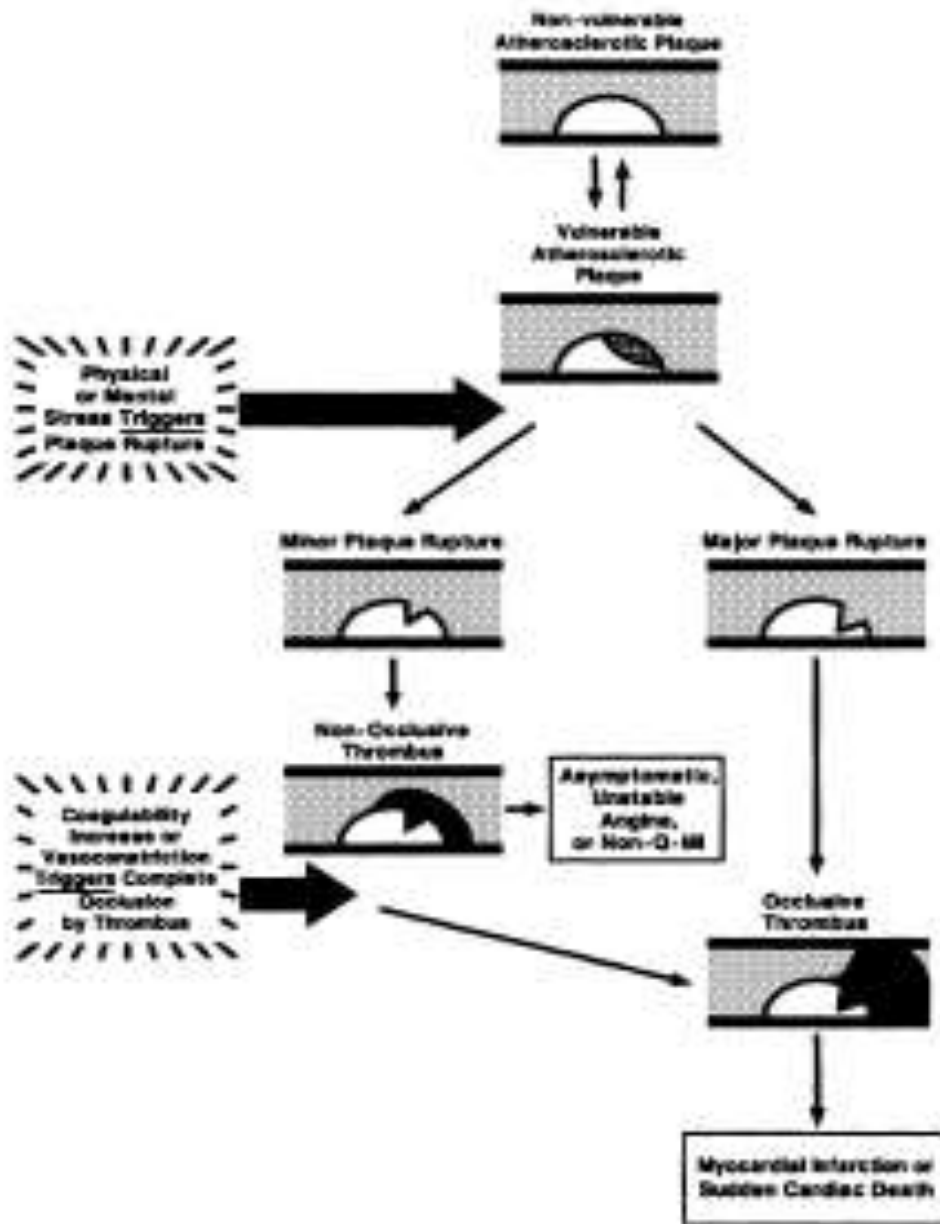


TCTAP April 2015

How to Detect and Treat Vulnerable Coronary Plaques:  
Results with NIRS IVUS Imaging

James Muller MD  
Chief Medical Officer  
Infraredx, Inc.

