structural biology and is a top “methods” group worldwide both through the combination of different experimental techniques for structure determination of biological macromolecules and the development of novel software for both EM and X-ray analysis. The research is reflected in publications on extremely challenging experimental systems (the ribosome, F1-ATPase etc). The leadership in the field is also evident in the establishment and/or contributions to the cell observatory, the Cytron/II and the upcoming national centre for electron microscopy (NeCEN).*”

⁴ http://www.qanu.nl/sites/default/files/bestanden/files/Chemistry_OZ_2011.pdf (p. 127)

Qualifications:

Full professorship:	1997 (Leiden University)
Ph. D. Diploma:	1991 <i>cum laude</i> (Leiden University)
Doktoraal Diploma:	1985 <i>cum laude</i> (Leiden University)
Kandidaats Diploma:	1984 (Leiden University, the Netherlands)
European Bacculaureate:	1979 (European School, Bergen, the Netherlands)

Employment :

2015-now:	Head of the Laboratory of Biomolecular Research at the Paul Scherrer Institute (Switzerland) Full professor at the Biozentrum, Basel University (Switzerland) Full professor at the Institute of Biology Leiden, Leiden University (The Netherlands)
1997-2015:	Full professor at the Leiden Institute of Chemistry, Leiden University (The Netherlands)
1990-1997:	Post-doc, then staff scientist at MRC Laboratory of Molecular Biology, Cambridge UK
1985-1990:	Netherlands Scientific Organisation (Leiden University)

Grants & Prizes (37.5 MEuro in total):

2017:	SNI NanoArgovia "Applicability of 3D Electron Diffraction in the Pharmaceutical Industry" (co-applicant, 100 kCHF)
2016:	SNF R'Equip grant "Detector Direct electron detector for cryo-EM single particle analysis, electron tomography and protein nanocrystallography" (co-applicant, 325 kCHF) NanoArgovia "Hybrid Pixel Detectors for Electron Diffraction of Nano-Samples" (co-applicant, 150 kCHF)
2015:	SNF grant "SwissFEDI – a free electron diffraction instrument for nano-diffraction of biological specimens" (741 kCHF) SNI grant "A programmable e- beam shaper for diffractive imaging of biological structures at Å resolution" (together with S Tsujino), Project P1505 (270 CHF)
2014:	TA grant for developing novel electron detectors for structural biology (775 kEuro)
2014:	STW Valorization Grant stage I for See-e's, valorizing a novel detector for electron diffraction (25 kEuro)
2013:	LIC: PhD grant (200 kEuro): Max Clabbers
2012:	CSC Grant for Yaowang Li for PhD research in my group (160 kEuro)
2011:	Joint Research PhD grant LUMC/LWN (150 kEuro): Eric van Genderen
2010:	EFRO (6.2 MEuro for a Titan Krios Microscope)
2010:	NWO Groot (6.2 MEuro for a second Titan Krios Microscope)
2010:	FES2009: (10 MEuro for CyttronII, including 1.2 MEuro for own research group)
2009:	NWO-CW Top grant (720 kEuro)
2006:	EU FP6 Max-Inf (30 kEuro for travel, organising workshop)
2005:	STW (600 kEuro)
2004:	BSIK (8.8 MEuro for Cyttron project, including about 1.1 MEuro for own research group).
2003:	NWO (Molecuul tot Cel) (700 kEuro);
2001:	Softlink: FOM & NWO-CW (350 kEuro);

2000: Avantium Technologies BV(100 kEuro), Leadd BV (50 kEuro), Crystallics BV (200 kEuro), KeyDP BV (70 kEuro), Isotis (50 kEuro)
1999: Swiss National Foundation (50 kEuro)
1999: STW (400 kEuro), Senter (170 kEuro);
1998: NWO-CW (jonge chemici) (150 kEuro), NWO-MW (NWO-middelgroot) (400 kEuro)
1997: European Union FP5 (120 kEuro)
1991-1992: EMBO-fellowship (at LMB, Cambridge)
1990-1991: Royal Society & Royal Dutch Academy of Sciences (at MRC Laboratory of Molecular Biology, Cambridge, UK)
1990: Shell Travel Award (5000 Euro)
1989: FEBS (Århus, Denmark; short term)
1987, 1988: EMBO (Bayreuth, Germany; short term)

