PROGRAM 프로그램 안내

1. KIOM 30th Anniversary International Symposium

October 29 (Tue.) 2024, 10:00 ~ 17:00 I KIOM, Guam Building, Main Auditorium

Day 1		
10:00~10:30	Opening	
Keynote Session - Celebrating the Past, Present, and Future		
10:30~11:00	The Past, Present, and Future of Traditional Korean Medicine Research	Byungmook LIM I Pusan National University
11:00~11:30	Leveraging the BraveNet Practice Based Research Network for Understanding The Impact of Integrative Medicine: The Past, Present and Future	Jeffery Dusek I University of California - Irvine
11:30~13:00	Lunch	
Session 1 - Future Society and Traditional Korean Medicine	**Chair :** Byungcheul SHIN I Pusan National University	
13:00~13:20	Transforming the Paradigm of Korean Medicine for Future Healthcare	Changsub UHM I Korea University
13:20~13:40	Postoperative Delirium: Mechanisms and Prevention	Daqing Ma I Imperial College London
13:40~14:00	Convergence of Traditional Korean Medicine and Synthetic Biology: Innovative Research and Future Perspectives	Daehee LEE I KRIBB
14:00~14:20	Research on Traditional Korean Medicine to Overcome Disease	Taesoo KIM I KIOM
14:20~14:35	Q&A	
14:35~15:00	Break	
Session 2 - Future Technology and Korean Medicine	**Chair :** Kyungmo PARK I Kyunghee University	
15:00~15:20	The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture	Vitaly Napadow I *Online Recording Harvard University
15:20~15:40	Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology	Jaeuk KIM I KIOM
15:40~16:00	Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine	Sanghun LEE I KIOM
16:00~16:20	Integrative Health & AI: Strategic Approaches for the Future of Medicine	Claudia Witt I *Online Recording University of Zurich
16:20~16:35	Q&A	
16:35~16:55	Prize Draw	
16:55~17:00	Closing	

* The 2024 KIOM Research Networking Day will be held simultanesouly (Venue: Guam Building, in front of the Main Auditorium)
* Lunch will be provided to the symposium participants

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OPENING REMARKS

〈INTERNATIONAL SYMPOSIUM COMMEMORATING THE 30TH ANNIVERSARY OF KOREA INSTITUTE OF ORIENTAL MEDICINE〉

Distinguished Guests, I am Jin-Yong Lee, President of the Korea Institute of Oriental Medicine.
It is an honor and a great pleasure for me to be here today.
This year marks the 30th anniversary of the founding of the Korea Institute of Oriental Medicine.

For the past three decades, we have dedicated ourselves to the specialized research and development of Oriental Korean medicine, driven by our mission to contribute to the health and well-being of the public and humanity. Today, the Korea Institute of Oriental Medicine is hosting an international symposium to celebrate our 30th anniversary. We have invited experts from home and abroad to reflect on the path Oriental Korean medicine has taken and to explore its roles and potential in the society of the future. First, I would like to express my sincere gratitude to Chairperson Kim Bok-cheol of the National Research Council of Science and Technology for taking the time to join us, President Yoon Sung-chan of the Association of Korean Medicine for attending following the 30th-anniversary ceremony, Vice President Ko Sung-kyu, representing the Society of Korean Medicine, and to all the distinguished experts and guests from home and abroad who will be presenting today. I would also like to extend a warm welcome and gratitude to the experts from the United States, the United Kingdom, Switzerland, and other countries who have joined us in person or online, due to difficult circumstances.

Oriental Korean medicine has established itself as an integral part of Korea's healthcare system and has now gained global attention beyond the borders of Korea. The Korea Institute of Oriental Medicine has contributed to enhancing the credibility and value of Oriental medicine through foundational research in Oriental Korean medicine, therapeutic techniques, herbal medicine, medical devices, and informatics, as well as through interdisciplinary studies with advanced science and technology. We are also actively engaged in various international collaborative research efforts, including joint studies with the Martinos Center at Harvard Medical School and the China Academy of Chinese Medical Sciences. We have taken the lead in establishing international standards for traditional medicine and strengthening its global presence by being designated a WHO Collaborating Center in 2012, preparing the international standard for acupuncture points between Korea, China, and Japan under WHO guidance, and being appointed as the Korean Secretariat for ISO TC249 in 2016. Our institute now aims to fulfill its role in establishing Oriental Korean medicine as a proud pillar of future medicine. To realize the future we envision, we will strengthen foundational research at the intersection of medical science and technology innovation, with a particular focus on integrating studies of the brain and acupuncture points. In particular, the Acupuncture & Meridian Science Research Center (AMSRC) which broke ground on the 2nd, will play a vital role in providing scientific evidence for acupuncture and meridian therapies and will become a hub for future Oriental medicine research. We will lead the digital transformation of Korean medical technologies. By spearheading the digital transformation of Oriental Korean medicine in response to the evolving healthcare landscape, including the rise of telemedicine, innovations in diagnostics and treatment, and advancements in medical technology, we aim to develop and industrialize technologies that contribute to strategic research initiatives in advanced biotechnology. I hope today's gathering will serve as a valuable opportunity for our institute and the top experts from Korea and abroad to discuss the future direction of Oriental Korean medicine.

Distinguished guests, In celebration of the 30th anniversary, the institute selected a commemorative slogan earlier this year through a contest involving all our employees. Outside the building, a large banner proudly displays our slogan: "Soaring to the World on the Wings of Science." This slogan reflects our vision for the future of Oriental Korean medicine, one that enhances the foundational principles passed down through generations by integrating them with modern science and evolves into a new form of Oriental Korean medicine through the fusion of advanced technologies. The Korea Institute of Oriental Medicine will continue to move forward while always keeping this vision in mind.

Once again, I would like to express my gratitude to all the distinguished guests, experts, and everyone who has worked hard to prepare for the International Symposium Commemorating the 30th Anniversary of the Korea Institute of Oriental Medicine.

Thank you.

2024. 10. 29

Lee Jin-yong

President of the Korea Institute of Oriental Medicine

개 회 사

〈한국한의학연구원 개원 30주년 기념 국제심포지엄〉

존경하는 내외 귀빈 여러분, 안녕하십니까. 한국한의학연구원장 이진용입니다.
올해로 한국한의학연구원은 개원 30주년을 맞이하였습니다.

한의학 연구개발을 전문적으로 수행하고 국민과 인류의 건강한 삶에 공헌한다는 사명으로 열심히 달려온지 어느덧 30년이 지났습니다. 오늘 한국한의학연구원은 한의학 연구가 걸어온 길을 돌아보고 앞으로 나아갈 미래사회에서 한의학의 역할과 가능성을 모색하기 위해 내 외 전문가 분들을 모시고 개원 30주년 기념 국제심포지엄을 개최하게 되었습니다.
먼저 귀중한 시간을 내어 발걸음 해주신 국가과학기술연구회 김복철 이사장님, 30주년 기념식에 이어 참석해 주신 대한한의사협회 윤성찬 회장님, 대한한의학회를 대표해 참석해주신 고성규 부회장님, 그리고 주제 발표를 해주실 내외 전문가와 귀빈 여러분께 깊은 감사의 말씀 드립니다. 미국과 영국, 스위스 등 발표를 위해 직접 참석해 주시거나 사정이 허락하지 않아 온라인으로 참석해 주신 전문가 여러분들께도 환영과 감사의 말씀을 드립니다.

한의학은 우리나라 보건의료체계의 한축으로 자리잡았고 이제는 대한민국을 넘어 세계적으로 관심받는 의학이 되었습니다.
한국한의학연구원은 한의학의 기초원천연구와 치료기술, 한약, 의료기기, 정보화 연구에 이어 첨단과학기술과의 융합연구를 통해 한의학의 신뢰성과 가치향상에 기여하고 있습니다. 또한 미국 하버드의대 마르티노스센터, 중국중의과학원과의 공동연구 등 다양한 국제공동연구를 지속적으로 수행하고 있고 2012년 WHO 협력센터 지정, WHO 한중일 경혈국제표준안 마련, 2016년 ISO TC249 국내 간사기관 지정을 통해 한의학 분야 국제표준제정에 앞장서는 등 국제무대에서 한의학의 위상을 강화하는 활동을 수행하고 있습니다. 우리 연구원은 이제 한의학이 당당히 미래의학으로서 거듭나기 위해 역할을 다하고자 합니다.
우리가 꿈꾸는 미래를 위해 의과학 기술혁신을 위한 융합형 기초 원천연구를 강화하며 뇌와 경혈의 융합연구를 추진하겠습니다.
특히 지난 2일 첫삽을 뜬 침구경락 ICT 융합연구센터는 침구경락의 과학적인 근거를 밝히는 데 기여하고 미래 한의학연구의 거점이 될 것 입니다. 한의의료기술의 디지털 대전환을 주도하겠습니다. 우리는 원격의료의 보편화, 진단과 치료의 혁신, 첨단의약기술의 등장 등 변화하는 의료환경에 대비하는 한의학의 디지털 대전환을 주도하여 기술을 개발하고 산업화함으로써 첨단 바이오의 전략연구사업에 기여하 겠습니다. 오늘 이 자리는 우리 연구원과 국내외 최고의 전문가들이 나서 앞으로 한의학이 나아가야 할 방향을 논의하는 귀중한 자리가 되길 기대합니다.

내외 귀빈 여러분,
우리 연구원은 30주년을 맞아 올해 초 전체 임직원이 참여한 공모를 통해 30주년 슬로건을 제정했습니다. 건물 밖에 큼직하게 '과학의 날개로 세계로 향한다'라는 플래카드가 걸려 있습니다. 우리가 생각하는 미래의 한의학은 현대과학과의 접목을 통해 선대로 부터 물려받은 한의학의 근거를 강화하고 첨단과학기술과의 융합을 통해 새로운 한의학으로 태어나야 한다는 염원을 담아 제정한 슬로건입니다. 우리 한국한의학연구원은 이런 염원을 기억하면서 전진에 전진을 거듭 하겠습니다.

다시 한 번 한국한의학연구원 개원 30주년 기념 국제심포지엄에 참석 해주신 내외귀빈 여러분과 전문가 여러분, 준비에 애써주신 모든 분들께 감사의 말씀을 드립니다.

감사합니다.

2024. 10. 29

한국한의학연구원 원장 이 진 용

CONGRATULATORY REMARKS

〈INTERNATIONAL SYMPOSIUM COMMEMORATING THE 30TH ANNIVERSARY OF KOREA INSTITUTE OF ORIENTAL MEDICINE〉

Distinguished Guests and Participants, It is an honor and a pleasure to be here today.
I am Yoon Sung-chan, President of the Association of Korean Medicine.
First, I sincerely congratulate the Korea Institute of Oriental Medicine, dedicated to the advancement of Korean medicine research, for the successful hosting of this international symposium on the occasion of its 30th anniversary. I would also like to express my deep gratitude to President Lee Jin-yong, all the members of the institute, and the presenters, who have successfully prepared this international symposium despite the challenging internal and external circumstances.

The theme of today's international symposium is "Traditional Medicine as Future Medicine." Korean medicine, with its accumulated clinical experience and treatments spanning over five millennia, has been healing humanity and is now being recognized as an alternative that offers a vision for the future of medicine through its fusion with modern science. At this pivotal time, I believe it is highly meaningful that experts from around the world have come together to engage in in-depth discussions on the relationship between Korean medicine and the future society, as well as between future technologies and Korean medicine.In particular, the Korea Institute of Oriental Medicine, which has spent the past 30 years working to promote and develop Korean medicine while uncovering its scientific mechanisms, is now driving forward with the development of new treatment technologies that utilize big data and artificial intelligence (AI) in response to the changing times. This will serve as a driving force that further enhances the value of Korean medicine as future medicine. In this regard, today's international symposium not only provides an opportunity to reflect on the achievements of the past 30 years but also to explore the future direction of Korean medicine in safeguarding human health and life, while considering what role Korean medicine can play in medical innovation.

I sincerely hope that this symposium will lead to greater collaboration and exchange, and serve as an opportunity for Korean medicine to further develop as a valuable asset and medical resource for all of humanity, and to fully realize its potential. As an organization that has been part of the Korea Institute of Oriental Medicine's founding, the Association of Korean Medicine promises to fully cooperate so that both institutions can continue to fulfill the historic mission of promoting human health and advancing Korean medicine together.

Last but not least, I would like to express my sincere gratitude to all the researchers and relevant members who have accompanied the Korea Institute of Oriental Medicine in its journey for the past 30 years.
I also wish for even greater achievements and advancements in the next 30 years.
Wishing health and happiness to you all, I once again extend my heartfelt congratulations on the 30th anniversary of the Korea Institute of Oriental Medicine.

2024. 10. 29

Yoon Sung-chan
President of the Association of Korean Medicine

축 사

〈한국한의학연구원 개원 30주년 기념 국제심포지엄〉

안녕하십니까? 대한한의사협회장 윤성찬입니다.
먼저, 전심전력을 다해 한의학 연구에 매진해 온 한국한의학연 구원의 개원 30주년 기념 국제심포지엄을 진심으로 축하드립니다.
그리고 대내외 어려운 상황에도 불구하고 성공적으로 국제심포지엄 준비하신 이진용 원장님을 비롯한 모든 연구원 가족 여러분과 발표를 맡아 주신 강연자 여러분께도 깊은 감사의 말씀을 드립니다.

오늘 국제심포지엄의 주제는 '미래의학으로서의 전통의학'입니다.
한의학은 지난 반만년의 축적된 임상경험과 치료법으로 인류를 치료하고 있으며, 현대 과학과 융합하여 의학의 미래를 제시하는 대안으로 각광받고 있습니다. 이러한 시점에 세계의 전문가들이 함께 어울려 미래사회와 한의학, 미래기술과 한의학에 대해 심도 깊게 논의하는 소중한 자리가 마련된 것은 매우 뜻 깊은 일이라고 생각합니다. 특히 30년간 한의학 육성 · 발전을 위해 노력하고 과학적 기전을 밝혀 한의학연구원이 시대의 변화에 부응하는 빅데이터와 인공지능(AI)를 활용한 새로운 치료기술 개발에 박차를 가하고 있는 것은 미래의학으로서 한의학의 가치를 더욱 빛나게 하는 원동력이 될 것입니다. 이러한 점에서 오늘 국제심포지엄은 지난 30년의 성과를 되돌아 볼 뿐 아니라, 인류의 건강과 생명을 수호하기 위해 한의학의 발전 방향을 모색하고 의료 혁신에 한의학이 어떤 역할을 할 수 있을지 고민하는 기회가 될 것입니다.

모쪼록, 이 자리를 통해 더 나은 협력과 교류가 이루어지기를 기대하며, 한의학이 인류 모두의 자산이자 의학으로 발전하고 그 가치를 발휘할 수 있는 계기가 되기를 바랍니다.
대한한의사협회 역시 한국한의학연구원의 태동을 함께한 단체로써 인류의 건강증진과 한의학 발전이라는 역사적 사명을 양 단체가 함께 수행해 나갈 수 있도록 최선을 다해 협력해 나갈 것을 약속드립니다.

끝으로, 한국한의학연구원의 지난 30년을 함께해 주신 모든 연구자들과 관계자분들께 진심으로 감사드리며, 앞으로의 30년 역시 더욱 찬란한 성과와 발전이 함께하기를 기원합니다.
여러분 모두의 건강과 행복을 기원하며, 다시 한 번 한국한의학연 구원 30주년을 진심으로 축하드립니다.

감사합니다.

2024. 10. 29

대한한의사협회 회장 윤 성 찬

CONGRATULATORY REMARKS

〈INTERNATIONAL SYMPOSIUM COMMEMORATING THE 30TH ANNIVERSARY OF KOREA INSTITUTE OF ORIENTAL MEDICINE〉

Distinguished guests, ladies and gentlemen,
I am Choi Do-Young, President of the Society of Korean Medicine.
I sincerely congratulate the Korea Institute of Oriental Medicine, a leading institution in Korean medicine R&D and a pioneer in the future of Korean medicine, on its 30th anniversary during this season of abundance. I am also very pleased to participate in the international symposium held to commemorate this momentous year. First, I would like to express my gratitude to Director Jin-Yong Lee of the Korea Institute of Oriental Medicine and all the staff for their tireless efforts in preparing for this meaningful event. I would also like to thank the domestic and international presenters and distinguished guests who have joined us today out of their passion for Korean medicine.

Recently, Korean medicine has solidified its position in the global field of traditional medicine, playing a crucial role in promoting public health. These achievements are due to the continuous efforts of the Korea Institute of Oriental Medicine in scientifically elucidating the theories of Korean medicine and strengthening clinical evidence. Through this, the value and potential of our long-preserved Korean medicine have been scientifically proven, and its worth has been widely recognized through its integration with modern medicine.

I hope that this international symposium will serve as an important starting point for sharing insights on the latest research based on Korean medicine and for establishing a new medical paradigm through the convergence of advanced scientific technologies, extending beyond the development of Korean medicine. The Society of Korean Medicine will continue to strengthen its cooperation with the Korea Institute of Oriental Medicine as we work together toward our shared goal of providing high-quality medical services and promoting public health.

Once again, I sincerely congratulate the Korea Institute of Oriental Medicine on its 30th anniversary.
I hope this international symposium will serve as an opportunity to reflect on the value of Korean medicine and help establish it as a key pillar in leading the future of medicine.
I wish happiness and peace to all of you and your families in attendance today.

Thank you.

2024. 10. 29

Choi Do-Young
President of the Society of Korean Medicine

축 사

〈한국한의학연구원 개원 30주년 기념 국제심포지엄〉

안녕하십니까, 대한한의학회 회장 최도영입니다.
풍성한 결실의 계절에 한의학 R&D의 산실이자 한의학의 미래를 선도하는 한국한의학연구원이 개원 30주년을 맞이하게 된 것을 진심으로 축하드립니다.
또한 이번 기념비적인 해를 기념하여 개최된 국제심포지엄에 함께 하게 되어 매우 기쁘게 생각합니다.
먼저, 이 뜻깊은 자리를 준비하기 위해 많은 노고를 아끼지 않으신, 한국한의학연구원 이진용 원장님과 관계자 여러분께 감사드리며, 한의학에 대한 열정으로 이 자리에 참석 해주신 국내 · 외 발표자 여러분과 내빈 여러분께도 감사의 말씀을 전합니다.

최근 우리 한의학은 세계 전통의학 분야에서 확고한 입지를 다지며, 국민 건강 증진에 중요한 역할을 차지하고 있습니다. 이러한 성과는 한국한의학연구원이 한의학 이론을 과 학적으로 규명하고, 임상 근거를 강화하기 위해 꾸준히 노력해 온 덕분입니다. 이를 통해 오랜 시간 지켜온 우리 한의학의 가치와 잠재력을 과학적으로 입증하고, 나아가 현대 의학과의 융합을 통해 그 가치를 널리 알릴 수 있었습니다.

이번 국제 심포지엄이 한의학을 바탕으로 한 최신 연구에 대한 지견을 공유하고, 한의학 발전을 넘어 첨단 과학기술과의 융합을 통한 새로운 의료 패러다임을 구축하는 중요한 출발점이 되기를 희망합니다.
대한한의학회는 앞으로도 한국한의학연구원과의 협력을 강화하며, 양질의 의료서비스 제공과 국민건강 증진이라는 공동의 목표를 위해 함께 나아가도록 노력하겠습니다.

다시 한번 한국한의학연구원 개원 30주년을 진심으로 축하드리며, 이번 국제 심포지엄이 한의학의 가치를 되새기고, 한의학이 미래 의학을 선도하는 중요한 축으로 자리잡는 계기가 되길 바랍니다.
참석하신 모든 분들의 가정에 행복과 평안이 가득하시길 기원합니다.

감사합니다.

2024. 10. 29

대한한의학회 회장 최 도 영

KOREA INSTITUTE OF ORIENTAL MEDICINE
INTERNATIONAL SYMPOSIUM

PRESENTATION

Byungmook LIM

Pusan National University

THE PAST, PRESENT, AND FUTURE OF TRADITIONAL KOREAN MEDICINE RESEARCH

KIOM 30th Anniversary International Symposium

The Past, Present, and Future of Korean Medicine Research

LIM, Byungmook. KMD. MPH. PhD.

PUSAN NATIONAL UNIVERSITY
School of Korean Medicine

PUSAN NATIONAL UNIVERSITY KIOM

Past

Before the 1990s

Research of Korean Medicine has been conducted mainly at colleges of Korean Medicine and colleges of pharmacy since the 1970s.

- Main purpose of research was to verify the efficacy of a specific prescription or herbal medicine.
- Experimental studies using mice or rats
- Reviews of the classical medical literature

3

Examples

- A literature study related to the serious condition of abdominal pain (1974)
- A experimental study of the effect of yellow-colored light on the body weight of a rat (1975)
- Effects of Baekso-hwan on Carbon Tetrachloride-induced Liver Damage in Rats (1978)
- A Study on the theory of the Yeong-Su-Bo-Sa (迎隨補瀉) acupuncture manipulation techniques (1978)

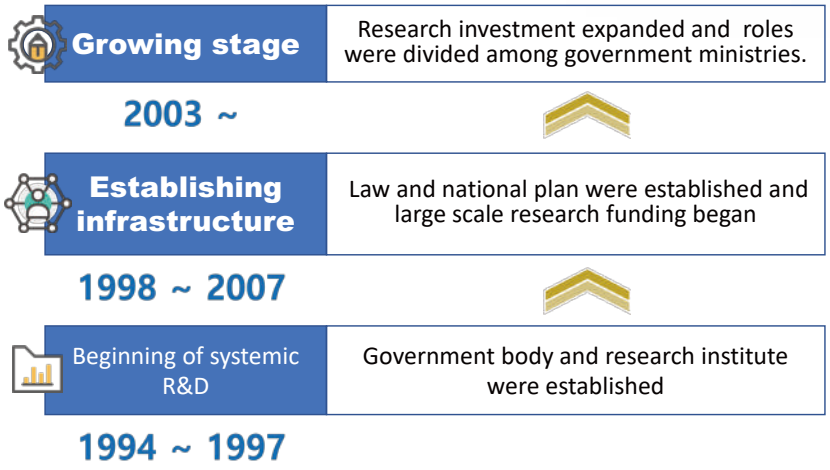
4

Implementation of Korean Medicine coverage in Public Health Insurance

- In 1987, Korean Medicine therapies, mainly acupuncture and herbal preparations, began to be covered in the National Health Insurance.
- Use of Korean medicine has increased rapidly.
- As more Korean Medicine colleges were established, the pool of research personnel had expanded.
- 5 colleges -> 11 colleges

5

Growth of Korean Medicine R&D



6

Big dispute on Herbal Medicines

- In 1993, Korean Medicine doctors and (Western) Pharmacists clashed over the scope of dispensing authority of herbal medicines.

7

Agreed arbitration and its results

- Implementing the dualised pharmaceutical system
- Enforcement of herbal license exams for western pharmacists
- Separation of prescribing and dispensing herbal medicines
  - ✓ caused the separation only in western medicine in 2000

8

Before herbal medicine dispute

	Herbal Medicines		Western drugs	
	Prescribing	Dispensing	Dispensing	Prescribing
Korean doctor	■			
Western doctor			■	
Pharmacist		■		

After herbal medicine dispute

	Korean Medicines		Western drugs	
	Prescribing	Dispensing	Dispensing	Prescribing
Korean doctor	■			
Western doctor				■
Pharmacist		■		
Herbal Pharmacist		■		

9

PERGAMON

Social Science & Medicine 51 (2000) 505–520

SOCIAL SCIENCE & MEDICINE

www.elsevier.com/locate/socscimed

The politics of herbal drugs in Korea

Byong-Hee Cho

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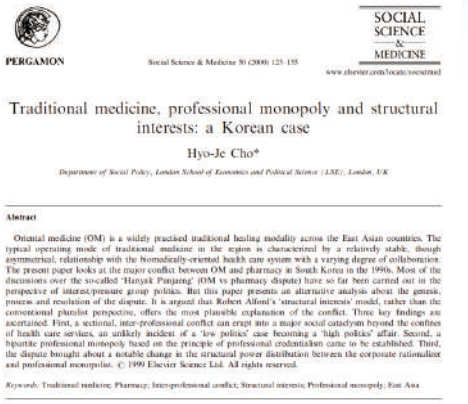
Abstract

Hanbang, the Korean medical practice with origins in classical Chinese texts, is a prominent part of the Korean health care system. Hanbang physicians, called hanuisas, are looked down on by biomedical doctors, but their practice has enjoyed increasing popularity for several decades. As the market for herbal preparations has become more lucrative, biomedical pharmacists have begun to participate in it. The Pharmaceutical Act in 1993 explicitly allowed pharmacists to prescribe and dispense herbal drugs. This provoked a bitter public conflict between hanuisas and pharmacists, involving street demonstrations and strikes. The hanuisas asserted that the pharmacists were unqualified to assume their traditional practice. They also agitated for recognition in the state-sponsored system of health care and for the state's support for developing Hanbang medicine. This paper attributes the conflicts concerning Hanbang to the expanding market for herbal preparations, Korean nationalism, and to the oversupply of biomedical pharmacists. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Traditional Korean medicine; Asian medicine; Herbal drugs; Medical policy



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Social Science & Medicine 50 (2000) 123–135

SOCIAL SCIENCE & MEDICINE

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Traditional medicine, professional monopoly and structural interests: a Korean case

Hyo-Je Cho*

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Abstract

Oriental medicine (OM) is a widely practised traditional healing modality across the East Asian countries. The typical operating mode of traditional medicine in the region is characterized by a relatively stable, though asymmetrical, relationship with the biomedically-oriented health care system with a varying degree of collaboration. The present paper looks at the major conflict between OM and pharmacy in South Korea in the 1990s. Most of the discussions over the so-called 'Hanyak Punjaeng' (OM vs pharmacy dispute) have so far been carried out in the perspective of interest/pressure group politics. But this paper presents an alternative analysis about the genesis, process and resolution of the dispute. It is argued that Robert Alford's 'structural interests' model, rather than the conventional pluralist perspective, offers the most plausible explanation of the conflict. Three key findings are ascertained. First, a sectional, inter-professional conflict can erupt into a major social cataclysm beyond the confines of health care services, an unlikely incident of a 'low politics' case becoming a 'high politics' affair. Second, a bipartite professional monopoly based on the principle of professional credentialism came to be established. Third, the dispute brought about a notable change in the structural power distribution between the corporate rationalizer and professional monopolist. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Traditional medicine; Pharmacy; Inter-professional conflict; Structural interests; Professional monopoly; East Asia

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During the herbal medicine dispute, Korean Medicine doctors demanded that the government provide support for the development of Korean Medicine.