## Triggering of Coronary Thrombosis

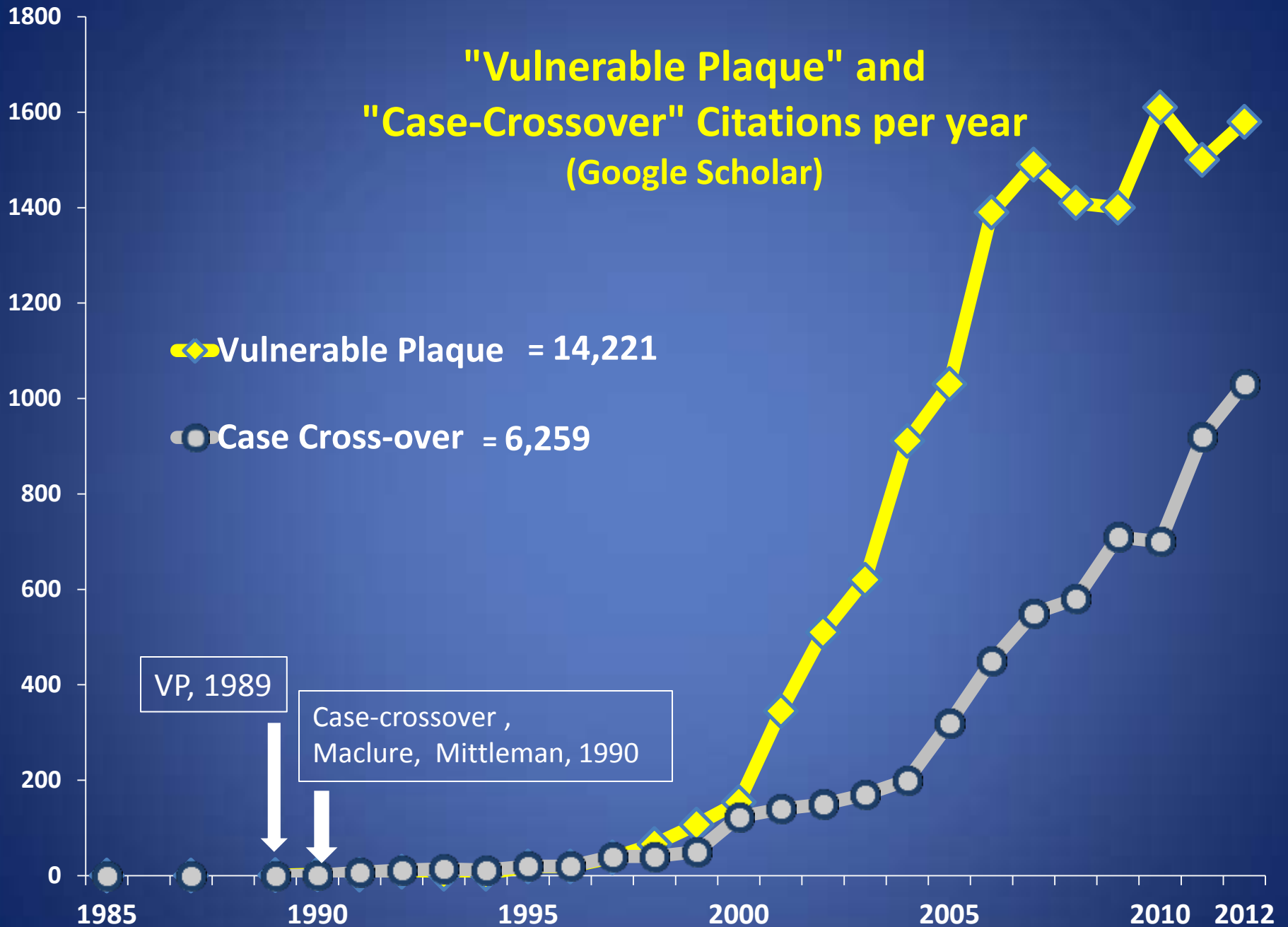


**Introduction of the  
“Vulnerable Plaque”  
concept.**

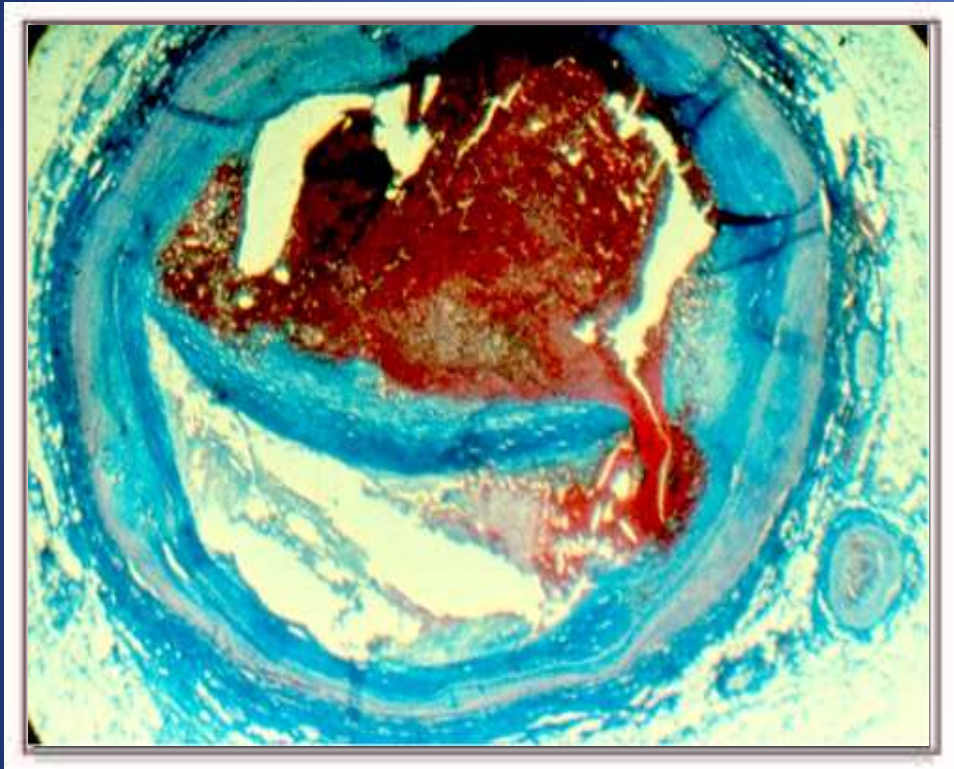
“ a plaque at increased  
risk of disruption and  
thrombosis.”

Muller, Tofler, Stone  
Circulation, 1989

# "Vulnerable Plaque" and "Case-Crossover" Citations per year (Google Scholar)



# The Problem



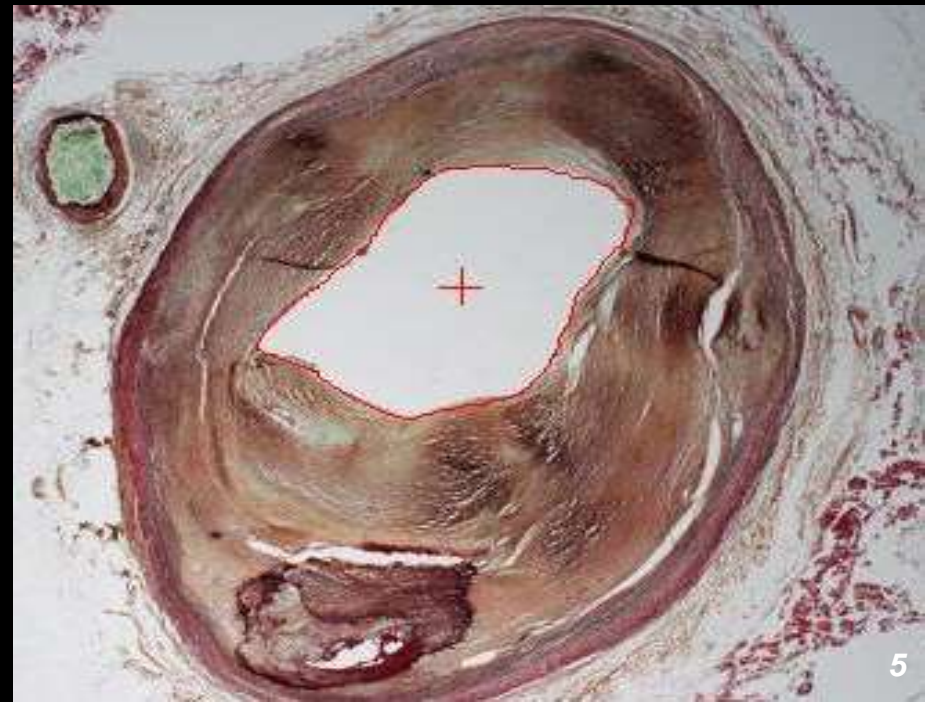
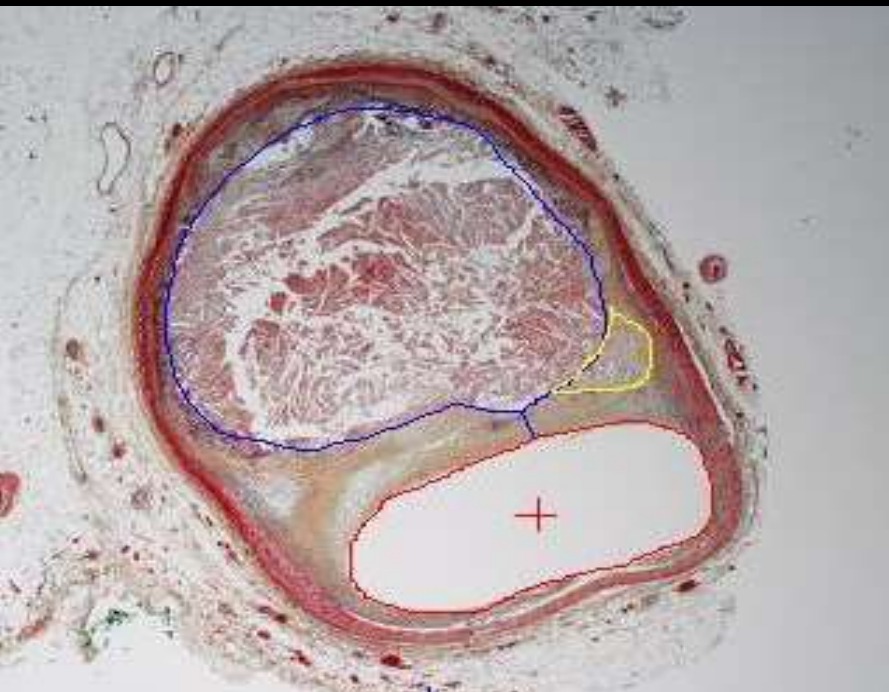
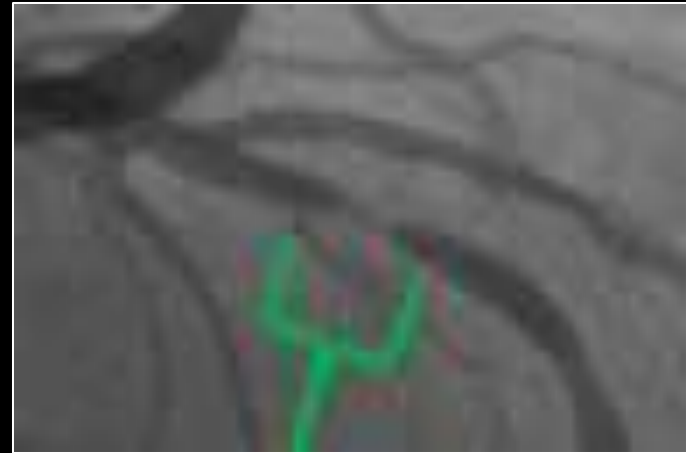
**7.4 Million  
Coronary Deaths  
Per Year  
and  
Complicate Stenting**