Supervised PhD students (PhD obtained):

Yaowang Li (2017, promotor)
Eric van Genderen (2015, promotor)
Jinghui Luo (2014, promotor)
Igor Nederlof (2013, promotor)
Willem-Jan Waterreus (2013, promotor)
Elisabeth Meulenbroek (2012, promotor)
Jan de Sonnevile (2011, promotor)
Hanna Lindfors (2010, promotor)
Sandra Zovko (2010, promotor)
Daniel de Geus (2009, promotor)
Linhua Jiang (2009, promotor)
Pavol Skubak (2008, promotor)
Dilyana Georgieva (2008, promotor)
Ying-hui Zhang (2006, promotor)
Ineke Bos (2005, co-promotor)
Ellen Thomassen (2005, promotor)
Marieke van Roon (2004, promotor)
Rutger Leliveld (2003, promotor)
Lei Jin (MRC LMB, 1997 supervisor)
Peter Elliott (MRC LMB, 1996 supervisor)
Richard Skinner (MRC LMB, 1995 supervisor)

Currently supervised PhD students (projected PhD date):

Max Clabbers (2018), Inayatullah Mohammed (2018), Jonas Heidler (2020), Poojah Thakkar (2020), Liu Bingrun (2020), Julian Wennmacher (2020)

Stimulation of talent

Dr Linhua Jiang (PhD student in my group 2005-2009) and Dr Zunfeng Liu (postdoc in my group 2007-2012) both became full professor in 2013.

Science Management

Main:

2015-now Head of the Laboratory of Biomolecular Research at the Paul Scherrer Institute
2003-now Initiator & director of CyttronI & CyttronII, two consecutive consortia of Universities and commercial enterprises (18 MEuro & 20M Euro budgets resp.)

Other:

2013 Board member NeCEN
2009-12 Director & initiator of NeCEN
2008-12 Director & initiator of Leiden Cell Observatory
2011 Chair of the VICI committee STW
2010 Invited member of EU FP7 advisory committee on “4D Biology for health and disease”
2006-10 Member of WECO (science advisory board of the Leiden University Science Faculty)
2008 Invited member of EU KP7 advisory committee on “Detection, Diagnosis and Monitoring”
2005: Invited member of MAX-INF2 (continuation of MAX-INF), invited member of SRS DUBBLE beam line allocation committee, invited member and rapporteur of EU KP7 advisory committee on Molecular testing and bioimaging
2002: Invited member of SLS protein crystallography beam line allocation committee
2001: co-founder of KeyDP BV – a company for high throughput crystallography and bioinformatics; Elected member of Biological Chemistry policy advisory committee (BAC) of the Dutch NWO chemistry council; Invited member of the National Dutch genomics committee, advising and prioritising national programme in fundamental genomics research; Invited member of MAX-INF: EU funded infrastructure Network (protein crystallography)
2000: Elected member of the board of the Dutch NWO Protein Community; co-founder of Crystallics BV – a company for high throughput polymorph screening
1999: Elected member of the board of the Dutch Society for Biochemistry & Molecular Biology;

