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#STI18LDN

A Bibliometric Framework for Identifying "Academic Chain"



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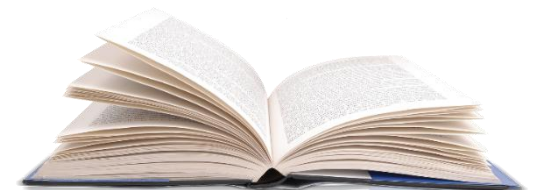
2018.09.12





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Background

- *Scientific Development*

Scientific research is an ever-evolving process and the new research achievements are always based on the existing research achievements as the cornerstone (academic inheritance). All the **achievements** which determines the emergence and development of the specific field can be arranged **in chronological order** and then form a story line.

- *Academic Chain*

The nodes are the **papers** which are essential to promote the development of the specific field and the linkages are **academic inheritance relationship** between the papers.



Background



Scientific Development

Academic Chain

Achievements

Papers

in chronological order

academic inheritance relationship

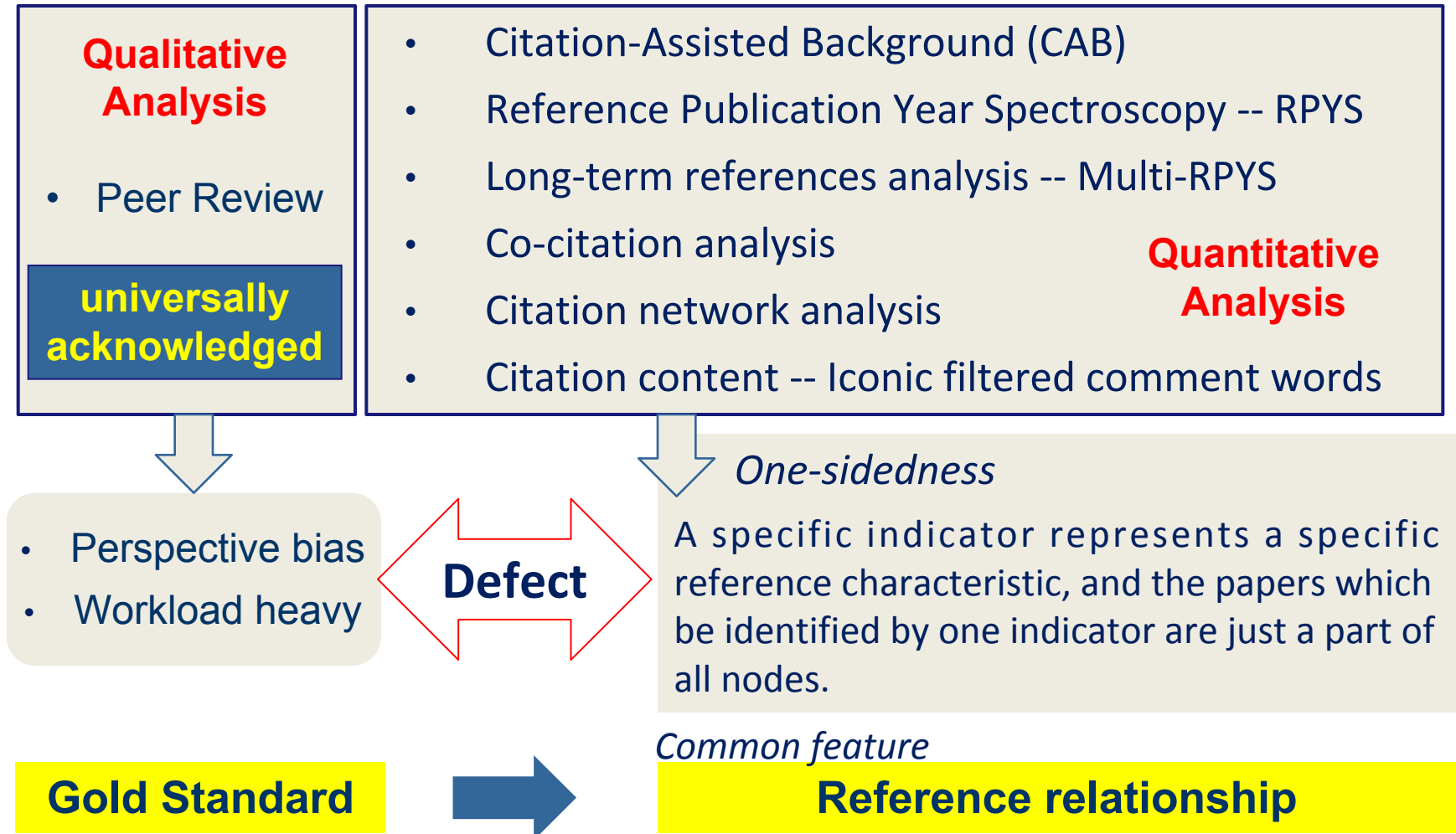
- *Significance*
 - ✓ **In Theory**
 - ❑ Quantitative research in the history of science.
 - ✓ **In Practice**
 - ❑ Scientific and technological evaluation.
 - ❑ Academic literature recommendation.



