



Universiteit
Leiden
The Netherlands

Nanosized blood microparticles

Yuana, Y.

Citation

Yuana, Y. (2011, October 27). *Nanosized blood microparticles*. Retrieved from <https://hdl.handle.net/1887/17987>

Version: Corrected Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/17987>

Note: To cite this publication please use the final published version (if applicable).

NANOSIZED BLOOD MICROPARTICLES

Yuana

NANOSIZED BLOOD MICROPARTICLES

PROEFSCHRIFT

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van de Rector Magnificus prof. mr. P.F. van der Heijden,
volgens besluit van het College voor Promoties
te verdedigen op donderdag 27 oktober 2011
klokke 11:15 uur

door

Yuana

geboren te Jakarta, Indonesië
in 1976

Promotiecommissie

Promotores: Prof. dr. S. Osanto
Prof. dr. R.M. Bertina

Overige leden: Prof. dr. H.J. Tanke
Prof. dr. A.F. Cohen
Dr. P. Harrison (Oxford Haemophilia and Thrombosis
Centre, Churchill Hospital, Oxford, United Kingdom)

The research presented in this thesis was performed in the Department of Clinical Oncology and Einthoven Laboratory of the Leiden University Medical Center, The Netherlands.

The studies published in this thesis were supported by a grant of the Dutch Cancer Society (KWF UL 2006-3618).

Financial support for the printing of this thesis was obtained from the Department of Clinical Oncology of the Leiden University Medical Centre and from Beckman Coulter Nederland B.V.

Cover photo and design: Beach on Terschelling by Yuana and M.J.W. Dignum

Printed by: Uitgeverij BOXPress, Oisterwijk

© 2011, Yuana

ISBN: 978-90-8891-325-9

**Rejoice in the Lord always. I will say it again: Rejoice!
(Philippians 4:4)**

In memoriam of

Tiromsa Sinaga (1976-2006)

Lidyawati (1956-2007)

Table of contents

	Page	
Chapter 1	General Introduction	7
Chapter 2	Pre-analytical and analytical issues in the analysis of blood microparticles	19
Chapter 3	Atomic Force Microscopy: A novel approach to detect nanosized blood microparticles	49
Chapter 4	The detection of tissue factor bearing-microparticles by atomic force microscopy	69
Chapter 5	Determination of the size distribution of blood microparticles directly in plasma using atomic force microscopy and microfluidics	81
Chapter 6	Cryo-electron microscopy of submicron particles in plasma	101
Chapter 7	Use of immuno-magnetic beads for direct capture of nanosized blood microparticles from plasma	121
Chapter 8	Microparticle-associated tissue factor activity and venous thrombosis in multiple myeloma	139
Chapter 9	Summary and General Discussion	155
	Nederlandse samenvatting	167
	Curriculum vitae	177
	List of publications	179
	Acknowledgments	181

