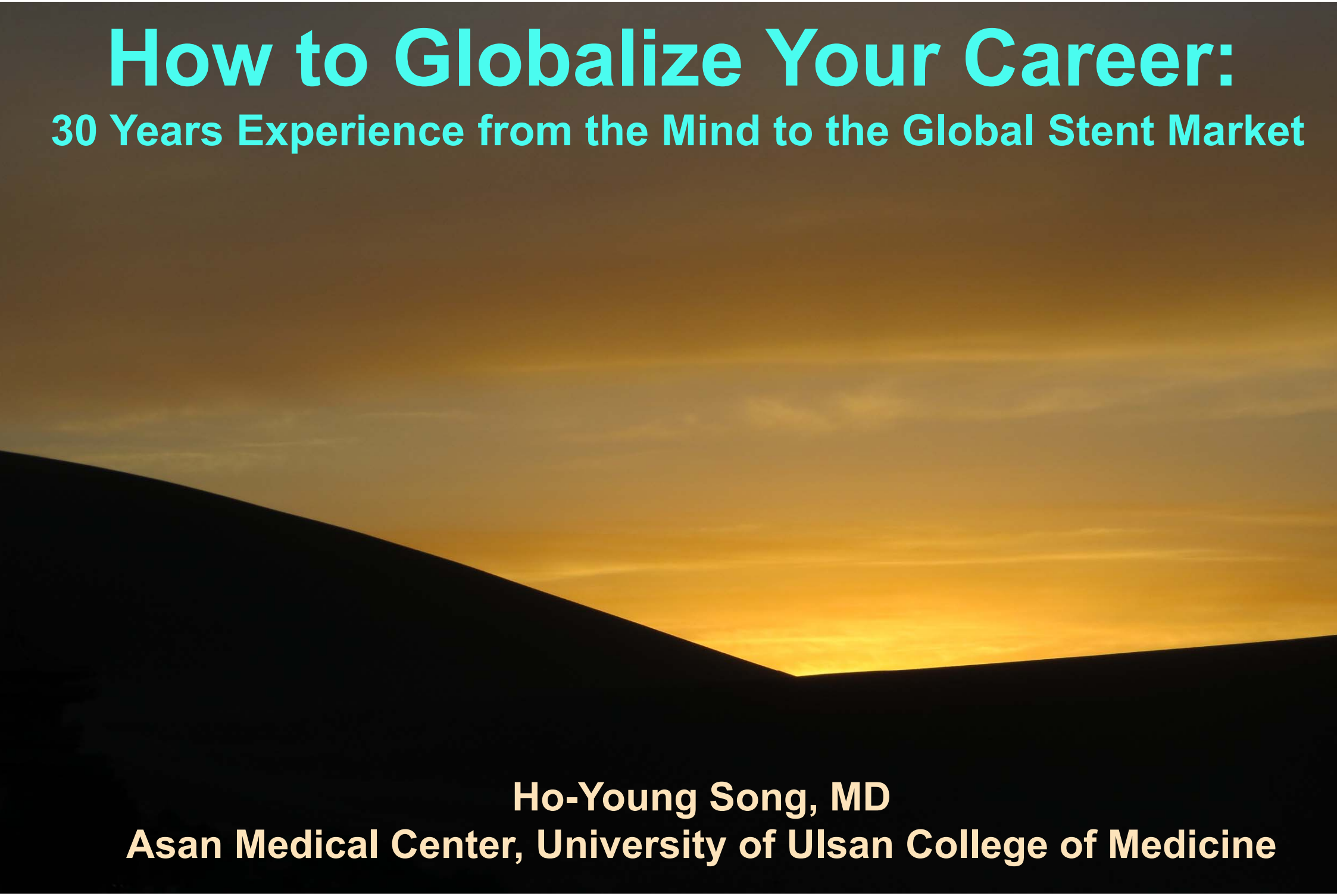
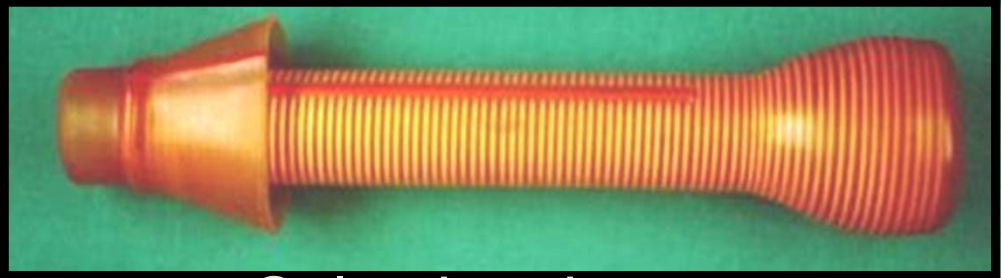
How to Globalize Your Career:

30 Years Experience from the Mind to the Global Stent Market



Ho-Young Song, MD
Asan Medical Center, University of Ulsan College of Medicine

Developments in Esophageal Stent Technology



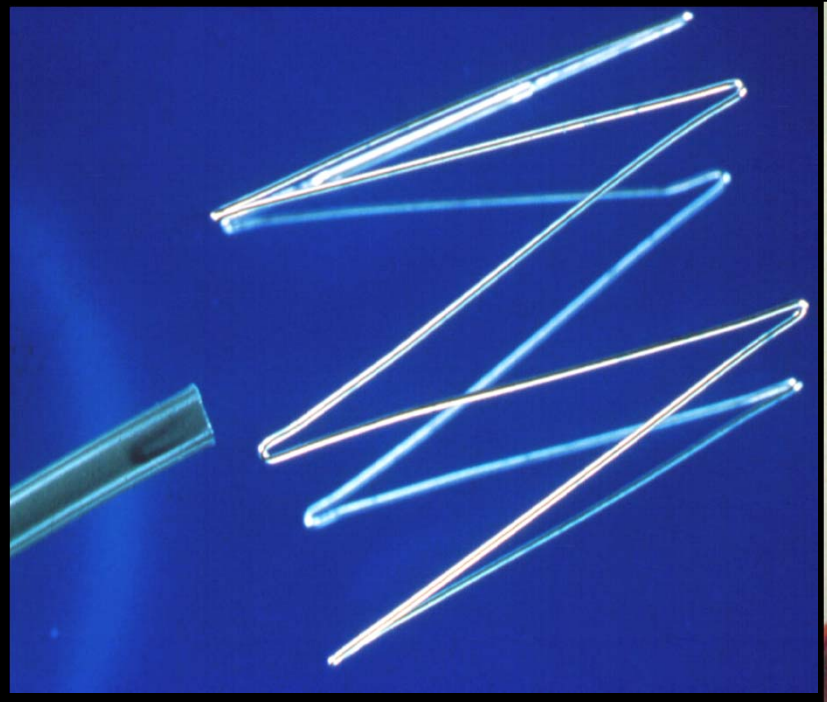
Celestin tube

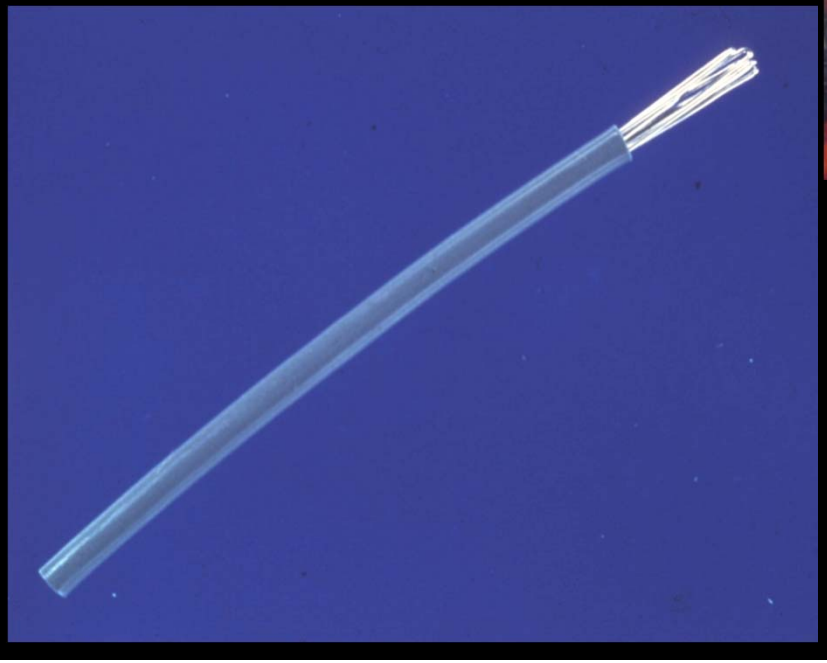
Wilson Cook tube

Tube: 18 - 20mm in OD.
Delivery system: 25mm in OD.
Esophageal rupture: 10-11%

** Ogilvie, et al. Gut 1982;23:1060-1067*

Developments in Esophageal Stent Technology

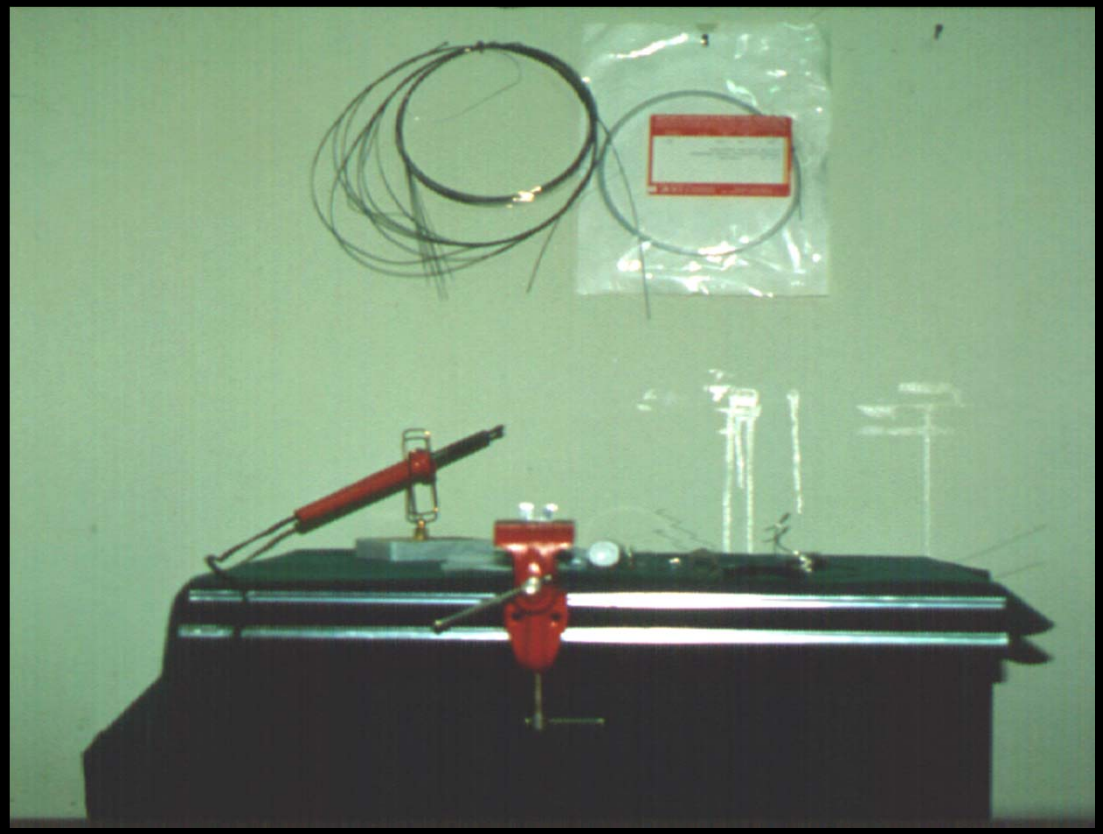


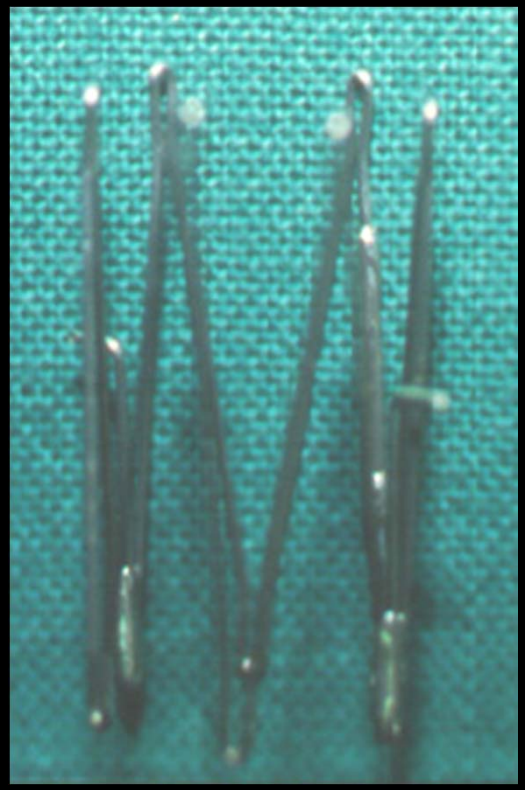


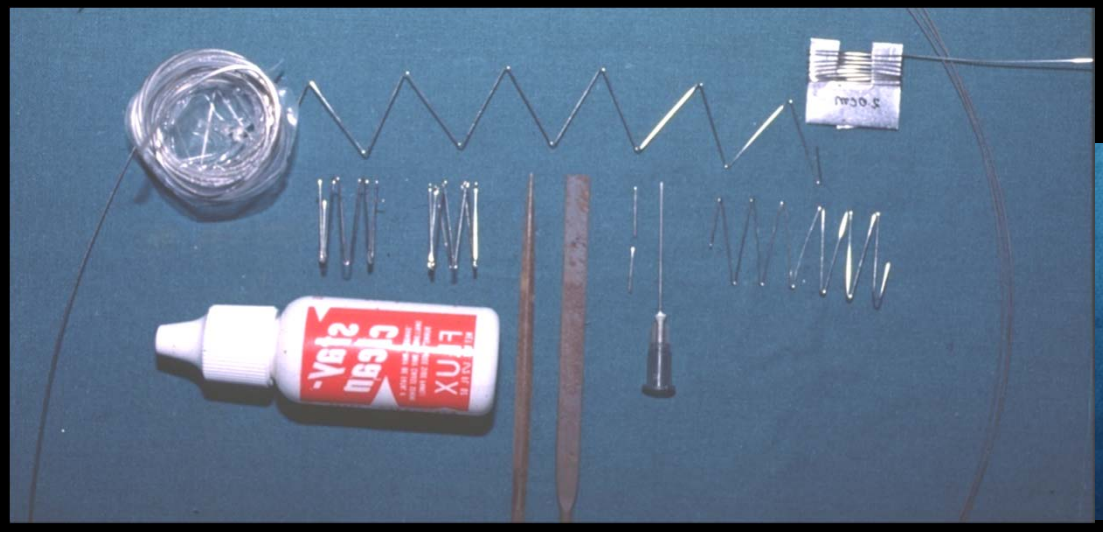
Wright KC, Wallace S, et al. Percutaneous endovascular stents: an experimental evaluation. Radiology 1985;156:69-72