**Courtesy  
Dr. Paris Constantinides**

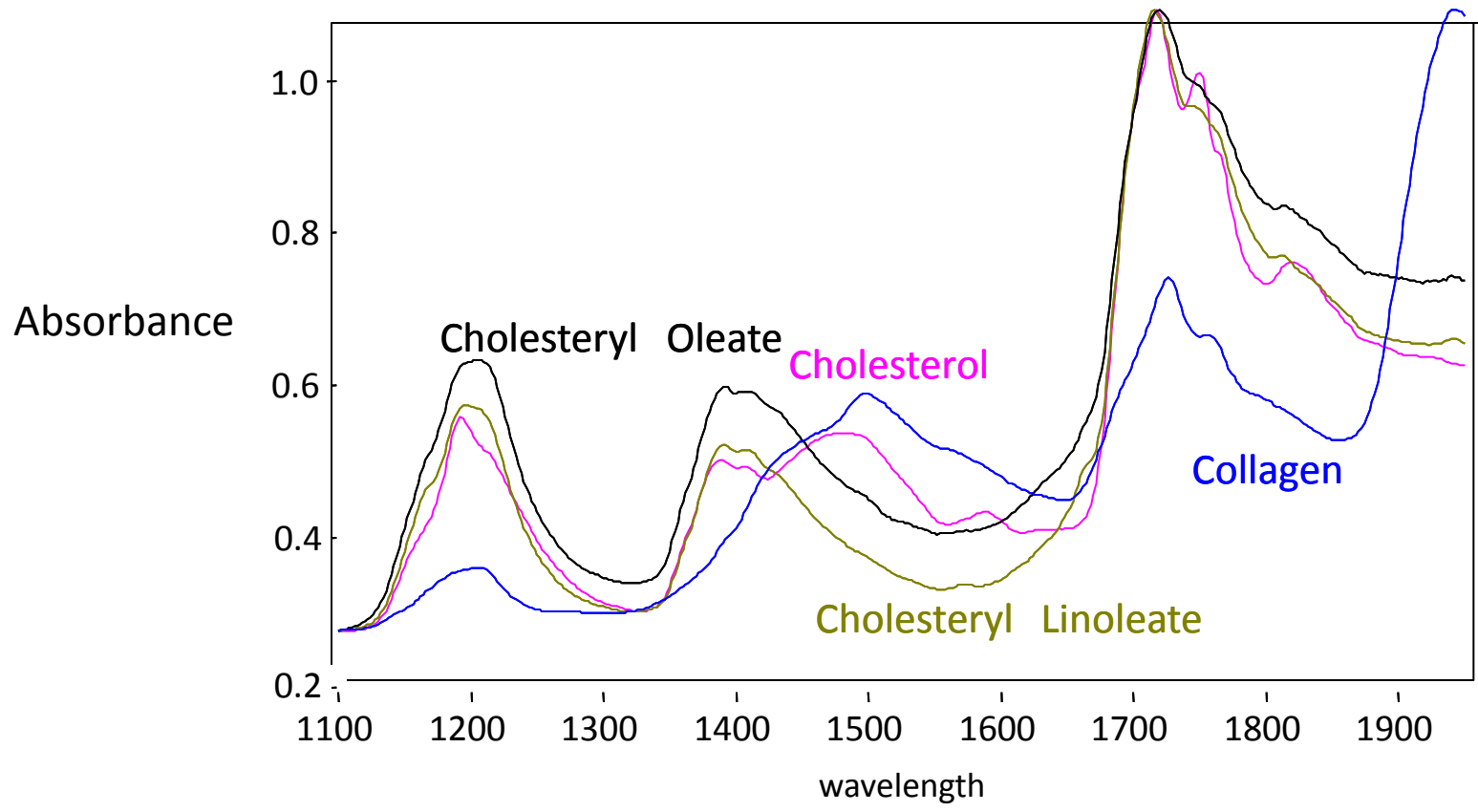
Oncologists know tissue type before treating.

Cardiologists are not able to know tissue type in most cases.

But lipidic and fibrotic plaques respond differently.