Invited lectures & organised conferences, 2002 onwards

12-02-16 Ringberg meeting on Structural Biology with FELs, invited speaker
13-01-16 Biozentrum Symposium, keynote speaker
16-11-15 Cyttron II symposium, Naturalis, Leiden, conference organiser & chair
24-09-15 Engelberg (Switzerland), RegioMeeting 2015 (invited speaker)
16-09-15 Vercelli (Italy), XLIV Annual Meeting of the AIC (keynote lecturer)
26-08-15 Rovinc (Croatia), EMC15, Hybrid Sessions (chair)
25-08-15 Rovinc (Croatia), EMC15, electron diffraction (invited speaker)
14-04-15 Bad Ramsach (Switzerland), Basel FP Structural Biology Meetings, invited
24-12-14 I broke my foot, was home-bound on doctor's order for 3 months and had to cancel invited lectures at the Ringberg meeting on “Recent progress on soft- and hard-X-ray FEL applications in structural biology aswell as developments in electron microscopy/crystallography and synchrotron based microcrystallography”, and at the Gordon Conference on “Polyamines”
10-11-14 PSI photon science workshop, invited speaker
03-11-14 Lorentz Workshop Life Science & Industry, organiser
16-10-14 Basel University, speaker at Symposium ‘Nano-Diffraction of Biological Specimens’
08-10-14 110th International Titisee Conference on “Structure, forces and dynamics of macromolecular complexes”, Titisee, Black Forest, Germany, invited speaker
11-09-14 Basel University, invited seminar
18-09-14 ICCBM 15, Hamburg ‘Macromolecular crystallization for novel radiation sources’, session ‘Complementary Methods’, invited speaker
24-06-14 Gordon Conference ‘3DEM: a rising star in structural biology’, Girona, Spain, invited speaker
28-03-14 Cyttron II symposium, Naturalis, Leiden, conference organiser & chair
16-01-14 Paul Scherrer Institute, Villigen, Switzerland, invited speaker
03-10-13 Co-organiser, host and speaker at the Lorentz workshop ‘Life Science and Industry’
28-06-13 Changzhou University – invited speaker
22-03-13 Leiden: CyttronII symposium – invited speaker, chair
16-06-12 Stockholm: Electron crystallography school: new methods – invited speaker
08-06-12 Hamburg: CFEL seminar, keynote speaker
16-03-12 Leiden: CyttronII symposium, keynote speaker
05-01-12 Warwick: CCP4 study weekend, invited speaker

28-10-11	Leiden: Reedijk symposium, invited speaker
01-06-11	Erice: Electron Crystallography, invited speaker
14-09-10	Dublin: ICCBM13, invited speaker
07-07-10	Berlin: Facets of Electron Crystallography, invited speaker
16-03-10	Brussels: "4D Biology for health and disease", invited speaker
05-02-10	LUMC: LUMC meets TUDelft, invited speaker
07-05-09	Geneva: Cleveringa lecture
22-09-09	Italian Crystallographic Association (AIC) Congress : Methods & Crystallography (in Salerno, Italia) (keynote lecture)
19-08-09	25th European Crystallography Meeting (in Istanbul, Turkey) (keynote lecture)
15-05-09	Seminar Swiss Light Source, Villigen, Switzerland, invited speaker
07-05-09	SGC seminar (Oxford) , invited speaker
21-02-08	Tiling 3D Rotation Space, Lunteren, invited speaker
06-03-08	LIFE symposium, keynote lecture
17-05-08	Max-Inf2/Lorentz Center workshop <i>New algorithm in macromolecular crystallography and electron microscopy</i> , invited speaker
02-11-07	Proteins Killing Tumour Cells (Lorentz workshop), invited speaker
13-06-07	Advances in EM, Valencia, keynote lecture
18-01-05	This Weeks Discoveries – Univ. Leiden, invited speaker
31-01-05	XFEL meeting, Woudschoten, invited speaker
17-02-05	Fysisch Genootschap, keynote lecture
23-03-05	Hybrid Methods, Granlibakken, California – invited speaker
18-04-05	Diligentia, keynote lecture
25-08-05	ECM – Antwerp, invited speaker
27-10-05	Structural Biology of Molecular Motors, Inst. Lorentz, invited speaker
14-06-04	ETH Structural Biology Symposium, Zürich, invited speaker
29-09-04	ELBA Max Planck Forum (Porto Conte, Sardinia) – invited speaker
08-12-04	Studium Generale, Univ. Leiden, keynote lecture
16-12-03	Mathematics in Biology, Wageningen, invited speaker
03-05-02	Genomics Momentum, keynote lecture
18-02-02	Orleans, SOLEIL, invited speaker
18-04-02	IOP symposium, Wageningen, invited speaker
04-01-02	CCP4 study weekend, York, invited speaker