- Installation of Korean Medicine department within the Ministry of Health and Welfare, etc.
- Establishment of government-supported research institute on Korean Medicine
- Establishment of National college of Korean Medicine
- Appointing Korean Medicine doctor as Military doctor and public health doctor

11

Start of government funding for Korean Medicine R&D

1994. Korea Institute of Oriental Medicine opened

- The first government-funded research organization for traditional medicine under Ministry of Health & Welfare
- It became possible to conduct large-scale, long-term research projects under systematic planning.

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- In accordance with the government's plan to foster Korean Medicine announced in 1996, Ministry of Health & Welfare launched the 'Korean Medicine development research project' with a budget of 2.2 million USD.
- This project was converted to long-term program (1998-2010) with a total budget of 153million USD.
- It was a project that encompassed from basic research to clinical research and practical application research, but only one-fifth of the planned budget was invested.

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Changes in the external environment

- In 1992, Korea established diplomatic relations with China.
- China's drive to develop traditional Chinese medicine recognized.
- Interest in alternative medicine has increased in the US and Europe in the 1990s
- NCCIH (NCCAM) was established in 1998.

14

Growth of Korean Medicine R&D funding

- From 2004, the Korea Institute of Oriental Medicine began to receive large-scale research budgets from the Ministry of Science and ICT, and the investments from the Ministry of Health and Welfare also increased.
- The Act on the Promotion of Korean Medicine was implemented in 2004, which stipulated government's obligation to support Korean Medicine R&D.

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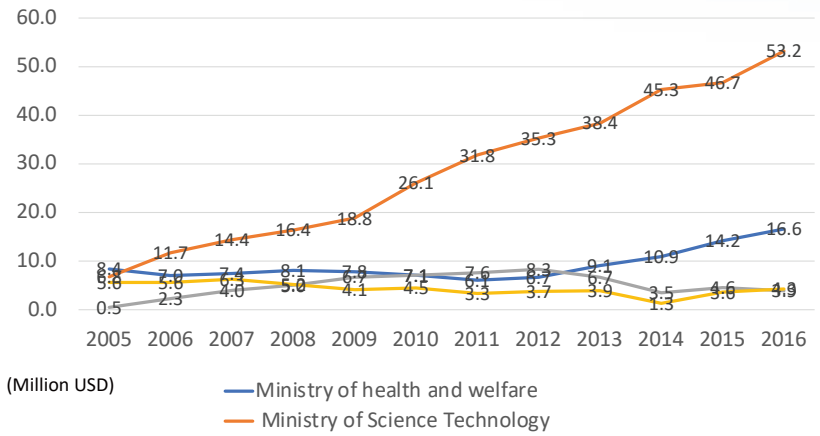
Annual growth of government funding



* KIOM & Pusan Natl Univ, et al. Yearbook of Korean Medicine. 2018.

16

Adjustment of inter-ministerial roles

- As each ministry's investment in R&D has increased, there has been a recognition that investment efficiency should be increased.
- In 2008, Through pan-government discussions, the division of roles for research and development among ministries was established.

17

Ministry	Field of research
Ministry of Science and ICT	Basic and original technology - Ingredient exploration - Identification of Effectiveness Mechanisms Multidisciplinary large-scale study
Ministry of Health and Welfare	Clinical research to find treatment technology Research on cooperative treatment of Korean Medicine and western medicine
Ministry of Trade, Industry and Energy	Development of medical devices Commercialization research Enhancement of industrial competitiveness
Ministry of Food and Drug Safety	Evaluation and management of Quality and safety of herbal medicines and medical devices

* Yu SJ. Recommendations for advancement of Korean medicine R&D and activation of the Korean medicine industry. KISTEP R&D focus. Vol 4. 2008.

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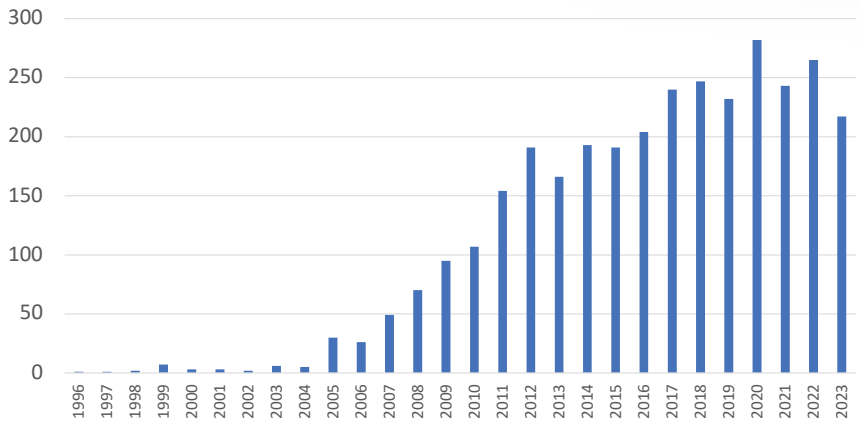
No. of SCI(E) publication of KIOM



* KIOM. Internal document. 2024.

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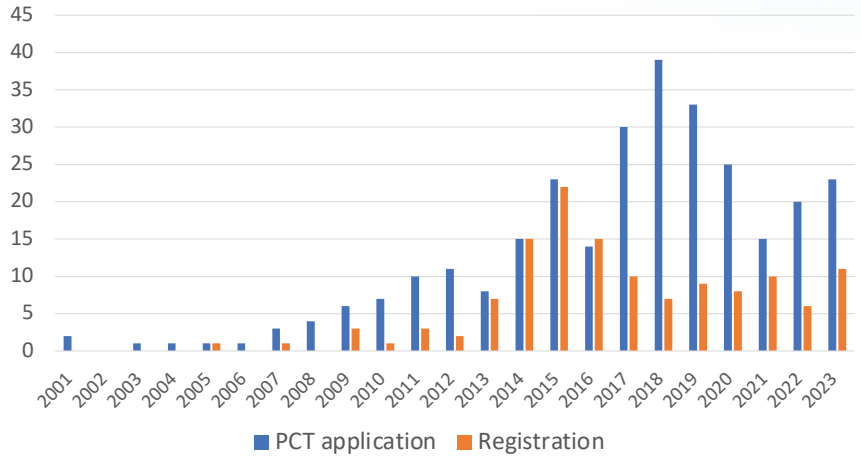
No. of patents of KIOM



* KIOM. Internal document. 2024.

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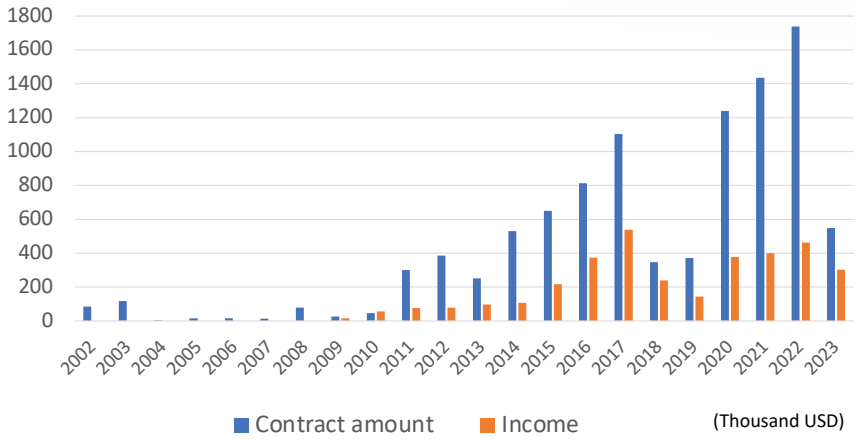
Technology transfer of KIOM



* KIOM. Internal document. 2024.

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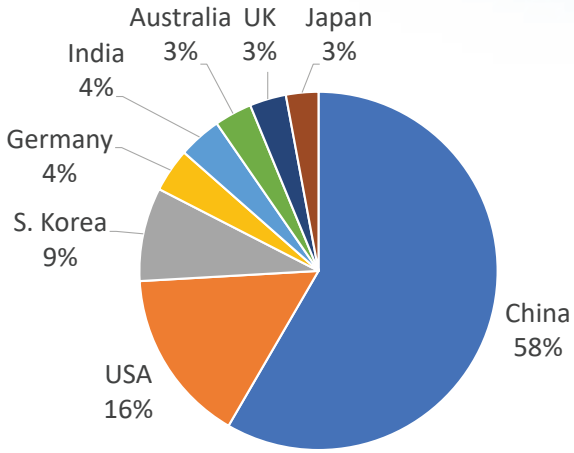
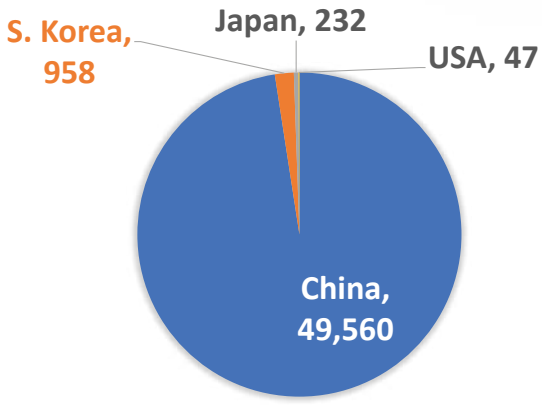
No. of paper publication (2003-2022)



* KIOM. Research on analysis of research results of Korean Medicine R&D. 2023.

22

No. of patent applications (2003-2022)



* KIOM. Research on analysis of research results of Korean Medicine R&D. 2023.

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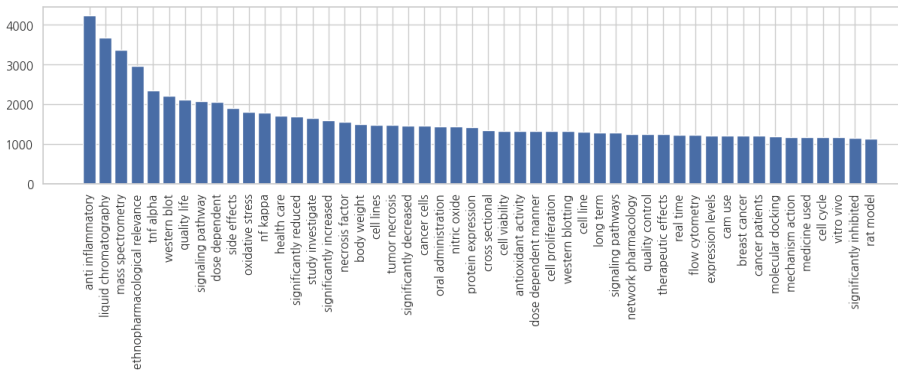
Top keywords (2003-2022)

in the 50,654 paper abstracts



* KIOM. Research on analysis of research results of Korean Medicine R&D. 2023.

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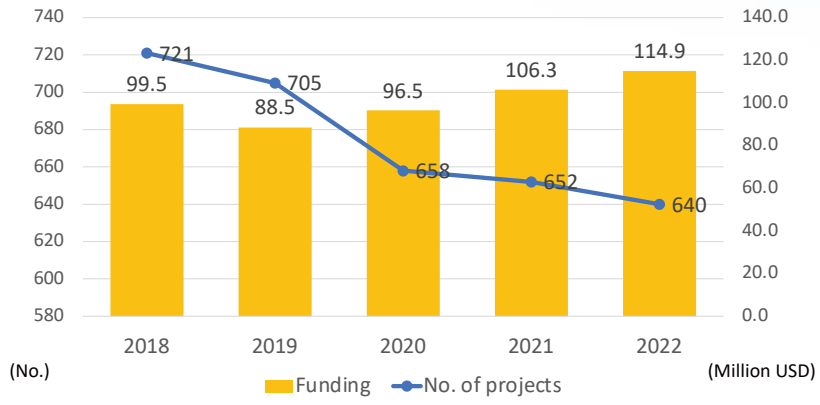
Present

KIOM

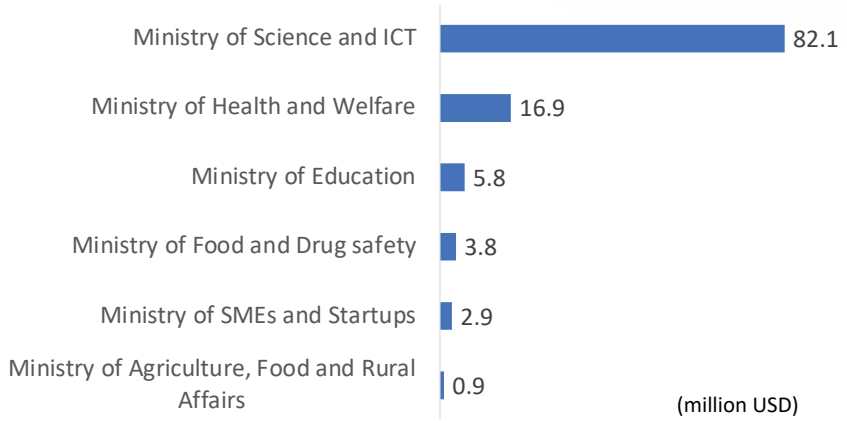
Government funding for Korean Medicine R&D



* KIOM. Analysis report on the National R&D Project for Korean Medicine. 2023.

26

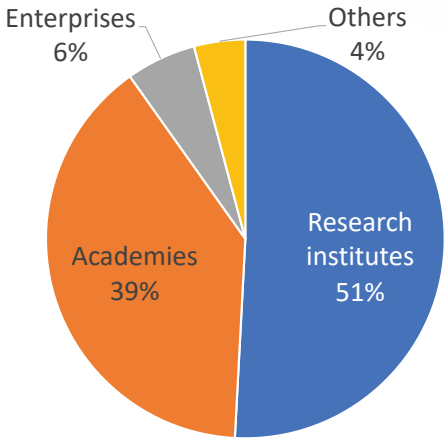
Government funding for Korean Medicine R&D (2022)



* KIOM. Analysis report on the National R&D Project for Korean Medicine. 2023.

27

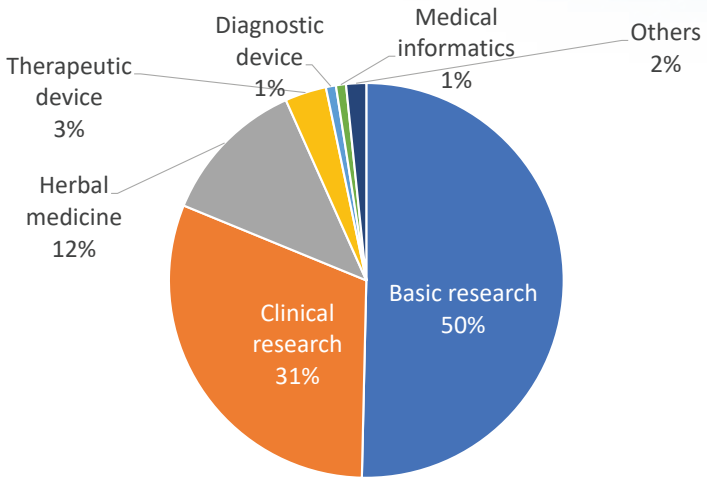
Who spent the money? (2022)



* KIOM. Analysis report on the National R&D Project for Korean Medicine. 2023.

28

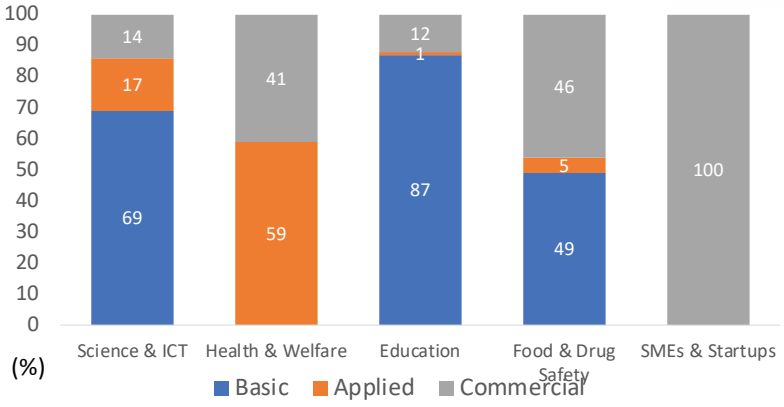
Categories of research field (2022)



* KIOM. Analysis report on the National R&D Project for Korean Medicine. 2023.

29

Research fields by supporting Ministries (2022)



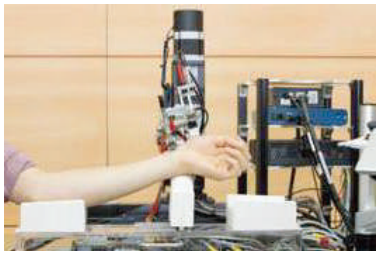
* KIOM. Analysis report on the National R&D Project for Korean Medicine. 2023.

30

What has been achieved so far

Diagnosis

- Pulse detection device
- Tongue diagnostic device
- identification system of Sasang constitution



* KIOM. Korean Medicine project 50 Making future. 2016.

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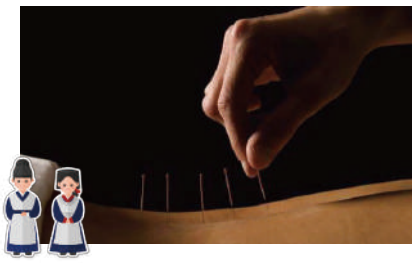
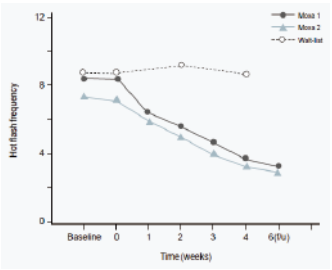
Acupuncture and moxibustion

- Scientific investigation into the analgesic effect of acupuncture
- Effect of electric acupuncture to reduce side effects of anti-cancer therapies
- Verification of acupuncture effect for Osteoarthritis, Hot flush, Xerophthalmia, etc.





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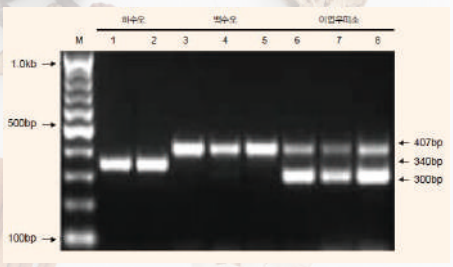
Herbal medicine

- Evidence building of herbal therapies
- Discrimination of herbal medicines
- Investigation of herbal medicine for anti-virus, atopy, thrombosis, etc.



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Information research

- Korean translation of classic medical literature
- Multi-lingual translation of Korean Medicine literature
- Semantic searching system of Korean Medicine

34

EBM & Standardization

- Development of Clinical practice guidelines (CPG) of Korean Medicine therapies
- contributed to expand health insurance coverage
- International and domestic standardization of acupuncture needle and moxibustion

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Problems are...

- Despite continuous investment, core performance and industrialization are insufficient.
- Lack of linkage between basic and clinical studies due to inter-ministerial barriers
- The gap between on-site demand and R&D investment

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Demand vs Investment

Rank	Research demand		Investment
	General public	Korean Medicine doctor	
1	Cooperation of KM & WM	Standardization of diagnosis	New drug development
2	Mixed use of western and herbal drugs	Clinical convergence research	Standard identification of constitution
3	Herbal formula information	Effectiveness and safety of herbal medicine	Evaluation of components of herbal medicine
4	Non-drug effectiveness and safety	Guideline for prescribing herbal medicine	Applied development of herbal medicine
5	Effectiveness and safety of herbal medicine	Guideline for non-drug therapies	Herbal medicine standard
6	Standardization of diagnosis	Mechanism identification of non-drug therapies	Medical device development
7	-	Standardization of medical information	Effectiveness of herbal formulae
8	-	-	Standard acupuncture skill

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Mismatch between demand and investment

- Lack of research investment in East-West medicine cooperation and parallel use
- Also a lack of research support to provide evidence on the effectiveness and safety of Korean Medicine treatment
- Less research support for acupuncture and moxibustion compared to herbal medicine
- Very little research with policy demand

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KIOM

Ministry of Science and ICT

- Basic and original technology
- Multidisciplinary large-scale study

Government funded research institutes
(KIOM, KRIBB, etc.)
Colleges

Ministry of Health and Welfare

- Clinical research to develop treatment technology
- Research on cooperative treatment of Korean Medicine and western medicine

Colleges
(Korean Medicine, Medicine, Pharmacy, etc.)

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Future

4th Korean Medicine development plan (2021-2025)

- Support for full-cycle R&D from clinical research to industrialization
- Expansion of clinical research support
- Building digital healthcare platform for Korean Medicine
- Research support to diversify the application areas of Korean Medicine
- Herbal medicine research for treatment of chronic and geriatric diseases
- Developing Korean Medicine treatments against new infectious diseases

* Ministry of Health & Welfare. 4th National plan for developing Korean Medicine. 2021.

41

- Establishment of infrastructure to utilize big data and AI in Korean Medicine
- Building big data hub center
- Establishment of Big data-based AI development system
- Expansion of public research infrastructure
- Establishment of clinical research centers for Korean Medicine
- Expansion of herbal medicine material bank

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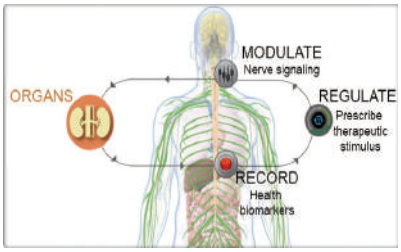
KIOM's future research strategy

- Convergence-type basic and original research
- Brain neuroscience-based acupuncture meridian study
- Making an acupuncture point-nerve maps
- Developing advanced acupuncture point stimulation technology
- Developing biosignal sensing technology



* KIOM. Korean Medicine 2050 Future Vision and Future Image. 2023.

43

Digital transformation in Korean Medicine

- Digital convergence device
- Digital therapeutics using Korean Medicine
- Korean Medicine-based telemedicine
- Digital twin simulation for health prediction and management

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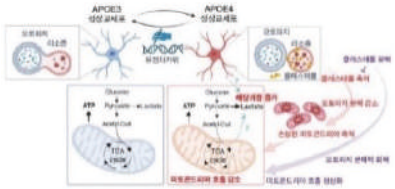
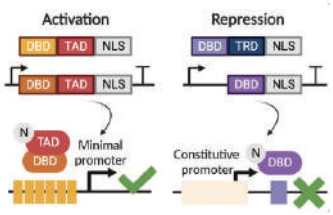
Creating future value of herbal medicine

- Herbal medicine-based next generation therapeutics
- Treating cancer, Alzheimer disease, mental disease, etc.
- Development of treatment technology for solving social problems
- new infectious diseases, infertility, geriatric disease, etc.
- Research on herbal medicine resources based on synthetic biology





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Summary

- Over the past 30 years, research in oriental medicine has made remarkable quantitative and qualitative growth centered around KIOM.
- It has accumulated achievements such as creating evidence for the effectiveness and safety of oriental medicine, clarifying the mechanism of acupuncture treatment, and standardizing diagnosis and treatment techniques.
- The lack of industrialization of research results and the mismatch between government support and on-site research demand are issues that need to be resolved.
- In order to cope with changes in the future health care environment, it is expected that convergence research utilizing cutting-edge science and digital health care research will be conducted.

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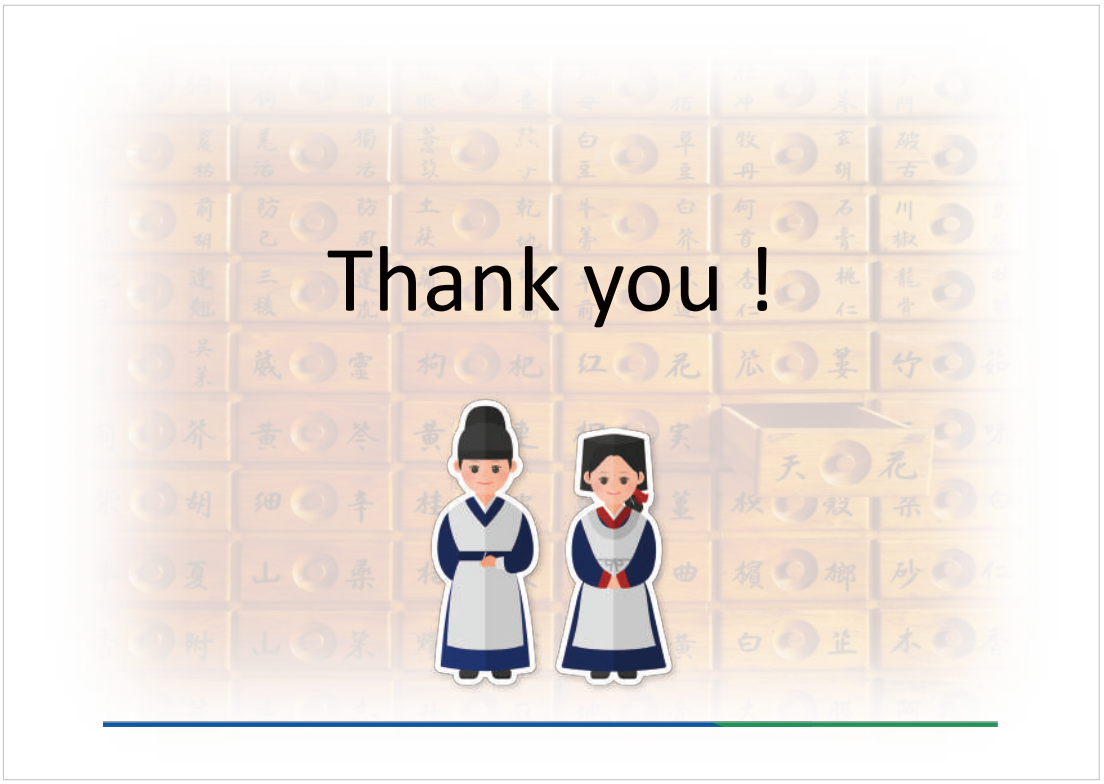

Thank you !