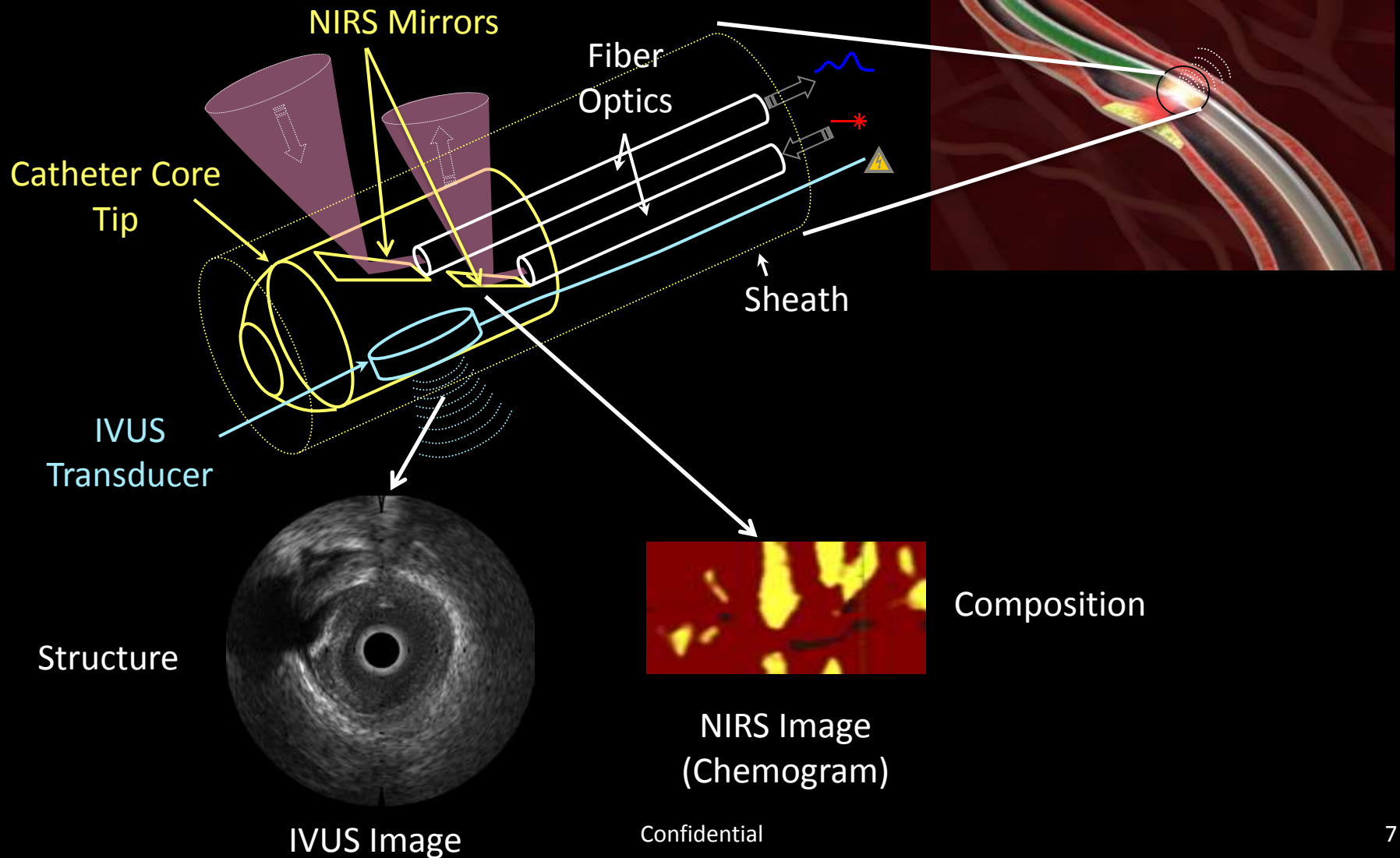
# Diffuse Reflectance NIR Spectroscopy to Identify Chemical Composition of Unknown Substances



Spectroscopy in 1998



# NIRS and IVUS Combined Catheter



# Chemogram Findings in a Coronary Autopsy Specimen: Comparison with Histology



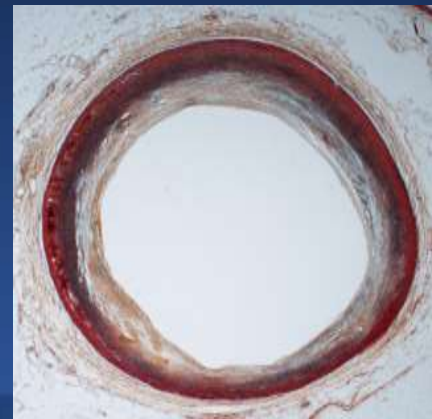
40 mm



36 mm



26 mm



20 mm



# Utilization of NIRS and IVUS Data to Identify Lipid-rich Plaque Burden

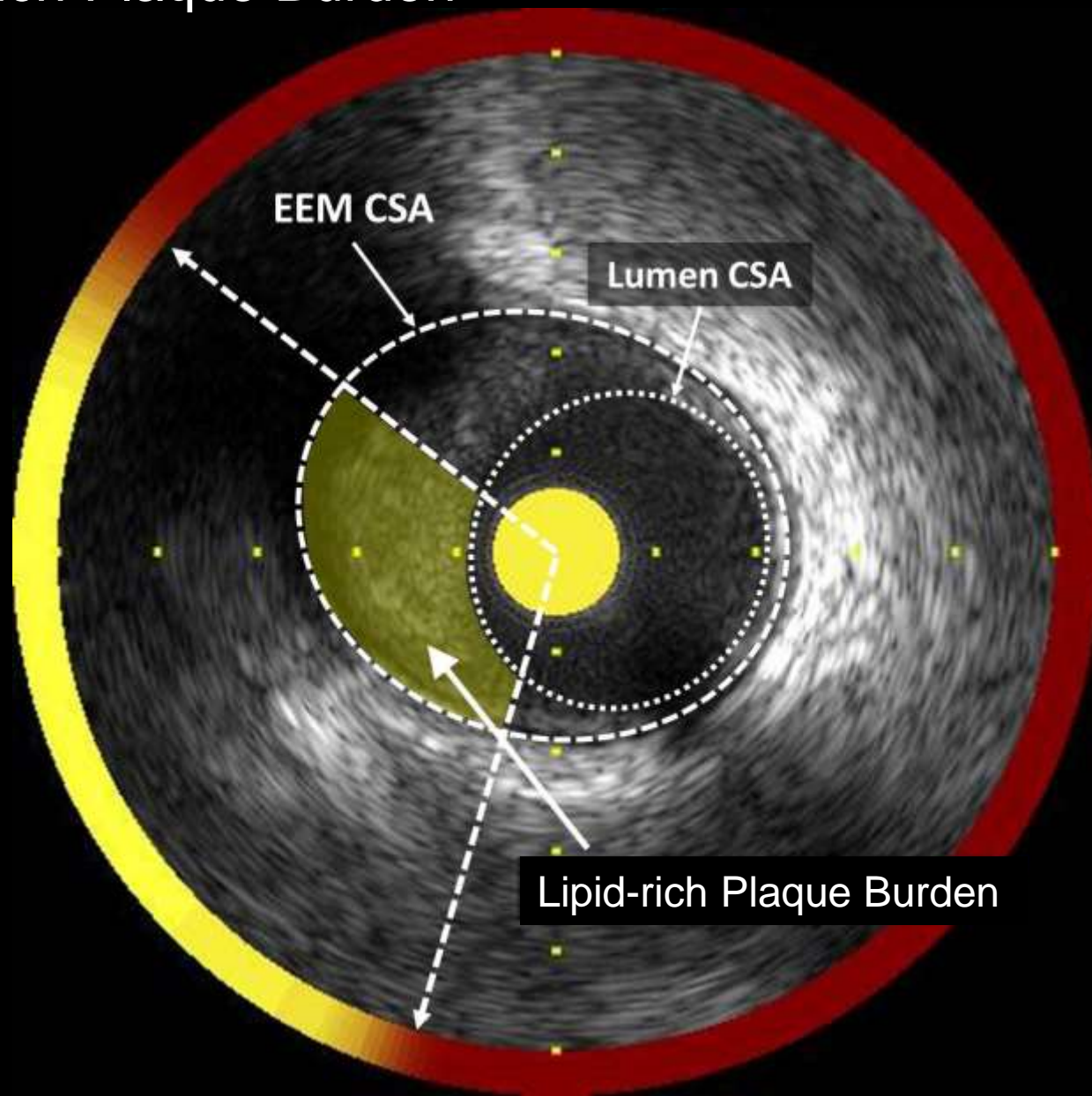
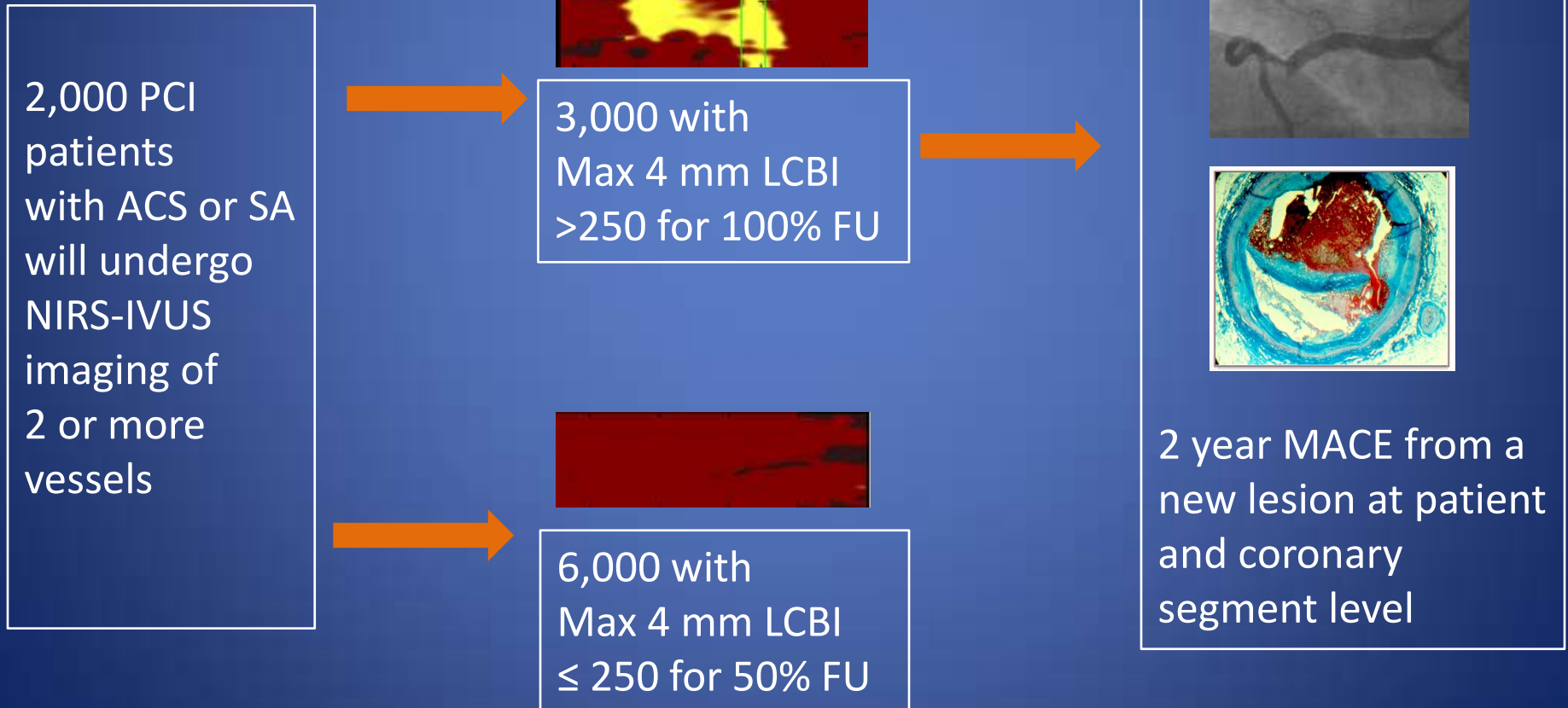