Background



- *Research Status*

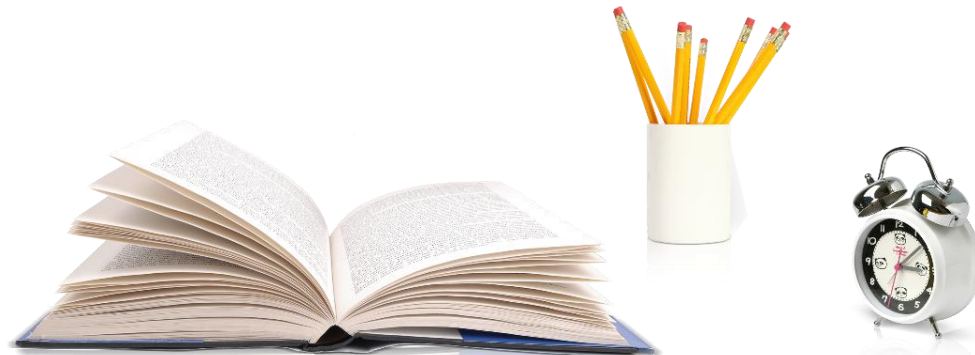


Theoretical Basis



Measurement of reference relationship:

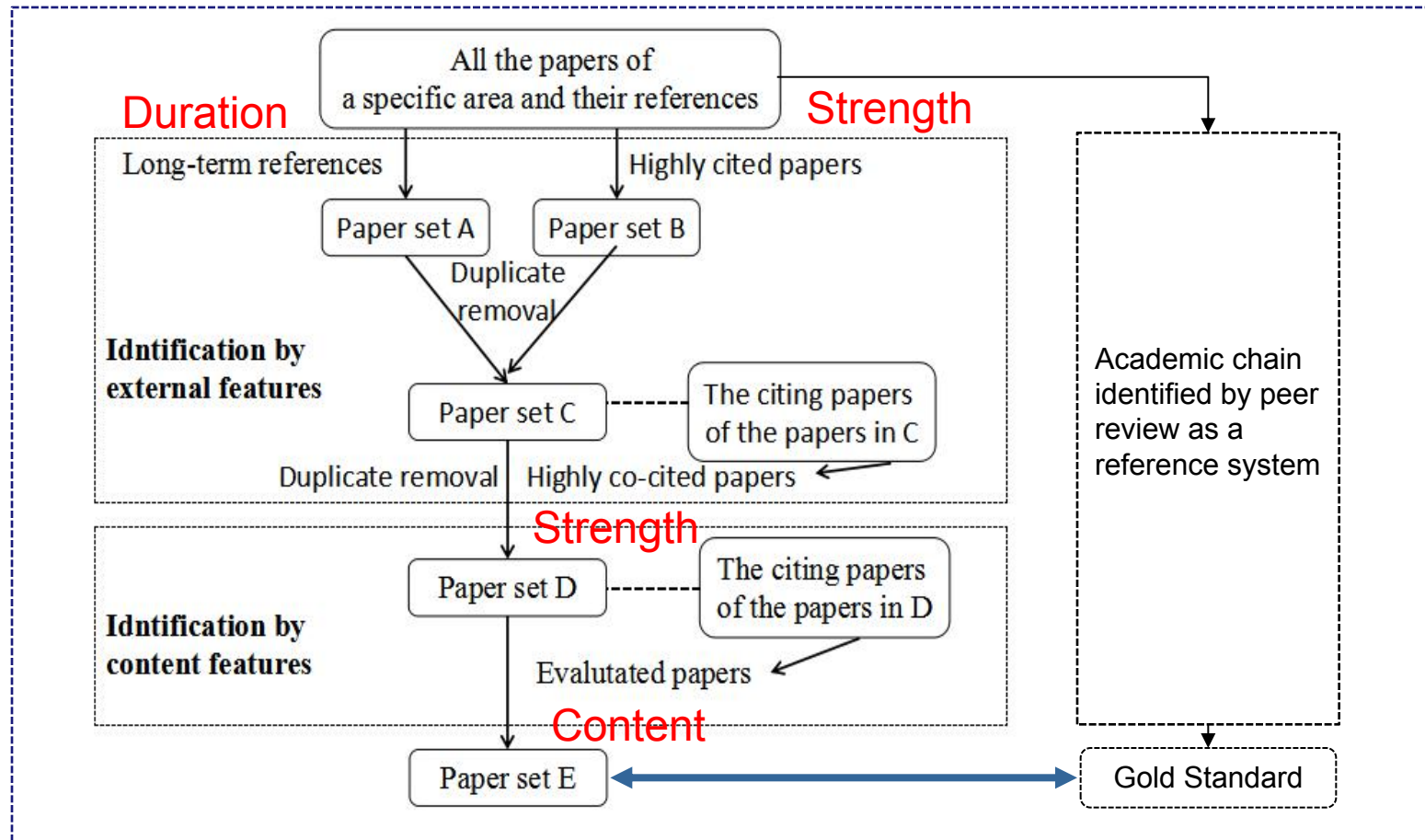
- **Duration**— —Only papers following the trajectory of a ‘sticky knowledge claim’ can be expected to have a sustained impact
- **Strength**— —Highly cited papers/Highly co-cited papers
- **Content**— —Symbolic evaluation about the paper’s inheritance



Identification Framework



Theoretical identification framework of the academic chain 1.0



Indicators: Cumulative coverage rate & Cumulative accuracy rate

Case Study



- *Topic introduction*

Based on the 2014 Nobel Prize in chemistry, we arranged the development process of the STED technology illustrated by the official introduction of the Nobel Prize and a review about the super-resolution microscopy published in Natural Methods in 2009.

- ✓ In **1873, Abbe** first proposed the rule of diffraction-limited imaging.
- ✓ In **1994, Hell S W** proposed the theory of STED
- ✓ In **2000, Klare** used the STED to produce the first truly nanoscale fluorescence images, which proved the STED's feasibility.
- ✓ In **2000, Gustafsson** proposed Structured Illumination Microscopy (SIM)
- ✓ In **2005, Gustafsson** proposed the Saturated Structural Illumination Microscopy(SSIM) based on the SIM.
- ✓ In **2006, Betzig's** group published their Photoactivated Localization microscopy (PALM) method.
- ✓ In **2006, Xiaowei Zhuang's** group developed Stochastic Optical Reconstruction Microscopy, STORM
- ✓ In **2006, Hess's** group reported on their Fluorescence Photoactivation Localization Microscopy, FPALM
- ✓ In **2008, Hell's** group used the STED method to show the movement of synaptic vesicles inside living neurons at video rate, the proteins of interest tagged with antibodies.