KOREA INSTITUTE OF ORIENTAL MEDICINE
INTERNATIONAL SYMPOSIUM

PRESENTATION

Jeffery Dusek

University of California–Irvine

LEVERAGING THE BRAVENET PRACTICE BASED RESEARCH NETWORK FOR UNDERSTANDING THE IMPACT OF INTEGRATIVE MEDICINE: THE PAST, PRESENT AND FUTURE

Leveraging the BraveNet Practice Based Research Network for Understanding The Impact of Integrative Medicine: The Past, Present and Future

- Jeffery Dusek I University of California–Irvine

Past, Present and Future of the BraveNet Practice Based Research Network

Jeffery Dusek, PhD

- Director of Outcomes Research, Susan Samueli Integrative Health Institute, University of California, Irvine
- Professor, Dept of Internal Medicine, School of Medicine, University of California, Irvine

UCI Susan Samueli Integrative Health Institute

What is the BraveNet PBRN?

Mission

To conduct and disseminate high quality practice-based research that evaluates the effectiveness, safety, and impact on patient experience of integrative medicine approaches.

BraveNet

BraveNet Focus

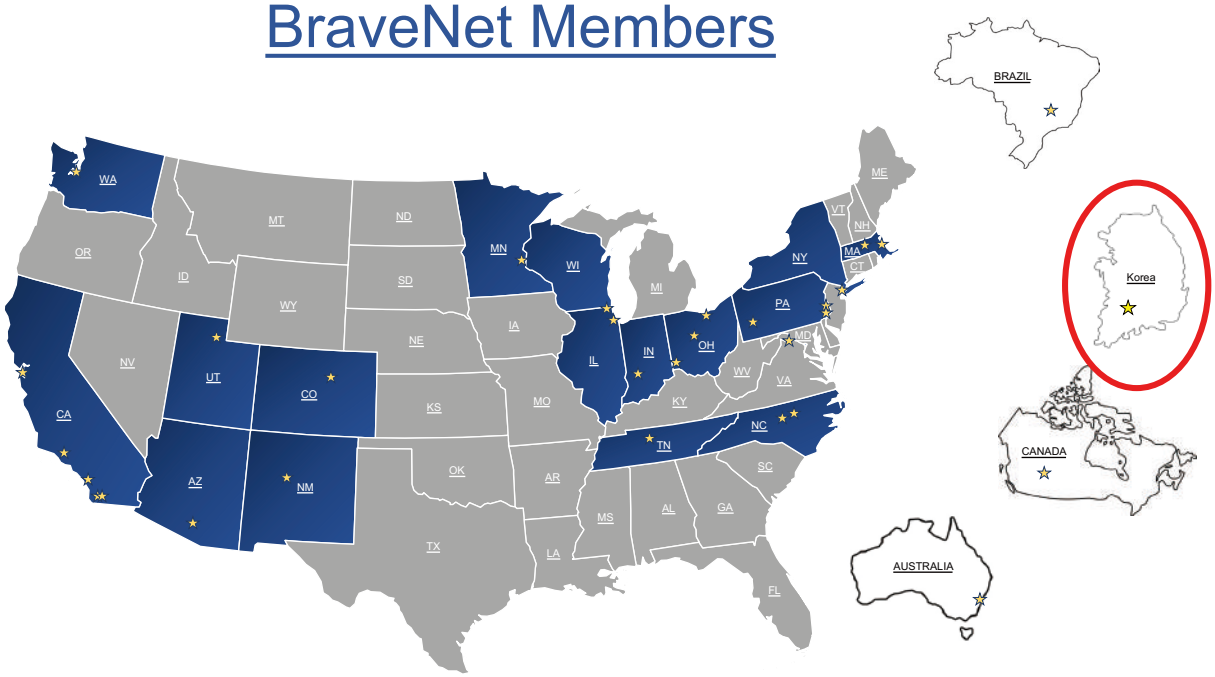
- 32 site **Practice Based Research Network**
- Focus on patient reported outcomes in real world integrative medicine (IM) settings
- Multi-site collaboration for
  - Observational ambulatory IM care
  - Randomized controlled trials

PRESENTATION

Leveraging the BraveNet Practice Based Research Network for Understanding The Impact of Integrative Medicine: The Past, Present and Future

- Jeffery Dusek I University of California–Irvine

BraveNet Members



Current BraveNet Members

1. **Irvine, CA** – Susan Samueli Integrative Health Institute, University of California, Irvine
2. **Albuquerque, NM** – **Center for Life and Integrative Medicine, University of New Mexico*****
3. **Bloomington, IN** – **University of Indiana*****
4. **Boston, MA** – Boston Medical Center
5. **Calgary, Alberta** – **ACTION Centre, University of Calgary*****
6. **Chicago, IL** – Osher Center for Integrative Medicine, Northwestern University Medical Center
7. **Cincinnati, OH** – Alliance Integrative Medicine
8. **Cleveland, OH** – Connor Whole Health
9. **Columbus, OH** – Center for Integrative Health and Wellness, Ohio State University
10. **Denver, CO** – University of Colorado
11. **Chapel Hill, NC** – **University of North Carolina Medical Center*****
12. **Durham, NC** – Duke Integrative Medicine, Duke University
13. **Los Angeles, CA** – **East West Clinic, University of California, Los Angeles*****
14. **Milwaukee, WI/Chicago, IL** – **Aurora Advocate Research Institute*****
15. **Minneapolis, Minnesota** – Penny George Institute for Health and Healing, Allina Health.

New Sites***

16. **Nashville, TN** – Osher Center for Integrative Medicine, Vanderbilt University Medical Center
17. **New York, NY** – **Department of Family Medicine, Mount Sinai*****
18. **New York, NY** – **Columbia University*****
19. **Philadelphia, PA** – Jefferson Myrna Brind Center of Integrative Medicine
20. **Philadelphia, PA** – **Integrative Health Program, Children's Hospital of Philadelphia*****
21. **Pittsburgh, PA** – Center for Integrative Medicine, University of Pittsburgh Medical Center
22. **Salt Lake City, Utah** – **Osher Center for Integrative Health, University of Utah*****
23. **San Diego, CA** – Scripps Center for Integrative Medicine
24. **San Diego, CA** – Centers for Integrative Medicine, University of California, San Diego
25. **San Francisco, CA** – Osher Center for Integrative Medicine, University of California, San Francisco
26. **São Paulo, Brazil** – **Brazilian Academic Consortium for Integrative Health*****
27. **Seattle, WA** – **Osher Center for Integrative Medicine, University of Washington*****
28. **Sydney, Australia** – **NICM Health Research Institute, West Sydney University*****
29. **Tucson, Arizona** – **Andrew Weil Center for Integrative Medicine*****
30. **Washington, DC** – **Integrative Medicine George Washington University*****
31. **Worcester MA** – University of Massachusetts Chan Medical School
32. **Daejeon, Korea- Korea Institute of Oriental Medicine, Daejeon Korea*****

UCI Susan Samueli Integrative Health Institute

BraveNet

BraveNet's Past

BraveNet Timeline: Multi-site Observational

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Registry Aims and Summary

Objective: To describe characteristics/motivation of patients seeking care at an IM clinic.

Design, Setting, and Participants: Patients from nine practice-based research network sites participated in this cross-sectional survey.

Main Outcome Measures: Demographics, lifestyle factors, and reasons for seeking IM care.

Results: 4,182 patients (84.5% white; 72.7% college- educated; and 73.4% female)

Top reasons for seeking IM:

1. "to improve health and wellness now to prevent future problems" (83.9%);
2. "to try new options for health care" (76.7%); and
3. "to maximize my health regardless of whether or not my illness is curable" (74.6%).

BraveNet Timeline: Multi-site Observational

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Study on Integrative Medicine Treatment Approaches for Pain (SIMTAP) Overview

Design: **Prospective, longitudinal observational study** conducted at 9 BraveNet clinical sites (2013)

Data Collection: *Patient Reported* data and Demographics:

Primary Outcome: Pain severity and interference

Patient-reported outcome measures collected at 4 time points: **baseline, 6, 12, 24 weeks**.

- **Brief Pain Inventory** —Pain Severity and Interference
- **Short Form 12** (SF12v)
- **Center for Epidemiologic Studies- depression** (CES-D)
- **Perceived stress scale-** (PSS-4)

Secondary Outcome: Vitamin D, CRP (baseline and 12 weeks)

Inclusion/Exclusion criteria: 18^{+} years, seen by a provider in IM clinics, chronic pain, $\geq$ 4/10 on NRS

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SIMTAP SUMMARY

- **409 enrolled and 252 (62%)** participants completed all follow-up visits.
- **White** (81%) and **female** (73%), age **49.1 years** (15.44) and **8.0** (9.26) years of chronic pain.
- **Decreased pain severity (–23%)** and **interference (–28%)** at 24 weeks.
- **Improved mood, stress, quality of life, fatigue, sleep** and **well-being** at 24 weeks. Depression (52%) at baseline to 35% at wk 24.
- **Vitamin D increased** from 33.4 (17.05) ng/mL at baseline to 39.6 (16.68) ng/mL at week 12.

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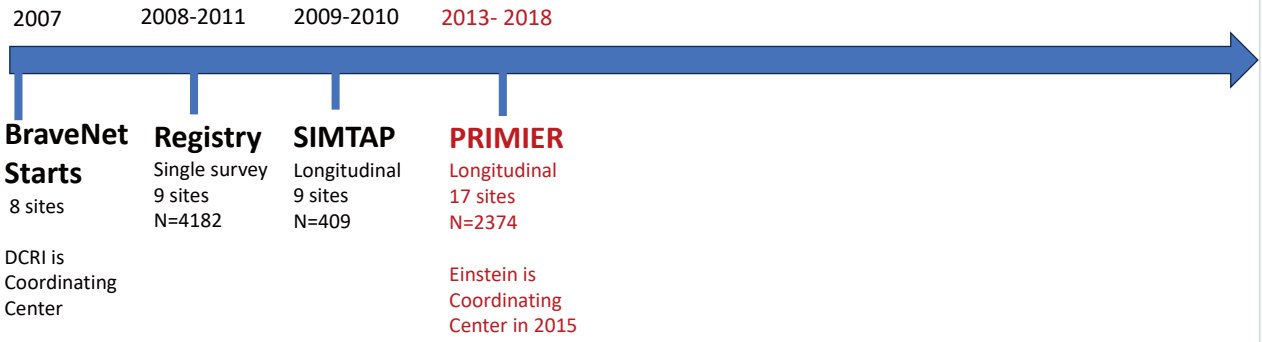
BraveNet Timeline: Multi-site Observational



Patients Receiving Integrative Medicine Effectiveness Registry (PRIMIER) Overview

Design: **Prospective, longitudinal, observational study** conducted at 17 BraveNet clinical sites (2013)

Data Collection: *Patient Reported* data and Demographics: Primarily **REDCap,** paper forms, electronic assessment center; *Health Service Utilization*: Electronic Health Records

Primary Outcome: Health related quality of life

Patient-reported outcome measures collected at 5 time points: **index, 2, 4, 6, 12 months**.

- **PROMIS-29** (physical function, anxiety, depression, sleep disturbance, fatigue, pain interference, social roles)
- **Perceived Stress Scale-4** (PSS4)
- **Patient Activation Measure** (PAM)

Secondary Outcome: Integrative Health service utilization (from electronic health records): **ICD diagnostic codes, CPT codes, Clinician type, Visit date**

Inclusion/Exclusion criteria: 18^{+} years, seen by a provider in IM clinics, consented to study

Recruitment: Flyers, QR Code in clinic, email blast to clinic patients, **Integration into clinical care**

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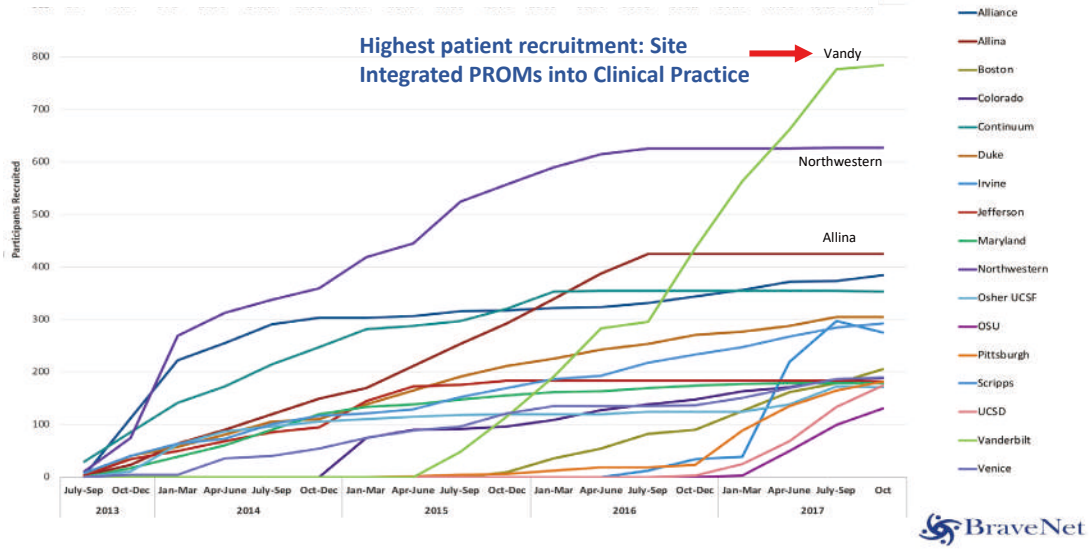
Final PRIMIER Participants Recruited by Site



BraveNet

PRIMIER Summary

- **2,374 (65%)** completed at least 1 follow-up assessment, had evaluable EHR data and ≥1 IM visit through 12 months
- **White** (88.4%), **female** (79.7%), **age=51.4** yrs and **college-educated** (78.5%).
- At index visit, **most common conditions** were **chronic pain**, **acute pain**, and **wellness**
- Significant improvements observed at 12-months on **all PROMIS-29 measures**, **PSS** and **PAM**
- At 12 months, clinically meaningful improvements found on **PROMIS-29 Mental Health** (38%) and **Physical Health** (28%) Summary scores
- **IM service utilization** was possible (albeit painful) with EHR extracts

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BraveNet

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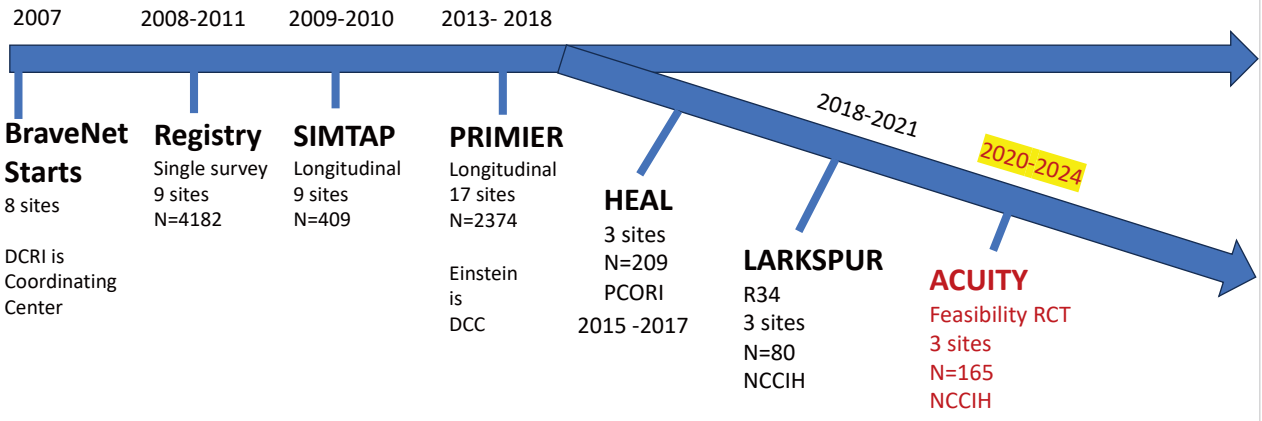
BraveNet's Present

BraveNet Timeline



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ACUITY: Aims

1. Develop a responsive **acupuncture** intervention
2. Implement a **feasibility RCT** in 3 emergency departments affiliated with BraveNet research sites
3. Assess implementation using **qualitative interviews** and **structured observation**

Icahn School of Medicine at Mount Sinai

NIH National Center for Complementary and Integrative Health 17 | University Hospitals | UC San Diego | Vanderbilt Health | BraveNet | UMass Chan Medical School | Einstein Albert Einstein College of Medicine

ACUITY: Study Summary

1.Recruitment:

- Despite challenges of launching/conducting study during COVID-19 pandemic, recruitment achieved (26.1%)
- 42% overall - 80% of subjects were African American/Black (UH)
- 13% overall - 45% of subjects were Hispanic (UCSD)
- A high % of low income & public insurance individuals were enrolled

2. Retention:

- Post-treatment rate: 91.5% 1-week follow-up: 77.6%

3. Adverse Events:

- Serious Adverse Event (n=2: not linked to acupuncture or usual care)
- AEs (n=61) were mostly mild and expected, unlinked to acupuncture

4. Overall:

- Strong framework for a future definitive study (UG3/UH3)

NIH National Center for Complementary and Integrative Health 18 | BraveNet | Vanderbilt Health | UC San Diego | University Hospitals | UMass Chan Medical School | Einstein Albert Einstein College of Medicine

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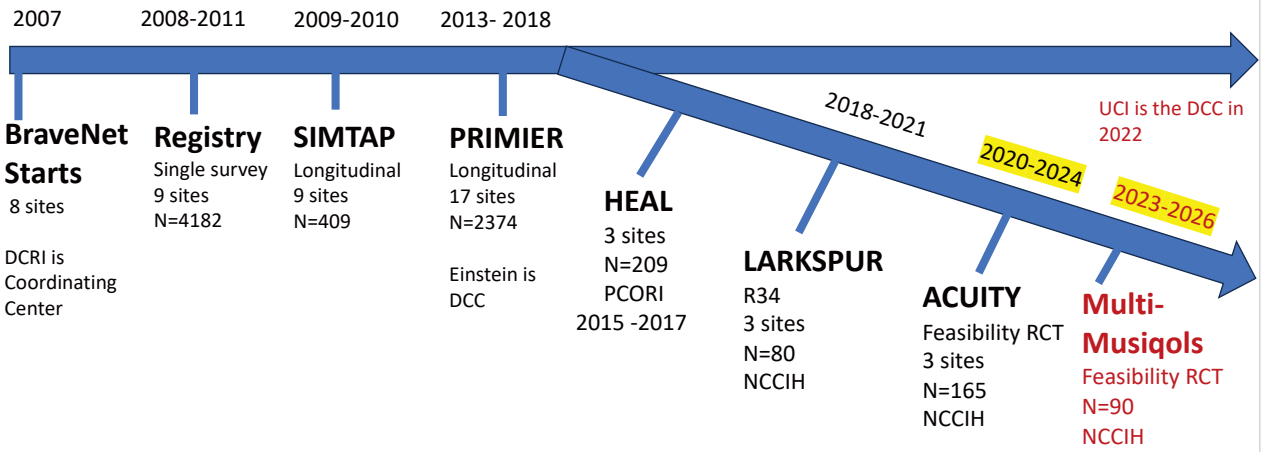
BraveNet Timeline



Multi Musiqols: Protocol

Aim 1) examine the feasibility of recruitment, retention, data collection, hybrid intervention implementation, and treatment outcomes overall and across sites

Aim 2) evaluate implementation outcomes (i.e., feasibility, adoption, appropriateness, acceptability, and treatment fidelity) and processes (i.e., strategies and barriers/facilitators) related to the MT intervention.

Multi Musiqols will provide the necessary framework for conducting a future, multi-site, pragmatic, RCT of MT compared with HealthEd.

NIH National Center for Complementary and Integrative Health
PRISMA HEALTH
University Hospitals
UCI Susan Samueli Integrative Health Institute

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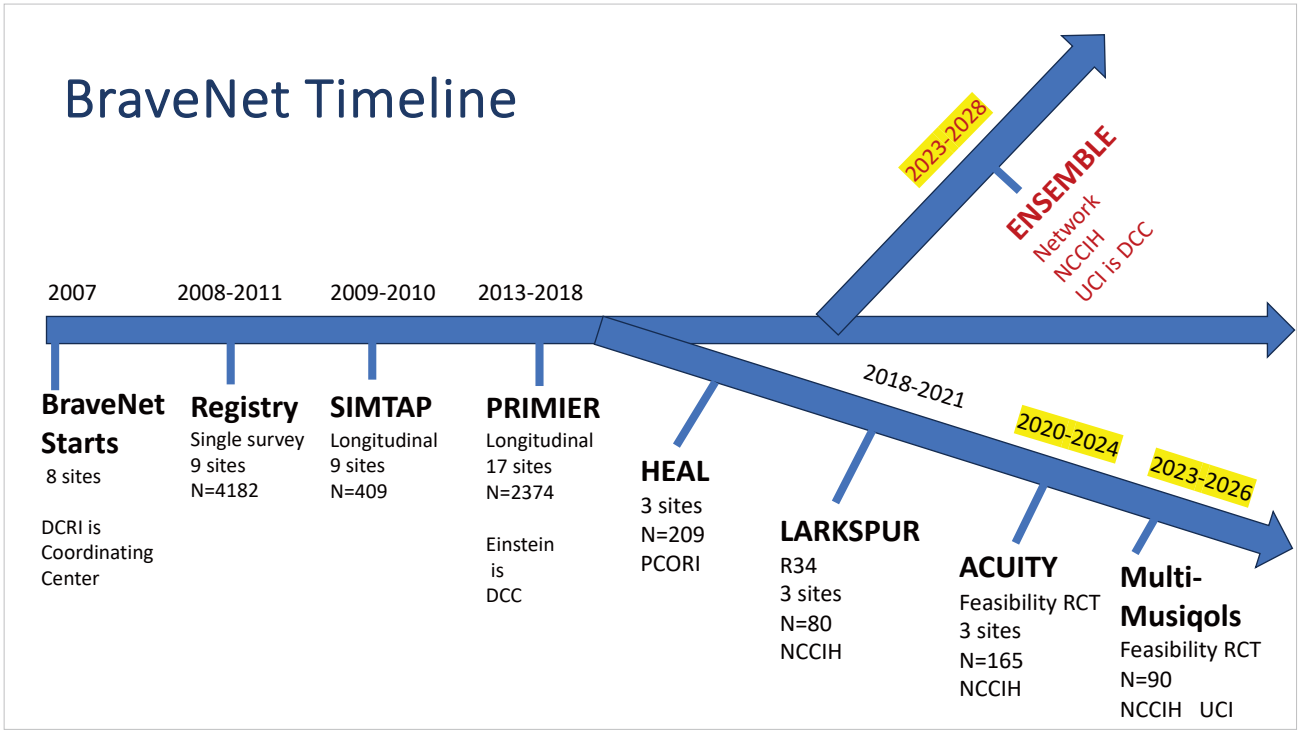

Effective Network to advance Scientific Evidence related to Mechanisms of music-Based interventions for pain and support coLlaborative Efforts (**ENSEMBLE**)

Aim 1: Promote meaningful, inclusive, and interdisciplinary collaboration between music therapists, mechanistic scientists, and pain + IHM researchers

Aim 2: Develop a comprehensive framework for conducting mechanistic studies in MT for pain management

Aim 3: Advance multiple pilot projects investigating novel biological mechanisms of action underlying the effects of MT interventions for various pain phenotypes

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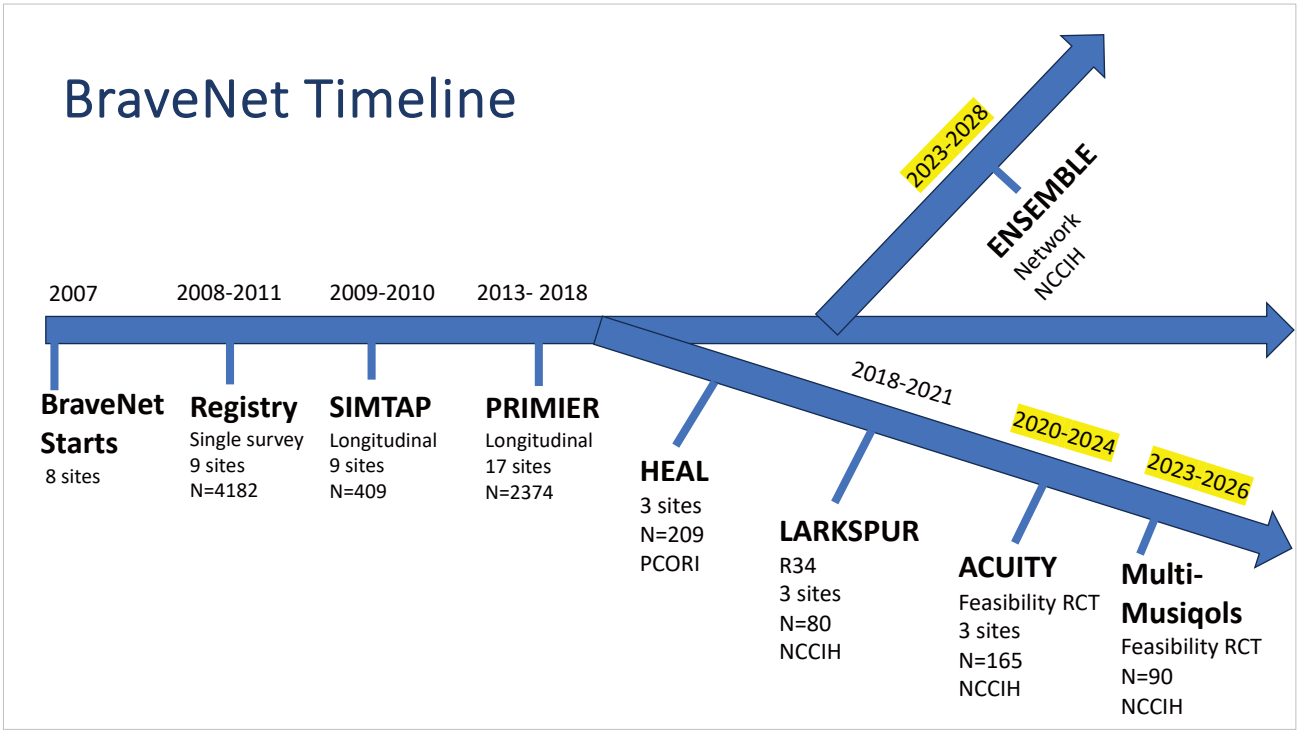

BraveNet's Future

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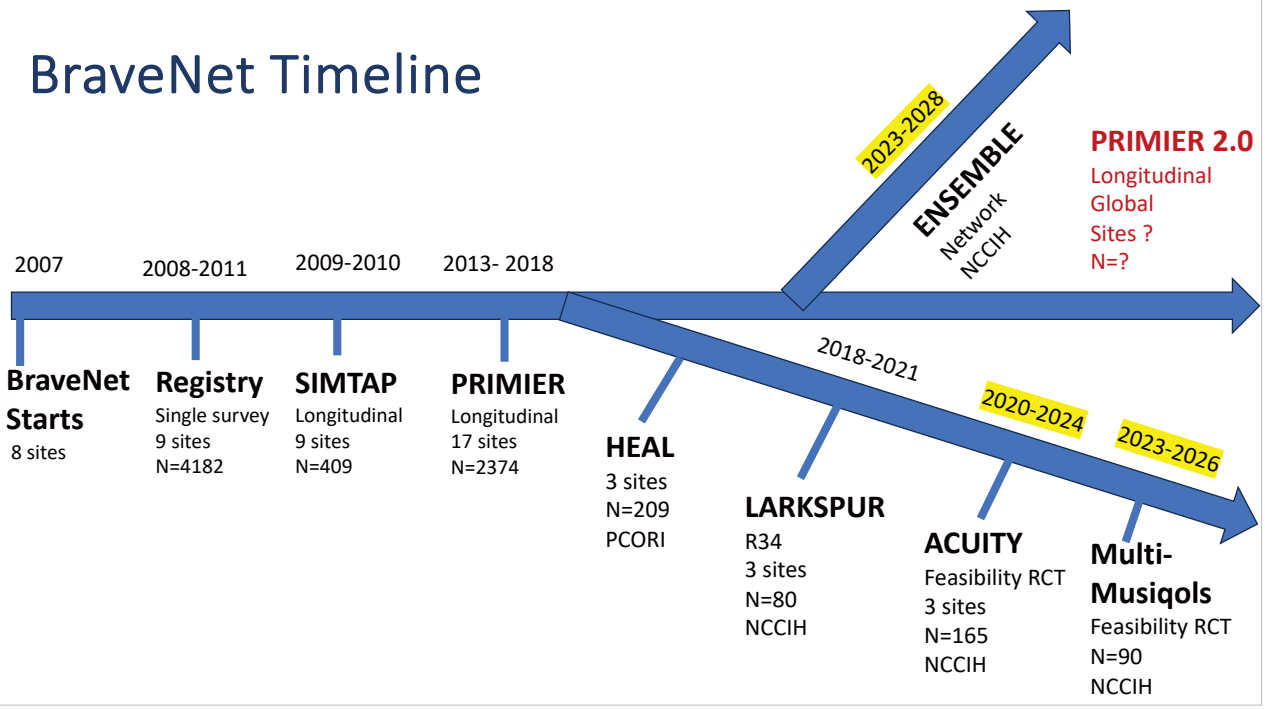
Future Directions for BraveNet: Future RCTs

- Maximize the opportunity for RCTs by using the BraveNet framework with diversity of practices
  - ✓Some practices are consultative whereas others are primary care
  - ✓Clinics vs whole hospitals of IM or CIH
- No BraveNet study has included global partners- this needs to change
- By working together, we will be able to explore and disseminate the impact of IM to the world!

