

Institute for Regenerative Medicine

4th Annual

Regenerative Medicine Essentials:

From the Fundamentals to the Future

June 5-9, 2017

Wake Forest Bowman Gray Center for Medical Education, Winston-Salem NC

Official Course of



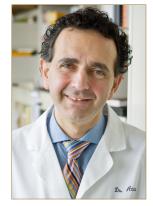




Welcome to Regenerative Medicine Essentials 2017

On behalf of the course organizing committee and our prominent group of course instructors, I welcome all of you to the 4th Annual Regenerative Medicine Essentials: From the Fundamentals to the Future course.

Often referred to as the next evolution of modern health care, regenerative medicine touches many disciplines — from clinical care and engineering to basic science and bioethics. This one-week course — the "official course of the Regenerative Medicine Foundation (RMF)"—taught by prominent experts in the field, addresses the interdisciplinary nature of regenerative medicine and provides



attendees a foundation in this exciting field as well as a glance towards the future.

In partnership with RMF, the organizing committee has put together a dynamic and informative course that covers "essential" topics and addresses the fundamental principles and progress in tissue engineering and regenerative medicine, including stem cells and cell therapy, biomaterials, technology-based tissue engineering and enabling technologies, as well as regulatory, ethical, and economic issues critical to the field. Our instructors, which include faculty from the Wake Forest Institute for Regenerative Medicine (WFIRM) as well as distinguished, prominent experts in the field from industry, academia and the government from across the globe, offer a firm foundation with insights into the future directions and potential applications of tissue engineering and regenerative medicine. Further, the course is a dynamic event, providing an ideal setting for academic, clinical and industry professionals to network with colleagues, and encouraging the formation of new exchanges, collaborations and learning opportunities in translational bioscience.

We are also excited to offer three "Into the Lab" workshops that provide hands-on interaction and demonstrations with cutting-edge technologies and techniques for regenerative medicine applications. Participants will have an opportunity to review and interact with these technologies and leading WFIRM researchers at WFIRM. Workshops are also designed to provide translational and commercial insight regarding these technologies and will highlight some of the current challenges and discuss potential approaches to overcome technical hurdles.

We hope this course will further interactions among basic scientists engaged in discovery and development, translational researchers who bring laboratory discoveries to the clinical forefront, clinicians and those engaged with funding, regulatory and commercialization endeavors. I look forward to an exciting, enjoyable and productive course for all.

With warmest regards, Anthony Atala, MD, Director, Wake Forest Institute for Regenerative Medicine

Welcome to Regenerative Medicine Essentials 2017

Dear colleagues,

On behalf of the Regenerative Medicine Foundation (RMF), I welcome you to RMF's "official course"— the 4th annual Regenerative Medicine Essentials: From the Fundamentals to the Future. We believe the course is a perfect platform for advancing the RMF mission to accelerate regenerative medicine to improve health and deliver cures.

Here at RMF, we recognize that the power of collaboration grows in a nonlinear fashion. One plus one is more than two, and one plus one plus one is much, much more than three — offering explosively



positive and unpredictable possibilities. By attending this course, you will expand your knowledge in a totally immersive experience and gain personal connections and collaborations. Be open to all opportunities presented.

Interact with the outstanding interdisciplinary faculty and the superlative researchers of our host institution, the Wake Forest Institute for Regenerative Medicine, led by our treasured friend, Dr. Anthony Atala. We are here for you. Open to your questions and points of view.

This week I urge you to network with fellow attendees. Break bread, make new friends and remember to collect those opportunities.

In my journey, I have found Winston-Salem to be one of the most collegial places on the planet. This week, I assure you, it's the best place to learn about the future of medicine!