Refereed publications

(142 papers/book(chapter)s, 88 as first or last author, total number of citations until August 2016:

~8000, H-factor: 34 (ResearchGate))

- [1] Yin Q, Liu Z, Laroche FJF, Zhou X, Shao N, Lin B, Wang R, Yuan N, Ding J, Abrahams JP (2017) "A Novel Capturing Method for Quantification of Extra-Cellular Nanovesicles" *J. Nanosci. Nanotech.* 17, 908-913
- [2] Su J, Wang H, Wu K, Liu ZS, Yin Q, Wang R, Lv Wei, Yin S, Liu Z, Abrahams JP (2017) "Neutravidin-Mediated Extraction of Isolated Small Diameter Single Walled Carbon Nanotubes for Bio-Recognition" *J. Nanosci. Nanotech.* 17, 3588-3596
- [3] Clabbers MTB, van Genderen E, Wan W, Wiegers EL, Gruene T, Abrahams JP (2017) "Protein structure determination by electron diffraction using a single three-dimensional nanocrystal" *Acta Crystallogr. D* (in the press)
- [4] Wang R, Boleij M, Yin Q, Galjart N, Lin B, Yuan N, Zhou X, Tan M, Ding J, Liu Z, Abrahams JP (2017) "Purification of Biotinylated Proteins Using Single Walled Carbon Nanotube-Streptavidin Complexes", *J. Nanoscience and Nanotechnology* 17, 926-931
- [5] Abrahams JP (2016) "Electron nanodiffraction for structural biology" *Acta Crystallogr.* A72(a1), s6
- [6] Tiiman A, Luo J, Wallin C, Olsson L, Lindgren J, Jarvet J, Roos P, Sholts SB, Rahimipour S, Abrahams JP, Erikson Karlström A, Gräslund A, Wärmländer SKTS (2016) "Specific Binding of Cu(II) Ions to Amyloid-Beta Peptides Bound to Aggregation-Inhibiting Molecules or SDS Micelles Creates Complexes that Generate Radical Oxygen Species" *J. Alzheimer's Disease* 54, 971-982
- [7] Luo J, Wärmländer SKTS, Gräslund A, Abrahams JP (2016) "Cross-interactions between the Alzheimer disease amyloid- β peptide and other amyloid proteins: A further aspect of the amyloid cascade hypothesis" *J. Biol. Chem.* 291, 1485-1493
- [8] Wallin, C., Kulkarni Y.S., Abelein, A., Jarvet, J., Liao, Q., Strodel, B., Olsson, L., Luo, J.,