A tremendous lucky break for me

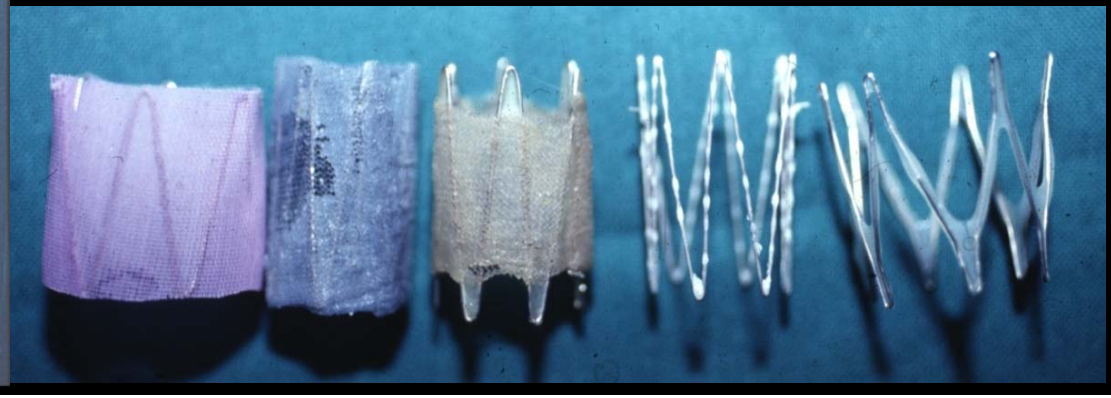
Developments in Esophageal Stent Technology

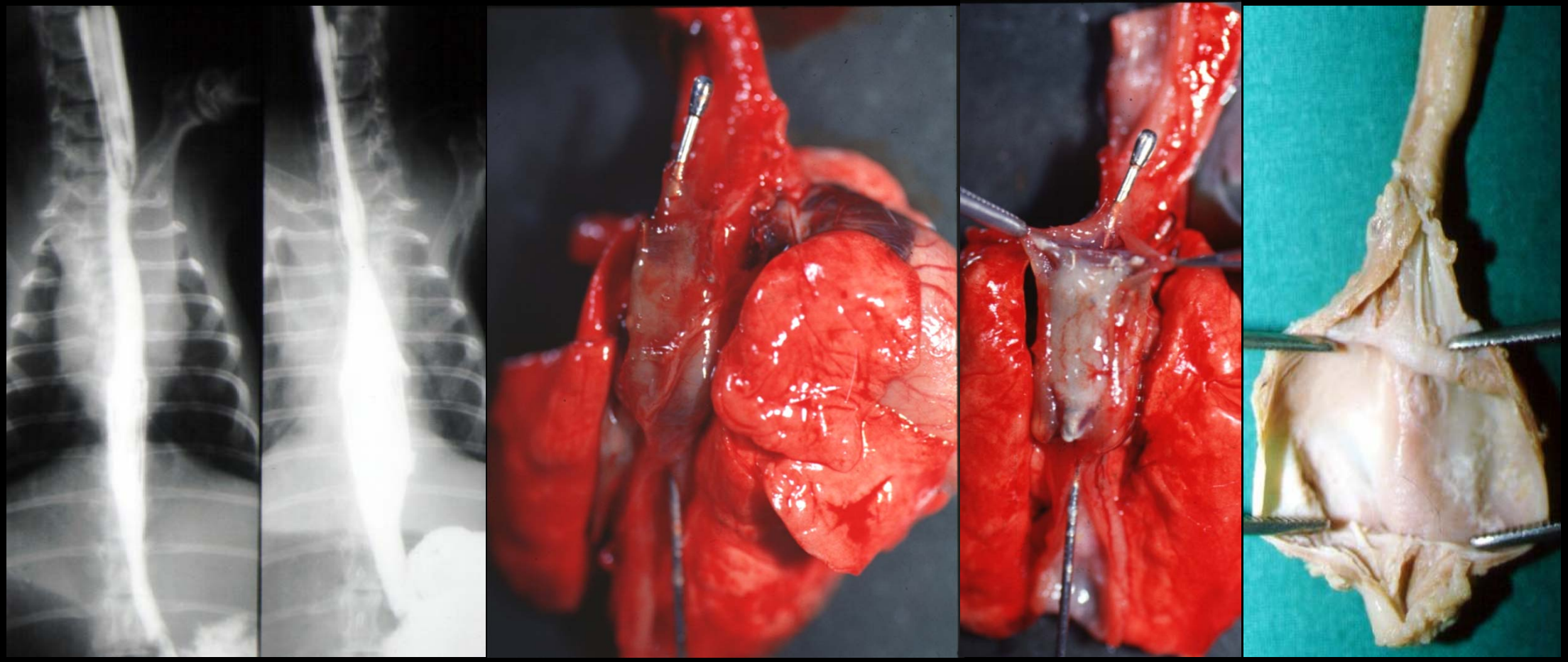






0.4-mm wire, 10mm / 20mm, 2 barbs
Cover: nylon mesh, silicone rubber





Experimental study*

10 stents in the esophagus of 10 rabbits Stent delivery system: 12-F

Sacrifice: 1, 4, 8 weeks after stent placement

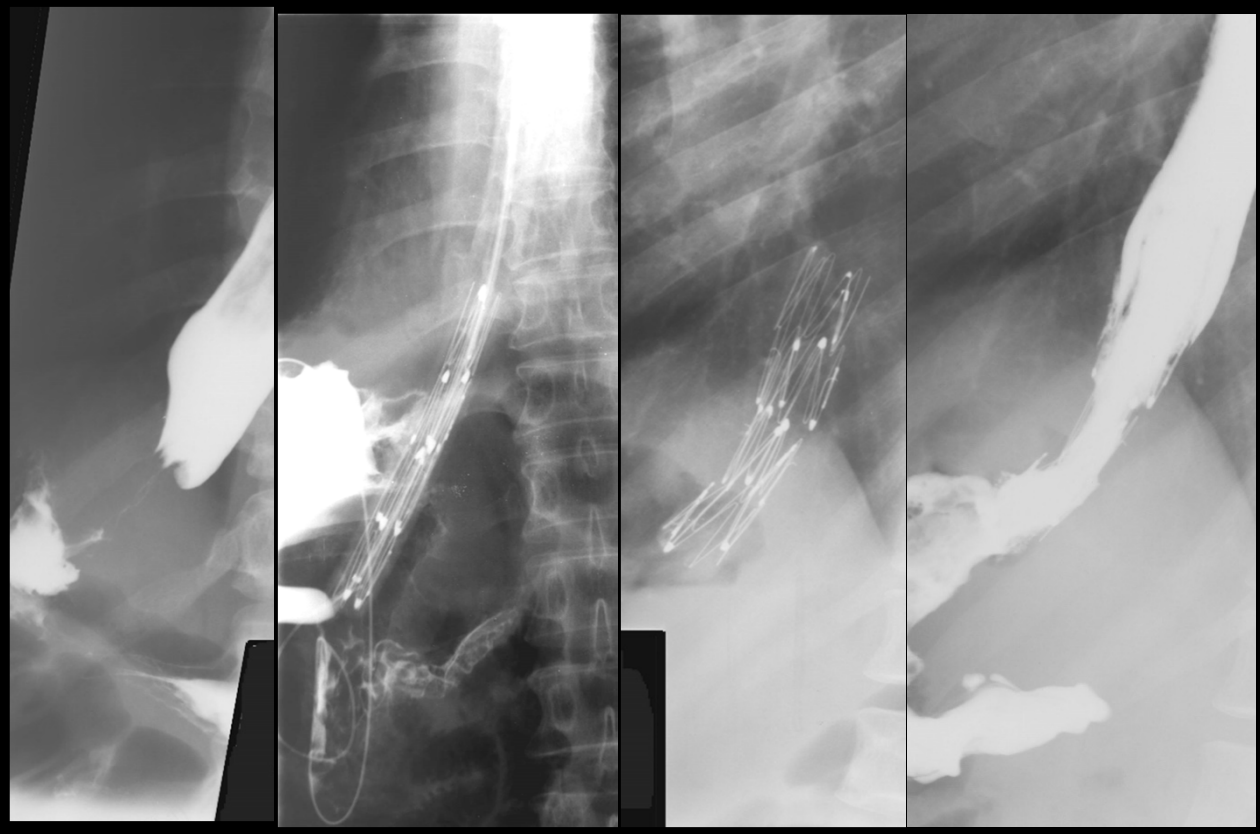
* *Song HY, et al. J Korean Rad Soc 1990;26:829-834*

* *Esophagogastric neoplasms: Palliation with a modified Gianturco stent*
Radiological Research Foundation of Korea,1990.6 -1991.5, 4,000,000 Won