Image courtesy of  
Drs. Tomotaka Dohi,  
Gary S. Mintz,  
Bo Zheng,  
and Akiko Maehara

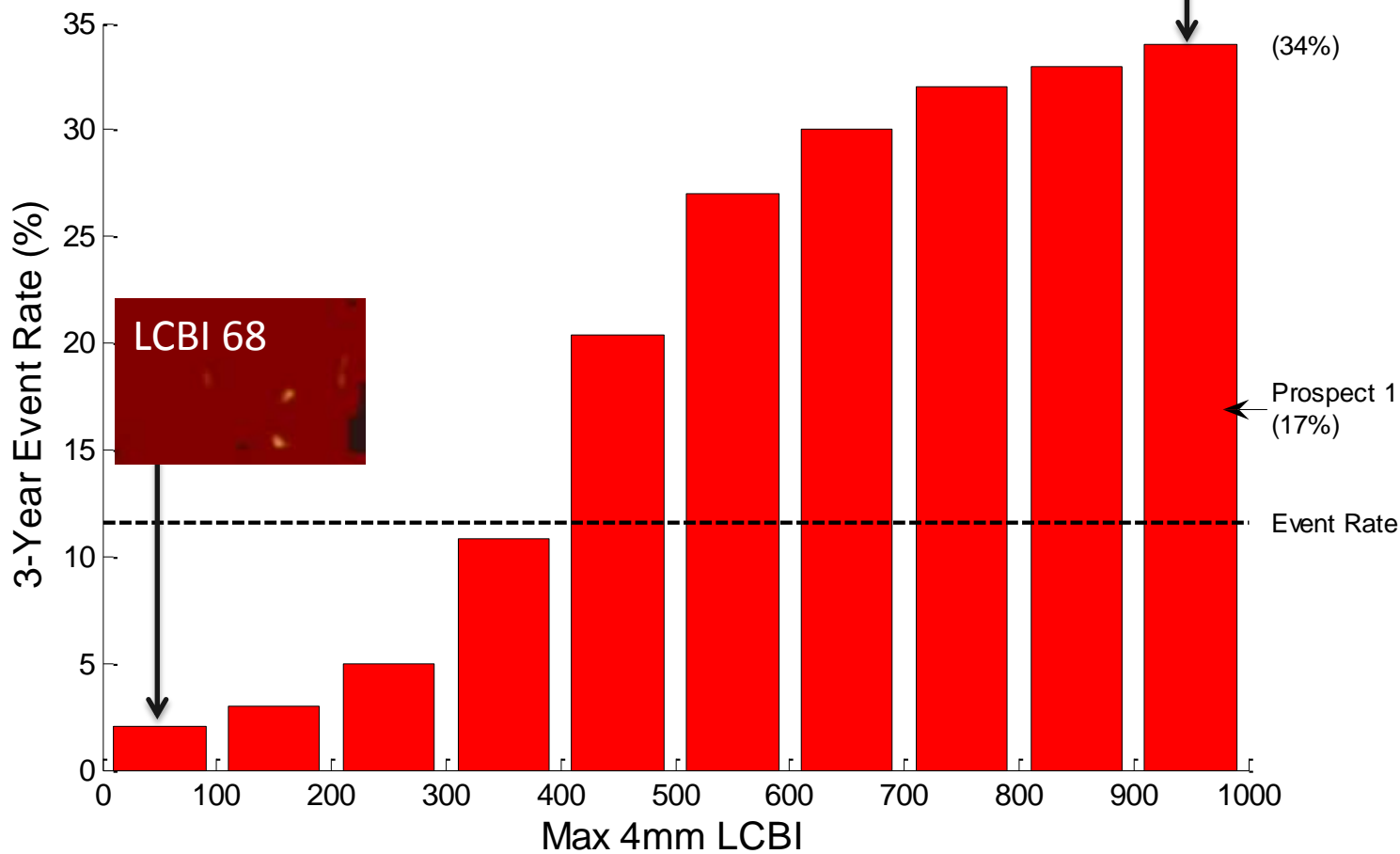
# The Lipid-rich Plaque (LRP) Study

Dr. Ron Waksman, PI  
PI, Japan, Dr. Takashi Akasaka  
Co-PI, Japan, Dr. Yasunori Ueda  
PI, Europe, Dr. Carlo Di Mario  
PI, Korea, Dr. Seung-Jung Park



Possible Outcome of LRP Study: Risk that a 30 mm coronary segment with a given 4 mm Max LCBI will produce a MACE event in 3 years. Estimate only.