Case Study

- *Data sources*

- ❑ Database: Web of Science core collection database
- ❑ Query: "Stimulated emission depletion" OR (STED microscopy)
- ❑ retrieval period: 1970-12/12/2017
- ❑ records Records: 944

- *Tools*

- ❑ CReXplorer
- ❑ HistCite
- ❑ Microsoft Office Excel

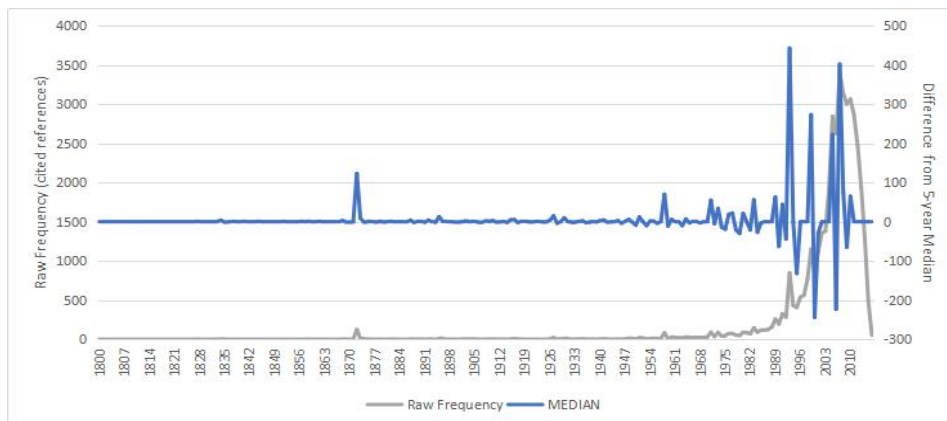




Case Study

• Results & Analysis

- ▣ The references at peaks in the spectrum by RPYS, and then pick out the long-term references by citation curve.



Years of peak values :

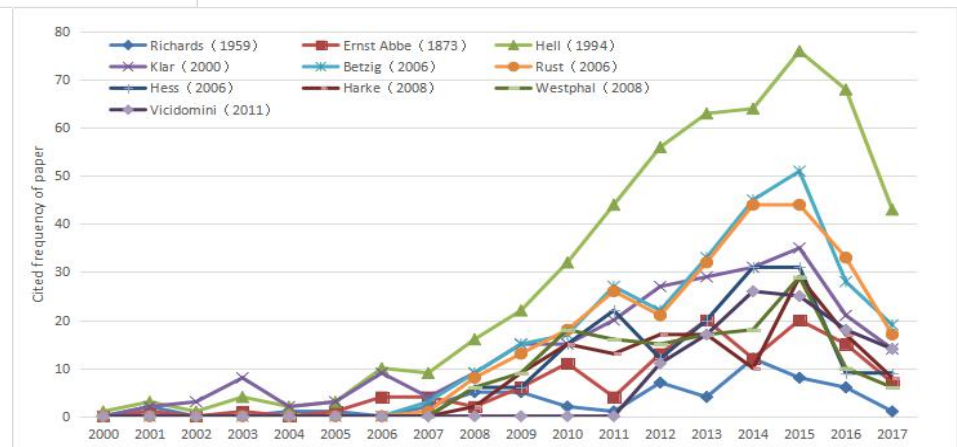
peak is usually caused by a single paper, but not always that.

1873, 1959, 1994, 2000, 2006, 2008, 2011.

Two papers were excluded:

Whether continue to be cited more than 10 years after publication or not

Richards (1959)
Vicidomini (2011)





Case Study

- Highly cited papers whose cited frequencies are in the top 5.