Developments in Esophageal Stent Technology

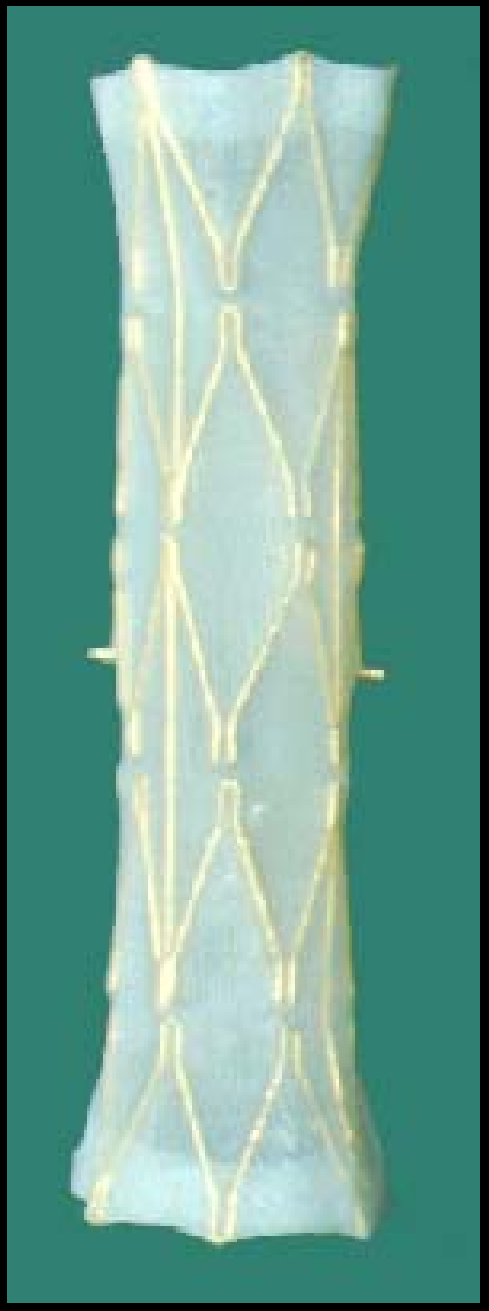
First covered metallic stent placement*

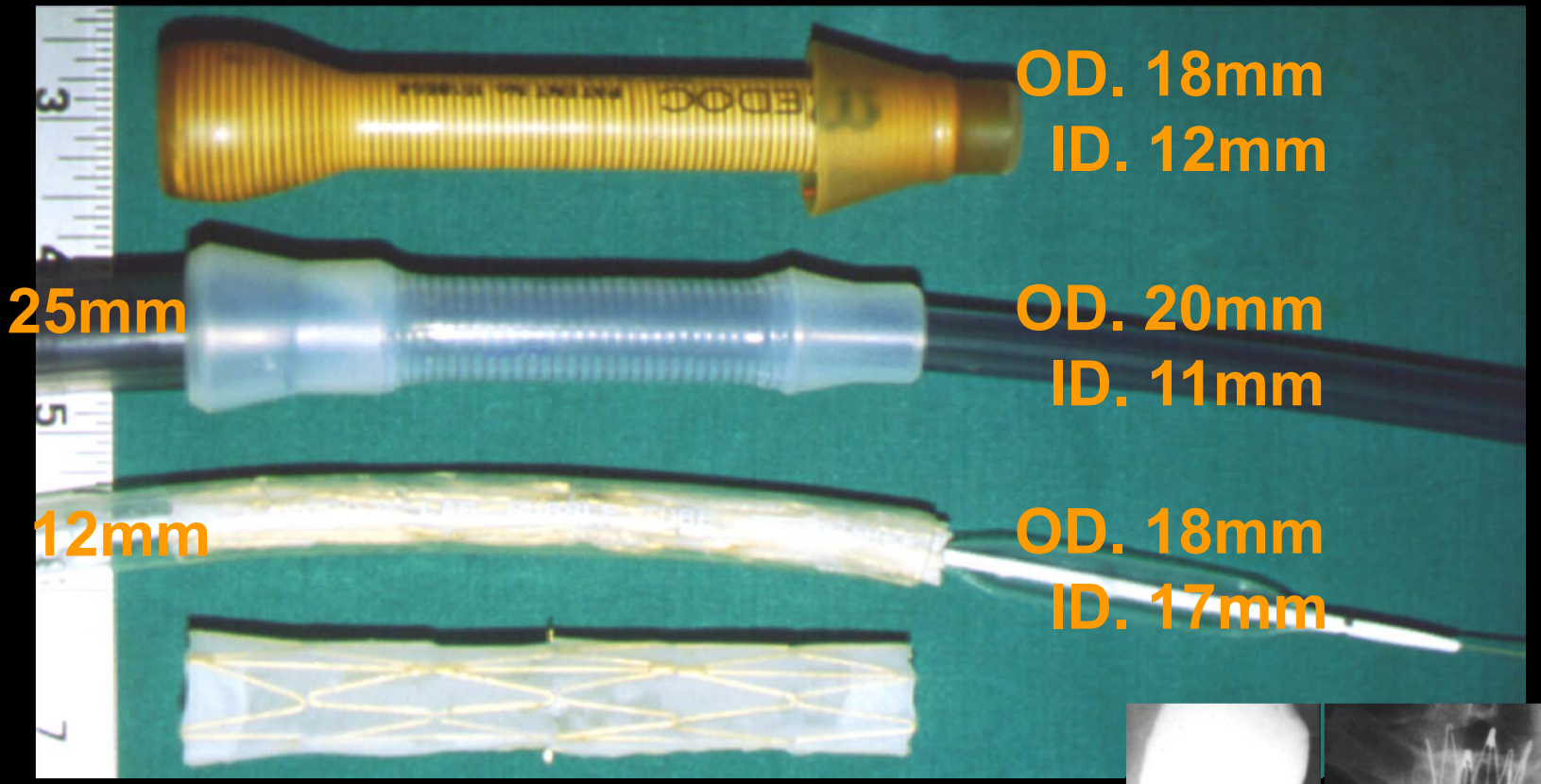
* 18-mm covered Z-stent with two barbs
* Eight patients
* 12-mm delivery system
* Local anesthesia
* No esophageal rupture
* No stent migration



** Song HY, et al. Radiology 1991;180:349-354*

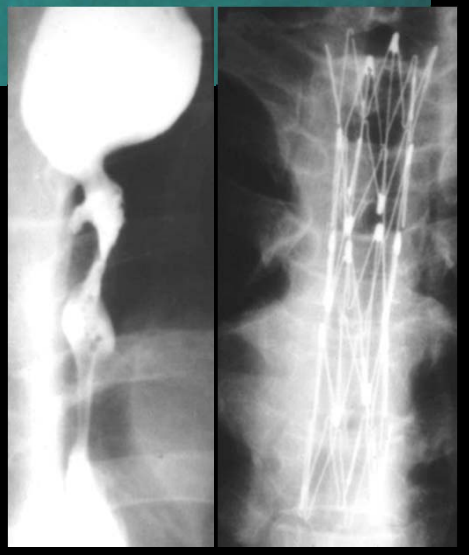
1st Generation Stent



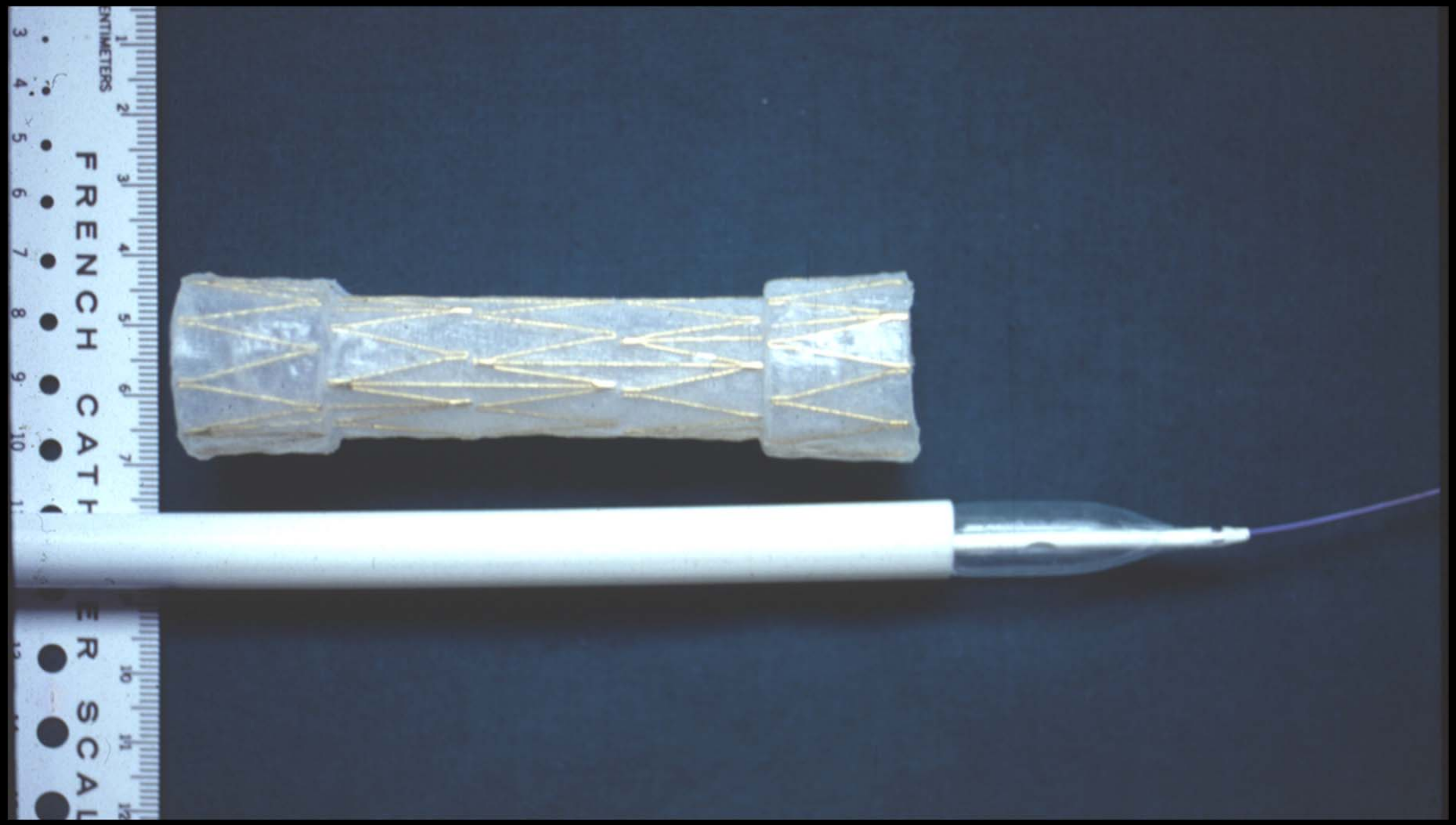


Advantage of compression
1) Larger internal diameter
2) Far lower profile delivery system

Disadvantage
1) Friction between stent and sheath
2) Risks of barb-related complications



2nd Generation Stent



* 119 patients with malignant or benign (n=3) strictures*
* 16-mm covered Z-stent with no barbs
* Esophageal rupture rate: 0%
* Migration rate was 10%, and as high as 32% at the EG junction

** Song HY, et al. Radiology 1994;193:689-695*

2nd Generation Stent

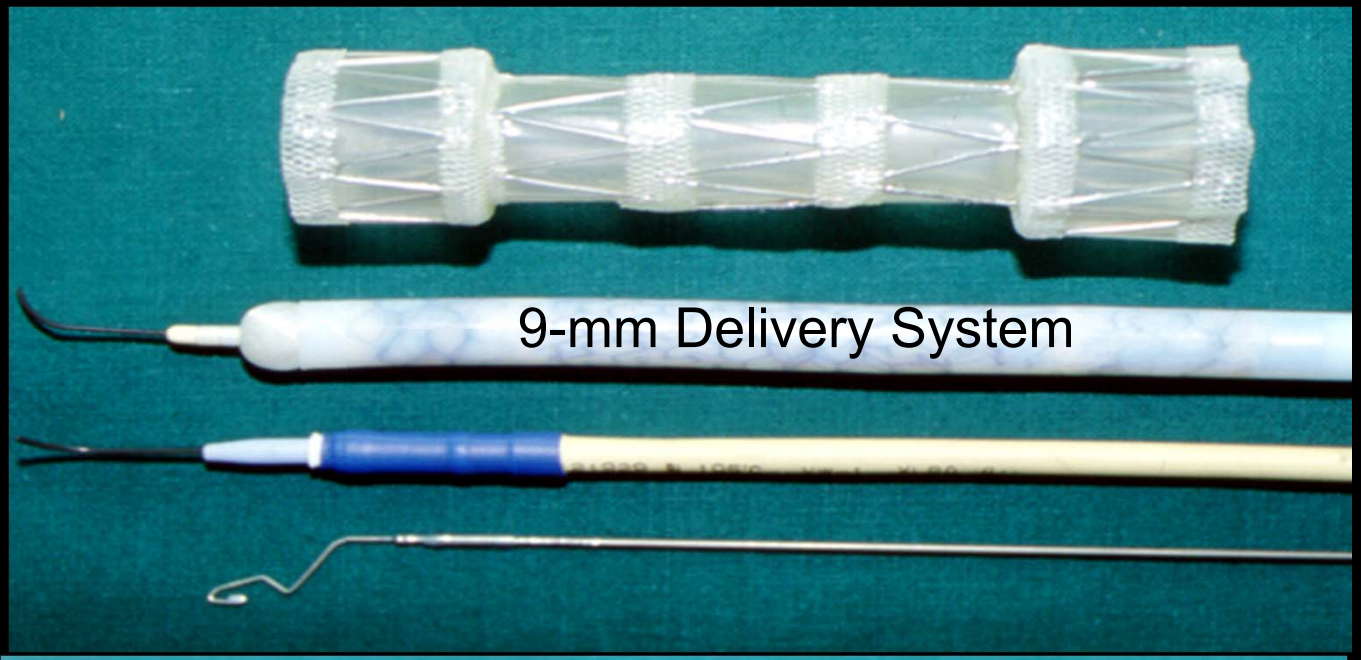
76/M. Downward stent migration

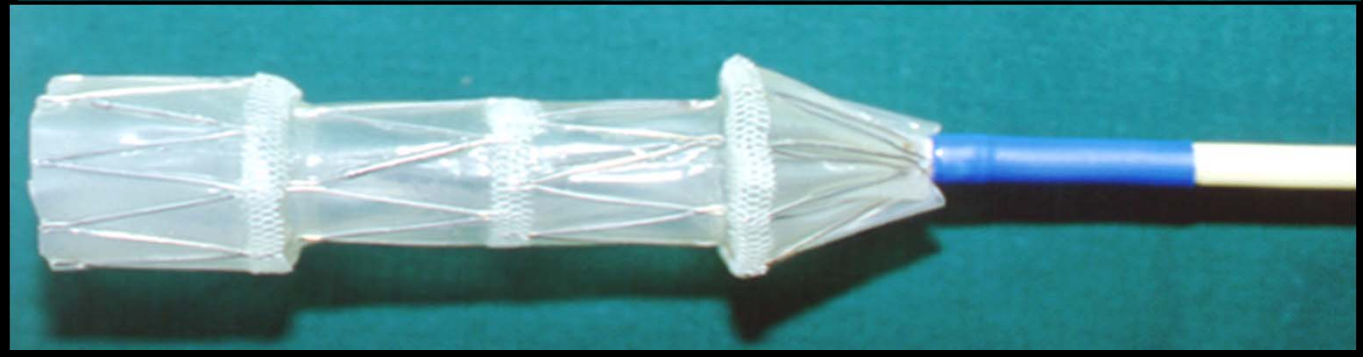
2 months

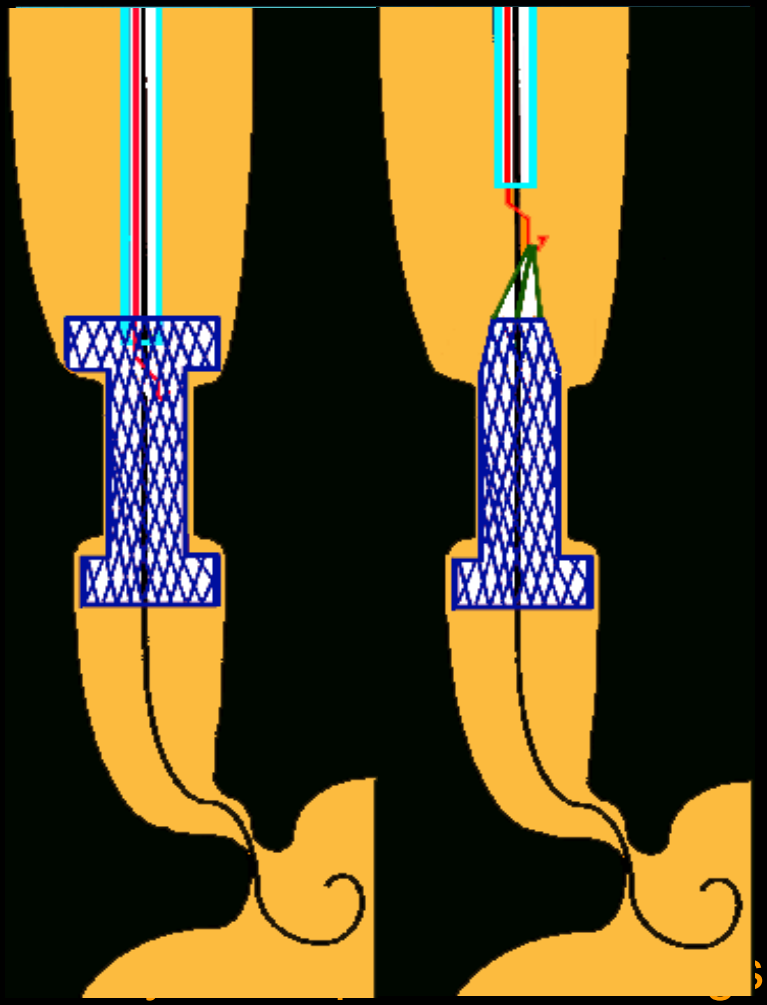
8 months

8 months

3rd Generation Stent (PU Covered Retrievable Stent)