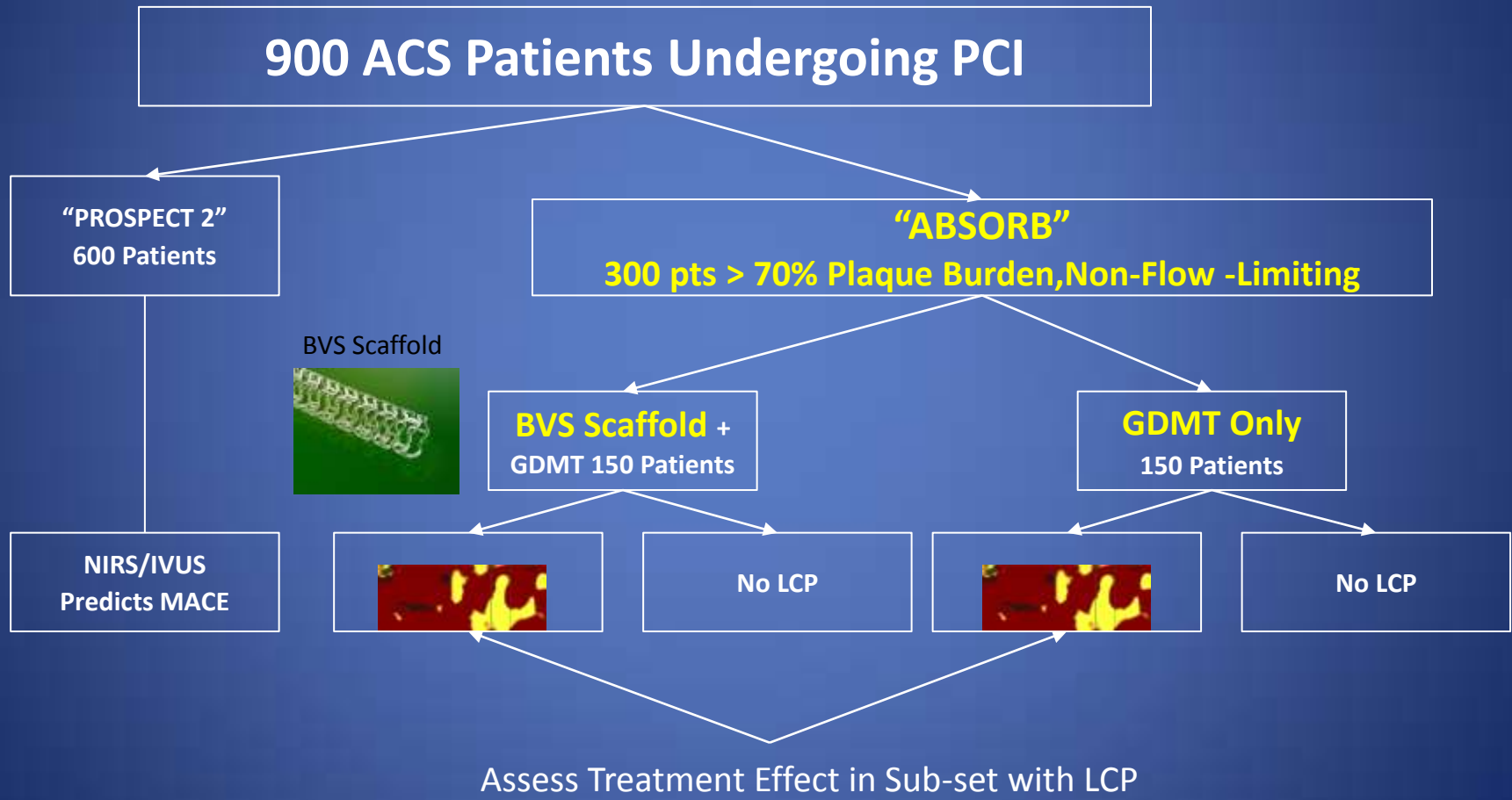
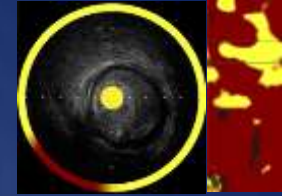
Dr. Jim Muller, Infraredx, Inc., March, 2015



Distribution of LCBI from COLOR:	(21.3%)	(15%)	(16.2%)	(16.3%)	(13%)	(7.6%)	(5%)	(3.1%)	(1.3%)	(1.3%)
No. of Evaluable Patients (1000):	213	150	162	163	130	76	50	31	13	13
Estimate of Evaluable Events (116):	4	5	8	18	27	21	15	10	4	4