BraveNet

BraveNet Timeline



Future Directions for BraveNet: PRIMIER 2.0

- Standardize IM documentation and data collection practices across sites using EHR with global partners
  - ✓PROMs: Use of Common Data Elements with customization for each clinical site's needs to **incorporate recruitment and data collection into routine clinical care**
  - ✓IM Utilization: Use of common visit types to be able to identify when IM has occurred
- Use of Propensity Score Matching to create comparison groups
- GOAL: deliver IM to the right patient, at the right time, at the right dose, for the most effective duration

BraveNet

Total outpatient visits in 2023 (19 sites 10 awaiting data)

Total: ~349,000

✓Acupuncture	78,633
✓Chiropractic	109,786
✓IM Consult	47,402
✓NP Consult	7,875
✓Massage Therapy	36,912
✓Mind/Body	4,810
✓Osteopathy	7,654
✓Physical Therapy	6,193
✓Biofield	10,029
✓Other	39,170

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Thank you

KOREA INSTITUTE OF ORIENTAL MEDICINE
INTERNATIONAL SYMPOSIUM

PRESENTATION

Changsub UHM

Korea University

TRANSFORMING THE PARADIGM OF KOREAN MEDICINE FOR FUTURE HEALTHCARE

2024.10.29. 14:00-14:20
한의학연 개원 30주년기념 국제심포지엄

미래의료와 한의학

- Trasforming the Paradigm of Korean Medicine for Future Healthcare -

고려대학교 의과대학 해부학교실
엄창섭

우리나라에 현존하는 2 주류 의학

서양의학

- 현대 사회에서 가장 보편적으로 사용되는 치유 방식
- 일반적 평가: 질병의 원인을 탐구하고 실험을 통해 증명하는 과학에 근거한 **과학적 지식체계**
- 개별적으로 정의된 질병에 국한하여 접근
- 타 학문의 지식을 흡수 융합하여 활용함으로써 새로운 지식과 기술 창출 및 융합이 용이함
- 의료인이 배타적 지위에 위치

한의학

- 학문보다는 사회화된 실용적 지식
- 일반적 평가: 질병의 구체적인 원인과 병리보다 몸의 건강을 경험적 연역적 방법으로 탐구하고 해결하는 **철학적 지식체계**
- 신체 전체의 조화를 중시하는 통합적 관점에서 질병에 접근
  - 한의학적 이론은 질병과 관련하여 이미 발생한 현상을 설명할 수 있으나 새로운 현상을 예측하거나 치료법을 추론하는데는 한계가 있음 (개별화된 치료법보다 처방을 중시)
- 도그마적 성격이 강해 권위에 대한 비판이 어려움

'의학(醫學)'에서 '한의학(韓醫學)'으로

- 서양 의학이 도입되기 전 우리나라 주류 의학의 전통은 하나
  - 황제내경: 중화적 전통 중국의학
  - 동의보감: 성리학적 의학
  - 향약집성방: 민중의 경험을 중시하는 실용의학
  - 동의수세보원: 중국 의학전통과 거리가 있는 독특한 의학체계
- 개항기 한의학의 특징
  1. 중화적 전통에 근거한 성리학적 정치 체계 옹호를 위한 논리 제공
  2. 일상 속의 실용의학: 실용의서(예: 방약합편)의 보급
  3. 새로운 의학 이론의 정립: 사상의학(이제마, 동의수세보원)의 도입

'의학(醫學)'에서 '한의학(韓醫學)'으로

- 실학자의 서양의학 소개와 선교사의 서양의학 도입에 대한 대응
  - 동도서기(東道西器) 정책에 따라 한의학의 도(道) 속에 서양의학의 기(器)를 담고자 함
    두 주류의학의 탄생 ⟹
- 일제강점기 중 한의학
  - 통감부의 한의학 비판: 동양적 전통을 미개 혹은 후진으로 서양문명을 근대 혹은 선진으로 인식한 일본이 전통의학 억압하는 정책
    - 한의사에게 서양의학(전염병)을 습득시켜 의생으로 활용
  - 제2차 세계대전 중 의료부족과 대동아공영권 제창으로 한의학 부흥정책
    - 한약조사위원회에서 한약에 대한 과학적 검증 시도
    - 한약약국방: 서양의학에 근거하여 한약을 화학적 성분에 따라 분류
      ⟹ 한약의 과학화를 통한 서양의학화 시도

'의학(醫學)'에서 '한의학(韓醫學)'으로

- 일제 말부터 시작된 한의학 부흥논쟁
  - 장기무 - 한방의학 부흥책: 서양의학이 가지는 제도적 장점 수용
  - 정근양 - 한방의학 부흥문제에 대한 제언: 한의학과 서양의학은 모두 동일한 의학이나 과학적인 서양의학을 중심으로 한의학이 보충, 서양의학교육기관에서 한의학 교육 주장
  - 조헌영 - 동서의학 비교 비판: 한의학은 학문의 측면이 아닌 조선인의 건강회복을 위한 도구로 필요
    - 서양의학: 국소처치 의술, 인공치료 의술, 정체의학, 치료의학, 방어의술, 외과의학, 획일주의 의학, 귀족의술, 관을 위한 의술
    - 한 의 학: 종합치료 의술, 자연치료 의술, 동체의학, 치본의학, 양생의술, 내과의학, 웅변주의 의학, 평민의술, 민을 위한 의술
  - 이을호 - 한의학 부흥론: 한의학에 서양의학 지식 수용

서양의학 속의 한의학

- 서양의학은 한의학을 포괄적인 대체-보완의학의 범주에 포함시키고 있음

- 그러나 한의학은
  - 서구의 대체-보완의학이 확산된 것 - 아님
  - 동양의학과 대체-보완의학의 접목 - 아님
  - 주도적으로 서양의학적 개념, 이론, 방법을 수용하여 새로운 의학으로의 변화를 시도하고 있는 중

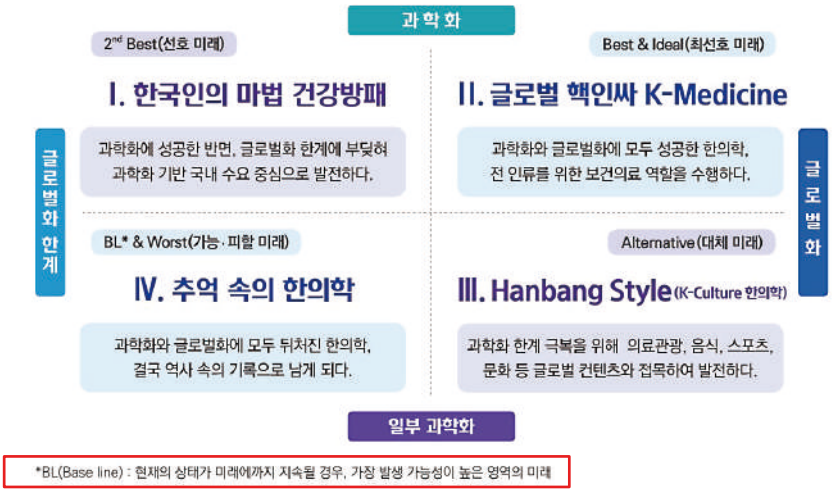
서양의학 속의 한의학

- 현대 한의학의 위치와 나아갈 방향
  - 의학적 패러다임
    - 한국화된 중국의학(기존의 전통)
    - 서양의학화한 전통의학(서양의학에 편입 혹은 소멸)
    - 독자적인 의학(현대 서양의학의 대안: 한의학 중심 혹은 동서의학융합을 통한 새로운 의학 전통)
      - 과학적 의학 (실험, 근거 중심) 중심
      - 철학적 의학 (경험, 실용 중심) 중심
  - 변화되는 사회에 대한 대응
    - 사회적 공인: 한의학 존재의 당위성과 필요성 - 서양의학과의 통합
    - 한의학의 과학화 --> 서양의학화가 아닌 한의학 자체의 과학적 방법론 발굴
    - 한의학의 국제화, 등...

서양의학 속 한의학의 가능성과 한계

	의료의 변화와 요구	한의학의 한계
사회학적 측면	의료의 상품화	- 보약 등 수요 감소 - 제한된 질환에 대한 수요 집중 - 의료 관광(medical tourism) 상품 부족
	의료의 일상화 (병원 및 보험 등 접근성 강화)	한의학의 실용의학으로서의 존재기반 약화
	의료의 세계화	- 서양의학 중심으로 규격화된 국제표준에 적응 미흡 - 한의학 자체의 국제표준화 미흡
	국민의 인식 변화	- 감염병, 외과술, 암 등에 대한 국민의 인식
철학적 측면	의료의 자본주의화	대형병원 중심 의료 체계 구축 미흡
정책적 측면	개인의 건강 및 인구관리	- 개인의 건강관리, 의료자원 분배의 정책적 배려 부족
과학적 측면	**의료의 과학화**	- 서양의학에서 사용하는 진단, 치료 기기 사용의 제한 - 한의학 자체의 과학화 연구 부족

한의학연, 한의학으로 실현될 미래모습 '2050 미래비전' 발표
'한국인의 마법 건강방패' 통한 '2050년, 초(超) 건강 대한민국' 실현



*BL(Base line) : 현재의 상태가 미래에까지 지속될 경우, 가장 발생 가능성이 높은 영역의 미래

2024-04-15 9

한의연의 선택

한의학 2050 미래 비전체계

9대 중점과제

비 전 "2050년, 초(超)건강 대한민국"

미래상 건강하고 안전하고 행복한 사회를 만들어가는 "한국인의 마법 건강방패"

인간의 생애 숫주기를 케어하는	시공간 제약 없는	정신과 신체가 모두
① 무병·유병 장수사회	② 新헬스케어 시대	③ 풍요롭고 건강한 사회

과학화는 가능하지만 국제화보다는 국내 의료에 집중하는 것이 적절하다.

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비전달성을 위한 9대 중점과제와 접근체계

9대 중점과제

비전과 미래상 실현을 위한 미래 도전과제

① 인간의 생애 주주기를 케어하는 무병·유병 장수사회

- 150세 평생 내 몸에 딱 맞는 일상건강관리 #디지털트윈 #만성질환 #음식·생활습관
- 우리 아이를 평생 건강하게, 유전자-체질 연계 질병예측 및 융합치료 #한의학적질병예측모델 #맹유아인지질량예측
- 신·변종 감염병이 발생해도 걱정없는 인체 면역 증강 예방의료 #항체형성촉진 #면역증진 #메디루드

② 시공간 제약 없는 新헬스케어 시대

- 언제 어디서나 간편하게 치료받는 한의 의료 큐브 #바이오센싱 #의료기기(침·약 등) #의료지원기 #융합치료
- 라이프로그 빅데이터를 활용한 초지능 AI 한의사 #한의생체정보 #체내삽입형나노로봇 #AI정착
- 내 손 안에 스마트 병원, 초연결 원격의료 기술 #원격한의치료로봇 #증강현실 #원격진맥

③ 정신과 신체가 모두 풍요롭고 건강한 사회

- 나에게 딱 맞는 맞춤형 건강환경 개선 기술 #스마트홈 #건강스마트카 #우주환경적응
- 삶의 만족과 행복을 높이는 한의 기반 정신·뇌 증강 기술 #치매예방 #바이오피드백 #지적능력향상
- 인체의 한계를 극복하는 한의 기반 신체 증강 기술 #스포츠한의학 #한의재생기술

미래를 위한 접근체계

미래 도전과제의 기초 선도연구 (Preliminary Projects)

- 생로병사의 한의학적 원리이해 #한의IDEA존구현 #한의과학적체제적 #정밀화
- 미래의료 통합 빅데이터 구축 #빅데이터지식동수집플랫폼 #전산지표표준화
- 한의 신물질·신소재 개발 #지지체정지적 #캡슐형한약 #지속가능성분보

미래 도전과제와 기초 선도연구 추진을 위한 기반 조성

- 미래의료를 열어가기 위한 융합의학 생태계 조성
- 미래 세대 한의학 인식제고
- 기초 의과학자 및 융합형 인재 양성
- 세계의 중심이 되는 글로벌 협력 체계

인간의 행복한 삶에 대한 욕구

- 아프지 말고
- 하고 싶은 거 다 하면서
- 오래오래 살자.

건강하게

- 현대 의학은 인류 역사상 최고 수준
- (폭등하는 의료비용 문제)

오래 사는 것

- 이미 고령사회에 진입, 초고령사회로
- (오래 사는 것에 따라오는 새로운 문제점들)

하고 싶은 일을 하면서

- 과학기술의 도움
- (새로운 의학적 패러다임 설정 필요)

질병치료 및 수명연장 기법

- 나노의학
- 정밀의학
- 인체의 냉동보관

등등등...

하고 싶은 일?

정신? 몸?

할 수 있도록?

과학기술혁명을 이용

현대는 의식기술사회로 발전 중

한의학은 행복한 삶을 위하여 어떠한 것을 제공할 수 있는가?

미래 의학의 트렌드

- 개인의 필요에 따라 맞춘 치료
- 개인의 유전자 등 상황에 맞추어 질병 발생 전에 예측, 대책 수립
- 원하지 않는 임신 예방, 유전자 조작, 각종 기능 보강

참여의학 (Participatory medicine)

- 환자의 적극적 참여

증강의학 (Augmented medicine)

- 인간의 기능 향상

- 미래 의료 수요 변화의 주된 요인
  - 웰빙에 대한 요구의 증가
  - 늘어난 수명
- 미래 의료 수요의 방향
  - 예측, 예방의학
  - 환경, 삶의 방식에 영향을 받지 않는 건강 관리
  - 최근 늘어나고 있는 요구
    - 개인맞춤의료(빅데이터 활용)
    - 스트레스 해소
    - 바이오해킹(biohacking)
    - 의료관광
    - 인공지능의 활용

요약

- 한의학은 서양의학이 도입되기 전까지 우리나라의 주류 의학이었다.
- 한의학은 서양의학과 달리 철학적 지식체계를 중시하는 의학이다.
- 현대 사회는 과학적 방법론을 통한 증거를 중시한다.
- 미래 의료는 늘어난 수명과 웰빙에 대한 요구를 충족시키는 방향으로 변화될 것이다.
- 현대 사회에서 한의학은 주류 의학으로서 한계를 가지고 있지만 동시에 다양한 가능성을 가지고 있다.
- 기존의 철학적 지식체계에 머무르지 않고, 현대 사회에서 인정하는 과학적 근거의 확보, 국민의 신뢰 회복, 새로운 의학적 가능성의 제시 등을 통한 혁신이 미래 의료에서 한의학의 위상을 공고히 할 수 있을 것으로 생각한다.

질의 응답

감사합니다.

PRESENTATION

Daqing Ma
Imperial College London

POSTOPERATIVE DELIRIUM: MECHANISMS AND PREVENTION

KOREA INSTITUTE OF ORIENTAL MEDICINE
INTERNATIONAL SYMPOSIUM

PRESENTATION

Daehee LEE
KRIBB

CONVERGENCE OF TRADITIONAL KOREAN MEDICINE AND SYNTHETIC BIOLOGY: INNOVATIVE RESEARCH AND FUTURE PERSPECTIVES

Convergence of Traditional Korean Medicine and Synthetic Biology

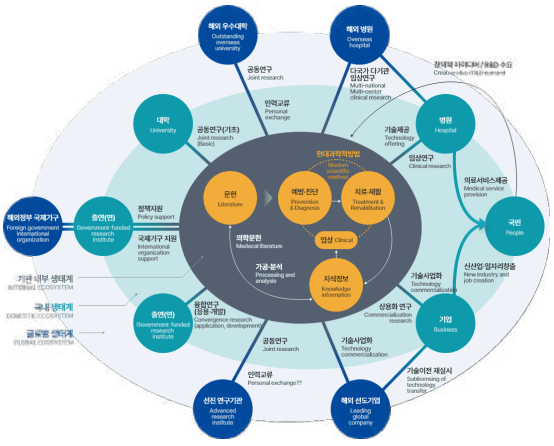
October 29, 2024

Daehee Lee

Synthetic Biology Research Center
Korea Research Institute of Bioscience and Biotechnology

Introduction

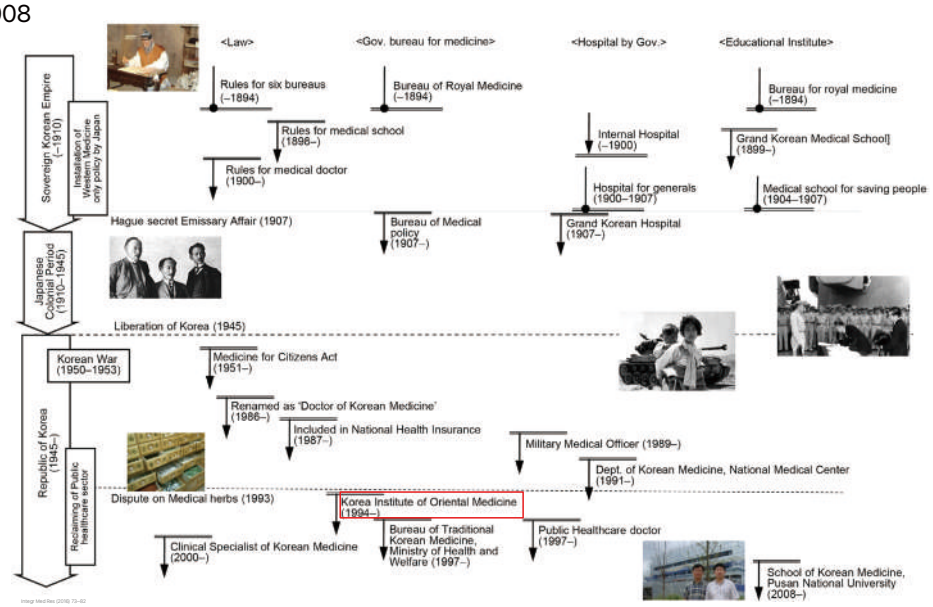
Congratulations



Introduction

History of Korean Medicine in the Public Sector

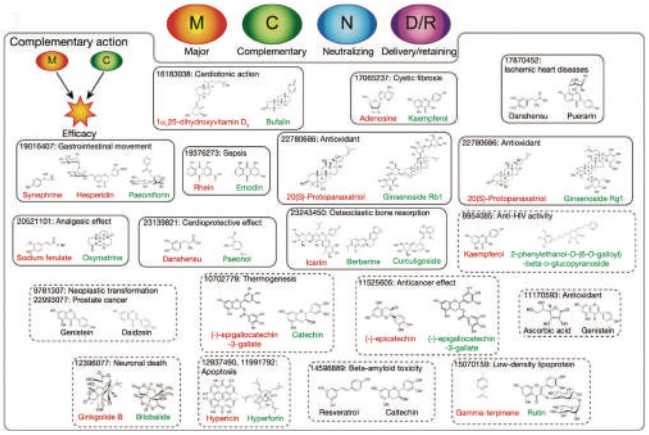
1894~2008

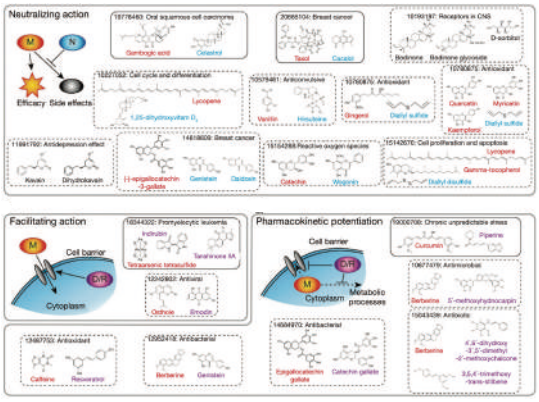


Introduction

Traditional Oriental Medicine (TOM)

One of the problems preventing TOM from more widespread adoption by modern healthcare is our poor understanding of the mechanisms of action of many of these natural products.