Cordially,

Bernard Siegel, JD Executive Director, Regenerative Medicine Foundation Founder & Chair, World Stem Cell Summit

With Special Thanks and Recognition

Organizing Committee

Anthony Atala, MD RME 2017 Course Director, Director, WFIRM

Bernard Siegel, JD RME 2017 Course Co-Director, Executive Director, Regenerative Medicine Foundation

Joan F. Schanck, MPA RME 2017 Course Manager Academic Research Program Officer, WEIRM

Joanne Gray Education and Outreach Coordinator, WFIRM

Emily McKenzie Gregg Web and Social Media Manager, WFIRM

Samantha Sells RME2017 Program Coordinator, WFIRM

Workshop Leaders and Committees

Introduction to Translation
Julie Allickson, PhD
Director, Regenerative Medicine
Clinical Center, WFIRM

Rich Payne, PhD Associate Director, Process Development, WFIRM

Lisa Hinshaw Project Manager I, WFIRM

Darren Hickerson, MS, MDiv Assistant Director, Manufacturing, WFIRM Todd Meinecke, MBA Assistant Director, Quality Assurance, WFIRM

Bioprinting Basics John Jackson, PhD Associate Professor, WFIRM

Daniel Cabrera Cofounder and CEO, BioBots, Inc.

Ricky Solorzano Cofounder and CTO, BioBots, Inc.

Carlos Kengla, PhD Student, WFIRM

Ashkan Shafiee, PhD, Post-Doctoral Fellow, WFIRM

Madeline Winter, VP of Operations, BioBots, Inc.

Margaret Prendergast Bioengineer at BioBots, Inc.

Gabe Montoya Wetware Intern at BioBots, Inc.

Decell/Recell Workshop Aleksander Skardal, PhD, Assistant Professor, WFIRM

Sean Murphy, PhD, Assistant Professor, WFIRM

John Jackson, PhD, Associate Professor, WFIRM

In Kap Ko, PhD, Assistant Professor, WFIRM

Julio Aleman, Research Lab Technician, WFIRM

Matthew Brovold, PhD Student, WFIRM Mahesh Devarasetty, PhD Student, WFIRM

Andrea Mazzocchi, PhD Student, WFIRM

Hema Sivakumar, PhD Student, WFIRM

Riccardo Tamburrini, MD, Post-Doctoral Fellow, WFIRM

Jao Paulo Zambon, PhD, Research Fellow, WFIRM

Cindy Zimmerman, MS, Histology Core Technician, WFIRM

Cara Cloud, DVM, Research Associate, WFIRM

Career Perspectives Committee

Kevin Enck, PhD Student, WFIRM

Oula Khoury, PhD Student, WFIRM

Renata Magalhaes, MD, PhD Student, WFIRM

Peter Prim, PhD, Post-Doctoral Fellow, WFIRM

Christina Ross, PhD, Post-Doctoral Fellow, WFIRM

WFIRM Lab Tours

James Yoo, MD, PhD, Professor, WFIRM

Tracy Criswell, PhD, Assistant Professor, WFIRM

In Kap Ko, PhD, Assistant Professor, WFIRM

Sang Jin Lee, PhD, Associate Professor, WFIRM Young Min Ju, PhD, Instructor, WFIRM

Aleksander Skardal, PhD, Assistant Professor, WFIRM

Thomas Eaton, MS, Lab Operations Manager, WFIRM

Kenneth Gyabaah, Imaging Core Technician, WFIRM

Ray Johnson, Cell Culture Core Technician, WFIRM

Tara Jones, Genetics Core Technician, WFIRM

Cindy Zimmerman, Histology Core Technician, WFIRM

Other Contributors

Robert Harrison Bardsley IV Research Lab Technician II , WFIRM

Terri Bowen, Administrative Manager, WFIRM

Bonnie Davis, Communications Manager, WFIRM

Sunil George, PhD, Post-Doctoral Fellow, WFIRM

Ernie Lookabilll, Financial Analyst WFIRM

Beth Manning, Administrative Assistant, WFIRM

Karen Richardson, Sr. Manager, Communications, WFIRM

Donna Tucker, Administrative Assistant, WFIRM

Norma Zayas, Administrative Assistant, WFIRM

Important Information

RME 2017 Course Materials Dropbox link: bit.ly/RME17

Registrants may also email Joan Schanck at <u>jschanck@wakehealth.edu</u> to request link be sent to them.

We're Social!

Like, Follow, and Connect with Wake Forest Institute for Regenerative Medicine on social media. We will be live-tweeting and taking questions directed to any of the session and/or individual course instructors. You can submit questions NOW and DURING the course by using the hashtag #RMEssentials. We will also post daily pictures from the course on our Facebook account.