# PROSPECT 2 Study

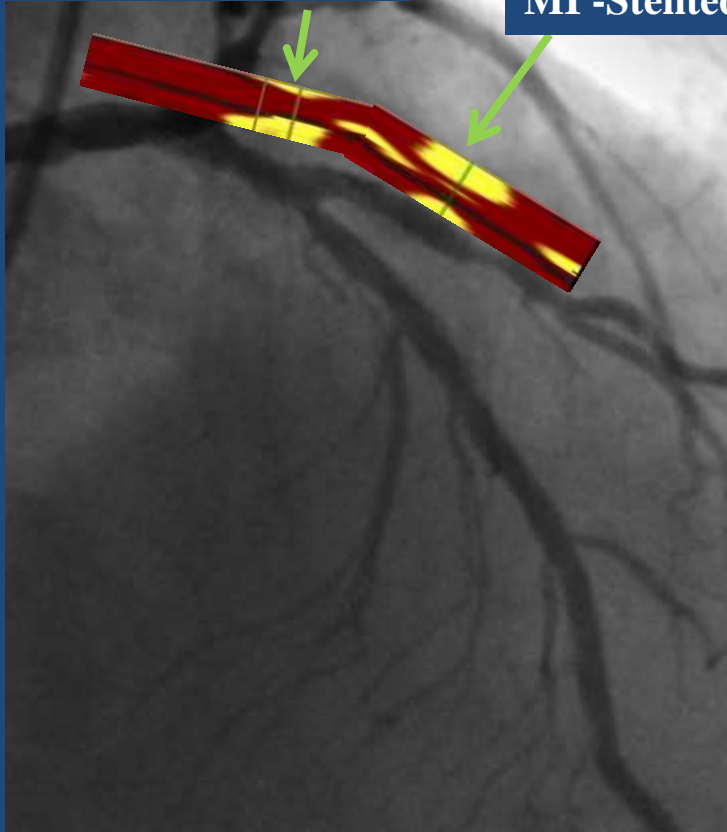
## PROSPECT / ABSORB RCT



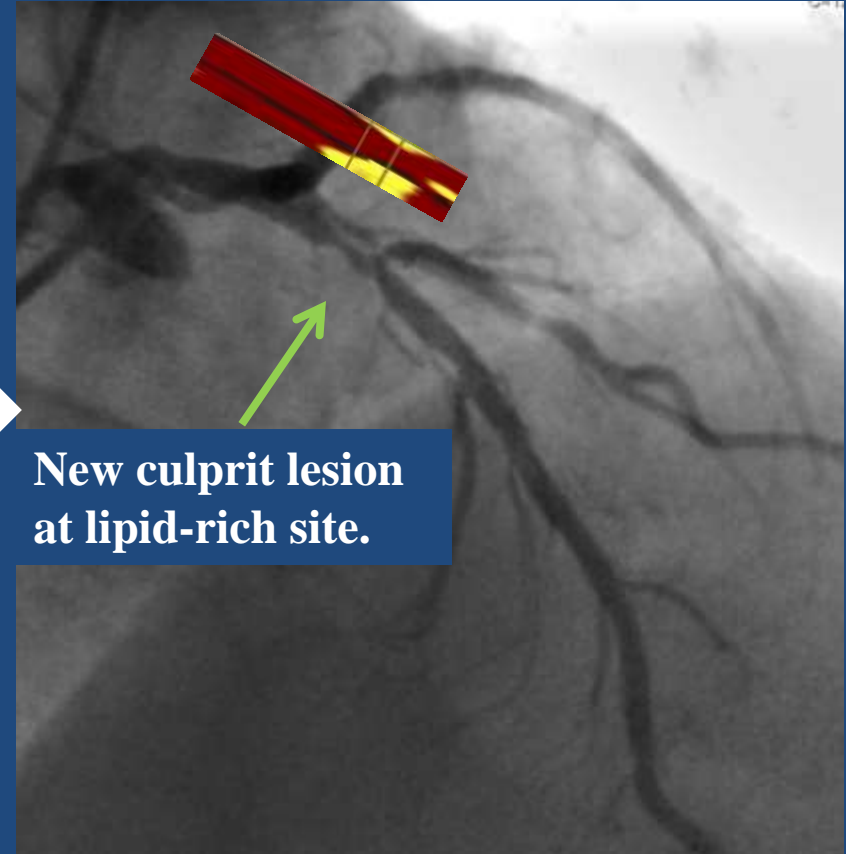
# Prospective Identification by NIRS of a Lipid-rich Plaque that Led to a Myocardial Infarction

Possible Vulnerable  
Plaque in LAD

Site of Index  
MI -Stented



4 Months  
New MI



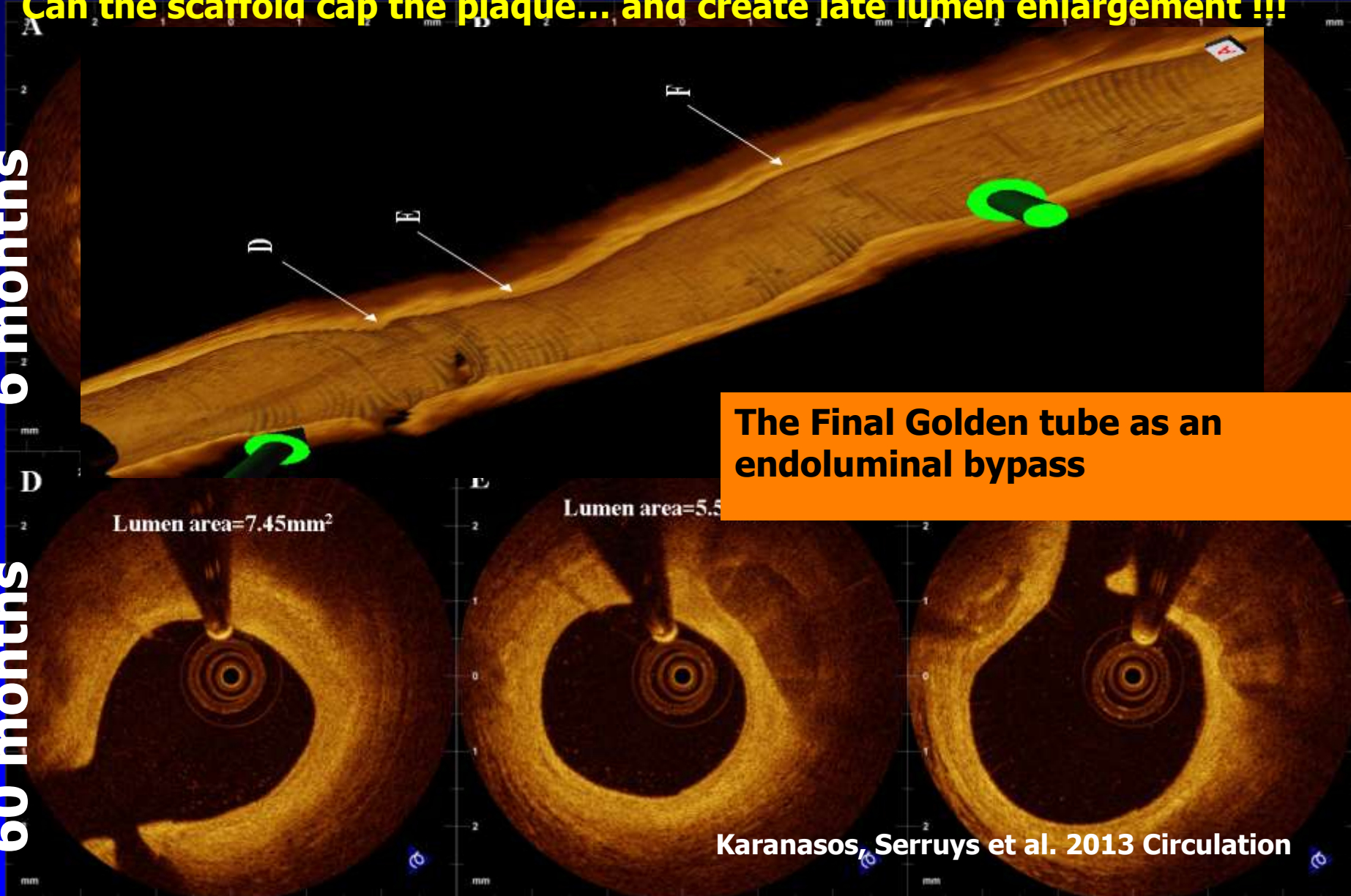
Courtesy of Dr. David Erlinge, Lund University, Lund, Sweden



# Concept #4

Sealing and shielding of plaques as a result of scaffold implantation:  
Can the scaffold cap the plaque... and create late lumen enlargement !!!

