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## Extending the self-assembly of coiled-coil hybrids

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## ABBREVIATIONS

A	alanine
Ac	acetyl
ACH	$\alpha$ -cyano-4-hydroxycinnamic acid
ATRP	atom transfer radical polymerization
BLG	$\gamma$ -benzyl L-glutamate
BOC	tertiary-butoxycarbonyl
bZIP	basic region leucine zipper
CD	circular dichroism
$C_p$	heat capacity
CH	cholesterol
D	aspartic acid
D <sub>2</sub> O	deuterated water
DCM	dichloromethane
$D_h$	hydrodynamic diameter
DIPEA	N,N-diisopropylethylamine
DLS	dynamic light scattering
DMF	N,N-dimethylformamide
DNA	deoxyribonucleic acid
DOPC	1,2-dioleoyl-sn-glycero-3-phosphatidylcholine
DOPE	1,2-dioleoyl-sn-glycero-3-phosphatidylethanolamine
DOPE-LR	1,2- dioleoyl-sn-glycero-3-phosphatidylethanolamine-lissamine-rhodamine B
DOPE-NBD	1,2-dioleoyl-sn-glycero- 3-phosphoethanolamine-N-(7-nitro-2-1,3-benzoxadiazol-4-yl) (ammonium salt)
DPA	dipicolinic acid
E	glutamic acid
EM	electron microscopy
EDTA	ethylenediaminetetraacetic acid
Fmoc	fluorenylmethoxycarbonyl
FPLC	fast protein liquid chromatography
FRET	fluorescence resonance energy transfer
FT-IR	fourier transform infrared
G	glycine
$\Delta G_u$	Gibbs free energy of unfolding
GdnHCl	guanidinium hydrochloride
GEF	guanine nucleotide exchange factor
GPC	gel permeation chromatography
HIV	Human immunodeficiency virus
HCTU	1H-benzotriazolium 1-[bis(dimethylamino)methylene]-5-chloro-hexafluorophosphate (1-),3-oxide
HEMA	poly(hydroxymethyl methacrylate)
$\Delta H_u$	enthalpy of unfolding
I	isoleucine
K	lysine
$K_u$	dimer dissociation constant
L	leucine

MALDI-TOF	matrix-assisted laser desorption-ionization time-of-flight
MD	molecular dynamics
$M_n$	number average molecular weight
MS	mass spectroscopy
NBD	nitrobenzofuran
NCA	<i>N</i> -carboxyanhydrides
NMP	nitroxide-mediated polymerization
NMP	<i>N</i> -methyl-2-pyrrolidone
NMR	nuclear magnetic resonance
NSF	<i>N</i> -ethylmaleimide-sensitive factor
OLPC	oleoyl lysophosphatidylcholine
P	proline
PAA	poly(acrylic acid)
PBD	polybutadiene
PBLG	poly( $\gamma$ -benzyl <i>L</i> -glutamate)
PBS	phosphate buffered saline
PCL	polycaprolactone
PDI	polydispersity index
PEG	poly(ethylene glycol)
PLL	poly- <i>L</i> -lysine
PNIPAM	poly( <i>N</i> -isopropylacrylamide)
PTA	phosphotungstic acid
PS	polystyrene
PSCOOH	monocarboxy terminated polystyrene
PYBOP	(1 <i>H</i> -benzotriazol-1- <i>yloxy</i> )tripyrrolidinophosphonium hexafluorophosphate
R	arginine
RAFT	reversible addition-fragmentation chain transfer
RNA	ribonucleic acid
ROP	ring-opening polymerization
RP-HPLC	reversed-phase high-pressure liquid chromatography
S	serine
SEM	scanning electron microscopy
SNARE	soluble NSF attachment protein receptor
SPPS	solid-phase peptide synthesis
TEA	triethanolamine
TEM	transmission electron microscopy
TFA	trifluoroacetic acid
TFE	trifluoroethanol
tBu	tertiary butyl
T	threonine
$T_g$	glass transition temperature
$T_m$	melting temperature
THF	tetrahydrofuran
TIS	triisopropylsilane
TMSBr	bromotrimethylsilane
UV	ultraviolet
V	valine
VdW	van der Waals
VIS	visible
W	tryptophan
Y	tyrosine

## CURRICULUM VITAE

Hana Robson Marsden was born on the second of January 1980 in Wellington, New Zealand. In 1998 she started studying a range of science and mathematics subjects at Victoria University of Wellington. She conducted research projects on the development of functionalized self-assembled monolayers on quartz crystal microbalances for use as chemical sensors, and the synthesis of titanium precursors for the production of piezoelectric ceramic films. She assisted in chemistry and technology practical courses. During her undergraduate degree she was awarded the Curtis-Gordon research scholarship in chemistry, an Industrial Research Ltd. scholarship, and a scholarship from the Foundation for Science Research and Technology. In 2002 she obtained her Bachelor of Science and Technology, with first class honors in materials science. She then received a Summer Research Scholarship from the Australian National University, and worked on the use of proteins to template mineral growth in the group of John White. Following this she worked on developing high temperature superconductors in the Materials Technologies group at Industrial Research Limited. In 2003 she left New Zealand and worked on thin film solar cells in the Physics of New Materials group at Rostock University, Germany.