- Abrahams, J. P., Sholts, S. B., Roos, P. M., Kamerlin, S.C., Gräslund, A., and Wärmländer, S. K. T. S. (2016) Characterization of Mn(II) ion binding to the amyloid- β peptide in Alzheimer's disease. *J. Trace Elem. Med. Biol.* 10.1016/j.jtemb.2016.03.009
- [9] Luo J, Wärmländer SKTS, Gräslund A, Abrahams JP (2016) "Reciprocal molecular interactions between the A β peptide linked to Alzheimer's Disease and insulin linked to Diabetes Mellitus type II" *ACS Chem Neurosci*. DOI: 10.1021/acschemneuro.5b00325
- [10] Van Genderen E, Li, YW, Nederlof I, Abrahams JP (2016) "Lattice filter for processing image data of 3D protein nano-crystals" *Acta Crystallogr. D72*, 34-39
- [11] van Genderen E, Clabbers MTB, Das PP, Stewart A, Nederlof I, Barentsen KC, Portillo Q, Pannu NS, Nicolopoulos S, Gruene T, Abrahams JP (2016) "Ab initio structure determination of nanocrystals of organic pharmaceutical compounds by electron diffraction at room temperature using a Timepix quantum area direct electron detector" *Acta Crystallogr. A72*, 236-242, doi: 10.1107/S2053273315022500
- [12] Abrahams JP, Van Genderen E, Nederlof I, Li, YW, (2015) "Electron diffraction and imaging of 3D nanocrystals of pharmaceuticals, peptides and proteins" *Acta Crystallogr. A71*, S103
- [13] Clabbers MTB, Van Genderen E, Nederlof I, Abrahams JP (2015) "Electron crystallography of 3D nano-crystals" *Acta Crystallogr. A71*, S405
- [14] Afanasyev P, Ravelli RBG, Matadeen R, De Carlo S, van Duinen G, Alewijnse B, Peters PJ, Abrahams JP, Portugal RV, Schatz M, van Heel M (2015) "A posteriori correction of camera characteristics from large image data sets" *Scientific Reports* 5, doi:10.1038/srep10317
- [15] Luo J, Wärmländer SKTS, Gräslund A, Abrahams JP "Alzheimer Peptides Aggregate into Transient Nanoglobules That Nucleate Fibrils" (2014) *Biochemistry* 53, 6302-6308
- [16] Luo J, Wärmländer SKTS, Gräslund A, Abrahams JP "Non-chaperone Proteins Can Inhibit Aggregation and Cytotoxicity of Alzheimer Amyloid- β Peptide" (2014) *Biomacromolecules*, DOI: 10.1021/bm401874j
- [17] Luo J, Mohammed I, Wärmländer SKTS, Hiruma Y, Gräslund A, Abrahams JP "Endogenous Polyamines Reduce the Toxicity of Soluble A β Peptide Aggregates Associated with Alzheimer's Disease" (2014) *Biomacromolecules*, DOI: 10.1021/bm401874j
- [18] Luo J, Wärmländer SKTS, Yu CH, Muhammad K, Gräslund A; Abrahams JP (2014) "The A β peptide forms non-amyloid fibrils in the presence of carbon nanotubes" *Nanoscale* 6, 6720-6726
- [19] Luo, J, Abrahams JP (2014) "Cyclic peptides as inhibitors of amyloid fibrillation" *Chemistry Eur. J* 20, 2410-2419
- [20] Abelein A, Abrahams JP, Danielsson J, Gräslund A, Jarvet J, Luo J, Tiiman A, Wärmländer SKTS (2014) "The hairpin conformation of the Amyloid β peptide is a common structural motif along the aggregation pathway" *J. Biol. Inorg. Chem.* 19, 623-624
- [21] Ten Bruggencate F, Laroche, F, Zhang, Y, Song G, Yin S, Abrahams JP, Liu Z (2013) "Visualizing the localization of transfection complexes during graphene nanoparticle-based transfection" *J. Mater. Chem. B* 1, 6353-6358
- [22] Luo J, Otero JM, Yu C-H, Wärmländer SKTS, Gräslund A, Overhand M, Abrahams JP (2013) "Inhibiting and reversing A β peptide (1-40) fibrillation by gramicidin S and engineered analogues" *Chemistry* 19, 17338-17348
- [23] Luo J, Wärmländer SKTS, Gräslund A, Abrahams JP (2013) "Human lysozyme inhibits the in vitro aggregation of A β peptide, which in vivo is associated with Alzheimer's disease" *Chem. Comm* 49, 6507-6509