@WFIRMNews



Internet Access

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4th Annual

Regenerative Medicine Essentials: From the Fundamentals to the Future

Wake Forest Institute for Regenerative Medicine

With Special Thanks to our Sponsors:

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Exhibitors:



















Contributor:



Workshop Sponsor:



Visitor Information

Directions to the Bowman Gray Center for Medical Education

475 Vine Street Winston-Salem, NC 27101



Bowman Gray Center for Medical Education

From the east (Greensboro): Take I-40W/73N toward Winston-Salem. Following 73N, keep left at the fork to continue on, following signs for I-40W. Merge onto I-40W. Use the right two lanes to take exit 206 for I-40W Business toward Winston-Salem Downtown. Take exit 6C toward ML King Jr. Dr./Winston-Salem State University. Turn right onto ML King Jr. Dr. then left onto E. 4th St. Turn right onto Vine St. then turn right onto E. 7th St. Parking lot P8 will be located on the right past Reseach Parkway. Follow path down E. 7th St. to turn left onto Vine St. to access the Bowman Gray Center for Medical Education.

From the west (Statesville): Take I-40E to Winston-Salem. Keep left to take exit 188 for I-40E Business toward Winston-Salem/Downtown. Take exit 5D and merge onto Main St. Turn right onto E. 4th St. Turn right onto Vine St. then turn right onto E. 7th St. Parking lot P8 will be located on the right past Reseach Parkway. Follow path down E. 7th St. to turn left onto Vine St. to access the Bowman Gray Center for Medical Education.

Hotels Near the Bowman Gray Center for Medical Education



- The Cardinal Hotel (a Kimpton property) 336-724-5599
- Fairfield Inn & Suites by Marriott 336-714-2800
- Winston-Salem Marriott 800-770-5675

- Embassy Suites by Hilton 336-724-2300
- Hawthorne Inn and Conference Center 877-777-3099
 Owned by the Medical Center, the Hawthorne Inn offers special rates for guests.

Stay An Extra Day: Places To Visit

Old Salem Museums and Gardens 900 Old Salem Rd.,
Winston-Salem, NC
www.oldsalem.org
In the middle of bustling
downtown Winston-Salem, you
are steps away from the quieter
place of the 18th-century Moravian
village of Old Salem Museums
and Gardens. Enjoy a self-guided
walking tour of the historic town.
Don't miss a meal at the Tavern
or Moravian sugar cake at Winkler
Bakery.



Old Salem



Reynolda House

Reynolda House Museum of American Art

2250 Reynolda Rd., Winston-Salem, NC www.reynoldahouse.org

As one considers great homes of the South, few possess more personal appeal than Reynolda House Museum of American Art. Its stellar collections of American art, decorative arts and costumes transport visitors into the era of the early 20th century. Nearby Reynolda Village offers shops and restaurants.

Downtown Arts District & Shopping

400-700 Trade St., Winston-Salem, NC (and surrounding areas) www.dadaws.org

Downtown/Trade Street District has restaurants, retail shops, residences, business offices, and more located in this eclectic area of downtown between 5th and 7th Streets on Trade Street. Many businesses are housed in historic buildings that are characteristic to Winston-Salem's past and present.

For additional ideas visit www.visitwinstonsalem.com.

Stay An Extra Day: Places To Eat

The Tavern in Old Salem - American 736 South Main St., Winston-Salem, NC 336-722-1227

Winkler Bakery - Baked Goods 521 South Main St., Winston-Salem, NC 336-721-7302

Sweet Potatoes - Southern 529 Trade St., Winston-Salem, NC 336-727-4844

Bib's Downtown - Barbeque 675 West 5th St., Winston-Salem, NC 336-722-0007

Quanto Basta - Italian 680 West 4th St., Winston-Salem, NC 336-893-6144

Krankies - Coffee/American 211 East 3rd St., Winston-Salem, NC 336-722-3016

Famous Toastery - Breakfast 770 Liberty View Ct. Winston-Salem, NC 336-306-9023

Willow's Bistro - American 300 South Liberty Ct., Winston-Salem, NC 336-293-4601



The Tavern in Old Salem pecan pie



Bibs Downtown BBQ plate

4th Annual

Regenerative Medicine Essentials:

From the Fundamentals to the Future

Course Instructors



Anthony Atala, MDDirector, Wake Forest Institute for Regenerative Medicine



Julie Allickson, PhD
Director, Regenerative Medicine Clinical Center, Wake
Forest Institute for Regenerative Medicine



Graca Almeida-Porada, MD, PhDProfessor, Wake Forest Institute for Regenerative Medicine



Guillermo Ameer, PhD
Professor, Biomedical Engineering and Department
of Surgery at the Feinberg School of Medicine,
Northwestern University



Daniel G. Anderson, PhD
Department of Chemical Engineering, Institute for
Medical Engineering and Science, Harvard-MIT
Division of Health Sciences and Technology; David H.
Koch Institute for Integrative Cancer Research



Arnold Caplan, PhD
Professor, Departments of Biology, General Medical
Sciences (Oncology), Pathology, and Biomedical
Engineering, Case Western Reserve University;
Founder of Osiris Therapeutic



Gabor Forgacs, PhD
Professor of Biological Physics, University of
Missouri-Columbia; Chief Scientific Officer, Modern
Meadows, Inc.



Beth Fordham-MeierPrincipal and Founder, NovoCreation Consulting, LLC



Rosemarie Hunziker, PhD
Director of Tissue Engineering and Regenerative
Medicine, National Institute of Biomedical Imaging
and Bioengineering (NIBIB)



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John Jackson, PhDAssociate Professor, Wake Forest Institute for Regenerative Medicine



Nancy King, JD Co-Director, Center for Bioethics, Health and Society, Wake Forest University



Joanne Kurtzberg, MD
Director, Pediatric Blood and Marrow Transplant
Program, Duke University Medical Center



Frank Marini, PhDProfessor, Wake Forest Institute for Regenerative Medicine



Antonios G. Mikos, PhD
Louis Calder Professor of Bioengineering, Chemical
and Biomolecular Engineering, Director for Center
for Excellence in Tissue Engineering, Director for J.W.
Cox Laboratory for Biomedical Engineering, Rice
University



C. Randal Mills, PhD
President & CEO, California Institute for Regenerative
Medicine (CIRM)



Sean Murphy, PhDAssistant Professor, Wake Forest Institute for Regenerative Medicine



Daniel K. Nelson, MS, CIP
Professor and Director of U.S. Environmental
Protection Agency and University of North Carolina Chapel Hill



Steven Oh, PhDChief, Cell Therapies; Office of Tissues and Advanced Therapies, FDA, CBER



Chris Porada, PhD Associate Professor, Wake Forest Institute for Regenerative Medicine



Robert Preti, PhD President & CEO, PCT



Becky Robinson-Zeigler, PhDChief of Pharmacology/Toxicology Branch 2 in CBER/OTAT



Bernie Siegel, JD Executive Director, Regenerative Medicine Foundation



Aleksander Skardal, PhDAssistant Professor, Wake Forest Institute for Regenerative Medicine



Igor Slukvin, MD, PhD
Professor, Department of Pathology and Laboratory
Medicine, University of Wisconsin



Rachel Smith, PhD
Research Scientist and Faculty, Cedars Sinai
Heart Institute; Vice President of Research and
Development, Capricor Therapeutics



Doris A. Taylor, PhD, FAHA, FACC Director, Regenerative Medicine Research, Texas Heart Institute; Director, Center for Cell and Organ Biotechnology at Texas Heart Institute and TAMU College of Veterinary Medicine

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Omid Veiseh, PhDAssistant Professor of Bioengineering, CPRIT Scholar in Cancer Research, Rice University



Julie Watson, JD
Special Counsel, Marshall, Gerstein & Borun, LLP;
Intellectual Property Director and Legal Counsel,
WFIRM



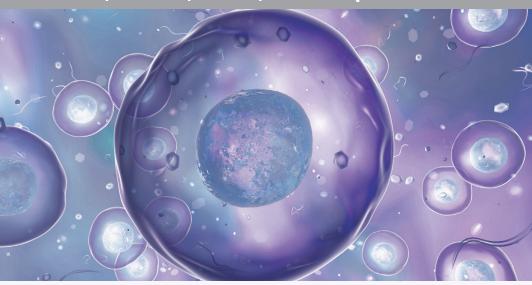
David Williams, DScProfessor and Director of International Affairs, Wake
Forest Institute for Regenerative Medicine