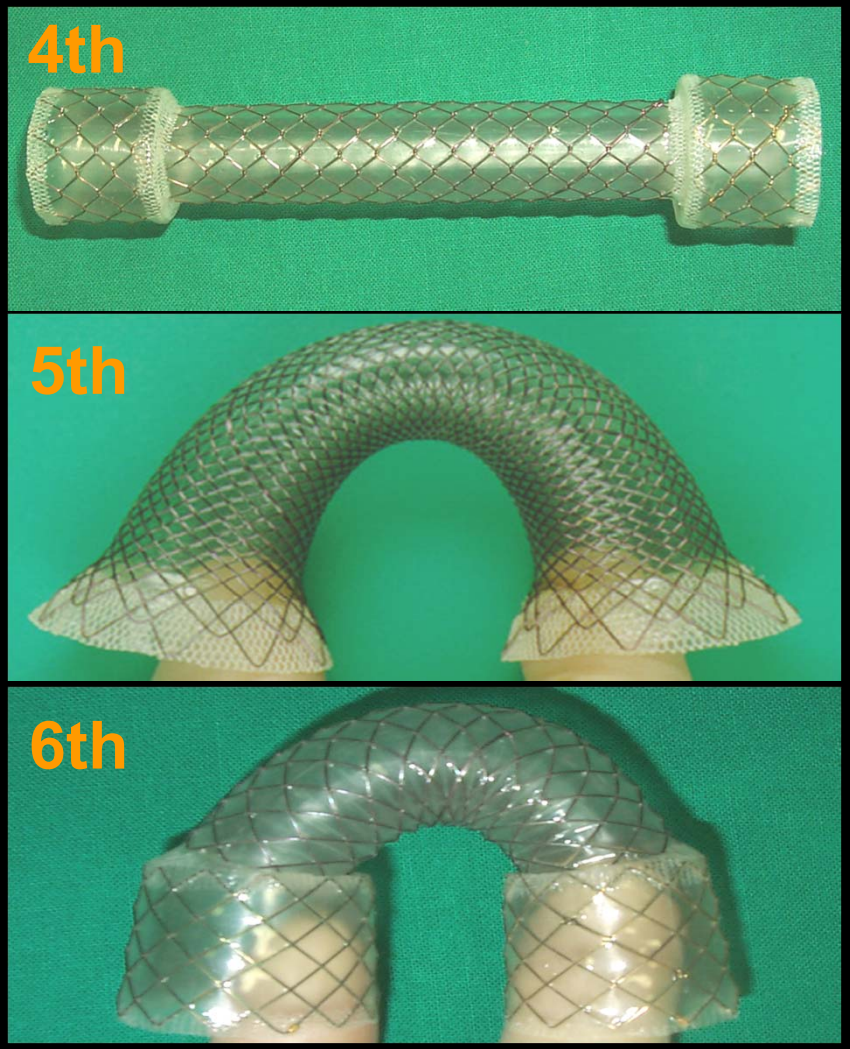




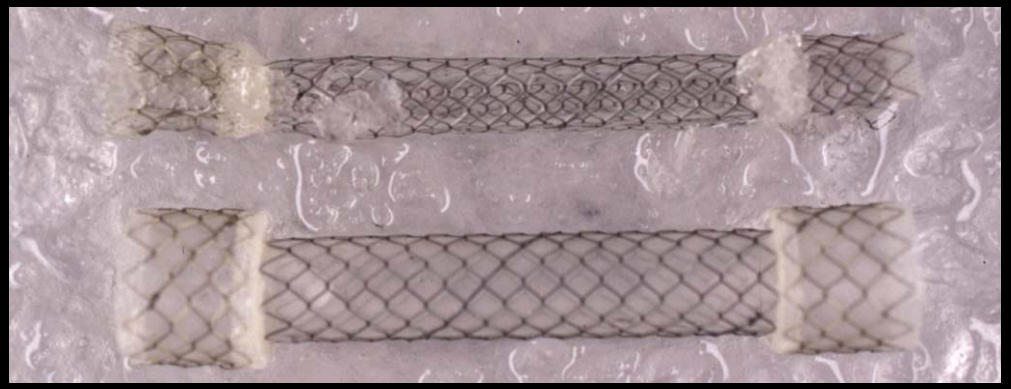
* 21 patients with malignant or benign (n=5) strictures*
* Limitations of using stainless steel wires
  1) Lack of flexibility of the stent
  2) The size of their delivery system: 9-mm

** Song HY, et al. Radiology 1997;203:747-752*

4th, 5th, and 6th Generation Retrievable Stents



* 4th generation:
  Temperature dependent shape memory



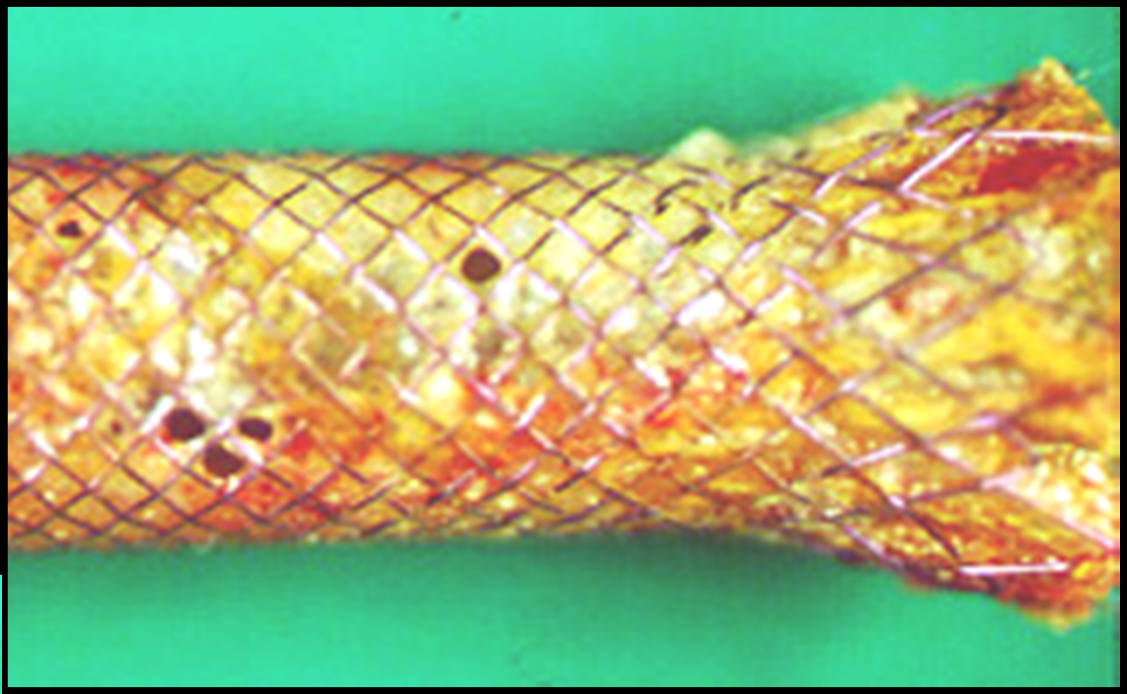
* 5th and 6th generations:
  Non-temperature dependent superelasticity

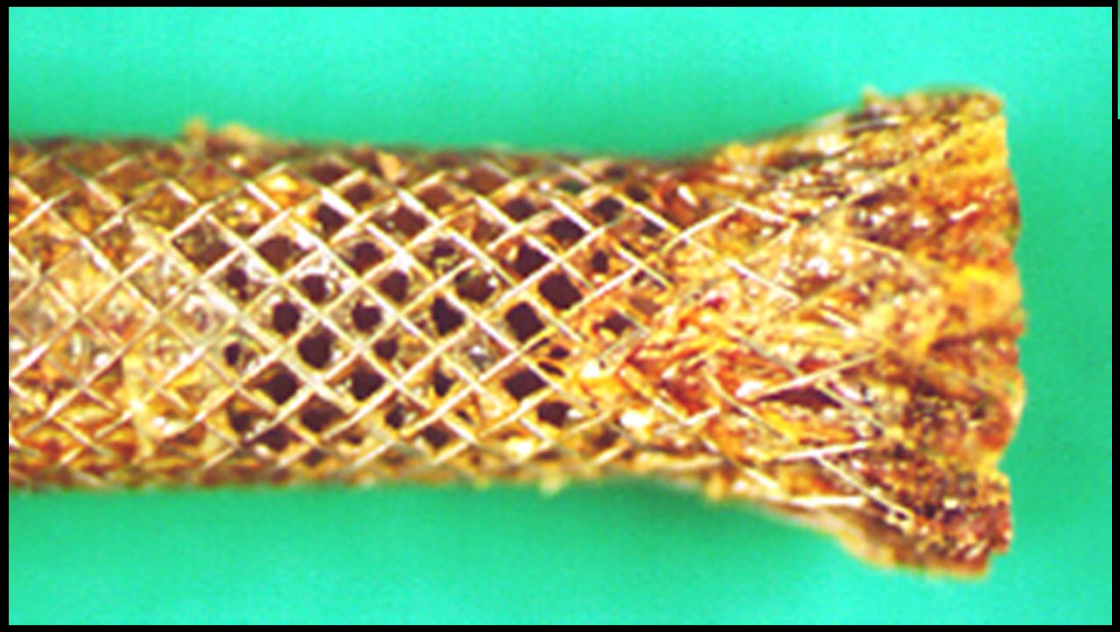
108 consecutive patients with malignant esophageal strictures:
4th generation (n=45), 5th generation (n=29), 6thgeneration (n=34)