- [24] Liu ZF, Voskamp P, Zhang Y, Chu FQ, Abrahams JP (2013) "Capture of unstable protein complex on the streptavidin-coated single-walled carbon nanotubes" *Journal of Nanoparticle Research* 15
- [25] Nederlof I, van Genderen E, Li YW, Abrahams JP (2013) "A Medipix quantum area detector allows rotation electron diffraction data collection from submicrometre three-dimensional protein crystals" *Acta Crystallogr D69* 1223-1230
- [26] Nederlof I, Li YW, van Heel M, Abrahams JP (2013) "Imaging protein three-dimensional nanocrystals with cryo-EM" *Acta Crystallogr. D69*, 852-859
- [27] Luo JH, Yu CH, Yu Hx, Borstnar R, Kamerlin SCL, Gräslund A, Abrahams JP, Wärmländer SKTS (2013) "Cellular Polyamines Promote Amyloid-Beta Peptide Fibrillation and Modulate the Aggregation Pathways" *Biophys J* 104 398A-398A
- [28] Luo JH, Zwier R, Abrahams JP (2013) "An efficient nanolitre-volume multi-channel device for highly viscous materials used in membrane protein crystallization" *Appl. Crystallogr.* 46, 829-831
- [29] Luo JH, Yu CH, Yu Hx, Borstnar R, Kamerlin SCL, Gräslund A, Abrahams JP, Wärmländer SKTS (2013) "Cellular Polyamines Promote Amyloid-Beta Peptide Fibrillation and Modulate the Aggregation Pathways" *Neuroscience* 4, 454-462
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- Pannu NS, Oosterkamp TH, Koster AJ, Dame RT, Abrahams JP (2012) "Single-Walled Carbon Nanotubes as Scaffolds to Concentrate DNA for the Study of DNA-Protein Interactions" *Chem. Phys. Chem* 13, 1569-1575
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- [35] Jiang L, Georgieva D, Nederlof I, Liu ZF, Abrahams JP (2011) "Image Processing and Lattice Determination for Three-Dimensional Nanocrystals" *Microscopy and Microanalysis* 17, 879-885.
- [36] Sikharulidze I, van Gastel R, Schramm S, Abrahams JP, Poelsema B, Tromp RM, van der Molen SJ (2011) "Low energy electron microscopy imaging using Medipix2 detector" *Nucl. Inst. & Meth. In Physics Res* A633, S239-S242
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- [38] Georgieva D, Jansen J, Sikharulidze I, Jiang L, Zandbergen HW, Abrahams JP (2011) "Evaluation of Medipix 2 detector for recording electron diffraction data in low dose conditions" *J. Instrumentation* 6 C01033
- [39] Nicolopoulos S, Rauch EF, Georgieva D, Abrahams JP (2011) "Low-resolution electron crystallography challenges in organic and inorganic crystals with transmission electron microscope (TEM)" *Acta Crystallogr. D* 67, C188
- [40] Nederlof I, Georgieva D, Abrahams JP (2011) "Electron diffraction of submicron three-dimensional protein crystals" *Acta Crystallogr. D* 67, C228
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- [42] Abrahams JP (and 27 co-authors) (2011) "4D Biology for Health and Disease workshop report" *New Biotechnology* 28, 291-293
- [43] Liu ZF, Galli F, Janssen KGH, Jiang LH, van der Linden HJ, de Geus DC, Voskamp P, Kuil ME, Olsthoorn RCL, Oosterkamp TH, Hankemeier T, Abrahams JP (2010) "Stable Single-walled carbon nanotube-streptavidin complex for biorecognition" *J. Phys. Chem. C* 114, 4345-4352
- [44] Liu ZF, Jiang LH, Galli F, Nederlof I, Olsthoorn RCL, Lamers GEM, Oosterkamp TH, Abrahams JP (2010) "Graphene oxide.streptavidin complex for biorecognition – towards affinity purification" *Advanced Functional Materials* 20, 2857-2865
- [45] Abrahams JP (2010) "The Strong Phase Object Approximation May Allow Extending Crystallographic Phases of Dynamical Electron Diffraction Patterns of 3D Protein Nano-Crystals", *Zeitschr. F. Kristallografie* 225, 67-76
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