#	Author / Year / Journal	WoS	Recs
1	HELL SW, 1994, OPT LETT, V19, P780, DOI 10.1364/OL.19.000780	WoS	516
2	Betzig E, 2006, SCIENCE, V313, P1642, DOI 10.1126/science.1127344	WoS	267
3	Rust MJ, 2006, NAT METHODS, V3, P793, DOI 10.1038/nmeth929	WoS	257
4	Klar TA, 2000, P NATL ACAD SCI USA, V97, P8206, DOI 10.1073/pnas.97.15.8206	WoS	247
5	Hell SW, 2007, SCIENCE, V316, P1153, DOI 10.1126/science.1137395	WoS	231

#	Author / Year / Journal	WoS	Recs
1	Abbe E., 1873, ARCH MIKROSK ANAT, V9, P413, DOI 10.1007/BF02956173	WoS	121
2	#		
3	1 HELL SW, 1994, OPT LETT, V19, P780, DOI 10.1364/OL.19.000780	WoS	516
4	2 #		
5	3 1 Klar TA, 2000, P NATL ACAD SCI USA, V97, P8206, DOI 10.1073/pnas.97.15.8206	WoS	247
6	4 2 #		
5	3 1 Klar TA, 2000, P NATL ACAD SCI USA, V97, P8206, DOI 10.1073/pnas.97.15.8206	WoS	247
6	4 2 #		
5	3 1 Hess ST, 2006, BIOPHYS J, V91, P4258, DOI 10.1529/biophysj.106.091116	WoS	161
6	4 2 #		
5	3 1 Rust MJ, 2006, NAT METHODS, V3, P793, DOI 10.1038/nmeth929	WoS	257
6	4 2 #		
5	3 1 Hell SW, 2007, SCIENCE, V316, P1153, DOI 10.1126/science.1137395	WoS	231
6	4 2 #		
5	3 1 Harke B, 2008, OPT EXPRESS, V16, P4154, DOI 10.1364/OE.16.004154	WoS	137
6	4 2 #		
5	3 1 Westphal V, 2008, SCIENCE, V320, P246, DOI 10.1126/science.1154228	WoS	144
6	4 2 #		
5	3 2 HELL SW, 1994, OPT LETT, V19, P780, DOI 10.1364/OL.19.000780	WoS	114
6	4 2 #		
5	3 2 Betzig E, 2006, SCIENCE, V313, P1642, DOI 10.1126/science.1127344		
6	4 2 #		
5	3 4 Rust MJ, 2006, NAT METHODS, V3, P793, DOI 10.1038/nmeth929		
6	4 2 #		
5	3 5 Hell SW, 2007, SCIENCE, V316, P1153, DOI 10.1126/science.1137395		
6	4 2 #		
5	3 6 Hess ST, 2006, BIOPHYS J, V91, P4258, DOI 10.1529/biophysj.106.091116		

- Highly co-cited papers with each paper get above whose co-cited frequencies are row in the top 5.

- "first", "broken", "breakthrough" and other iconic filtered comment words.

No.	The first author (publication year)	Identification mark	The first author (publication year) of classical citing paper
1	Abbe E.(1873)	was originally recognized/ was first recognized by	Klar T A.(2001)
2	Hell S W.(1994)	opens up a new avenue	Eggeling, Christian(2009)
3	Klar T A.(2000)	the first ...technique	Fernandez-Suarez(2008)
4	Gustafsson M G.(2005)	has been broken by/ further improved	Ding J B.(2009)
5	Betzig E.(2006) Rust M J.(2006) Hess S T.(2006)	breakthrough	Toomre D(2010)
6	Westphal V.(2008)	First... succeeded by	Schermelleh L(2010)

Case Study



□ Identification results of academic chain theoretical framework.

The first author (publication year)	Identification by external features.			Evaluation by content features.
	Long-term references	highly cited papers	highly co-cited papers	
Abbe E.(1873)	√ ^Δ	--	√ ^Δ	√ ^Δ
Hell S W.(1994)	√ ^Δ	√ ^Δ	√ ^Δ	√ ^Δ
Klar T A.(2000)	√ ^Δ	√ ^Δ	√ ^Δ	√ ^Δ
Gustafsson M G.(2005)	--	--	√ ^Δ	√ ^Δ
Betzig E.(2006)	√ ^Δ	√ ^Δ	√ ^Δ	√ ^Δ
Rust M J (2006)	√ ^Δ	√ ^Δ	√ ^Δ	√ ^Δ
Hess S T.(2006)	√ ^Δ	--	√ ^Δ	√ ^Δ
Westphal V (2008)	√ ^Δ	--	√ ^Δ	√ ^Δ
Gustafsson M G.(2000)	--	--	√ ^Δ	--
Hell S W (2007)	--	√	√	--
Harke (2008)	√	--	√	--
Willig K I (2007)	--	--	√	--
Cumulative coverage (%)	77.78	77.78	100	88.89
Cumulative accuracy (%)	87.5	77.78	75	100

Discussion



- *Feasibility*

- The result shows that the academic chain nodes were identified by this framework are basically consistent with the milestone events in the actual development process.