** Song HY, et al. J Vasc Interv Radiol 2002;13:285-293*

4th, 5th, and 6th Generation Stents

Disruption of Covering Membrane

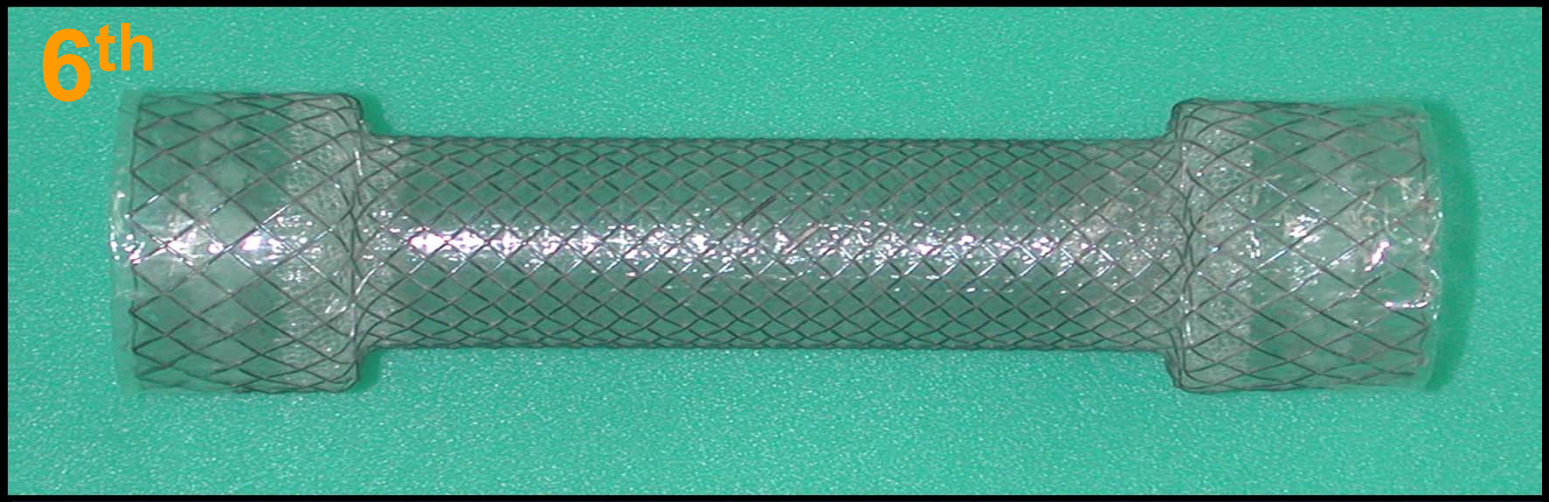


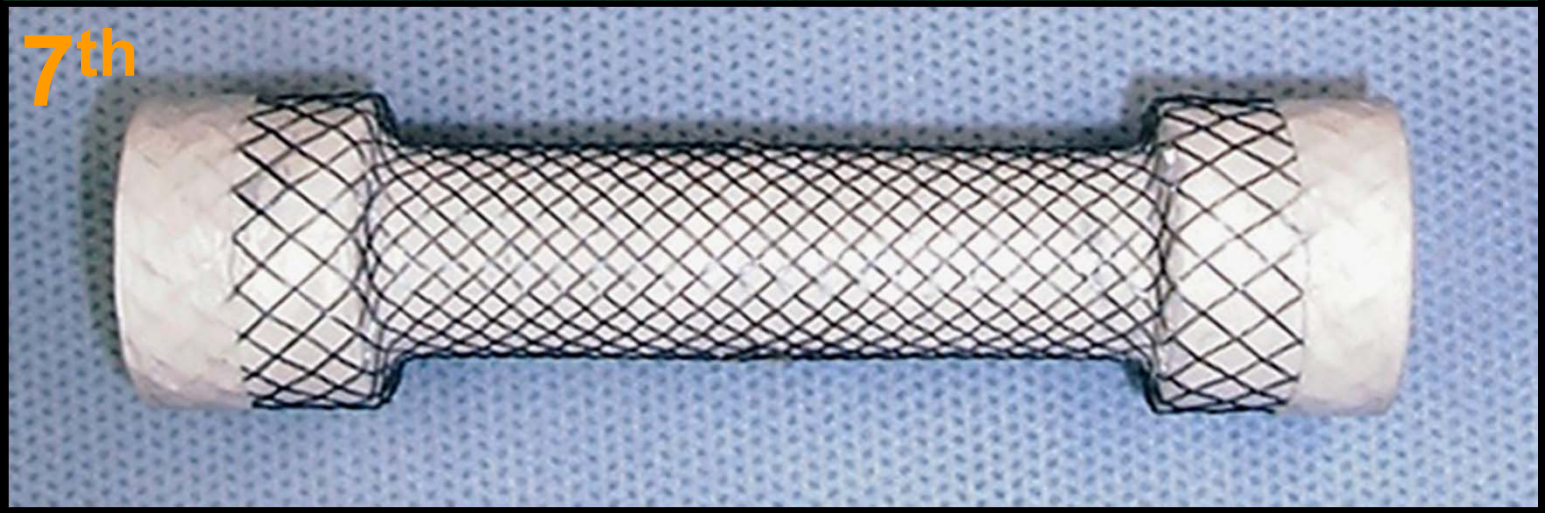


Partial disruption of covering membrane: 3% of removed stents from the esophagus

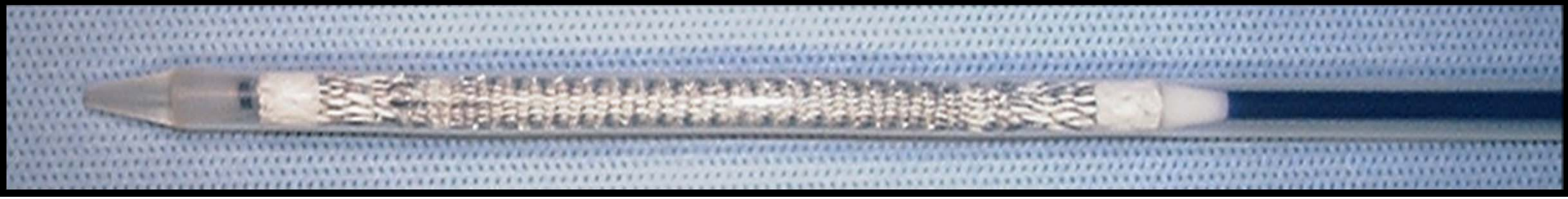
Kim JH, Song HY, et al. J Vasc Interv Radiol. 2008 ;19:220-224

7th Generation Stent

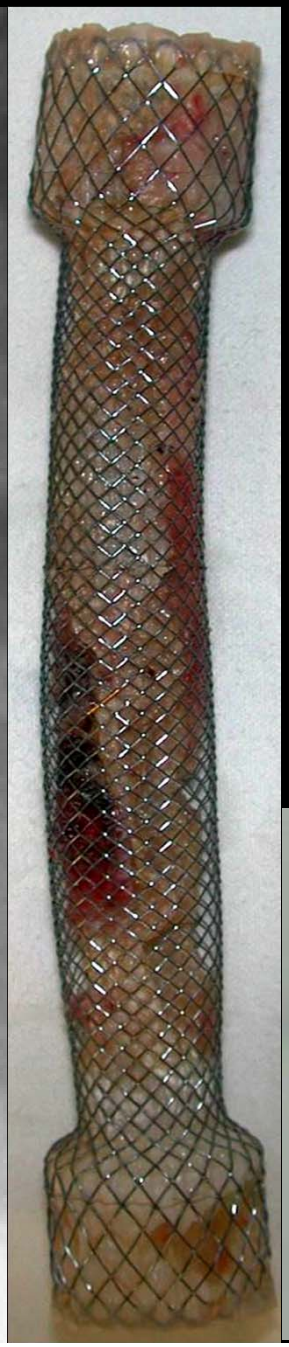




Polytetrafluoroethylene(PTFE) membrane sutured to both ends of the stent



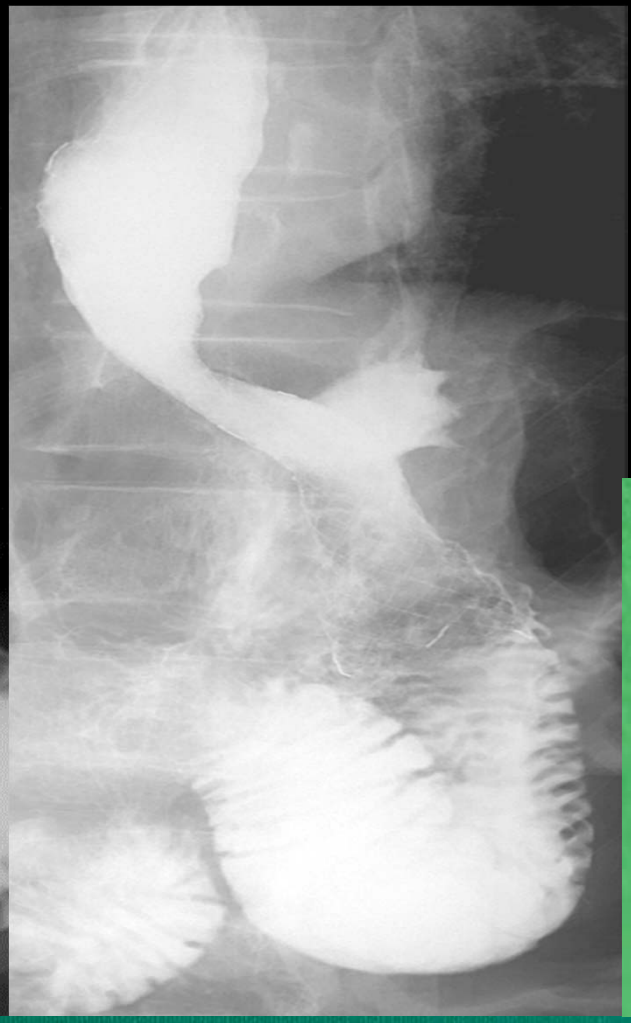
7th Generation Stent



Separation of membrane:
0.6% of removed
7th generation stents

Na HK, Song HY, et al.
Eur Radiol. 2013;23:786-796

8th Generation Stent



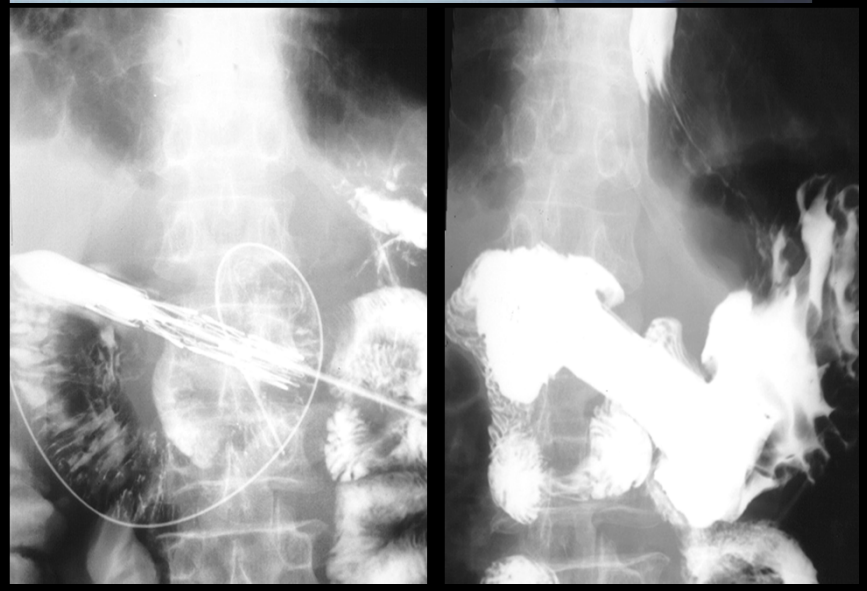
To create a stent

1. Less migration
2. Better conformability

Kim KY, Song HY, et al.
Eur Radiol.2016 (Submitted)

Gastroduodenal Stents

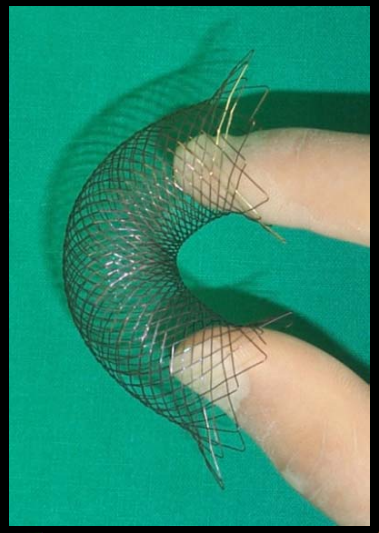
12.0mm-Stent Delivery



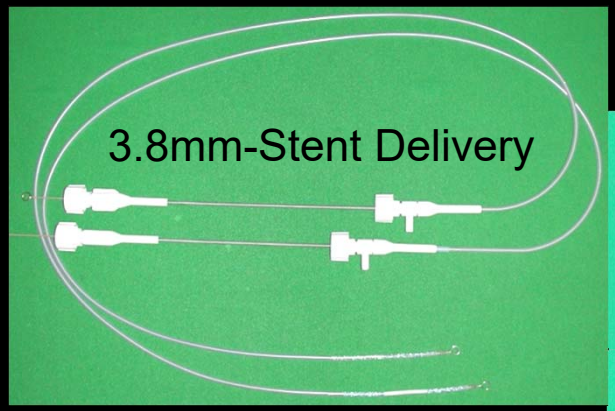
1st

2nd

3rd

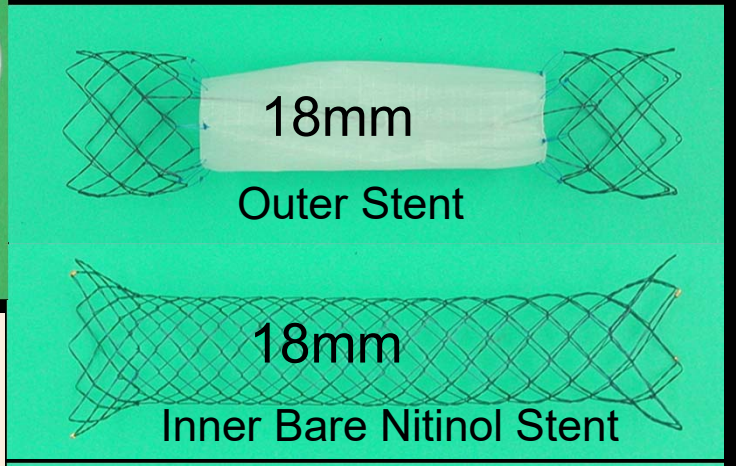


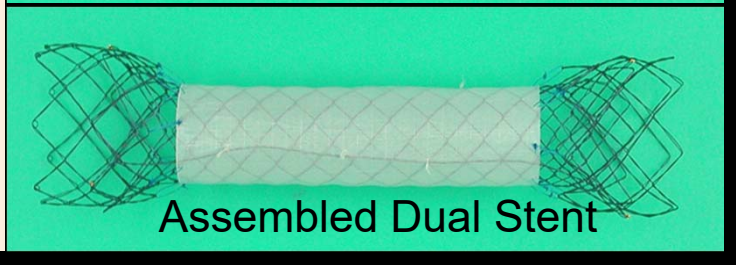
4th



5th

Dual Gastroduodenal Stent

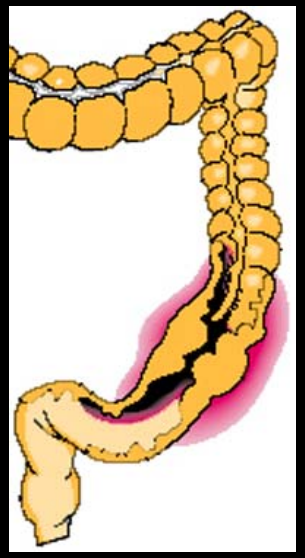


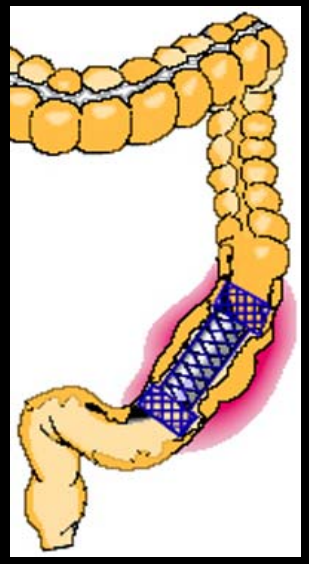


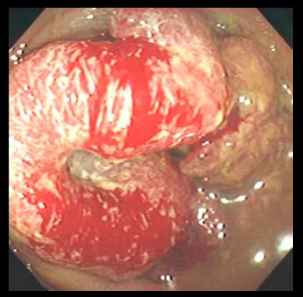
** Song HY, et al. Radiology 1991;180:349-354*