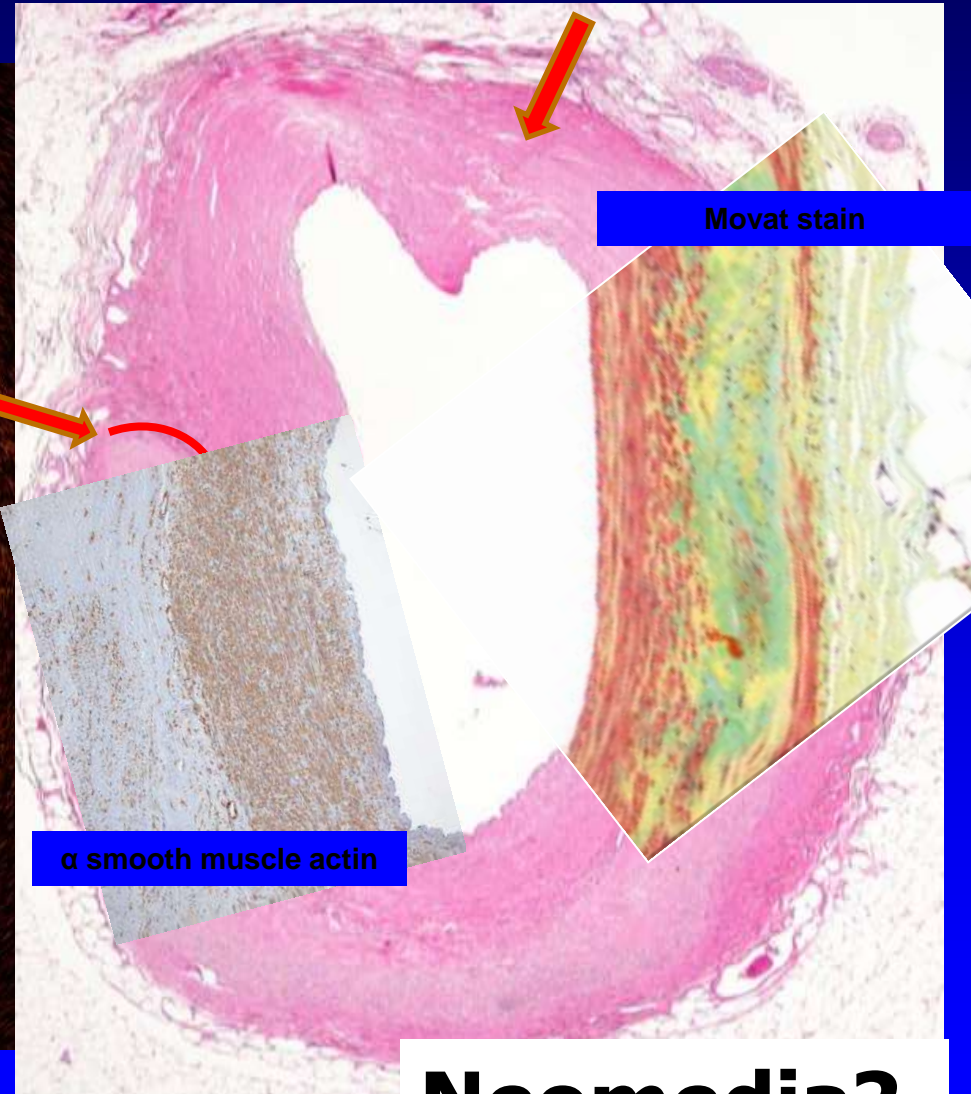
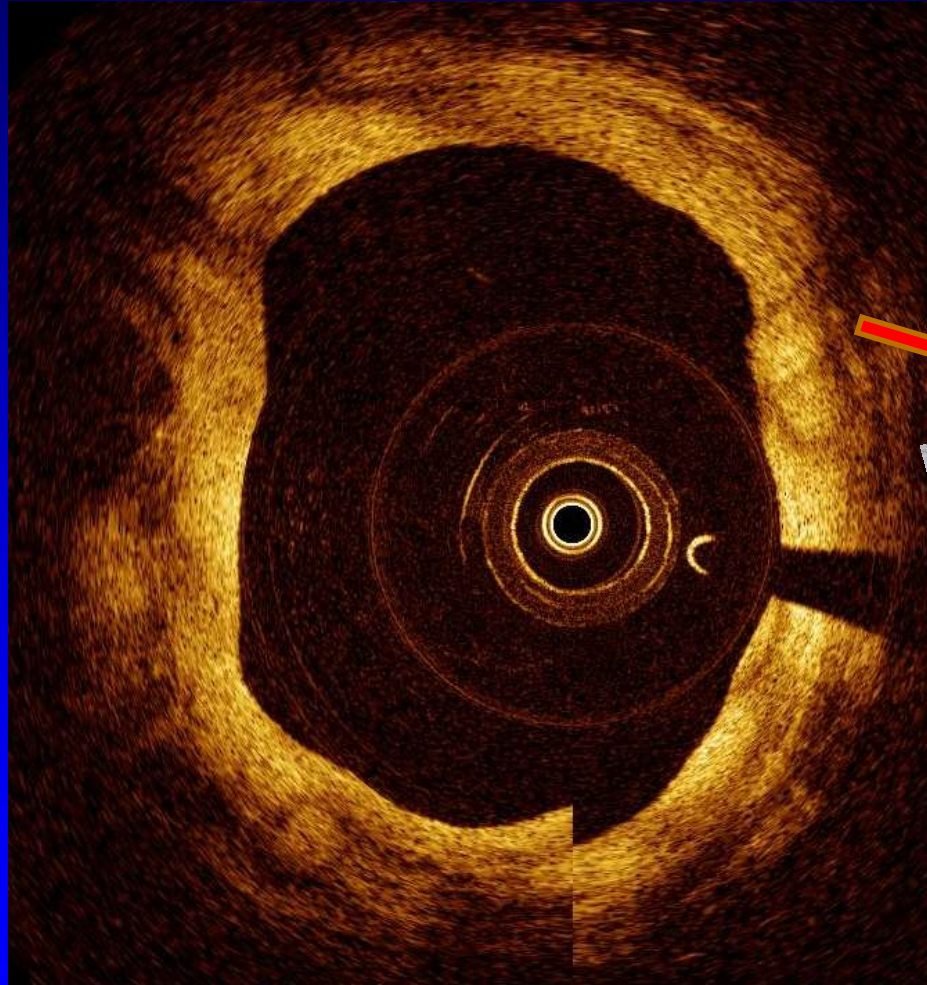
6 months  
6 months  
5 years  
60 months



The Final Golden tube as an endoluminal bypass



# OCT and Histology 10 years after implantation of Igaki-Tamai stent in human coronary artery



Onuma, Serruys et al. Eurointervention 2010  
Nishio, Serruys et al. Circulation 2014

**Neomedial?**

# Possible Vulnerable Plaque Treatment Trials

- Systemic Therapy of Vulnerable Patient and Vulnerable Plaque
  - PCSK9 Inhibitors
  - Apo A1 Milano
  - Anti-Inflammatory Drugs
- Local Therapy of Vulnerable Plaque
  - Scaffold – P2 Absorb and  
The Prevent Trial led by Dr. S. J Park
  - Stent
  - Drug-eluting Balloon
  - Cryotherapy