Nat Biotechnol 33, 264–268 (2015)

Convergence of Traditional Korean Medicine and Synthetic Biology: Innovative Research and Future Perspectives

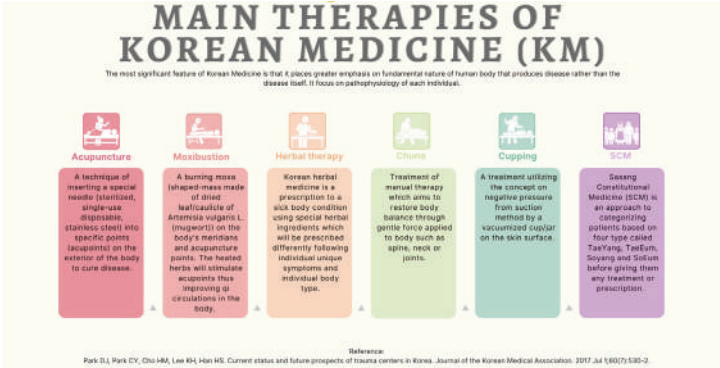
- Daehee LEE I KRIBB

Introduction

Systems Approach to TOM

https://thesoulofseoul.net/traditional-korean-medicine-hanyak-sasang/

- The majority of modern drugs contain a single active ingredient or component developed around a proof-of-concept test of their activity against a single biological target.
- Structural similarities of TOM-derived compounds to human metabolites can facilitate the identification of their mechanisms of action and potentially reduce toxicities.
- Further integration of TOM into modern drug discovery and development through synthetic biology

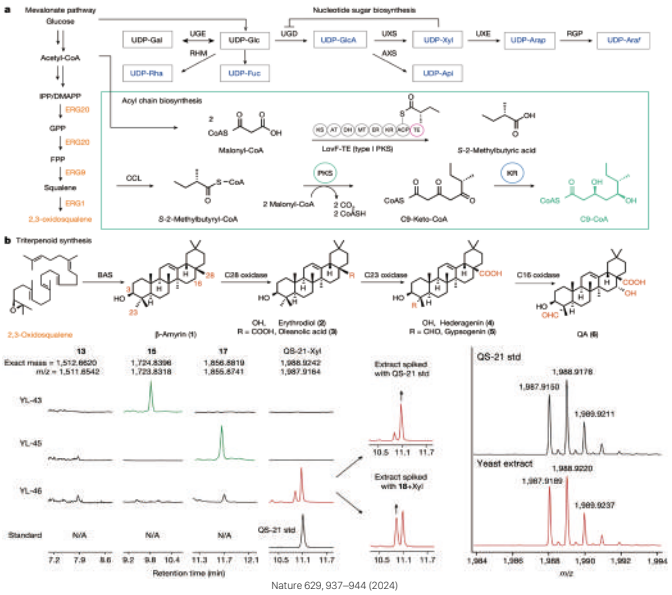


Introduction

Synthetic Biology for Natural Products in Medicinal Plants

Secondary metabolism

https://pacifichorticulture.org/articles/striving-for-diversity-quillaja-saponaria/



Nature 629, 937–944 (2024)

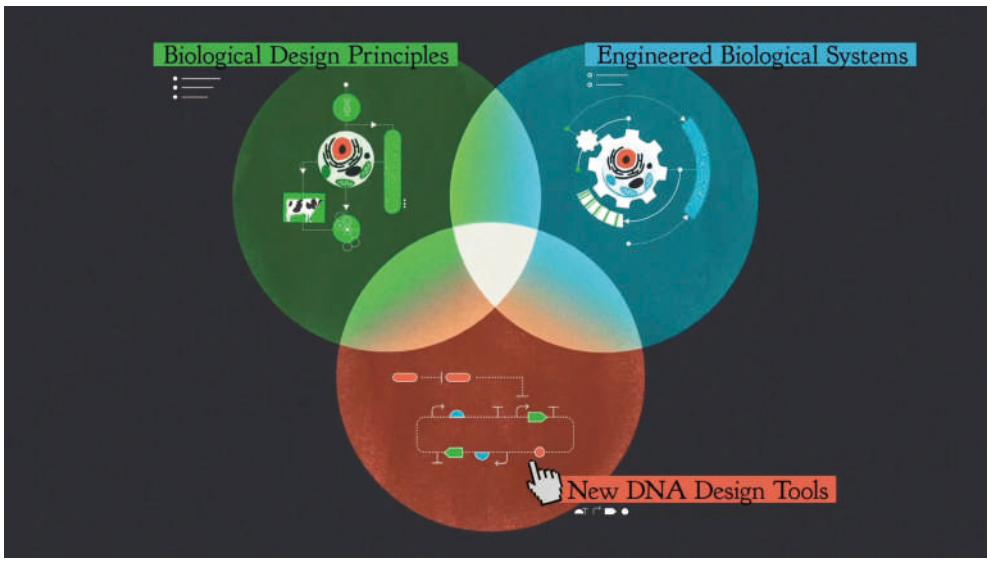
Convergence of Traditional Korean Medicine and Synthetic Biology: Innovative Research and Future Perspectives

- Daehee LEE I KRIBB

Introduction

Synthetic Biology

Make Biology Easier to Engineer



From Ginko Bioworks, https://www.youtube.com/watch?v=BJIIOr5FnnM

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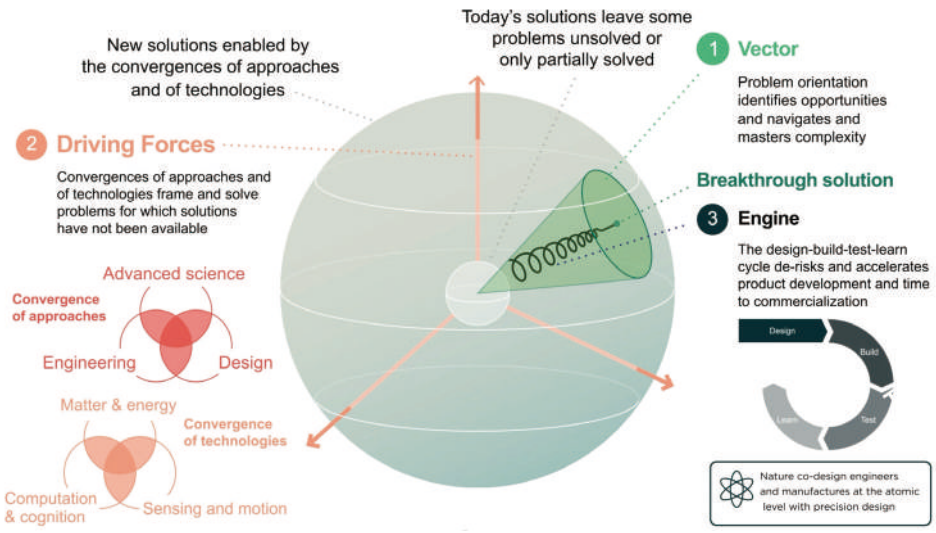
Introduction

Synthetic Biology

Make Biology Easier to Engineer



https://www.bcg.com/publications/2021/why-nature-co-design-will-be-so-important-for-the-next-industrial-revolution

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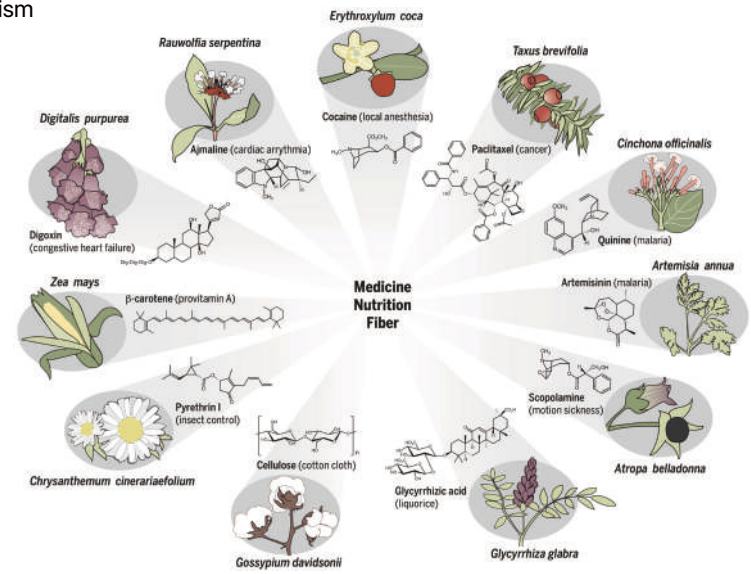
Introduction

Terpenoids

Secondary metabolism



Science 2016, 353 (6305): 1232-1236

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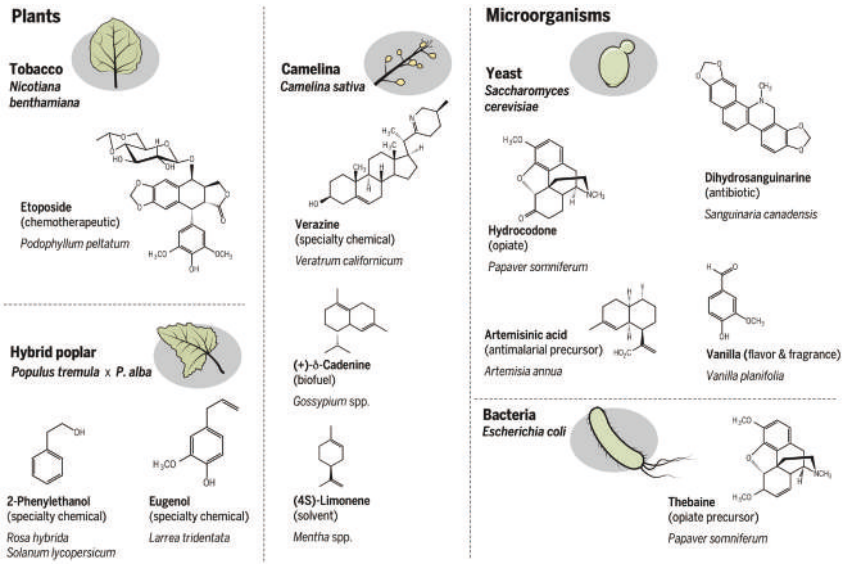
Introduction

Terpenoids



Science 2016, 353 (6305): 1232-1236

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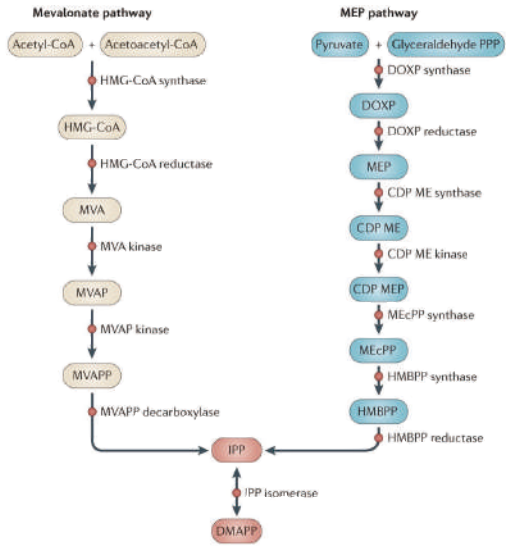
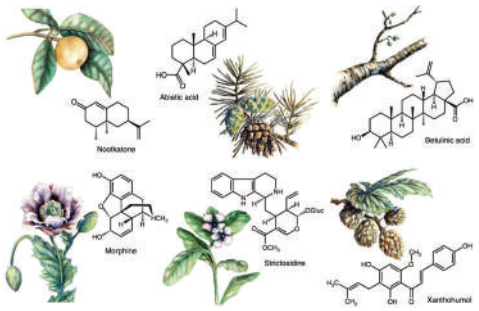
Introduction

Terpenoid Production Pathways



Nature Reviews Microbiology 2013, 11: 823–835

- About 60% of known natural products are terpenoids that derived from 5-C isoprene units
- Long history of being used as drugs, pharmaceuticals, flavors, fragrances, insecticides, & biofuels



Trends in Biotechnology 2012, 30(3): 127-131

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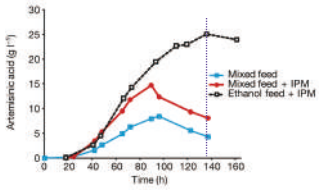
Introduction

Unmet Needs

- Low titer of terpenoids in engineered microbes
- Over-expression of pathway genes inhibits cell growth
- An increase in enzyme activity does not necessarily result in more product
- Library screening for increased production is time-consuming
- Production was limited by control mechanisms in the host



Nature 2013, 496: 528–532

Summary of selected terpenoids and heterologous host

Compound	Activity	Native host	Heterologous host	Titer (mg/L)	Ref
Artemisinic acid	Antimalarial	*A. annua*	*S. cerevisiae*	25000	[22]
Taxadiene	Anticancer	*T. chinensis*	*E. coli*	925	[12]
			S. cerevisiae	129	[37]
Astaxanthin	Antioxidant	*H.pluvialis*	*E. coli*	1180	[38]
			Y. lipolytica	55	[28]
Betulin	Anticancer and anti-HIV activities	*B.platyphylla*	*P. tricornutum*	–	[34]
(E)-α-bisabolene	Biodiesel precursor	*A. grandis*	*C. reinhardtii*	11	[32]
Ent-kaurene	–	*F. fujikuroi*	*A. nidulans*	–	[29]
Erinacine	Stimulating activity for nerve-growth-factor synthesis	*H. erinaceus*	*A. oryzae*	–	[31].
Geraniol	Antimicrobial and antitumor	*C. roseus*	*S. cerevisiae*	1680	[23]
Ginsenoside K	Antitumor and anti-inflammatory	Ginseng	*Y. lipolytica*	162	[24]
			S. cerevisiae	>1000	[49•]
Limonene	Antibacterial	Citrus	*S. cerevisiae*	918	[25•]
Lycopene	Antitumor and anticancer	Tomato	*E. coli*	925	[12]
			S. cerevisiae	129	[26]

Current Opinion in Biotechnology 2021, 69:281–289

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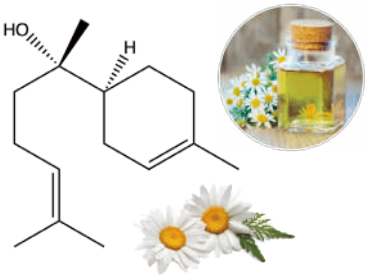
Introduction

(-)-α-Bisabolol

- **Synonyms**: Levomenol
- **Chemical name**: 1-Methyl-4(1,5-dimethyl-1-hydroxyhex-4(5)-enyl)cyclohexene
- **Molecular formula**: $C_{15}H_{26}O$
- **Molar mass**: 222.4 g/mol
- **CAS-No**: 515-69-5
- **Description**: Clear, colorless to slightly yellowish liquid with a faint, floral, sweetish odor
- **Solubility**: Soluble in ethanol, 2-propanol and in natural, mineral and synthetic facts and oils
  It is insoluble in water and glycerol. Clear aqueous solutions can be prepared with the aid of solubilizes.
- **Product**: Chemically synthetic vs. naturally occurred



- Application:
  - Bisabolol is **the main active ingredient of the medical plant chamomile** (*Matricaria chamomilla*) which is used in traditional medicine for hundreds of years.
  - Bisabolol **protects and heals the skin** from the effects of daily stress. It is a naturally occurring active ingredient that accelerates the healing process of skin.
  - Bisabolol can be used with confidence in **personal care formulations**, especially in products for sensitive skin, baby care, after-shave, and after-sun application.
  - Its added **anti-inflammatory properties** make it a truly versatile active ingredient for skin care products.

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Introduction

(-)-α-Bisabolol

https://www.marketresearchfuture.com/reports/alpha-bisabolol-market-9415

http://kfluous.com/?p=2919

못하는게 없는 만능 성분
비사보롤(bisabolol)

DAEBONG Life Science

BIOSPECTRUM

BASF The Chemical Company

CLARIANT Active Ingredients

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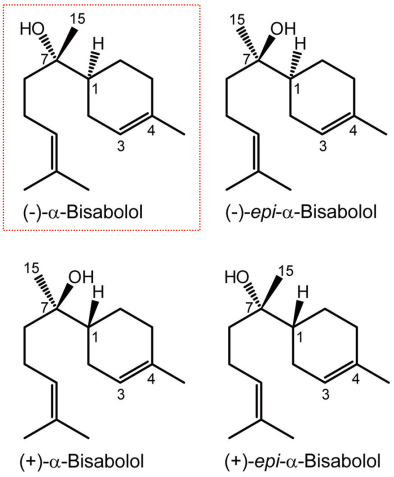
Introduction

(-)-α-Bisabolol Synthase



4 stereoisomers of α-bisabolol

- **The most common α-bisabolol** in nature(Brazilian candeia tree, German chamomile)
- **The main active ingredient of the medical plant chamomile** (*Matricaria chamomilla*) which is used in traditional medicine for hundreds of years
- **Protects and heals the skin** from the effects of daily stress
- Personal care formulations, especially in products for sensitive skin, baby care, after-shave, and after-sun application
- **Anti-inflammatory properties** make it a truly versatile active ingredient for skin care products

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Introduction

(-)-α-Bisabolol Synthase

Biochem. J. (2014) 463, 239–248 (Printed in Great Britain) doi:10.1042/BJ20140306

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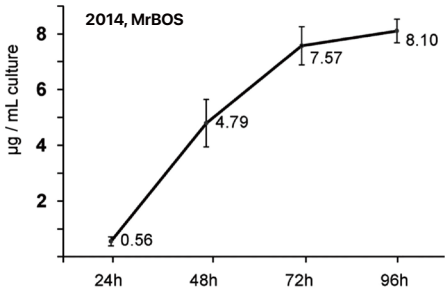
Enantioselective microbial synthesis of the indigenous natural product (−)-α-bisabolol by a sesquiterpene synthase from chamomile (*Matricaria recutita*)

Chamomile (*Matricaria chamomilla*)



Patent 10-2014-0129750, Seoul National University

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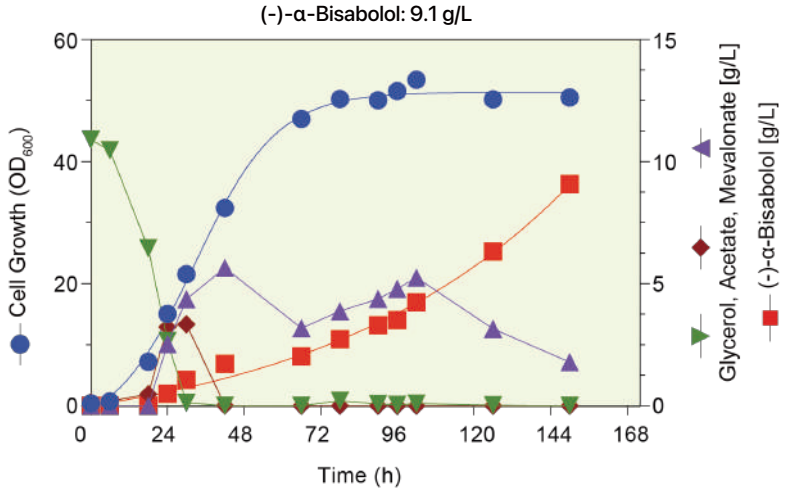
Technology

Host & Medium

- Bacterial production host ····· *Escherichia coli*



Microbial Cell Factories 2017, 15: 185

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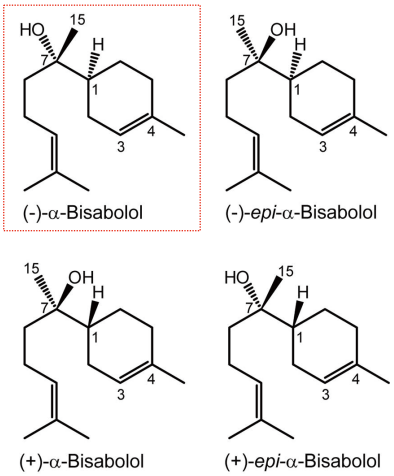
Introduction

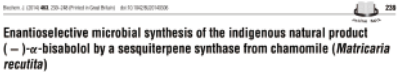
(-)-α-Bisabolol Synthase



- Four stereoisomers of α-bisabolol are produced in plants.
- The type of stereoisomer is determined by the catalytic reaction of α-bisabolol synthase.
- Only MrBOS and EeBOS have been shown to produce (-)-α-bisabolol enantioselectively.

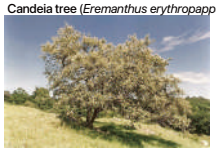
Chamomile (*Matricaria chamomilla*)

2014, MrBOS



Enantioselective microbial synthesis of the indigenous natural product (−)-α-bisabolol by a sesquiterpene synthase from chamomile (*Matricaria recutita*)

Candeia tree (*Eremanthus erythropappus*)



2018, EeBOS

Identification of the Bisabolol Synthase in the Endangered Candeia Tree (*Eremanthus erythropappus* (DC) McLeisch)

- Soluble expression in bacteria?
- Low activity → low production

- New enzyme is needed for the efficient production of (-)-α-bisabolol enantioselectively.

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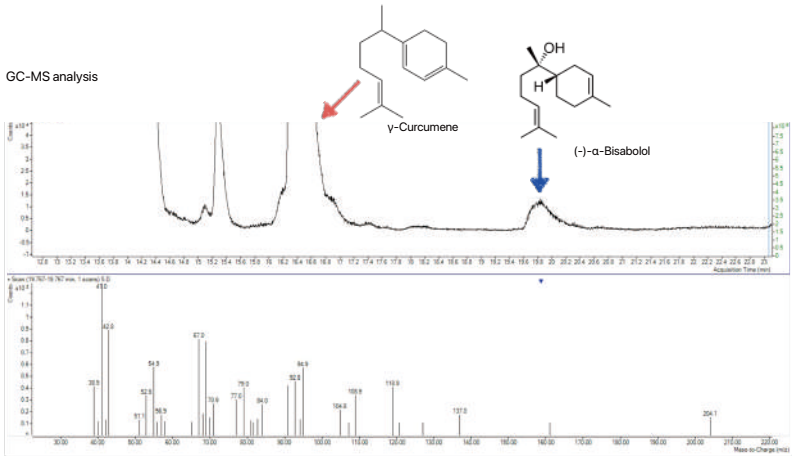
Technology

(-)-α-Bisabolol Synthase I

- Metabolic pathway genes ····· (-)-α-bisabolol synthase

Terpene synthase 3 (TPS3) from cDNA libraries of a rubber-producing plant (KRIBB)



Unpublished, Patent (10-2017-0135146)

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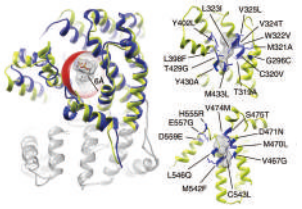
Technology

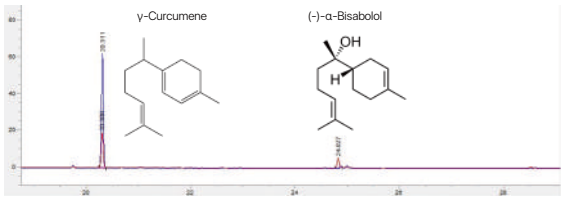
(-)-α-Bisabolol Synthase I

- Metabolic pathway genes ····· (-)-α-bisabolol synthase

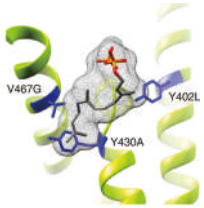
TPS3 mutant (N402L)

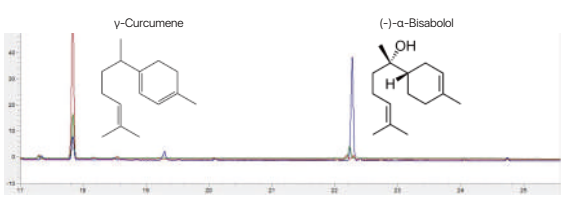


Nature Communications 2015, 6:6143



TPS3 mutant (N402L, T429G)





Unpublished, Patent (10-2017-0135146)

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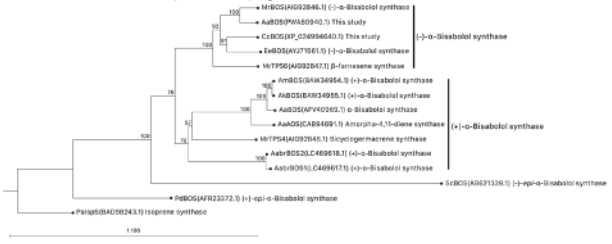
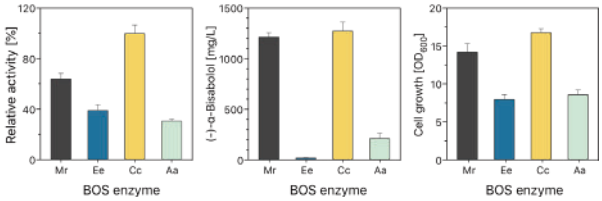
Technology

(-)-α-Bisabolol Synthase II (CcBOS)

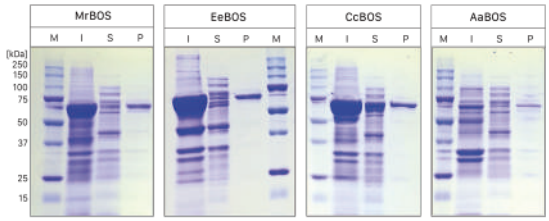
- Metabolic pathway genes

(-)-α-bisabolol synthase





- CcBOS showed the highest specific activity which was ~1.8-fold greater than that of MrBOS.
- *E. coli*-CcBOS produced the most (−)-α-bisabolol (1.3 g/L), followed by *E. coli*- MrBOS (1.2 g/L).
- The growth rates of *E. coli*-AaBOS and *E. coli*-EeBOS were inhibited by ~50% compared to that of *E. coli*-CcBOS



BOS	K_M (μM)	k_{cat} (S^{-1})	k_{cat}/K_M ($\mu M^{-1} S^{-1}$)
CcBOS	2.56 ± 0.19	0.95 ± 0.021	0.369 ± 0.0292
AaBOS	6.35 ± 0.95	0.193 ± 0.011	0.030 ± 0.0048
EeBOS	5.76 ± 0.56	0.415 ± 0.014	0.072 ± 0.0074
MrBOS	3.38 ± 0.23	0.697 ± 0.016	0.234 ± 0.0164

- Among the four BOS enzymes, CcBOS showed greater soluble expression than the other BOS enzymes

J. Agric. Food Chem. 2021, 70(4): 1203-1211, Patent (Reg. No.: KR 10-2343992)

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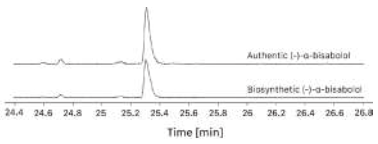
Technology

(-)-α-Bisabolol Synthase II (CcBOS)

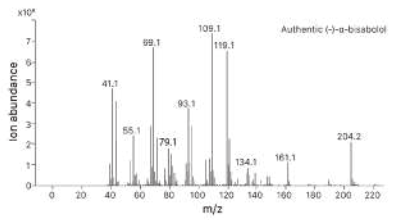
- Metabolic pathway genes

(-)-α-bisabolol synthase

GC



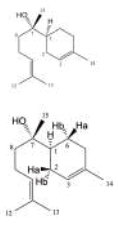
GC-MS

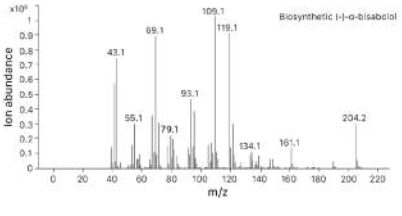


NMR

1H and 13C-NMR chemical shift ([H2]chloroform) values

C No.	^{1}H (δ)	multiplet	J (Hz)	Protons	^{13}C (δ)
1	1.04	dd	3.28, 5.02, 11.73	1H	43.0
2	a 1.79	m		2H	26.9
	b 2.00				
3	5.37	m		1H	120.5
4					134.2
5	1.98	m	9.35,	2H	31.8
6	a 1.28	m		2H	23.3
	b 1.91				
7					74.5
8	1.50	m		2H	40.1
9	2.06	q	7.93	2H	22.1
10	5.13	tqn	7.93, 1.33	1H	124.0
11					131.8
12	1.62	s		3H	17.7
13	1.69	d	0.84	3H	25.7
14	1.62	s		3H	23.4
15	1.11	s		3H	23.2





Microbial Cell Factories 2017, 15: 185; J. Agric. Food Chem. 2021, 70(4): 1203-1211; Patent (Reg. No.: KR 10-2343992)