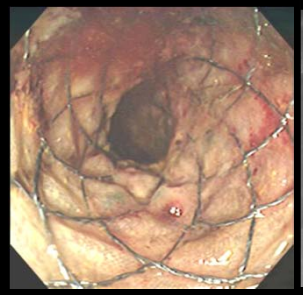
** Song HY, et al. Radiology 1993;187:357-358*

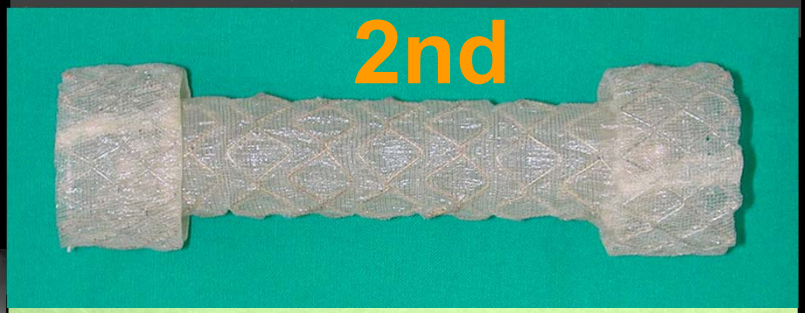
Colorectal Stents

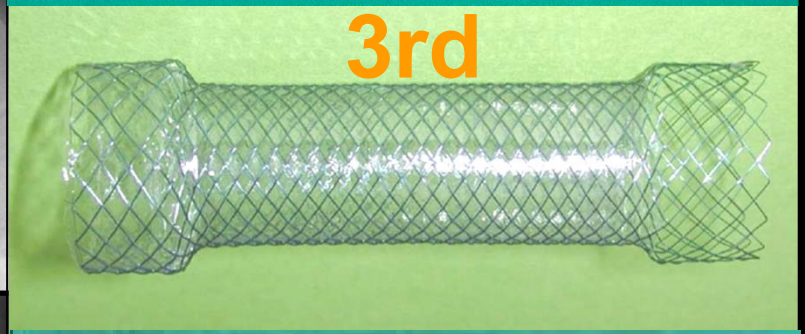


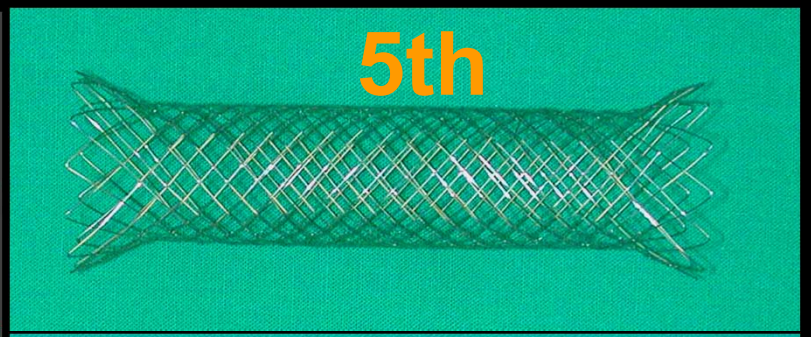


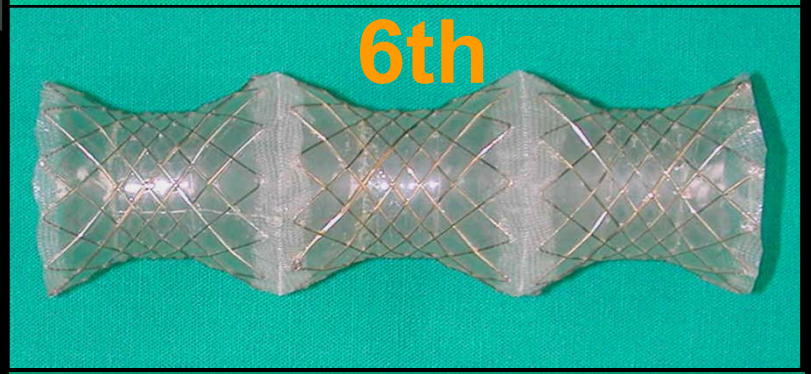


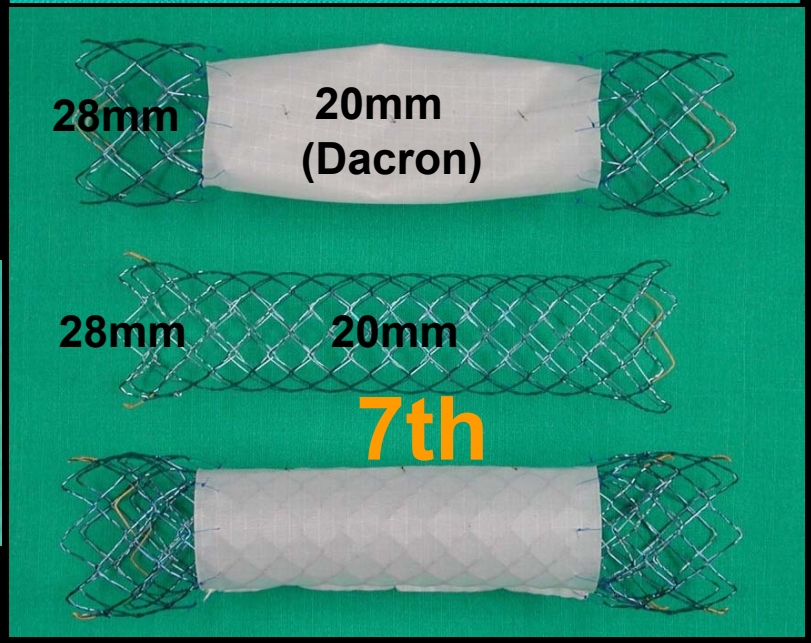










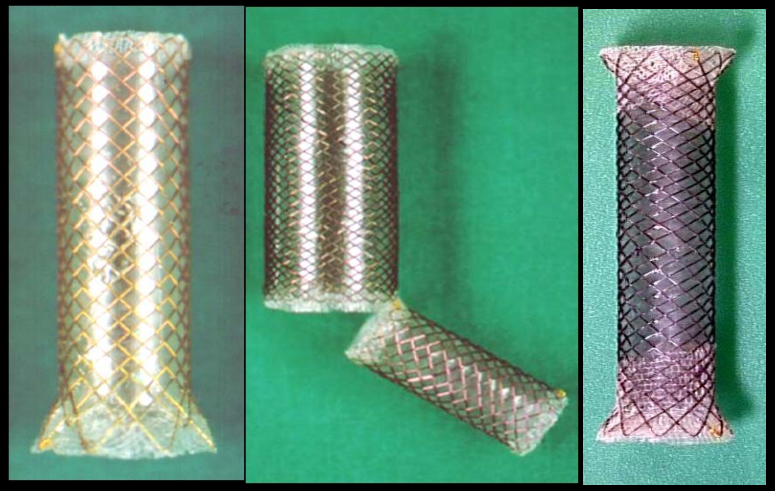


** Song HY, et al. Endoscopy2007; 39:448-454*

** Song HY, et al. Gastrointest Endosc 2008;68:713-720.*

Other Non-vascular Stents

Tracheobronchial Stents



Biliary Stents

Lacrimal Stents

Urethral Stents

Drug eluting

Prostatic Stents

Pressure necrosis of the prostate

June, 1988 (CNUH)

June, 1998 ,10 Years after beginning (AMC)



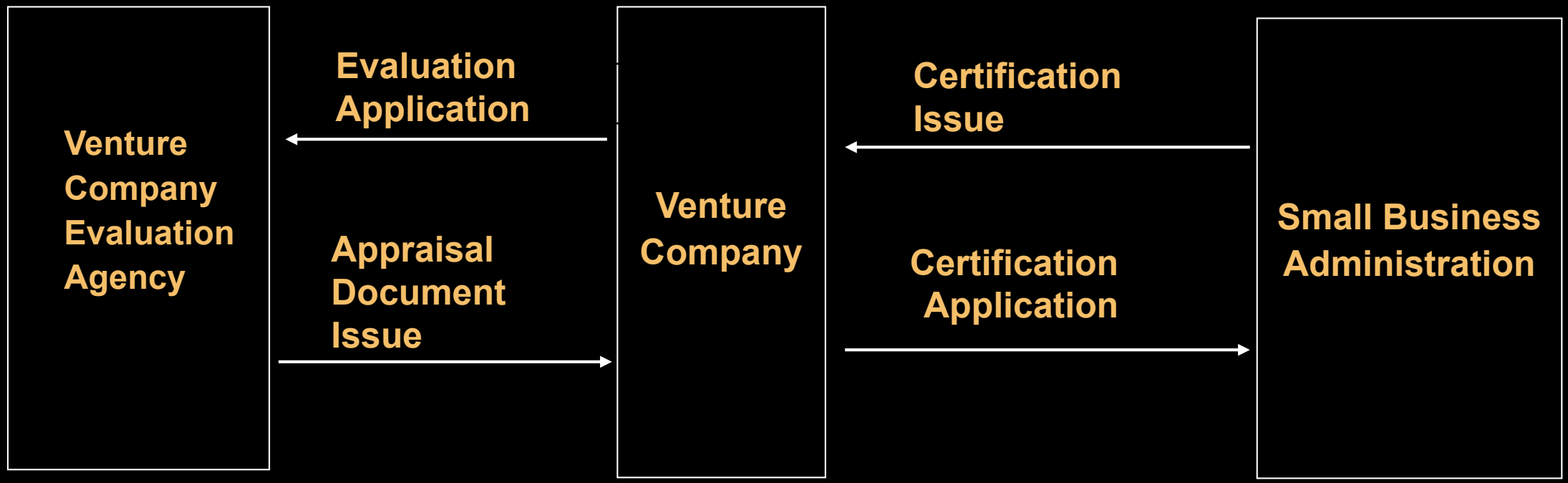







From the Mind to the Global Stent Market

Process of certification of a preliminary venture company in Korea



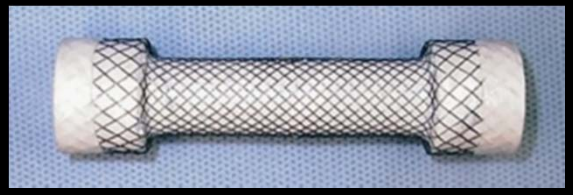
Under the late President Kim Dae-Jung's government, the government established the special professor-venture system.

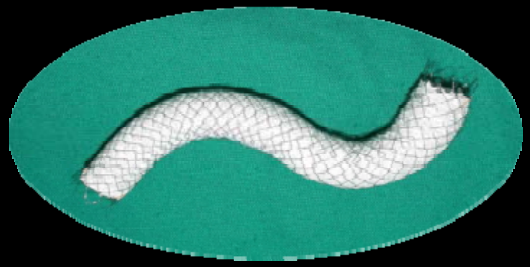
From the Mind to the Global Stent Market

S&G Biotech

S&G BIOTECH INC.

2000.2.12 : Promoters meeting (6 persons: capital outlay $ 100,000)
2000.4.12 : Approval of lab-venture company
2000.4.20 : **Foundation of S&G Biotech**
2000.5.01 : Issue of certification of venture company
2000.7.21 : 1st capital increase of face value (15 doctors)
2001. 3.5 : Certificate of business R&D center
2001.4.3 : 2nd capital increase of face value (36 doctors)
2001.5.17 : Formed a strategic cooperation (TaeWoong)
2002.4.20 : Quit the chairmanship of S&G as required by University rules

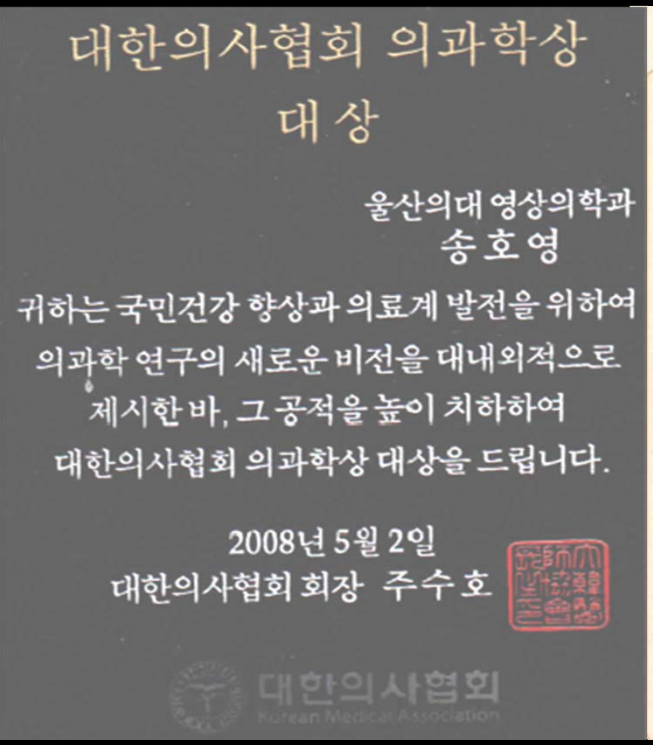




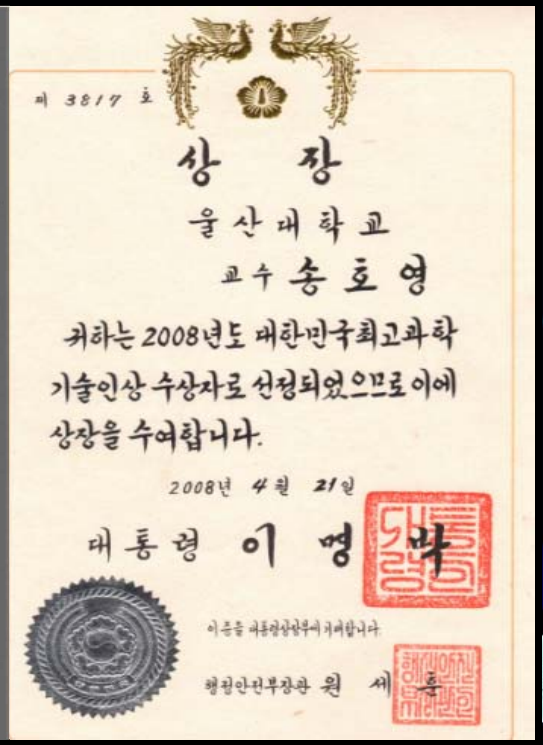
TaeWoongMedical

With this small step, S&G started and moved on, but it was really hard and inefficient to do research work and to run a company at the same time.