In May 2004 Hana began her PhD research in the Soft Matter Chemistry group at Leiden University. Her research, conducted under the supervision of copromotor Alexander Kros, concerned the orthogonal self-assembly of hybrid molecules containing coiled-coil forming peptides. A selection of the results of this research are presented in this thesis. During her PhD studies Hana attended the 2004 Physical Chemistry Han-sur-les winter school and presented her work at the 2005 Macroscopic Physical Chemistry Schiermonnikoog meeting, from 2004 to 2009 at the Dutch Polymer Days and Dutch Synthesis days, and at the Materials Research Society 2007 fall meeting in Boston. Throughout her PhD she supervised 2 bachelor students and 4 masters students in their research internships, some results of which are part of Chapters 4 – 7.

Hana is currently working as a post-doc in the Soft Matter Chemistry group, extending the membrane fusion system developed in this thesis to living cells.

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*By thinking of life as process, we must think of the organism actively and continuously engaged with its ecology at a complex hierarchy of levels—that is, we must think of the functioning of a system, not of life as the property of the organism alone.*  
*Louis Sander, Psychoanalytic Dialogues 12(1):11-42, 2002.*

This thesis, a collection of my research efforts of the last five years, is actually a front, or will soon come to be a front, for my life in the Netherlands. Behind the thesis, the five Dutch years have been woven from the personalities, the land, the work, the visitors, the language, the trips. These threads have been constantly fabricating something new and shifting, and I would like to hold up some strands that are particularly bright.

At the beginning there was the convent, the orchard, the lake, thunder and lightning, evenings at the kitchen table in the attic, Silvia with her intense ways, Rene who made me take breaks, Rene with morning sickness, hordes of New Zealanders. Cycling to the dunes and the straight muted coast. Wim tirelessly showing us the ropes and knowing everything, Dutch courses, and milk.

Then there was Ahmed on a quest, light scattering at night, swords, flat water, smooth rocks and never-ending Scandinavian days. There was capoeira, Valeska off-the-wall, Anna activated. There was Nathan and his princess, El 4 eva, and later on Flixie-pie. There was dialysis, and mass spec at the hospital, and microscopy and Gerda and Fons and Nico and Hans, keeping it all together. There were buildings from the 1600s and the secret garden; windmills with ancient Kauri beams, lubricated with lard, and plenty of bicycles. There was Sasha and his integral of  $e^x$  from the east, and disaster and new life.

Then there were the seventh floor years, with Nina the diligent, Luca at the perfect time, being me in the lab, and Christophe keeping on. There were the soaring poplars shifting outside the window, and drizzle, and mist, and mould, and 2 pm sunsets. There was Chun on the logic-train, and pragmatic Frank locking and loading. Joris the bold, Ke the acster, Ho Sze, Costas Agrios, Eduardo, Fabiola, Cecilia, and Valeria. Esther with her energy-spring, and Marsida my little sister. There was the beat and curving water in Amsterdam. There was moksi, residence permits, and chips in cones. There were Germans and Bulgaria and home.

There were walls of windows, and windowsills with sunshine and radiators. There was Finn and Esther and Joe and Amy on a limb, and a red bicycle and a ladybird. There was alpha-Alex the reader and clarifier, Agur, Hans, and chortling Edgar. There was Joanna, Jan-Willem, and silver-toothed Jacques. There was perseverance and curiosity. There was

Yoshiko and Kristo K. M. Kulju of the succulaciae, and tomatoes and frogs and reeds and stinging nettle and elderflower and mushrooms and dusk and the couch.

There was a glance on a bicycle, and a bump and a fright at the same time, and then there was delight and Otto, and a great rush of feelings and events. There was the hospital in a whole new light, and nurses and doctors and grandparents and heart gripping situations and the grind of repetition, and help materialising, and work understanding. There was Elena. There was the world to discover. There was the forest and time to see it changing. There were rabbits and peacocks. There were mothers and kids on the lawn. There were the Slovaks, and Rene and Margarita and Osha and Lily and Andrea. There was Robert and Sylvia and Tristanoček and another to discover everything together with.

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There was always Christian, the constant gardener, over the edge, and turning it into gold.

So thanks everyone. Either you were involved with the projects presented in this book, or we've been hanging out, or I've had you in mind, but the point is that you've been part of making me me, you've fleshed out the Dutch years. Also, I've had the feeling that you've all wished the best for me, and same back at ya. Especially thank you to Mum and Dad and Tossy and Finn and the whanau, you've made me me forever, and to Christian and Otto, we'll make ourselves as we ride on ride on.