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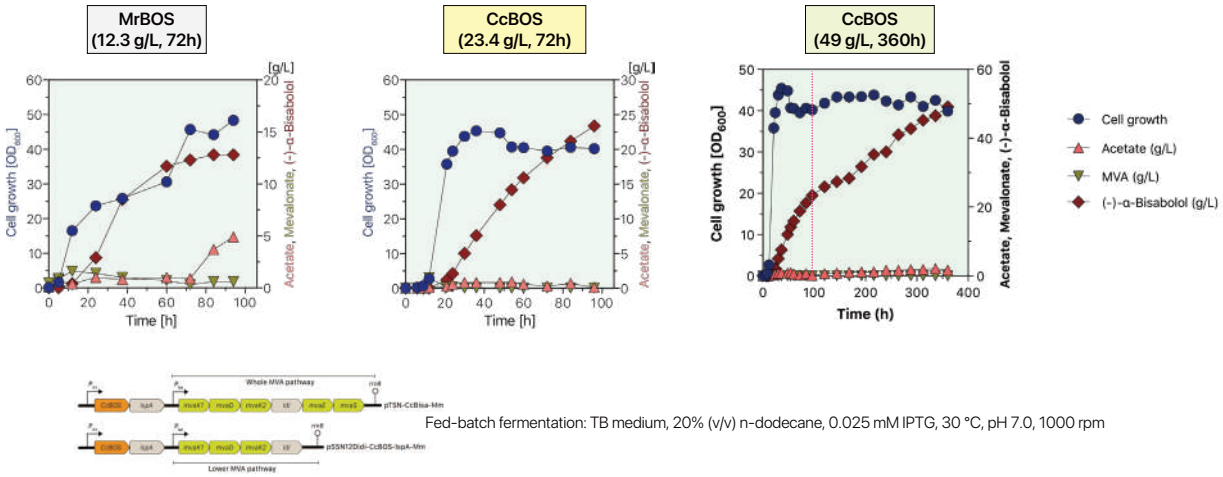
Technology

Fed-Batch Fermentation

- Fermentation optimization ····· Fed-batch fermentation, Strain preparation



Fed-batch fermentation: TB medium, 20% (v/v) n-dodecane, 0.025 mM IPTG, 30 °C, pH 7.0, 1000 rpm

J. Agric. Food Chem. 2021, 70(4): 1203-1211

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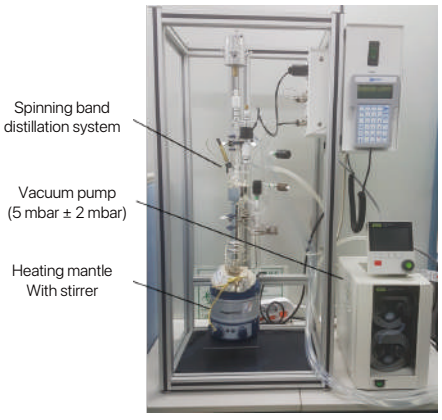
Technology

(-)-α-Bisabolol Purification

- Extraction and purification ····· Two-phase fermentation and distillation

Spinning Band Distillation



Recovery yield of (−)-α-bisabolol w/ common vegetable oils

Extracting solution	Extraction yield (%)
Soybean oil	98.5
Canola oil	98.8
Corn oil	98.5
Sunflower oil	96.7
n-Dodecane	99.5

(−)-α-Bisabolol in n-dodecane (−)-α-Bisabolol (Purity > 98%)

Unpublished, Microbial Cell Factories 2017, 15: 185

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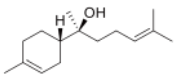
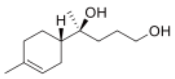
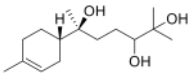
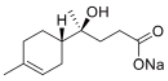
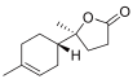
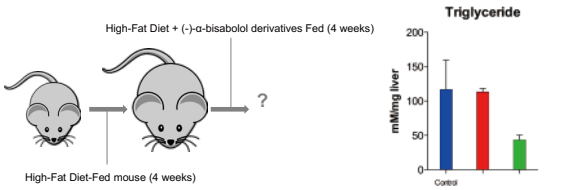
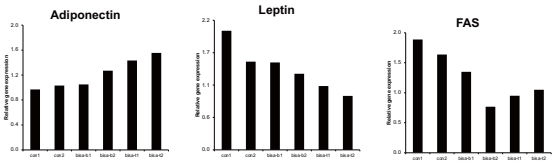
Technology

(-)-α-Bisabolol Derivatives

Compound	Structure	MW
(-)-α-bisabolol (BisaB)		222.37
(-)-α-bisadiol (BisaD)		198.31
(-)-α-bisatriol (BisaT)		256.39
(-)-α-bisaacid (BisaA)		234.27
(-)-α-bisalactone (BisaL)		194.27





- A (-)-α-bisabolol derivative reduced the amount of liver fat.

Patent (Reg. No. KR 10-2010520)

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Technology

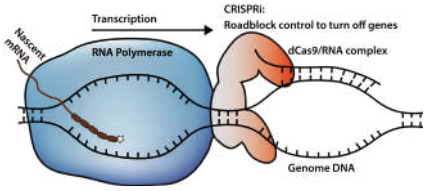
Antibiotic-free (-)-α-bisabolol production

- **CRISPRi-based inverter cascades** can mimic the relationship between antibiotics and antibiotic-resistance genes.

Single inverter Growth inhibition by antibiotics

Antibiotics → Growth inhibition

CRISPR interference (CRISPRi)



Single inverter Growth inhibition by CRISPRi

dCas9/sgRNA → Growth inhibition

Nucleic Acids Research, 2022, 50(22): 13155–13171 Patent (Reg. No.: KR 10-2166288)

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Technology

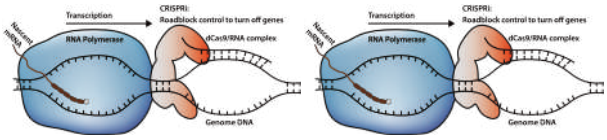
Antibiotic-free (-)-α-bisabolol production

- **CRISPRi-based inverter cascades** can mimic the relationship between antibiotics and antibiotic-resistance genes.

Bacteria w/ plasmid
(Antibiotic resistance gene)

Plate w/ antibiotics

CRISPRi cascade



Double inverter Growth recovery by antibiotic resistance gene

Antibiotic resistance gene → Degradation of antibiotics → Growth recovery

Double inverter Growth recovery by CRISPRi cascade

dCas9/anti-sgRNA → Repression of sgRNA → Growth recovery

Nucleic Acids Research, 2022, 50(22): 13155–13171 Patent (Reg. No.: KR 10-2166288)

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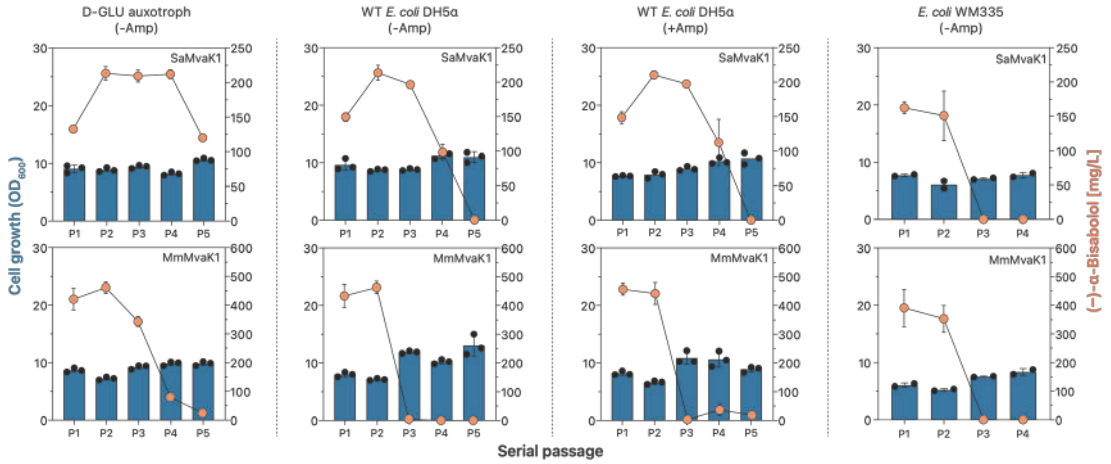
Technology

Antibiotic-free (-)-α-bisabolol production

- Cell growth and (–)-alpha-bisabolol production were monitored for 15-day transfers.



Nucleic Acids Research, 2022, 50(22): 13155–13171 Patent (Reg. No.: KR 10-2166288)

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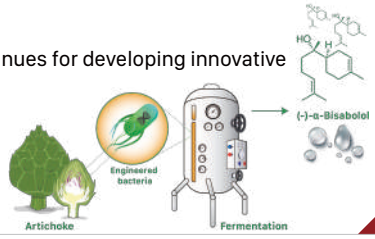
Conclusion

Reinforcement of acetyl-CoA pool

- Traditional Korean Medicine, with roots tracing back over a thousand years, is more than just a collection of herbal remedies. It embodies a holistic approach to health and well-being, emphasizing balance and harmony within the body.
- Despite its ancient origins, Traditional Korean Medicine has continued to thrive, adapting over centuries and offering valuable insights into healing and prevention. But like any tradition, it faces challenges: how do we preserve and expand this knowledge in a way that meets the needs of modern healthcare?
- This is where synthetic biology comes into play. Synthetic biology offers powerful tools to reimagine and re-engineer biological systems, allowing us to precisely replicate and enhance what nature has perfected over millennia.
- By integrating the two, we not only preserve traditional wisdom but also open new avenues for developing innovative therapeutics and sustainable bio-manufacturing.



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Acknowledgment

NRF 한국연구재단 National Research Foundation of Korea
KRIBB 한국생명공학연구원 Korea Research Institute of Bioscience and Biotechnology

KOREA INSTITUTE OF ORIENTAL MEDICINE
INTERNATIONAL SYMPOSIUM

PRESENTATION

Taesoo KIM
KIOM

RESEARCH ON TRADITIONAL KOREAN MEDICINE TO OVERCOME DISEASE

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3. 연구 결과 p 22.
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0. 한국한의학연구원 소개

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

조직도

대전본원

(대구) 한의기술응용센터

(전남) 한약자원연구센터

인 력

구분	임원 (원장)	연구부문	연구지원부문	계
인원	1명	241명	79명	321명

2

0. 한국한의학연구원 소개

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

한국한의학연구원 중장기 연구 목표

전략 목표 1 디지털 한의학 선도! 언택트시대 바이오·의료산업 혁신!

신개념 기술(디지털 치료, 전자약)을 접목, 한의의료기술의 디지털화로 언택트시대에 맞춰 바이오·의료산업 혁신

- 한의 디지털 헬스 기술 개발
- 한의 정밀의료 핵심기술 개발

전략 목표 2 과학화 난제 해결! 미래 융합의학 주도!

한의 이론의 과학적 증명, 진단지표 표준화 등 도전적 난제를 해결, 미래 융합의학 본격화에 노력

- 한의이론 과학적 규명
- 한의약 효능·안전성 근거 강화

전략 목표 3 사회적 관심질환 극복! 한의약 가치 혁신!

한의학이 강점을 가진 사회적 관심 질환 (항노화, 아토피, 장면역, 소화장애, 정신질환(외로움)) 극복으로 국민의 건강한 삶에 기여

- 만성·난치성 질환 예방·치료기술 개발
- 환경·정신성 질환 치료기술 개발

전략 목표 4 한의 정보·한약자원 플랫폼 강화! 혁신 기반 조성!

빅데이터 정보와 한약연구자원에 대한 선제적 확보·활용 플랫폼 강화로 R&D 혁신 기반을 조성

- 한의 빅데이터 수집·활용 플랫폼 구축
- 한약자원 확보·활용 플랫폼 구축

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0. 한국한의학연구원 소개

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

한의약융합연구부

전략목표3. 사회적 관심 질환 극복! 국민 생애 건강한 삶 실현!

(최종목표) 사회적 관심 질환에 대한 한의 기반 치료기술 개발을 통해 국민 생애 건강한 삶 실현

사회적 관심 질환

미래이슈 1위 저출산 초고령화 문제

대한민국 미래이슈 2019[1]

1. 저출산·초고령화
2. 격차 심화로 인한 사회 불안정
3. 저성장과 성장전략 전환
4. 남북관계 변화
5. 고용불안
6. 기후변화 적응 실패
7. 제조혁명
8. 건강수명 증대
9. 자연재난
10. 산업구조의 양극화

사망원인 상위 10위 중 7개가 만성질환

우리나라 사망 구성비[2]

1.	악성신생물	27.6%
2.	심장질환	10.8%
3.	뇌혈관질환	8.0%
4.	폐렴	6.8%
5.	고의적 자해(자살)	4.4%
6.	당뇨병	3.2%
7.	간질환	2.4%
8.	만성하기도질환	2.4%
9.	고혈압성 질환	2.0%
10.	운수사고	1.8%

성과목표 3.1 만성·난치성 질환 예방·치료기술 개발 — 세부연구내용

최종목표: 암·난치성 질환 면역치료기술 및 고령화·저출산 대응 한의 예방·치료기술 개발

연구분야:
- ★ 난치성 질환 면역치료기술 개발
- 노인성 질환 치료기술 개발
- 저출산 대응 난임치료기술 개발

세부연구내용: 면역관문차단 / 폐암 / 면역과민반응 / 노인성골질환 / 이상지질혈증 / 저반응난소군

성과목표 3.2 환경·정신성 질환 치료기술 개발 — 세부연구내용

최종목표: 환경·정신신경계 질환 한의 치료기술 개발 및 임상 연구 수행

연구분야:
- 신·변종 감염병 대응기술 개발
- 환경성 질환 치료기술 개발
- 정신·신경계 질환 치료기술 개발

세부연구내용: 신변종감염병 / 안구건조증 / 천식 / 미세먼지유래질환 / 정신성 질환 / 경도인지장애 / 퇴행성신경질환

1) 대한민국 미래이슈 2019 (2019), KISTEP, 2019-02(통권 제260호)
2) 만성질환 현황과 이슈 (2019), 질병관리본부

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0. 한국한의학연구원 소개

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

성과목표 3.1 만성·난치성 질환 예방·치료기술 개발

최종목표: 암·난치성 질환 면역치료기술 및 고령화·저출산 대응 한의 예방·치료기술 개발

연구 분야	타겟 질환	세부연구내용	1단계	2단계
난치성 질환 면역치료 기술 개발	대장암 폐암 (전체 사망 중 1위, 34.6%)	면역관문 차단	대장암 환자 대상 면역관문차단제 개발	면역관문차단제 개발 및 IND 승인	병용투여용 면역관문차단제 IND 승인
		한열변증 통합항암치료	폐암 면역개선 통합 진단·치료기술 개발 및 변증 기반 통합항암치료 임상근거 확립	한·양방 통합 중개 임상연구 수행 및 병용 치료의 비임상 효능연구	한·양방 통합항암치료 확증 임상시험 수행
	알레르기 질환	다중표적	다중표적 조절을 통한 면역과민반응 치료 기술 개발	다중표적 면역과민반응 후보소재 발굴	면역과민반응 치료 한약 소재 임상2상 완료
노인성 질환 치료기술 개발	골다공증	신규작용점 (구 골흡수억제)	노인성 골질환 치료용 후보소재 개발	후보소재 도출	허가용 IND 승인
	이상지질혈증	한의소재 기반	이상지질혈증 질환 치료를 위한 한약제제 발굴 및 효능 입증	후보소재 도출	이상지질혈증 임상2상 데이터 구축
저출산 대응 난임치료기술 개발	난임 (OECD국 최하위 출산율 0.84명)	한양방통합 / 자반응난소 기능개선	임상시험을 통한 한·양방 통합 난임치료기술의 유효성·안전성 검증	IND 자료 구축 및 임상진입	임상 안전성 유효성 규명

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0. 한국한의학연구원 소개

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

성과목표 3.2 환경·정신성 질환 치료기술 개발

최종목표 환경·정신신경계 질환 한의 치료기술 개발 및 임상 연구 수행

연구 분야	타겟 질환	세부연구내용		1단계	2단계
신·변종 감염병 대응 기술 개발	신·변종 감염병	면역증강 변증기반 예방·치료 후유증	신변종 바이러스 감염질환 대응 한의 범용기술 개발	신변종 감염병 예방치료 한약제제 후보소재 도출 신변종 감염병 후유증에 대한 연구자임상	신변종 감염병 예방·치료 한약제제 IND 승인 신변종 감염병 후유증 CPG 인증 및 보급
환경성 질환 치료기술 개발	환경성질환 • 안질환 • 안구건조증 • 천식	대기환경 모사 시스템	미세먼지성 안질환의 천연제품 소재 개발	안질환 외용제형 IND 승인	외용 후보소재 임상 연구 연계 중개연구
			미세먼지성 천식에 대한 한의 소재 개발	후보소재 도출 및 IND 승인	병용치료를 위한 후보 소재 도출 및 IND 승인
		외용제	안구 건조증 천연물 의약품 개발	안구건조증 의약품 IND filing 및 1상 진입	안구건조증 의약품 2상 진행
정신신경계 질환 치료기술 개발	퇴행성뇌질환	다중표적 뇌을개노이드	퇴행성 뇌질환에 대한 혁신형 한약제제 개발 및 임상 2상 완료	경도인지장애에 대한 2상 임상 완료	환자맞춤형 알츠하이머 치료 한약제제의 허가용 2상 IND 승인
	퇴행성뇌질환	적응증확대	정신신경계 질환의 기전 규명 및 한약제제 신효능 입증	정신성질환 치료 한약제제에 대한 중개연구 및 임상시험	정신성질환 치료 한약제제 품목허가 자료 구축

1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

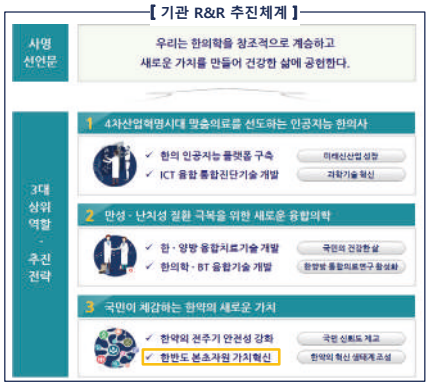
면역체계를 침범한 면역과민반응 개선 다중표적 한약제제 개발

최종목표

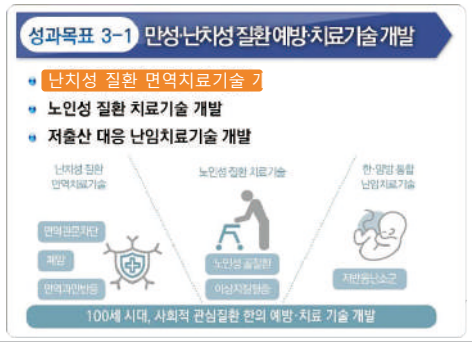
최근 급격한 환경변화 (미세먼지, 환경호르몬, 가공음식물 등)에 따라 아토피성 피부염, 알러지성 비염 등과 같은 면역과민반응 **알레르기 질환**이 급증하고 있어, **한의 기술의 장점**을 활용하여 **다중표적 혁신형 한약 개발**을 통해 기존 치료기술의 한계점을 극복하고자 함

R&R 및 연구사업계획 연계 체계

【 기관 R&R 추진체계 】



전략목표 3 사회적 관심질환 극복!
국민 생애 건강한 삶 실현!



1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

생애 전 주기에 걸쳐 지속적인 알레르기성 질환

알레르기 질환

✓ 문명 발달에 따른 급격한 환경변화에 의해 알레르기 질환 환자의 수가 선진국을 중심으로 크게 증가

✓ 국내 경우 알레르기 질환은 국내 소아·청소년에서 질병 부담률 1순위, 성인에서도 한국인질병부담 5위에 해당하는 질환으로 사회경제적 부담이 가중

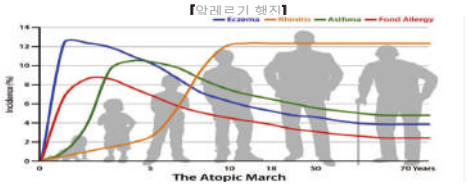
✓ 알레르기질환은 유전 및 환경 요인의 복합적인 상호작용에 의해 발병되고 있어 기존 단일 표적에 기반한 치료기술 개발에 한계성 존재

알레르기 행진 (Allergy March)

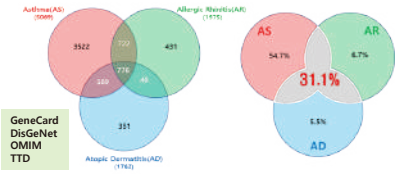
✓ 알레르기 행진이란?

- 알레르기질환이 특징적으로 순서에 따라 다양한 표현형이 나타나는 것을 의미
- 식품알레르기->아토피피부염->알레르기비염, 천식 순으로 발병
- 면역과민반응으로 인한 알레르기 행진 진행으로 생애 전 주기에 별 알레르기 질환 치료의 필요성 증대

【알레르기 행진】



【알레르기 질환간 유전자 연관성】



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1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

알레르기질환의 높은 유병률 및 지속적인 증가

해외

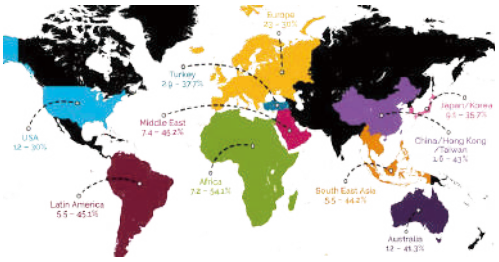
✓ 알레르기성 비염의 경우 전 세계 인구 중 20 ~30 % 유병률*

전 세계적으로 4억 명이 알레르기성 비염을 앓고 있는 것으로 추산

✓ 세계의 알레르기성 비염 치료제 시장의 지속적인 증가

2017년 122억 달러에서 2022년에는 143억 달러 예상 (3.3% CAGR)

【세계 알레르기 비염 유병률】



출처 Prevalence of allergic Rhinitis around the world (Tong & Lin, 2014)

국내

✓ 10 명 중 1.87* 명이 알레르기(비염, 천식, 아토피) 질환 환자

인구 1,000명 당 비염/천식/아토피 유병률 = 133.1/36.3/19명 (2014)

✓ 알레르기성 비염의 경우 최근 15년 사이에 유병률 6.7 배 증가**

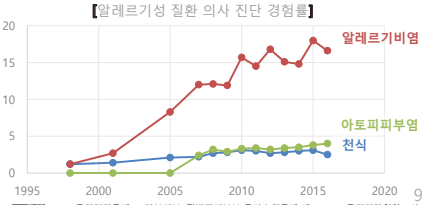
2001년 2.7% → 2015년 18%

【국내 연간 알레르기 질환 환자수 (2009~2014)】

	2009	2010	2011	2012	2013	2014
Allergic rhinitis	5,529,050	5,830,136	5,852,544	6,331,813	6,429,755	6,697,490
Asthma	2,377,683	2,245,778	2,264,275	2,181,144	1,969,078	1,827,068
Atopic dermatitis	1,051,747	1,049,290	1,010,527	981,028	1,015,186	954,000

출처: Allergol Int. 2016 Apr;65(2):186-191, Allergies are still on the rise?