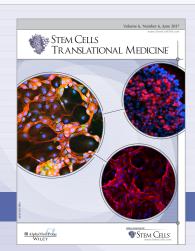
James J. Yoo, MD, PhD Associate Director and Chief Scientific Officer, WFIRM



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Agenda

	Day 1: Monday, June 5th		
11:45am - 1:15pm	Arrival and Registration		5th floor
1:15pm - 1:30pm	Welcome and Opening Remarks		5107
	Session I: Pluripotent Stem Cells and their Progenitors	rogenitors	
1:30pm - 2:15pm	Introduction and Background: PAST, PRESENT, FUTURE - The Evolution of Regenerative Medicine	Anthony Atala, MD	5107
2:15pm - 3:00pm	Stem Cells, Basic Biology, Therapeutics, and Vehicles for Gene Delivery	Graca Almeida Porada, MD, PhD (Chair)	5107
3:00pm - 3:15pm	Coffee Break		5th floor
3:15pm - 4:15pm	MSC's are not SC's	Arnold Caplan, PhD	5107
4:15pm - 5:15pm	Cord-Blood Derived Stem Cells	Joanne Kurtzberg, MD	5107
5:15pm - 5:45pm	Panel and Attendees Discussion	Bernard Siegle, JD	5107
-	Brief Closing Remarks	(Moderator)	
5.15pm - 7:00pm	Opening Reception		1st floor
11doo: / - 11dot: 0	(Heavy Hors D'oeuvres and Beer/Wine)		courtyard
	Day 2: Tuesday, June 6th		
7:45am - 8:30am	Continental Breakfast		5th floor
	Session II: Biomaterials		
8:30am - 9:15am	Essential Biomaterials Science	David Williams, PhD (Chair)	5107

5107	5th floor	5107	5107	5107		5207			5107	5107	5107	5th floor	5107	5107	5107 5th Floor
Guillermo Ameer, PhD		Aleks Skardal, PhD	Omid Veiseh, PhD		Christina Ross, PhD,	Peter Prim, PHD and Renata Magalhaes, MD, Student	Chairs/Moderators			Christopher Porada, PhD (Chair)	Frank Marini, PhD		John Jackson, PhD	Daniel G. Anderson, PhD	
Citrate-Based Biomaterials Enabling New Tools for Regenerative Engineering	Coffee Break and Exhibits	Hydrogel Biomaterials in Regenerative Medicine and Tissue Engineering Applications	Immune Modulatory Biomaterials for Cell-Based Therapies	Panel and Attendees Discussion		Lunch, Career Pathways in Regenerative Medicine Session I (From Postdoc to Faculty), and Exhibits		Session III: Enabling Technologies		Overview of Enabling Technologies in Regenerative Medicine (w/ Gene Therapy Applications)	Tracking Stem Cells Anywhere in the Body - A Look at	<i>Regenerative Imaging</i> Coffee Break and Exhibits	Bioprinting and Processes 101	CRISPR-Cas9 in the Clinic	Panel and Attendees Discussion Refreshments
9:15am - 10:00am	10:00am - 10:15am	10:15am - 11:00am	11:00am - 11:45am	11:45am - 12:15pm		12:15pm - 1:45pm				1:45pm - 2:30pm	2:30pm - 3:15pm	3:15pm - 3:45pm	3:45pm - 4:15pm	4:15pm - 5:00pm	5:00pm - 5:30pm 5:30pm - 6:15pm