From the Mind to the Global Stent Market



Grand-prix Winner (KMA)



Most Distinguished Scientist

Gold Medal Award from SIR-2016

Honorary Memberships from ECR 2009, RSNA-2009, CSIR-2010, BSIR-2017, and JRS 2019

From the Mind to the Global Stent Market

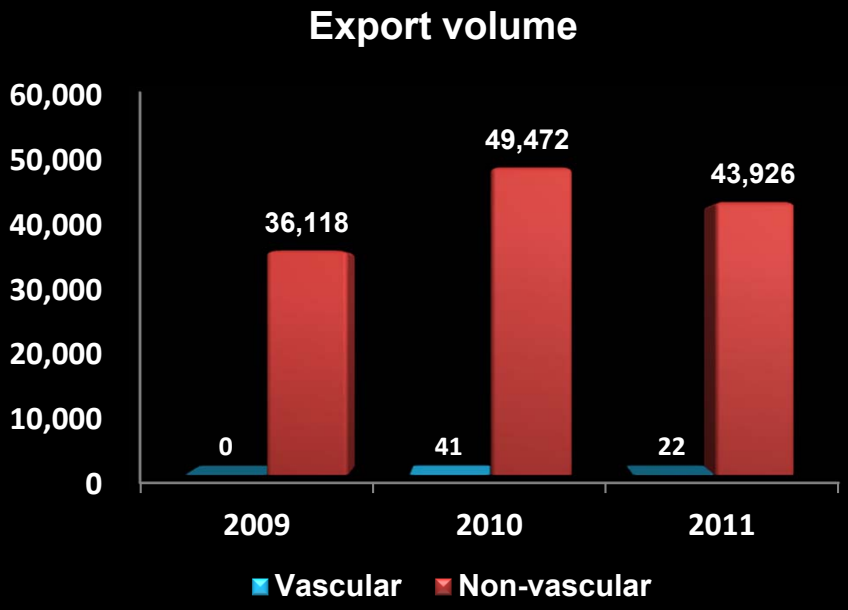
List of the top ten imported medical devices in Korea

No.	Items	2010			2011		
		Imports (USD)	Rate (%)	Rank	Imports (USD)	Rate (%)	Rank
1	**Stent**	104,759,297	4.62	**1**	107,323,268	4.26	**1**
2	**Soft contact lens**	64,395,054	2.84	5	94,908,711	3.76	2
3	**CT**	98,451,737	4.35	2	86,953,118	3.45	3
4	**MRI**	87,438,200	3.86	3	81,822,753	3.25	4
5	Artificial knee joint	71,719,682	3.17	4	73,877,478	2.93	5
6	Dialyzers for hemodialysis	48,187,322	2.13	6	57,755,648	2.29	6
7	I.V Catheter	27,076,876	1.20	18	45,294,640	1.80	7
8	Probe for medical use	35,958,908	1.59	13	43,624,049	1.73	8
9	Sight corrective ophthalmic lens	43,200,073	1.91	8	40,912,661	1.62	9
10	Ultrasonography system	39,957,742	1.76	10	40,240,450	1.60	10

From the Mind to the Global Stent Market

List of the top 16 exported medical devices in KOREA

Rank	Items	Export (1,000 USD, %)			
		2009	2010	2011	Rate of increase
1	Ultrasonography system	226,280	308,634	376,256	21.9
2	Soft contact lens	47,516	64,372	88,287	37.2
3	Corrective ophthalmic lens	74,162	78,231	87.270	11.6
4	Glucose analyser	50,643	67,704	82,795	22.3
5	Probe for medical use	50,178	68,033	74,121	8.9
6	Implant	35,783	52,104	73,581	41.2
7	Heating pad system	99,264	66,076	71,298	7.9
8	Combinational stimulator	33,312	45,573	49,979	9.7
9	Laser surgical unit	28,066	35,654	43,307	21.5
10	Digital X-ray system	31,973	45,118	38,610	-14.4
11	Medical image processing D.	26,367	30,096	37,456	24.5
12	Spinal internal fixation Sys.	12,486	23,996	35,417	47.6
13	Medical handpiece	21,380	25,339	29,382	16.0
14	Refractometer	19,081	22,999	25,551	11.1
15	Syringes	25,973	25,886	25,110	-3.0
16	**Stent**	**18,219**	**23,073**	**19,895**	**-13.8**



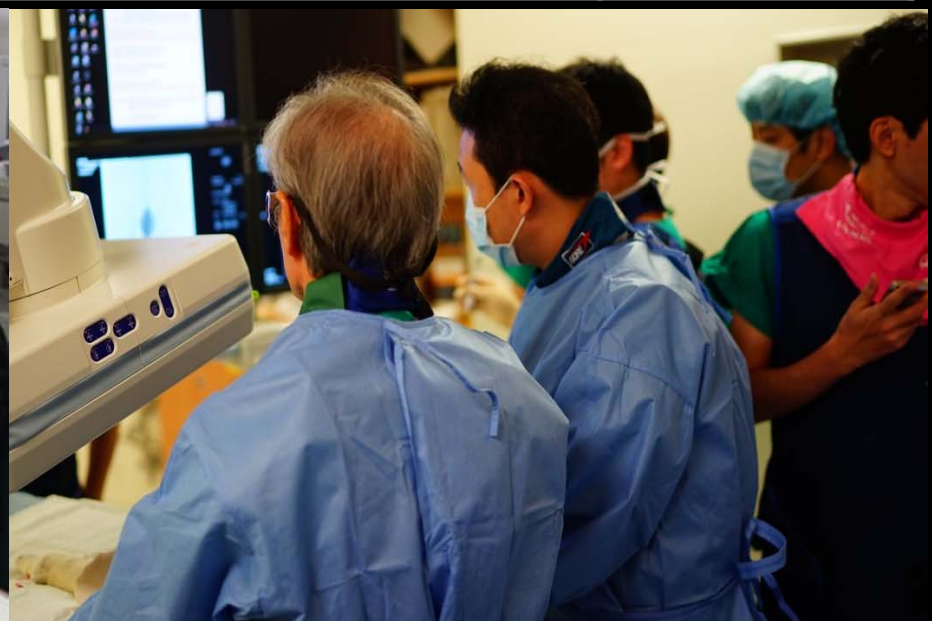
Korean government chose 10 hospitals including AMC to encourage cooperation between industry and hospitals, and to support them with research funds.

Interventional Medicine R&D Center, 2014

Sept. 2018, 30 Years after developing the stent concept

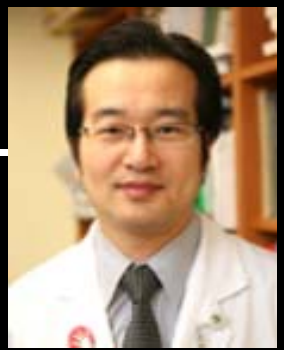
Interventional Medicine R&D Center (Present)

	Monday	Tuesday	Wednesday	Tuesday & Friday
1st	Lab. meeting 13:00 a.m. p.r.n Lectures & Authorship - 2:00 p.m.	**Lymphatic Research** - 7:30 a.m. / SH Yoon, Z Wang, KY Kim	**Stricture and Adhesion Model** - 7:30 a.m. / YJ Lim, SH Yoon, N Bakheet, KY Kim	**Clinical Research on /Eustachian tube intervention and GD stenting** HJ Park, KD Choi, HY. Song
2nd		**Obesity Treating Devices** - 7:30 a.m. / N Bakheet, MT Kiim, JH Park	**Eustachian Tube Intervention** - 7:30 a.m. / Z Wang, KY Kim	
3rd		**Drug Releasing Stents** - 7:30 a.m. / MT Kim, N Bakheet, JH Park	**Colon Cancer Model** - 7:30 a.m. / YJ Lim, N Bakheet, SH Yoon, KY Kim	
4th		**Application of Nanoparticles** - 7:30 a.m. / MT Kim, Z Wang, JH Park	**Robotic Delivery System** - 7:30 a.m. / JM. Choi, N Bakheet, Z Wang	

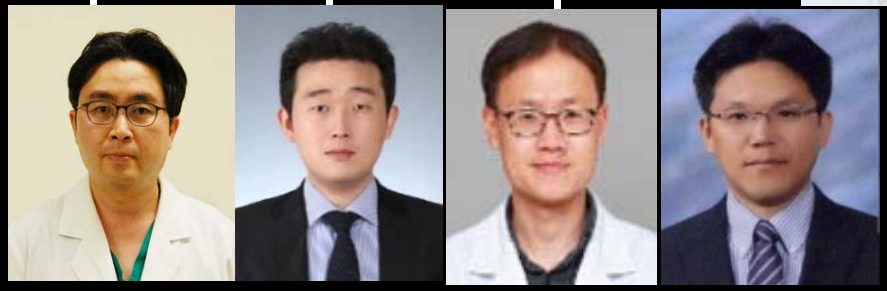


Sept. 2018, 30 Years after developing the stent concept

Interventional Medicine R&D Center (Present)

AMC Partners

Outside Partners



Researchers(M.D, biologist, engineer)

How to Globalize Your Career:

30 Years Experience from the Mind to the Global Stent Market

Tips on Doing Research

1. Building close relationships with patients
2. Try to do collaborative research
3. Find mentors and keep in touch with them
4. Train new scholars and cooperate with them
5. Always thank your spouse and family