【알레르기성 질환 의사 진단 경험률】



** 출처: 2016 국민건강통계; 보건복지부, 질병관리본부(국가승인통계 제117002, 국민건강영양조사)

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1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

알레르기 비염 치료 기술 현황 및 한계성

✓ 알레르기성 비염 치료 현황

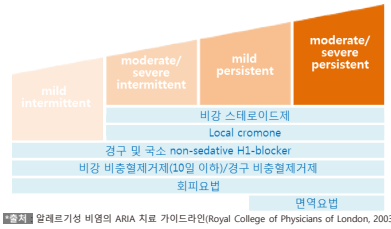
- 알레르기성 비염은 단계적 분류에 따라 치료 가이드라인이 달라짐
- 주로 알러젠과 접촉을 피하고 H1-antihistamine과 국소 비강 코르티코스테로이드를 사용하는 치료방법이 있으나 다양한 부작용이 존재
- 그러나 일부 설문조사에서는 약 60% 환자들이 이러한 약물들을 사용함에도 증상이 개선되지 않는 것으로 나타남

✓ 다양한 원인 기전, 그러나 고식적(姑息的) 치료방법

- 다양한 알레르기 유발 인자 – 꽃가루, 송진, 집먼지진드기 등
- 다양한 종류의 세포와 염증매개물질 존재
  - 대표 관여 세포 : 호산구, 비만세포 등
  - 염증매개물질 : 70여 종 이상의 Cytokine/50여 종 이상의 chemokine

이와 같이 다양한 외부요인과 내재적 요인의 조합에 의해 유발되는 알레르기성 질환 치료에 있어서 단일 타겟의 약물 개발 보다는 총체적 (holistic)이고 통합적(integrated)한 약물 개발 방법이 필요

【알레르기 비염 치료 가이드라인】



*출처 알레르기성 비염의 ARIA 치료 가이드라인(Royal College of Physicians of London, 2003)

【현용 알레르기 비염 치료제의 한계성】

치료법	효능				한계
	눈물	가려움	재채기	콧물	
항히스타민 (경구/비강)	√	√	√	√	• 진정작용(sedation) • 학습능력 저하 • Visual/physical reaction time 증가 • 심혈관계 이상
비강 스테로이드		√	√	√	• hypothalamic-pituitary-adrenal axis suppression • 성장저하(어린이), 골다공증(폐경기여성) • 장기투여 시 부작용
충혈감소제 (경구/비강)				√	• 불안, 초조 • 두통 • 불면
비강 항콜린제			√	√	• CNS 부작용 • 치매유발(장기)
류코트리엔 길항제	√		√	√	• 간독성 • 약물상호작용(theophylline, warfarin 등)
면역치료/Anti IgE	√	√	√	√	• 치료제한

1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

알레르기 질환 한의 치료 기술 현황

✓ 인체의 개체 특성을 고려한 변증 별 한의 치료 기술

- 서양의학에서 처방 선정에 있어서 단순한 증상 중심의 처방 선정
- 한의 핵심 진단 요소인 망(望)/문(聞)/문(問)/절(切)의 4가지 기법에 기반하여 환자의 증상과 상태를 진단하여 인체의 개체 특성을 고려한 처방을 선정

【아토피 피부염 처방*】

변증시치	치법	처방
습열내옹 외증기부 (濕熱內癰, 外蒸肌膚)	청열이습 소풍지양 (淸熱利濕, 消風止瘙)	용담사간탕(龍膽瀉肝湯) 가감 양혈제습탕(凉血除濕湯) 비해삼습탕(萆薢滲濕湯) 合 이묘산(二妙散) 가감
비허습옹 기부실양 (脾虛濕癰, 肌膚失養)	건비제습 (健脾除濕)	제습위령탕(除濕胃苓湯) 가감 * 상용약물: 창출(蒼朮), 백출(白朮), 진피(陳皮), 후박(厚朴), 지실(枳實), 복령(茯苓), 택사(澤瀉), 맥아(麥芽), 활석(滑石), 감초(甘草), 방풍(防風), 산치(山梔), 목통(木通), 육계(肉桂) 등
혈허풍조 기부실양 (血虛風燥, 肌膚失養)	자음양혈 소풍지양 (滋陰養血, 消風止瘙)	생혈윤부음(生血潤膚飮) 가감 * 상용약물: 생지황(生地黃), 현삼(玄參), 당귀(當歸), 단삼(丹參), 복령(茯苓), 택사(澤瀉), 맥문동(麥冬), 산치(山梔), 사상자(蛇床子) 등

【알레르기성 비염 처방*】

변증시치	치법	처방
신기부족, 간당울체 (腎氣不足, 肝膽鬱滯)	소간보신(疏肝補腎) 활혈양혈(活血養血) 거풍이규(祛風利竅)	소요산(逍遙散) 통규활혈탕(通竅活血湯) 금계신기환(金匱腎氣丸)
비폐기허 (脾肺氣虛)	배토생금(培土生金) 산풍리규(散風利竅)	목병풍산(玉屛風散) 팔진탕(八珍湯)
음양양허, 기혈부족 (陰陽兩虛, 氣血不足)	거풍통규(祛風通竅) 자음양혈(滋陰養血) 섭진고표(攝津固表)	형방패독산(荊防敗毒散) 백합고금탕(百合固金湯) 육미지황탕(六味地黃湯)
풍한내습, 폐비신양손 (風寒內襲, 肺脾腎陽損)	소산풍한(疏散風寒) 온폐신(溫肺腎) 승비양(升脾陽)	온폐지류단(溫肺止流丹) 보중익기탕(補中益氣湯) 우귀환(右歸丸)
폐비휴손, 습열내생 (肺脾虧損, 濕熱內生)	소산풍열(疏散風熱) 청열해독(淸熱解毒) 건비화습(健脾化濕)	보제소독음(普濟消毒飮) 상령백출산(泰苓白朮散)

【알레르기 질환의 변증 분류】

*출처: 아토피성 피부염 및알러지성 비염에대한생약(한약)제제의임상시험 평가지표개발연구 (식약청))
**출처: 생약(한약) 제제의 임상시험 지침 – 항천식제제 (식약청)

1. 연구 배경 및 필요성

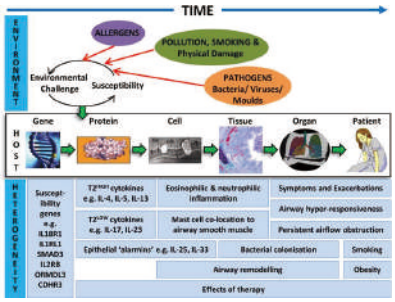
한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

알레르기 질환 치료 기술 현황 및 한계성

✓**알레르기 질환의 이질성(Heterogeneous)**

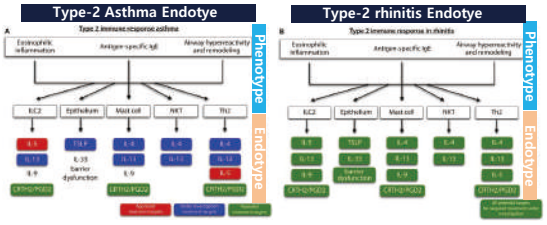
- 각각의 알레르기 질환(비염, 천식, 아토피 피부염 등)들은 이질적 질환(heterogeneous disease)으로 다양한 아형들(subtype)이 존재
- 질환의 이질적인 특징으로 인해 높은 미충족 의료 수요와 대체보완요법 비용이 소요
  - 알레르기 질환 미치료율 : 비염 69.4%, 아토피 64.0%*
  - 아토피 피부염의 경우 대체보완요법에 드는 비용 : 2조2천억원**
- 이들 질환의 다양한 아형들을 결정 짓는 요인은 다양한 내재형(endotype)으로부터 기인

【천식 질환의 이질성】



*출처 Pathogenesis of asthma: implications for precision medicine, Clinical Science (2017)

【알레르기질환의 아형】



*출처 Precision medicine in patients with allergic diseases, Journal of Allergy and Clinical Immunology (2016)

* 미충족 의료수준과 정책방안에 대한 연구, 한국보건사회연구원 (2009)
** 알레르기 질환으로 인한 사회경제적 비용 추계, 경기연구원 (2016)

1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

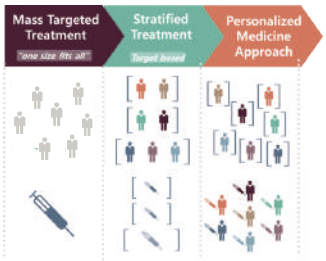
알레르기 질환 치료에 대한 패러다임의 변화

✓ **"질환" 중심에서 "사람" 중심으로**

- 기존 "one-size-fits-all"(천편일률적) 약물 치료 기술의 한계성
  - 미국 10대 블록버스터 의약품의 경우, 4~25%의 치료 효과를 나타남*
  - 스테틴(statin, 콜레스테롤 강하제)의 경우 2%의 효과만을 나타냄*
- 환자마다 다른 유전적, 환경적 요인과 질병 경력, 생활 습관 등에 대한 정보를 활용하여 인체의 개체 특성을 고려한 '정밀 의학' 치료 개념이 대두됨

【Imprecision Medicine】

【정밀 의학 발전 로드맵】

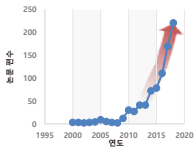


*출처 Personalized medicine: Time for one-person trials (Nature, 2015)

- 알레르기 질환의 이질적인(Heterogeneous) 특징으로 다양한 알레르기 질환의 아형들(Subtypes)을 구분하여 개인 맞춤형 치료(Personalized medicine)를 하고자 하는 개념이 대두
  - 알레르기 질환 관련 개인 맞춤형 치료 논문이 최근 10년 사이에 급격히 증가
  - "알레르기 질환에서의 정밀 의학"을 주제로 2015년 유럽 심포지엄에서 발표된 내용이 유럽 연합 의회 심포지엄에 보고

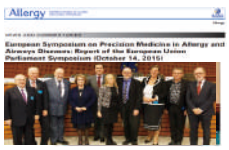
【알레르기 질환 정밀 의학 관련 논문 】

【논문 발표 현황】



*출처 Pubmed, Keyword : Precision medicine allergy disease (2000~2018)

【2015 유럽 심포지엄】



*출처 European Symposium on Precision Medicine in Allergy and Airways Disease Allergy 71 (2016)

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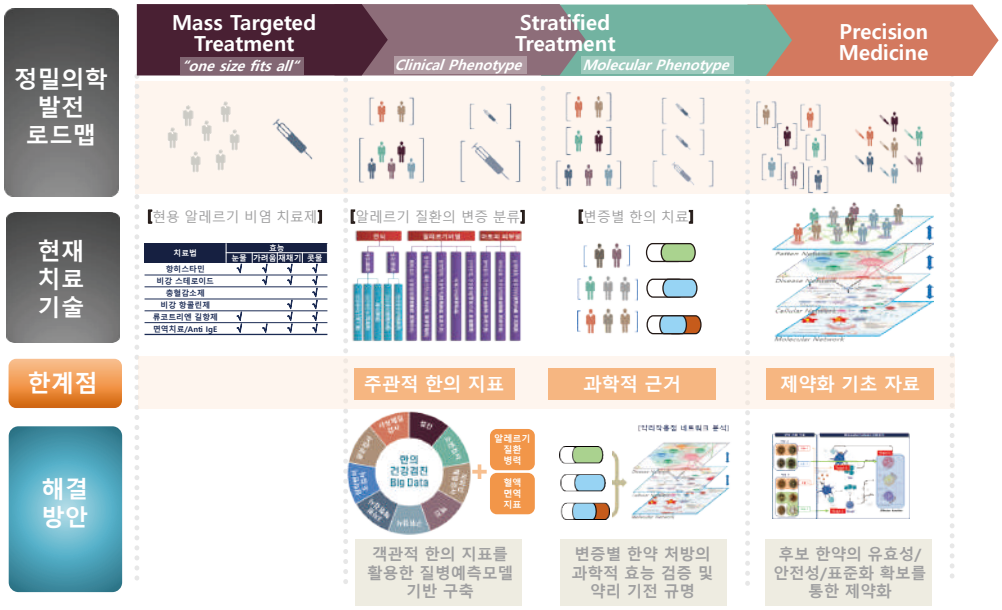
1. 연구 배경 및 필요성

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

알레르기 질환에 대한 한의 치료 기술 개발 방향

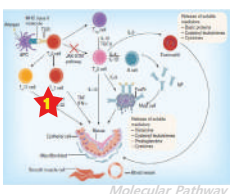


2. 연구 개요

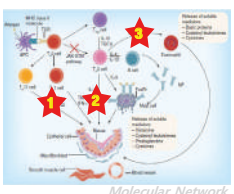
한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

핵심 추진전략 1. 질환 네트워크 조절 다중표적 약물 개발

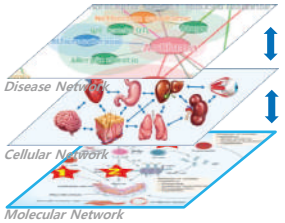
- 기존 약물 치료제: 질병과 관련되어 있는 중요 인자 하나를 표적함으로써 치료 효과를 나타내도록 하는 방법으로 개발되어 왔으나, 생체 반응은 각 인자가 네트워크를 구성해 상호 영향을 줌으로써 예기치 못한 부작용 등의 문제 발생 확률이 높음
- 질환 네트워크 표적 약물: 질환 발병과 관련된 생체 반응(단백질간, 세포간, 장기간 등) 네트워크를 분석하고 이를 활용해 질환 조절 시스템을 표적함
- **질환 네트워크 조절 다중표적 한약제제**: 한약의 다중약물-다중표적 (multi-drugs & multi-targets) 특성을 활용해 질환 네트워크를 구성하는 여러 조절 시스템을 표적함으로써 질환을 제어 및 치료하는 혁신형 한약제제



단일 표적 약물 개발



다중 표적 약물 개발



질환 네트워크 기반 다중 표적 약물 개발

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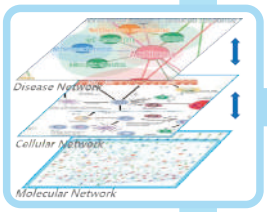
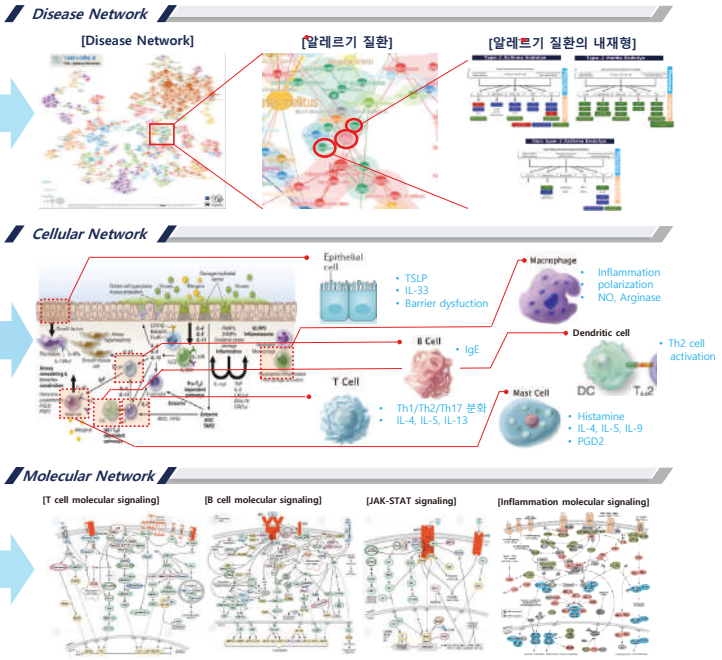
2. 연구 개요

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

질환 네트워크 기반
다중 표적 약물 개발





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2. 연구 개요

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

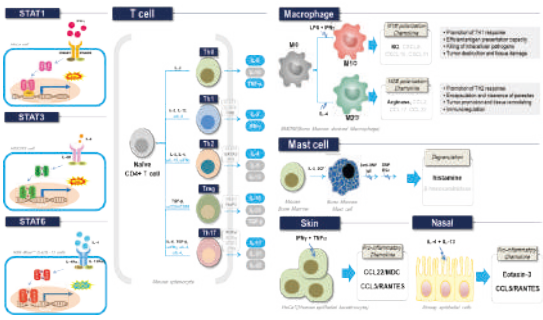
질환 네트워크 기반 다중표적 탐색 시스템 및 질환별 비임상 평가 모델 구축

알레르기 질환(비염, 아토피, 천식) 제어 다중표적 탐색 시스템

■ 알레르기 질환(비염, 아토피, 천식) 제어 다중표적 탐색 시스템 14건 구축

- Target-based screening 3건
  STAT1, STAT3, STAT6 reporter
- Cell-based screening 11건
  T cell 활성화 및 분화조절 : Th0, Th1, Th2, Th17, Treg
  Macrophage 분극화 조절 : M1, M2
  Mast cell 탈과립화 조절
  질환별 타겟 조직 염증 조절 : HaCaT(피부), HNEpCs(비강상피), NHBE(기관지상피)

[알레르기 질환 제어 다중표적 탐색 시스템]



알레르기 질환별 비임상 효능 검증 시스템

■ 알레르기 질환별(비염, 아토피, 천식) 비임상 효능평가 모델 구축

- 알레르기성 비염 비임상 모델
  OVA, RW, HDM 유발 알레르기성 비염 마우스 모델
- 아토피 피부염 비임상 모델
  HDM 유발 아토피 피부염 마우스 모델
- 천식 비임상 모델
  OVA 유발 천식 마우스 모델

[알레르기 질환 비임상 효능평가 모델]

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2. 연구 개요

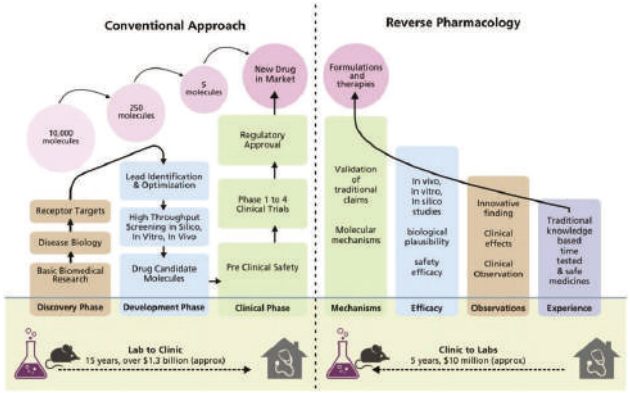
한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

핵심 추진전략 2. 한의 특성을 고려한 '역(逆)약리학'(reverse pharmacology) 개념의 치료제 개발

(기존연구와의 차별성) 기존 약물 연구인 '기초-중개-임상'의 직선형 연구 개발 방식과는 달리, 전통지식과 경험으로 검증되고 한의의료 현장에서 축적된 임상연구로 시작하여 **'임상-기초-중개-임상'**의 순환모델 구조로 약물을 개발하여 약물 개발 성공률을 극대화

【기존 약물 개발 연구】

【한의 약물 개발 연구】



[Conventional Pharmacology VS Reverse Pharmacology]

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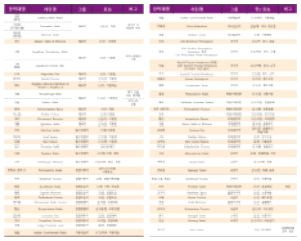
2. 연구 개요

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

면역과민반응 질환 핵심 한약 소재

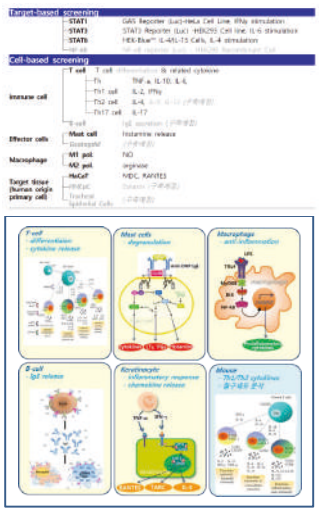
[동의보감]

[면역과민반응 질환 약재 추출]

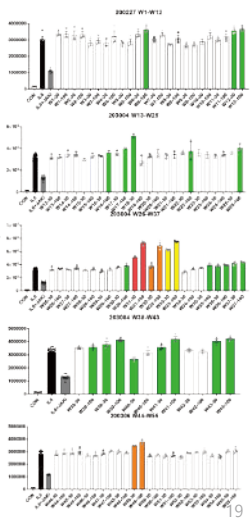


* 면역과민반응 한약소재 42종

[네트워크 기반 약효 탐색 시스템]



[약효 및 약리 작용점 탐색]



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3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

한의 생체지표 기반 알레르기 질환 변증 유형 분석을 통한 후보 처방 도출

알레르기 질환 중심 한의 건강검진 데이터 기반 변증유형 분류

- 한양방 건강검진데이터 5,000명중 알레르기 질환자 792명 데이터 비교분석
- 20종 기기검사 및 10종 설문을 통한 정상인 대비 알레르기 질환자의 한의학적 특징 분석
- **한증**이면서 **기허**, **기울** 등을 보이는 경향 관찰

알레르기 질환 변증유형에 따른 후보처방

- 알레르기 질환 중심 한의 건강검진 데이터에 기반한 변증유형에 따른 후보처방 목록 도출
- 남성의 경우 겸한 증상을 확인하여 **보중익기탕** 또는 **팔미환** 등에 가감 처방
- 여성일 경우는 상기 증상에 기울증이 심할 경우 **소요산** 가미, 체수분과다가 심한 경우 **진무탕** 가감이 적합
- 임상에서 활용도가 높은 상위 10개 비염 처방에서는 남성의 경우 **보중익기탕**, **소청룡탕** 그리고 여성의 경우 **시호계지탕**이 적합

알레르기성 비염에 대한 임상활용 처방 선정

[알레르기성 비염 임상 처방 순위]*

순위	처방명(보험 처방)	빈도(%)
1	소청룡탕	100
2	보중익기탕	68
3	형개연교탕	62
4	연교패독산	44
5	삼소음	40
6	갈근탕	36
7	인삼패독산	30
8	향소탕	20
9	구미강활탕	18
10	시호계지탕	16

- 보중익기탕은 알레르기 비염의 만성, 폐비기허 변증에 사용되는 대표 처방
- 기존 한약제제의 적응증에 알레르기 비염이 포함되어 있지 않음
- **확증형 임상연구 수행**을 통해 기존 한약제제에 새로운 적응증을 추가

*출처 김남권 외. 봉난성 알레르기 비염의 표준 치료 모델 개발 : 실용임상연구 프로토콜 개발을 위한 기초 연구 Kor.J.Oriental Preventive Medical Society 2013 : 17(3) : 143-153

3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

임상근거중심 면역 질환 한의 치료 기술 도출 (1/3)

보중익기탕의 알레르기성 비염에 대한 적응증 확대 임상연구

■ 보중익기탕의 적응증 확대 허가용 임상2a상 IND 파일링

1. 개발계획
2. 임상시험자 자료집
3. GMP에 맞게 제조되었음을 증명하는 서류 또는 자료
4. 임상시험용의약품 관련 제조 및 품질에 관한 자료
5. 비임상시험성적에 관한 자료
6. 임상시험실시기관, 시험자 및 수탁기관 등에 관한 자료
7. 임상시험 피해자 보상에 관한 자료
8. 시험대상자 동의서 서식
9. 임상시험계획서

[임상 시험 승인 및 수행 일정]

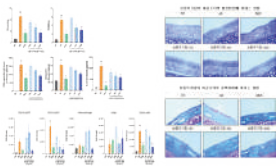
진행 내용	2020				2021				2022				해당 기관
	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	
사전미팅													KIOM-대전대
임상 시놉시스 작성 및 검토													KIOM-대전대
CRO 및 GMP 선정													대전대
비임상 효능 평가용 시료 생산													한국신약
임상시험 protocol													대전대-메디팁
비임상 효력시험자료													KIOM
시험약 및 위약 생산													한국신약
허가용 IND 신청 및 승인													메디팁
IRB 승인													대전대
임상2a 시험 수행													대전대
임상 결과 분석													KIOM-대전대

❶❷ 개발계획 및 임상시험자 자료집

❸❹ GMP 관련자료

[시험지시 및 성적서]

❺ 비임상 효능 자료



❽ 시험자 동의서

❾ 시험자 동의서

[임상시험용 의약품]

3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

임상근거중심 면역 질환 한의 치료 기술 도출 (2/3)

보중익기탕의 알레르기성 비염에 대한 허가용 2a상 승인

- 허가용 임상2a(식약처(제33662호) 승인 완료(21/4/6)
- 임상연구 실시기관(대전대) IRB 승인 완료(21/6/2)
- 지속성 알레르기성 비염 환자에 대한 보중익기탕의 2상 임상시험 개시 및 수행 (105명 대상, 대전대)

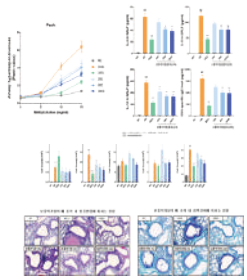
[임상시험계획 승인 (2021. 04)]

[IRB 승인서 (대전대)]

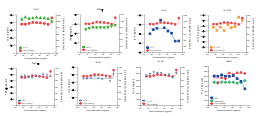
보중익기탕의 천식 비임상 효능 및 약리작용점 구명

- 천식 비임상 효능 검증을 통해 임상에서의 활용성 극대화
- 알레르기 질환 유전체 네트워크 상에 약리 작용점 분석
  - 알레르기 질환 관련 유전체의 질환 네트워크 구성 및 상호 연계성 분석
  - 임상 한약의 알레르기성 질환 효능에 대한 다중표적 약리 작용점 구명

[보중익기탕의 천식에 대한 비임상 효능 결과]



[다중표적 탐색 시스템상에서의 약리작용점]



[알레르기 질환 네트워크 약리 작용점]

3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

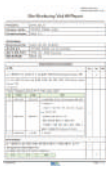
임상근거중심 면역 질환 한의 치료 기술 도출 (3/3)

임상시험 진행 현황

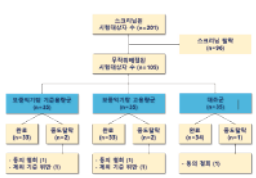
- 임상시험계획서 상 목표 105명 중 **105명 모집 완료**
- 임상시험기관 : 대전대 한방병원
- 단계 및 디자인 :
  - 단 계 : 2상 임상시험
  - 디자인 : 4주, 단일기관, 무작위배정, 양측눈가림, 위약대조, 평행설계

[임상시험 진행 흐름도]

[모니터링 보고]



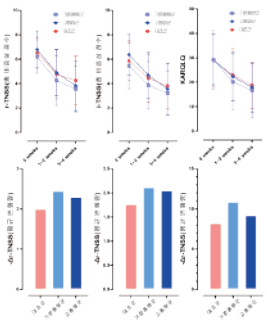
[시험대상자 배치]



임상 결과

- **임상시험 유효성 평가** :
  - 반영적 총 비증상 점수(**r-TNSS**) 및 즉각적 총 비증상 점수(**i-TNSS**)변화 모두 **기준용량군과 고용량군이 대조군보다 더 많은 감소**를 보였으나 군간 통계적으로 유의미한 차이는 나타나지 않음
  - **KARQLQ** 변화, **total IgE** 및 **eosinophil count** 변화, 한의학적 **변증별 총 비증상 점수** (r-TNSS)의 변화에서 모두 **기저값보다 개선**되었으나 통계적 유의성은 나타나지 않음
- **안전성 평가결과** : 이상반응, 활력징후, 임상병리검사의 모든 지표에서 임상적으로 유의미한 변화는 없었고, 나타난 이상반응 또한 **중대한 이상반응은 발생하지 않았으며** 추적검사를 거부한 1건 이외에 모두 소실됨을 확인

[임상시험 유효성 평가 결과]



[안전성 평가 결과]

	기준용량 군 례수	고용량군 례수	대조군 례수	합계
Infections & infestations - COVID19	0	2	0	2
Musculoskeletal & connective tissue disorders - pain knee	1	0	0	1
Investigations - CK or AST increased	3	2	1	6
Injury - Toe fracture	1	0	0	1
s & administration site conditions - Fever	2	1	0	3
Skin & subcutaneous tissue disorders - contact dermatitis	0	0	1	1
합계	7	5	2	14

[임상병리검사]

[활력증후]

3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

Kiom32의 아토피 피부염 치료제 개발을 위한 허가용 IND 자료 파일링 및 지재권 확보

아토피 피부염 소재 Kiom32 IND 파일링 (2019~2023)

- 전통적으로 염증에 사용되어 왔던 Kiom32 후보소재에 대하여 아토피 피부염 IND 승인을 위한 의약품 개발 자료 파일링 진행중
  - ❶ Kiom32 건조엑스 기준 규격 설정 완료 및 성적서를 확보
  - ❷ 외피용제 시제품 및 위약 제형 개발 완료(GMP)
  - ❸ 제1상 임상시험 계획 수립 및 임상시험자료집 작성 진행 완료(CRO)
  - ❹ 안정성 평가 자료 파일링(GLP, 켐온) 완료
    - 경피투여 코맷시험 ('21~'22)
    - 호흡기계 안전성약리시험 ('21~'22)
    - 중추신경계 안전성약리시험 ('21~'22)
    - 심혈관계 안전성약리시험 ('21~'22)
    - **Telementry 시험 자료 확보('22~'23)**

후보소재 Kiom32의 적응증 확대 관련 지재권 확보 진행중

- 아토피 피부염 치료를 위한 외피용제로 개발 중인 Kiom32의 적응증 확대를 위해 알레르기성 비염 비임상 효능 확인
- OVA 유발 마우스 모델에서 Kiom32의 비임상 효능 및 신규 작용점(Th2 세포 활성 조절) 규명을 통해 논문 게재 (Cells, 2023 IF 7.666)
- 신규 알레르기성 비염 효능에 대해 특허출원 완료(출원번호: 10-2022-0077015)

[신규 약리작용점 규명 및 논문 발표]

[특허 출원증]