- *Deficiency*

- Subjectivity — — The value of N

Discussion



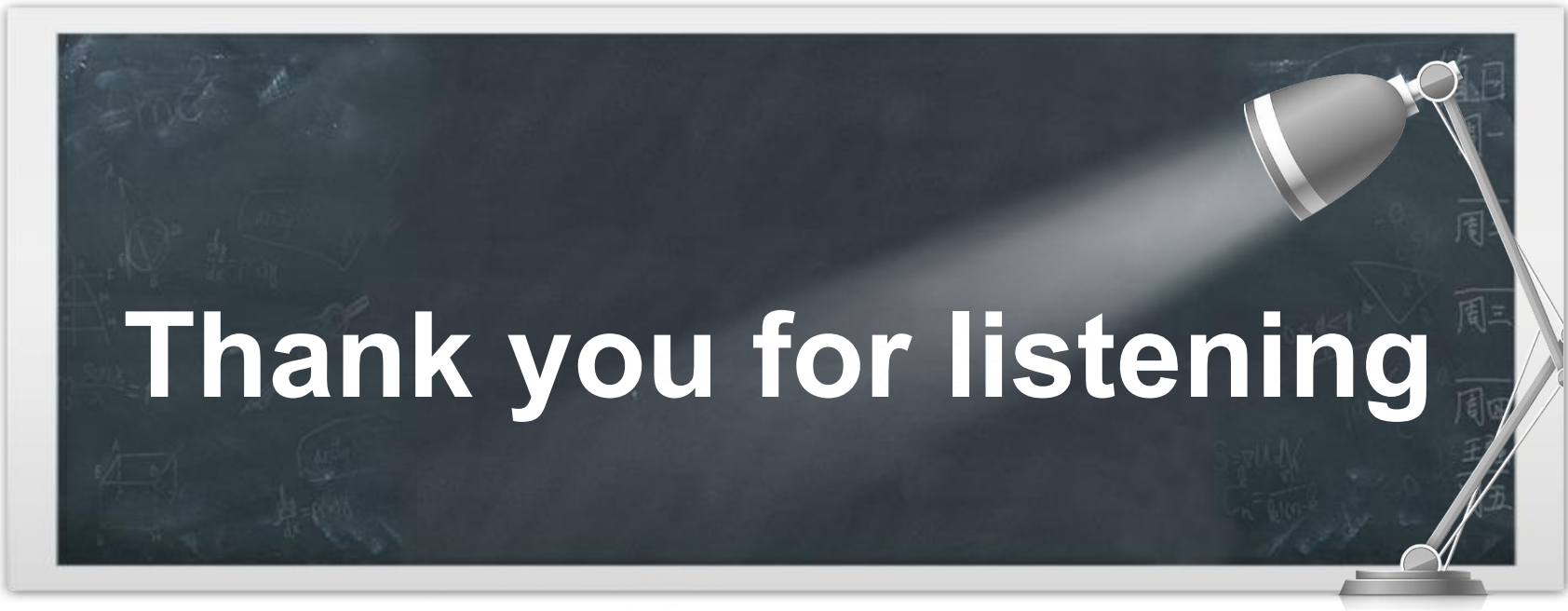
- *Future*
 - *Scientific activity plays a major role in innovation for suits biomedicine and healthcare. Whether applicable to medical science?*
Fundamental Research → Applied Research → Developmental Research
 - *Classification for academic chain nodes.*
Normal science OR Revolutionary science
 - *More cases study.*



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Thank you for listening