	Day 3: Wednesday, June 7th		
7:45am - 8:30am	Continental Breakfast Sign up for WFIRM Tours		5th floor
	Session IV: Cell Therapies		
8:30am - 9:15am	Overview w/Applications of Perinatal Stem Cells	Sean Murphy, PhD (Chair)	5107
9:15am - 10:15am	iPSC-based blood regenerative therapies	Igor Slukvin, MD, PhD	5107
10:15am - 10:30am	Coffee Break and Exhibits		5th floor
10:30am - 11:30am	Scale to Survive: The Future of Cell Therapy	Robert Preti, PhD	5107
11:30am - 12:00pm	Panel and Attendees Discussion		5107
, , , , , , , , , , , , , , , , , , ,	7 - L	Δ,	5th floor & 5203,
12:00pm - 1:15pm	Lunch and Exhibits		5205
12:00 pm - 4:00 pm	RMF Executive Board Meeting (Invitation only)		5405
	Session V: Tissue Engineered Products & Technologies (TEMPs)	ologies (TEMPs)	
77.7	Considerations for Developing Tissue Engineered and	James Yoo, MD, PhD	7
T:Topm - T:4opm	Regenerative Medicine Products	(Chair)	2107
1:45pm - 2:15pm	Biomaterials Commercialization	Tony Mikos, PhD	5107
2:15pm - 2:45pm	Commercial Applications of Bioprinting in Regenerative Medicine, Pharmaceutics and Beyond	Gabor Forgacs, PhD	5107
2:45pm - 3:15pm	Panel and Attendees Discussion		5107
3:15pm - 4:00pm	Coffee Break and Exhibits		5th floor

Outside main Iobby entrance	WFIRM		5th floor		5107	010	5107	010	5th floor	5107	5107	5107	5207		5107
Tours begin at 3:30; 3:50 and 4:10 pm				turing	Julie Allickson, PhD	(Chair)	Becky Robinson-	Zeigler, PhD		Steve Oh, PhD	David Williams, PhD		Kevin Enck and Oula Khoury, Student Chairs/Moderators		Daniel K. Nelson, MS, CIP
WFIRM Lab Tours (Shuttle Service or Walk. Van shuttle to WFIRM from WF Medical Education Center from 3:15 pm to 5:45 pm).	Social Networking at WHIRM with Refreshments <i>WFIRM Patio</i>	Day 4: Thursday, June 8th	Continental Breakfast	sion VI: Regulatory, Process Development & Manufacturing	Translational Research from Proof-of Concept to Clinical	Trials	Think Like a Regulator: US FDA Considerations for	Preclinical Studies for Regenerative Medicine Products	Coffee Break and Exhibits	Translation of TERM products into the clinic in US: FDA Perspectives II	Regional and Global Perspectives	Panel and Attendees Discussion	Lunch, Career Pathways in Regenerative Medicine Session II (Federal Perspectives), and Exhibits	Session VII: IRB, Clinical Trials & Bioethics	IRBs and Translational Research: Overlooking the Cutting Edge
3:30pm - 5:30pm	4:00pm - 5:30pm		8:00am - 8:45am	Sessi	8.45am - 0.15am		0.15am - 10:00am	7.10am - 10.00am	10:00am - 10:15am	10:15am - 11:00am	11:00am - 11:45am	11:45am - 12:15pm	12:15pm - 1:30pm		1:30pm - 2:30pm

2:30pm - 3:00pm	Translational Regenerative Medicine Research: Ethics Overview	Nancy King, JD	5107
3:00pm - 3:15pm	Coffee Break and Exhibits		5th floor
3:15pm - 3:45pm	Understanding NIH Funding of Regenerative Medicine (WebEx)	Rosemarie Hunziker, PhD	5107
3:45pm - 4:45pm	Cardiac Regenerative Medicine (Clinical Trials Case Studies)- Tentative Title	Rachel Smith, PhD	5107
4:45pm - 5:00pm	Panel and Attendees Discussion	Bernard Siegel, JD (Moderator)	5107
5:00pm - 5:30pm	Refreshments		5th floor
5:30pm - 6:45pm	NC BBQ and Social Networking		Bailey Park
	Day 5: Friday, June 9th		
8:00am - 8:45am	Continental Breakfast		5th floor
	Session VIII: Commercialization		
8:45am - 9:30am	IP 101: Securing IP for Regenerative Medicine	Julie Watson, JD	5107
9:30am - 10:00am	Opportunities and Risks in Commercializing Novel Regenerative Medicine Technologies	Beth Fordham-Meier	5107
10:00am - 10:15am	Coffee Break		5th floor
10:15am - 11:00am	Commercialization and the Pathways to Market (Case Study)	Doris Taylor, PhD	5107
11:00am - 11:45am	CIRM 2.0 and Beyond	C. Randal Mills, PhD	5107
11:45 - 12:00pm	Wrap-Up and Concluding Remarks		5107