1. Building close relationships with patients

2nd Generation Stent

Our relationship was similar to that of a father and his son

The majority of my ideas have come from patients

Listen to your patients and you will learn from them

2. Try to do collaborative research

Stent Generations

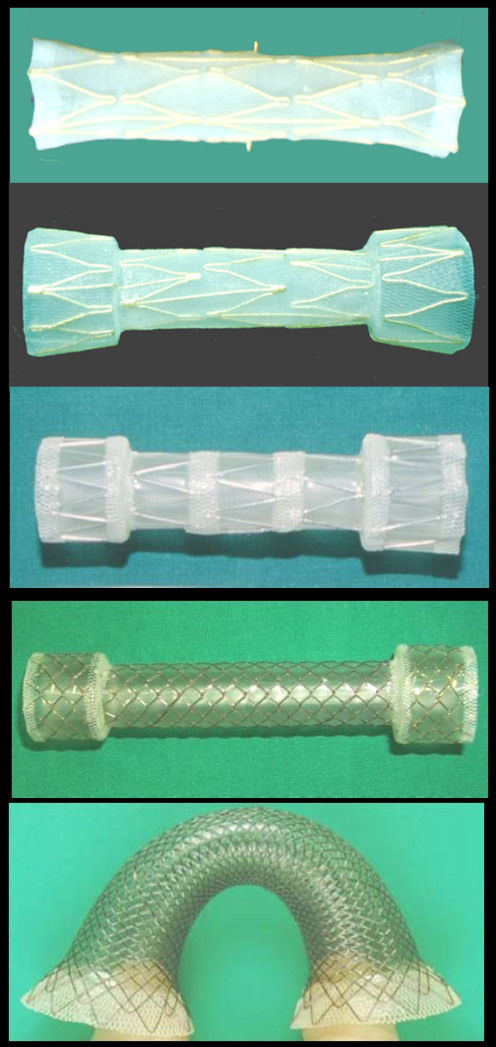
1st

2nd

3rd

4th

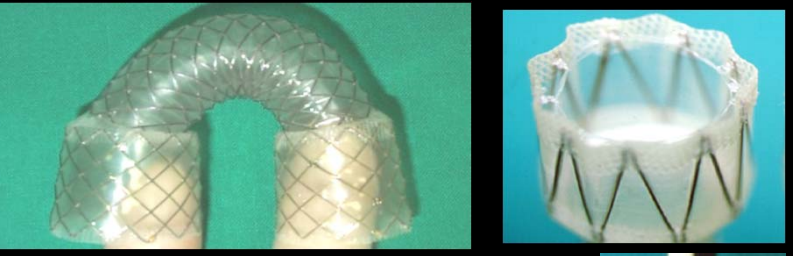
5th

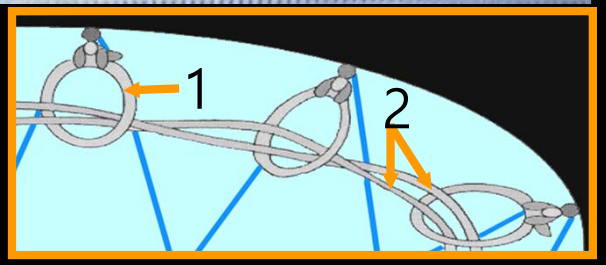


6th

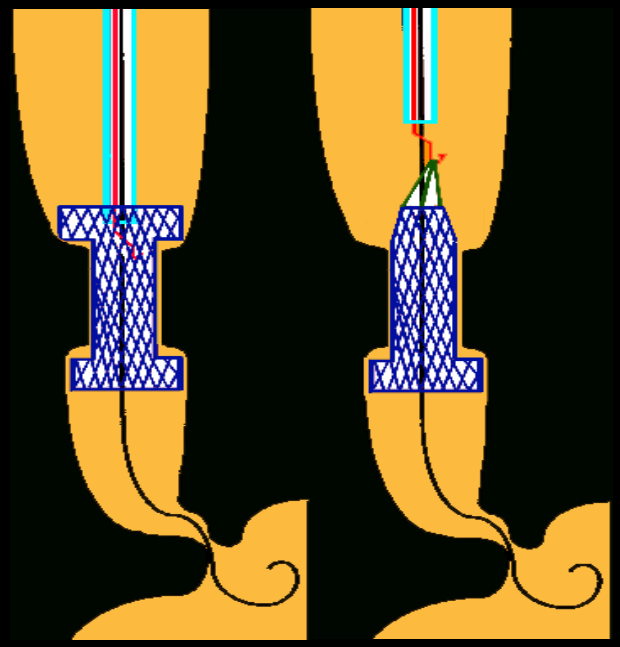
7th

8th



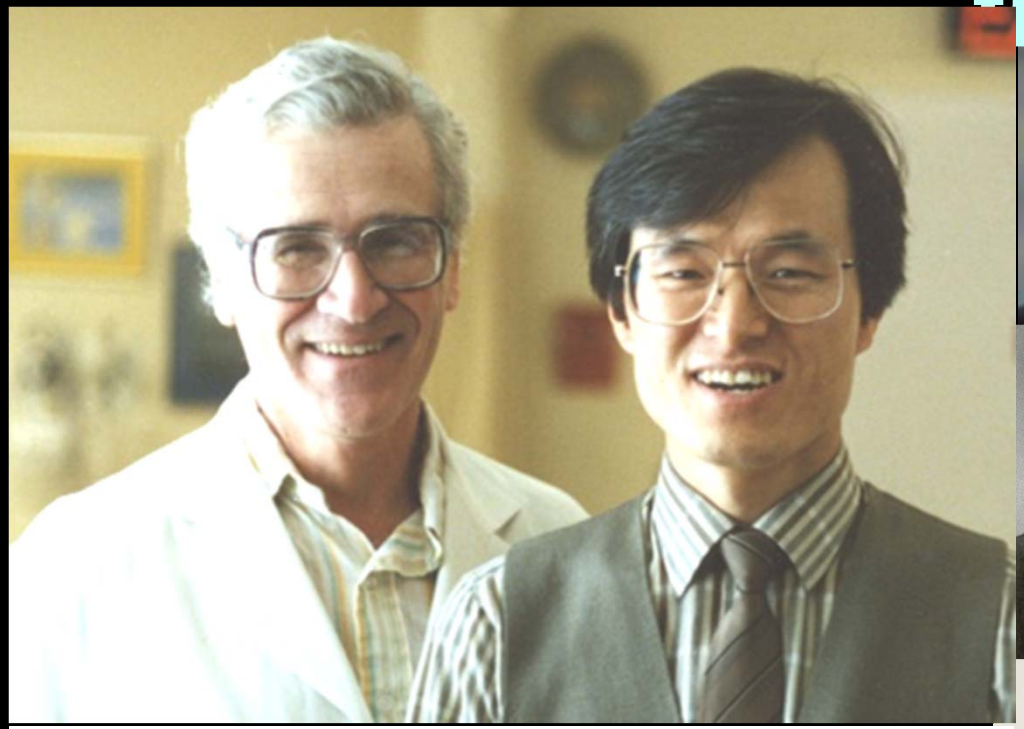


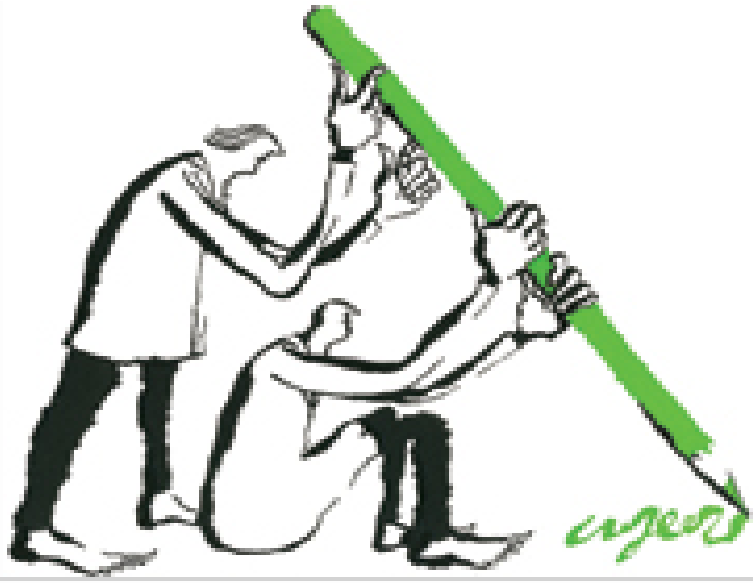
1. Nylon loop 2. Drawstrings

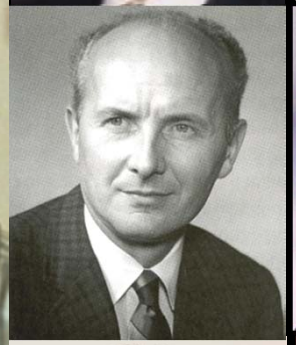


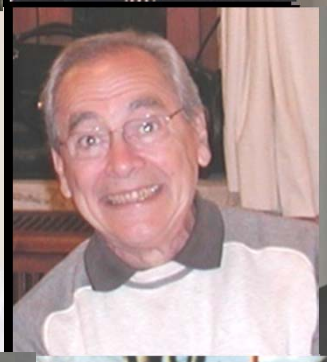
It is important to collaborate with physicians and scientists in other disciplines because invaluable ideas emerge from the interaction of different disciplines.

3. Find mentors and keep in touch with them









3. Find mentors and keep in touch with them

Dear Professor Castaneda-Zuniga,

These days I have one thing that gets me to have tossed and turned my way through the night. Of course it is not that serious and it is not so often, but I think I had better begin to consider my problem seriously. As you know, we are making many kinds of stents of stainless wire or nitinol wire and we have recently pretty good clinical results from using retrievable nitinol stents.
However, I think there are some problems there.
1. The design and function of our stent are believed to be excellent, but, the ensuing development and marketing are behind in the international competition because Korean medical companies are not so excellent for selling our products.
2. Most of university hospitals in our country put the priority in the clinical work, education and research in that order so that it is difficult for us to concentrate and keep going on the research. As I am getting older, other things like academic society work and family need me more than before.
3. Now that I got tenure from the university, I might not feel very stressful even though I don't do research work and obviously it is comparatively easy only to take care of patients without writing papers. But I wonder whether I am on the right track and is worthwhile to doing like that.

So I am thinking of moving to the States. In fact, some years ago, I got offers to work from a hospital in the States. At that time I never thought of living in other countries so that I hadn't given much thought on that idea at all. These days that idea strikes me all of sudden and finally I am in the state of being up and down during the night.

I am not sure I made myself understood, but, I think you are the person who can give me precious tips on this. If you were in my shoes, what shall you do? I know that there should be too many factors to be considered, but your general advice will do for me.

Truly yours,
Ho-Young

Dear Ho-Young

It was good to hear from you. It sound like you are going to a mid life crisis, not emotionally but an academic one. Concerning your questions or concerns, this is what I would do:

1.- I would establish a partnership with J. Lopera for the manufacturing and marketing of your inventions in Latinamerica. If it is a good product at a good price you will defeat the competition. Once you are sucessful in the latinamerican market you can expand to the Asian market. This could be very profitable
2.- I would not leave my academic position, keeping it will allow you to test new products and to continue to develop new ideas, which you can then manufacture in your southamerican manufacturing plant.
3.- You seem to enjoy your job. If there is no more pressure to write papers, you can do the clinical work that you enjoy, teach and do research at your own pace, since you are already tenured.
4.- Moving to another country is not going to solve your situation, it might even make it work, no tenure, pressure to produce clinically $$$$ and academically.
5.- Going to other country requires taking examinations on Medicine and Radiology. Otherwise you can only do research. Research doesn't pay!!!
6.- Overall my advice is to stay where you are, develop a relationship with Lopera to manufacture your inventions, this will bring you money and you enjoy your practice. Good Luck my friend

I have had a severe depression period every seven years in my academic career.

3. Find mentors and keep in touch with them

It would be impossible to recreate AMC's collaborative and supportive relationships in any institute in the States.

That was my turning point to realize that they are my treasure people.

4. Train new scholars and cooperate with them

Authorship Meeting in 2001

To teach junior doctors and radiological technologists how to write a paper in English

The first author of a manuscript emails the manuscript to the meeting attendees at least 5 days before the meeting.

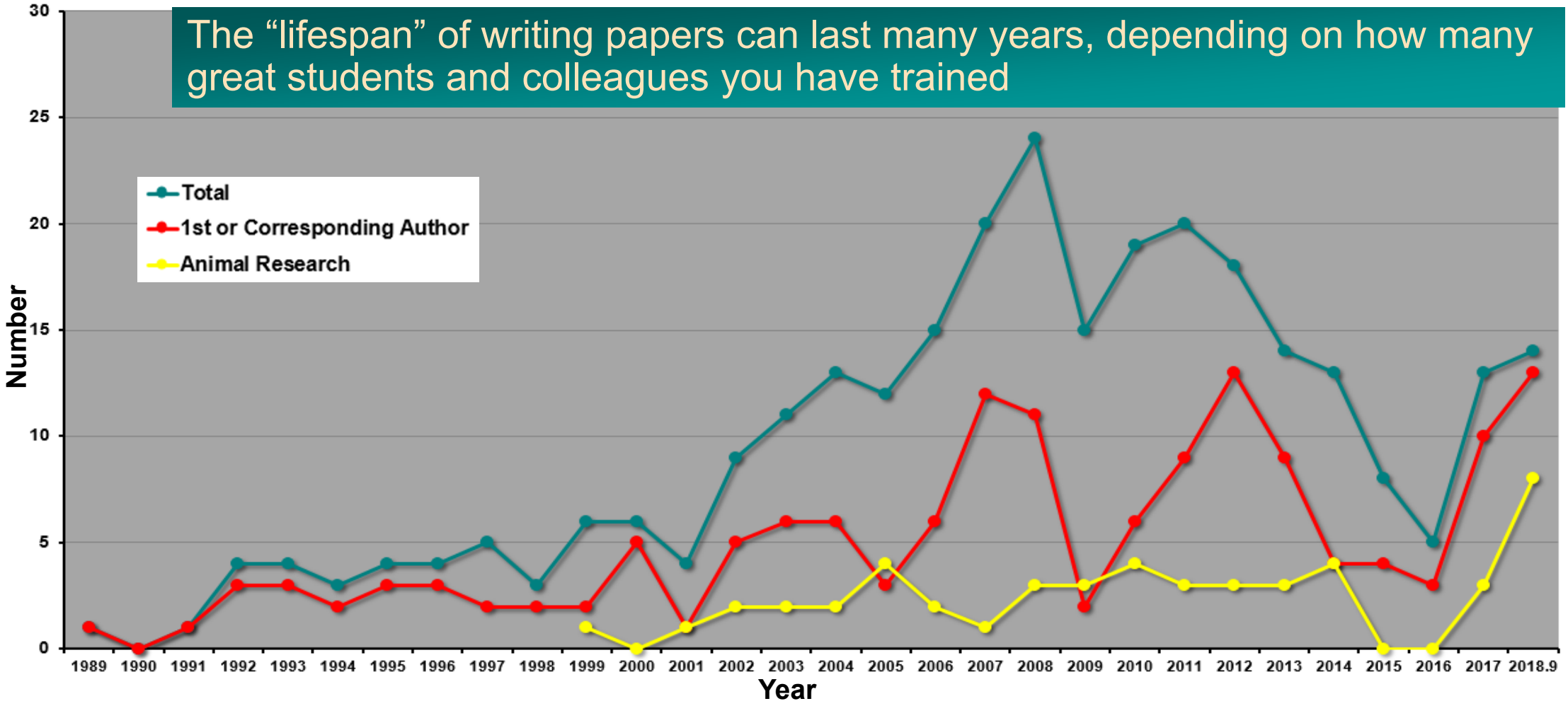
1. Read the manuscript to see what the first author had not seen
2. Provide constructive criticism to improve its quality
3. Integrate new ideas from all of the team members
4. Determine the target journal of manuscripts

4.Train new scholars and cooperate with them

Publication is critical for Successful Research and in Academia

SCI indexed journals: **288 (Total),** **150 (First or Corresponding Author)**

The “lifespan” of writing papers can last many years, depending on how many great students and colleagues you have trained



4. Train new scholars and cooperate with them

* Hard job for me to teach them how to perform research and how to write a paper
* Their enthusiasm, determination, and humbleness which allow me to forget the sweat

5. Always thank your spouse and family

Family:
Companions,
Healers and
Friends.

Your heart can rest there.

30 Years Experience from the Mind to the Global Stent Market

The number of scientific papers defines your academic life; but the number of mentors and mentees defines your real success in life.