3. 연구 결과

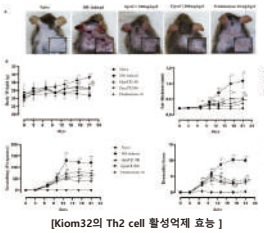
한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

Kiom32의 아토피 피부염 치료제 개발을 위한 허가용 IND 자료 파일링 및 지재권 확보

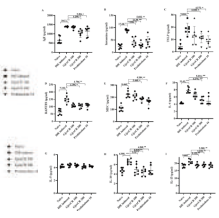
후보소재 Kiom32의 아토피 피부염 치료 효능 심화연구

- 아토피 피부염 치료를 개발 중인 Kiom32의 비임상 효능 검증 및 약리 작용 규명
- Th2 cell 활성 억제 작용점 규명

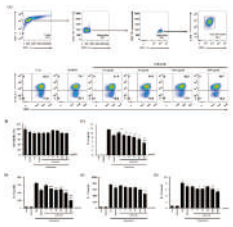
[Kiom32의 아토피 피부염 개선 효능]



[Kiom32의 Th2 cytokine 개선 효능]



[Kiom32의 Th2 cell 활성억제 효능]



[논문 게재 성과]

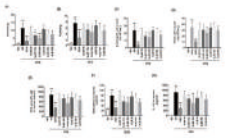
Biomedicine & Pharmacotherapy 2022
Gardenia jasminoides extract ameliorates DfE-induced atopic dermatitis in mice through restoration of barrier function and T-helper 2-mediated immune response

Pharmaceuticals 2021
Gardenia jasminoides Attenuates Allergic Rhinitis-Induced Inflammation by Inhibiting Periostin Production

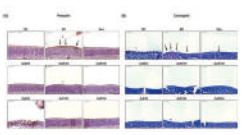
후보소재 Kiom32의 적응증 확대(비염) 예비 연구

- 아토피 피부염 치료를 위한 외피용제로 개발 중인 Kiom32의 적응증 확대를 위해 알레르기성 비염 비임상 효능 확인
- OVA 유발 비염 마우스 모델에서 Kiom32의 비임상 효능 확인

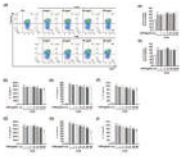
[비염 임상 증상 개선 효능]



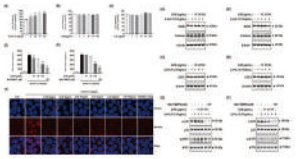
[비염 임상 증상 개선 효능에 대한 조직학적 분석]



[약리작용기전-T세포 활성 조절]



[분자생물학적 약리작용기전]



3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

면역과민반응 질환(비염, 아토피 피부염, 천식) 비임상 효능 검증을 통한 선도소재 발굴

유효 소재 및 선도소재 도출

■ 다중표적 탐색 시스템을 활용하여 한의소재의 효능 탐색을 통한 유효소재 선별

- 한약소재의 알레르기 질환 타겟 유효성 분석

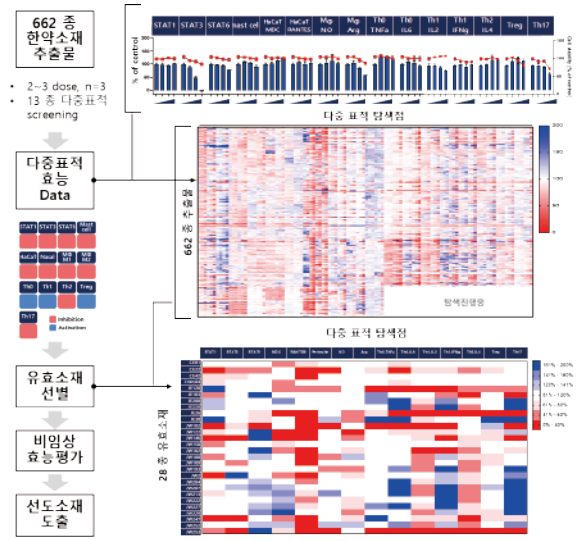
■ 비임상 효능 평가를 통해 선도소재 9건 도출

- 알레르기성 비염(AR) 선도소재 3종: JW122, JW158, JW207
- 아토피 피부염(AD) 선도소재 2종: JW158、JW188
- 천식(AS) 선도소재 4종: JW1, JW2, JW227, JW253

[비임상 효능 검증 선도소재 25종]

No	CODE	AD	AR	AS	No	CODE	AD	AR	AS	No	CODE	AD	AR	AS
1	JW01			23	10	JW182				19	JE30			
2	JW02			23	11	JW188	23			20	JE36			
3	JW25				12	JW204				21	JE40			
4	JW102				13	JW207				22	JE49			
5	JW122		23		14	JW227		23	23	23	JE74			
6	JW130				15	JW229				24	JE120			
7	JW144				16	JW247				25	JE220			
8	JW146				17	JW253			23					
9	JW158	23	23		18	JE26								

AD Atopic Dermatitis AR Allergic Rhinitis AS Athma 진행중



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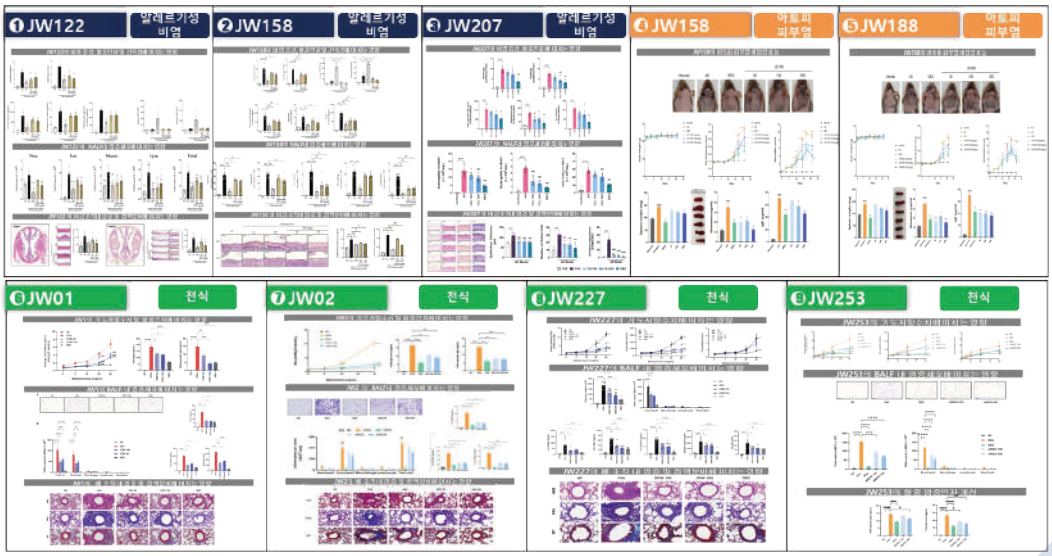
면역과민반응 질환 제어 선도 소재



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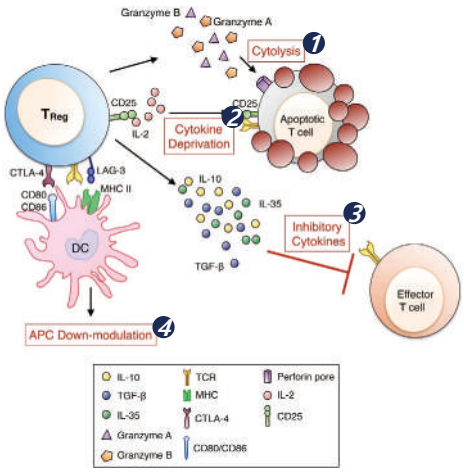
Treg 제어 통한 항천식 치료소재 심화 연구

Treg (regulatory T cell or suppressor T cells)

- ✓ 면역계를 조절하며 자가항원에 면역관용을 유지
- ✓ 자가 면역 질환을 예방하는 데에 중요
- ✓ Biological maker : CD4, FOXP3, CD25
- ✓ Treg based drug discovery : Cancer, autoimmune disease & Parkinson's disease etc.



Mechanisms of Foxp3+ Treg cell–mediated suppression

- ✓ **T-cell cytolysis** through a granzyme-dependent mechanism ❶
- ✓ **IL-2 deprivation** -> blocking the proliferation effector T (Teff) cells ❷
- ✓ **Immune-suppressive cytokines** (TGF-β, IL-35, IL-10) 생성 ❸
  -> blocking the proliferation effector T (Teff) cells
- ✓ Antigen-presenting cells (**APCs**) ❹
  -> LAG-3–MHC class II & CTLA-4–CD80/CD86 interactions

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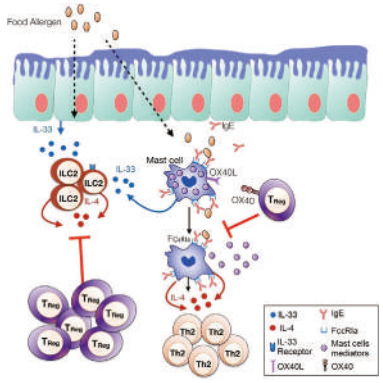
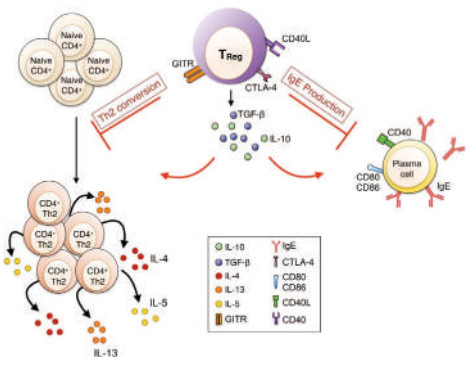
Treg 제어 통한 항천식 치료소재 심화 연구

The role of Treg on allergy

- ✓ **Innate immune responses** regulation
  - **Mast cell** 활성 억제 : OX40–OX40 ligand OX40L–mediated interactions
  - IL-33–의존성 **ILC2** 확장 억제 : IL-4 production.



- ✓ **Adaptive immune response** regulation
  - **Th2** 면역 반응 억제 : GITR(Glucocorticoid-Induced TNFR-related protein)->Treg activation -> Th2 conversion 억제
  - **B cell** 억제 및 **IgE** 생성 차단 : CTLA-4 and cell contact–dependent mechanism, IL-10



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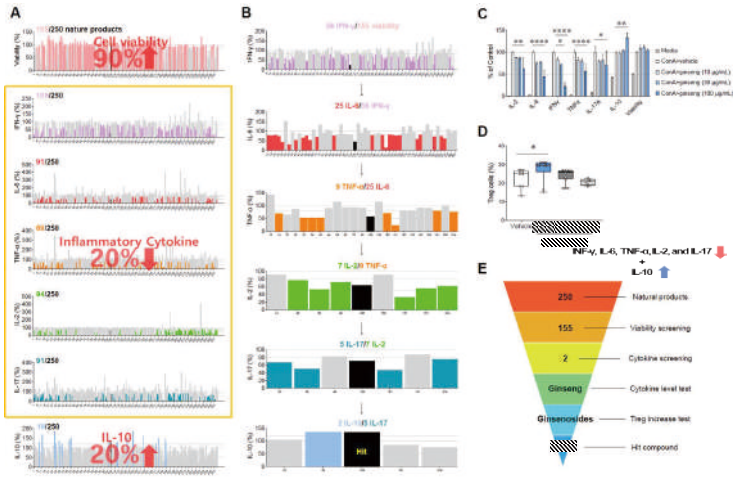
Treg 제어 한약 소재 screening



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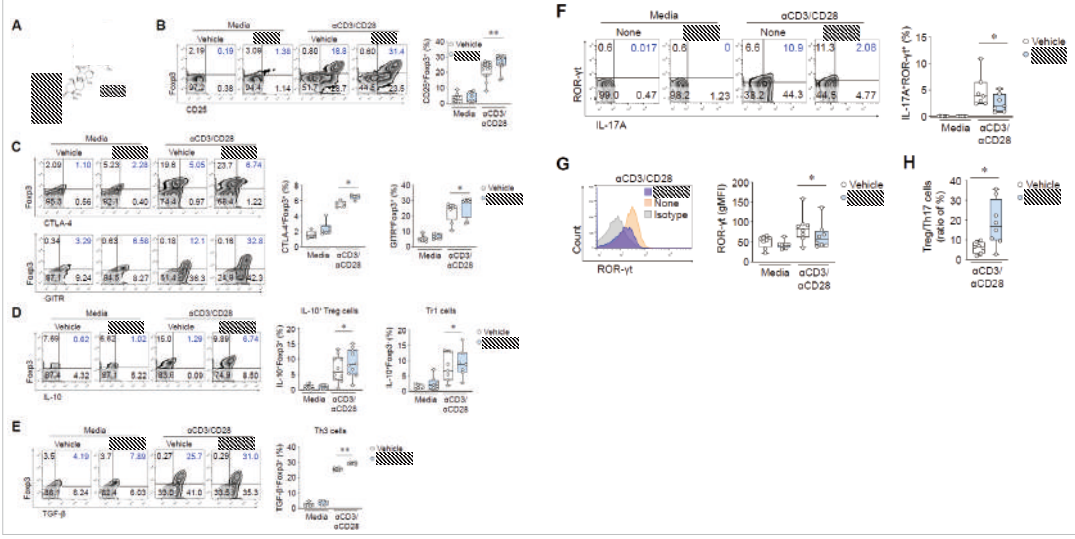
Comp.X 의 Treg 증가 촉진 효능



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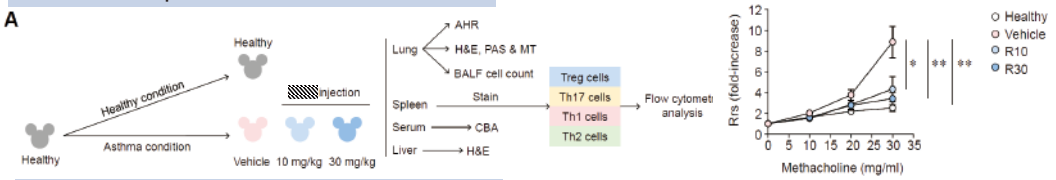
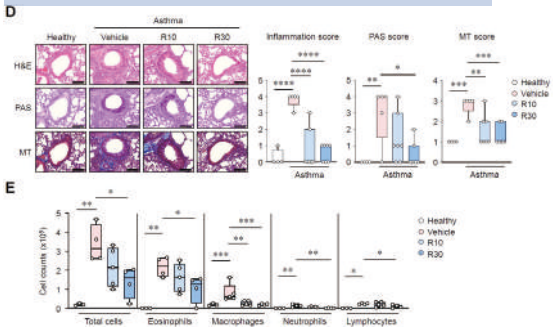
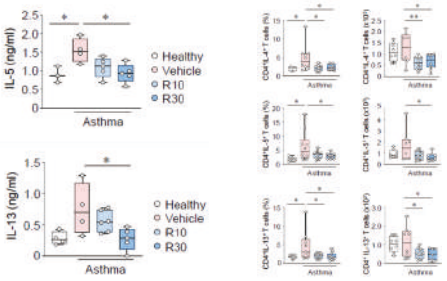
Comp.X 의 천식 비임상 효능 검증



천식 비임상 모델에서 조직학적 분석



천식 비임상 모델에서 Th2 cytokine 및 Th2 세포 분석



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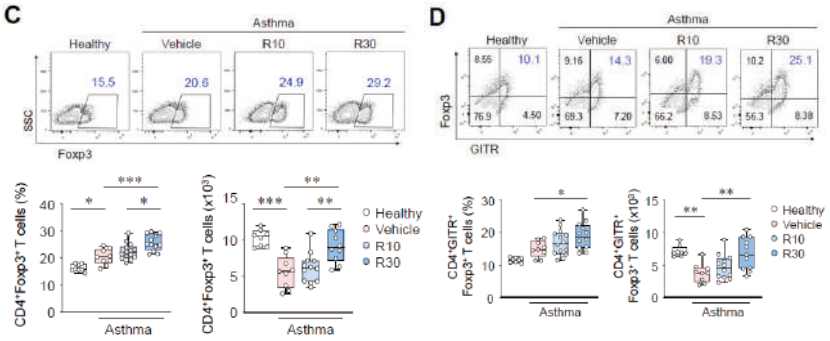

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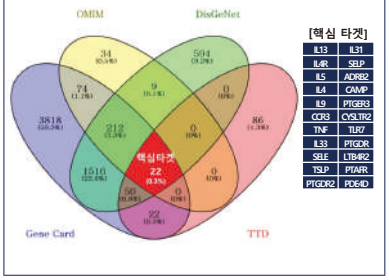
면역과민반응 질환(비염, 아토피 피부염, 천식) 선도소재의 약물 상승 효능 발굴

■ **알레르기 질환(아토피 피부염, 알레르기성 비염, 천식) 핵심 타겟 선별**

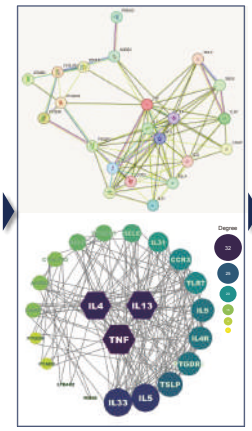
- GeneCards, OMIM, DisGeNET, 그리고 TTD databases상에서 공통적으로 나타나는 22개의 핵심 타겟을 선별
- protein-protein interaction(PPI) 네트워크 분석을 통해 가장 영향력이 높은 상위 3개의 타겟(TNF, IL4, IL13) 선별
- 상위 3개 핵심 타겟 기반 스크리닝 시스템 구축

[알레르기 질환 핵심 타겟]

Database	Atopic Dermatitis	Allergic Rhinitis	Asthma
OMIM	181	52	185
DisGeNet	751	178	2096
Gene Card	1424	1914	4930
TTD	54	34	177
Sum	1762	1975	5609



[핵심 타겟 PPI network]



[핵심 타겟 탐색 시스템]

[약물 상승 효능 탐색]

Dupilumap (상품명 : Dupixent)

- IL-4와 IL-13의 수용체 binding을 억제하는 단일클론항체
- 미국 사노피(사)에서 개발된 치료제이며, FDA에서 성인과 청소년 대상 중증 아토피와 천식 치료제로 승인('17)
- 현재 천식 및 만성비부비동염 치료로 확장('19~'20)
- **시장규모**: 2021년 8조원 글로벌 매출 (전년도 대비 50% 상승, '21)
- **치료비용**: 비급여 시 1년에 약 1000~1800만원 소요(국내)

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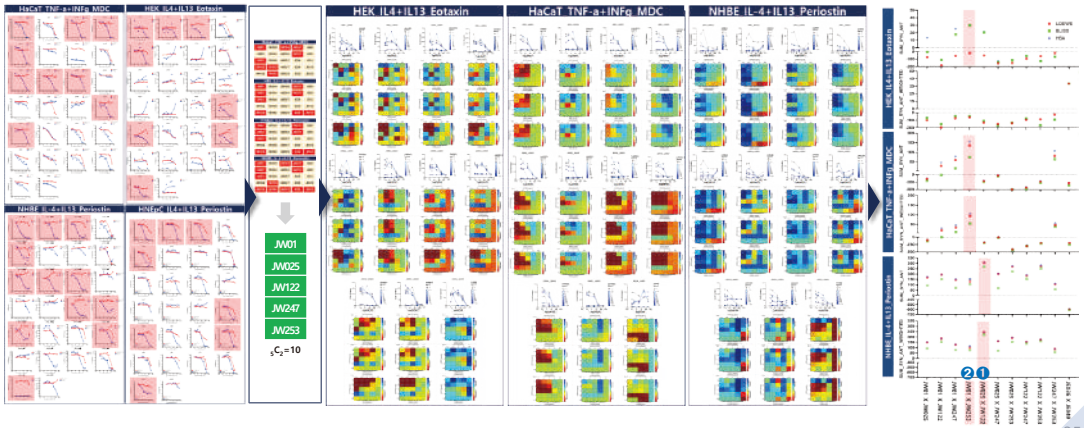
■ **선도소재 최적화를 위한 약물 상승 효능 탐색**

- 핵심 타겟에 우수한 효능을 나타난 소재 5종(JW01, JW25, JW122, JW247, JW253) 선발하여 두 소재간 조합에 의한 약물 상승 효능 평가 수행
- LOEWE, BLISS, Highest single agent (HSA)) 모델을 활용하여 약물 간 상승 및 길항 정도를 분석하여 최적 조합 선발
- 선발 최적 조합 : ❶JW01 + JW253, ❷JW25 + JW122



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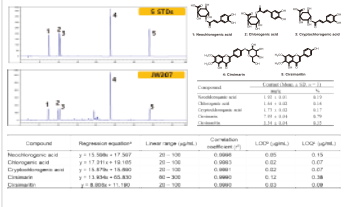
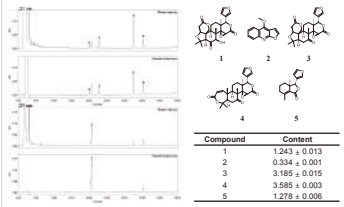
■ **선도소재의 CMC 기초 자료 확보**

- 선도소재 6종(JW207. JW227, JE26, JE30, JE94, CE22) 에 대한 지표성분 분석 및 성분 프로파일링 분석 자료 확보

JW207 대표 화합물 및 표준화 기초자료

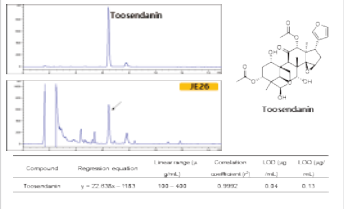


JW227 대표 화합물 및 표준화 기초자료

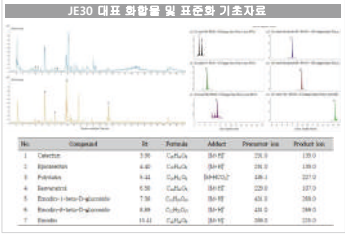


Compound	Content
1	1.243 ± 0.013
2	0.334 ± 0.001
3	3.185 ± 0.015
4	3.585 ± 0.003
5	1.278 ± 0.006

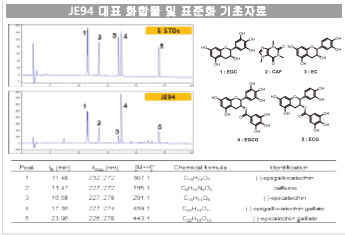
JE26 대표 화합물 및 표준화 기초자료



JE30 대표 화합물 및 표준화 기초자료



JE94 대표 화합물 및 표준화 기초자료



CE22 대표 화합물 및 표준화 기초자료

3. 연구 결과

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

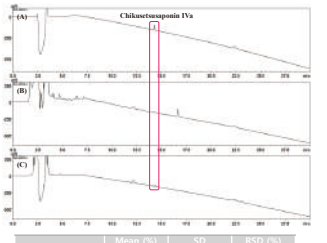
면역과민반응 질환(비염, 아토피 피부염, 천식) 선도소재의 표준화 기초 자료

■ **선도소재 JW229의 원료/제제 개발 및 생산 기초 자료 수집**

- 선도소재 JW229의 지표성분 함량 분석법 확립을 통한 제조공정(건조 방법) 및 원산지 별 표준화 기초 자료 확보

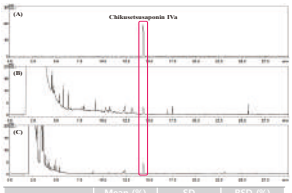
JW158 추출물의 지표성분 함량 분석법 확립

HPLC-PDA 함량 분석



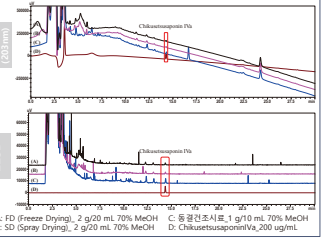
동결건조 시료	0.04	0.0005	1.15
원 시료	0.02	0.0004	1.92

HPLC-ELSD 함량분석



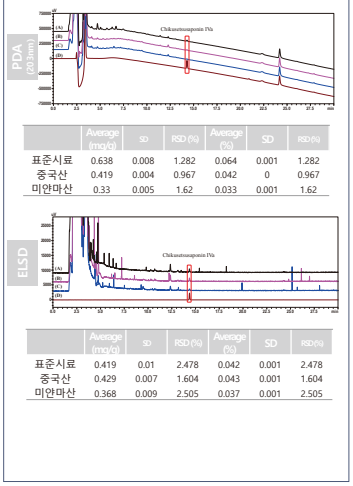
동결건조 시료	0.03	0.0009	2.78
원 시료	0.02	0.0004	2.09

제조공정(건조 방법)에 따른 표준화 분석법 확인



A: FD (Freeze Drying)_ 2 g/20 mL 70% MeOH C: 동결건조시료_1 g/10 mL 70% MeOH
B: SD (Spray Drying)_ 2 g/20 mL 70% MeOH D: ChikusetsusaponinIVa_200 ug/mL

원산지 별 분석 확인



	Average (mg/g)	SD	RSD (%)	Average (%)	SD	RSD (%)
표준시료	0.638	0.008	1.282	0.064	0.001	1.282
중국산	0.419	0.004	0.967	0.042	0	0.967
미얀마산	0.33	0.005	1.62	0.033	0.001	1.62

	Average (mg/g)	SD	RSD (%)	Average (%)	SD	RSD (%)
표준시료	0.419	0.01	2.478	0.042	0.001	2.478
중국산	0.429	0.007	1.604	0.043	0.001	1.604
미얀마산	0.368	0.009	2.505	0.037	0.001	2.505

4. 향후 연구 계획

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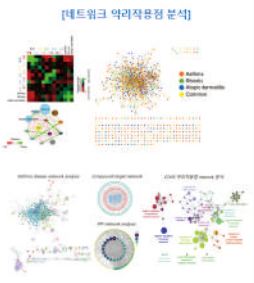
연구방법 및 추진체계

- 면역과민반응 질환(알레르기성 비염, 아토피 피부염, 천식) 비임상 효능 검증
- 다중표적 질환 네트워크 조절 약리 작용점 구명
- 면역과민반응 질환 네트워크 조절 다중표적 한약제제 개발

다중표적 탐색 시스템	약리학적 특성 분석	소재 최적화 및 표준화 기초자료	IND 파일링 & 임상 시험
❖ 다중표적탐색 시스템을 활용한 유효성 분석 ❖ 알레르기성 질환(비염, 천식, 아토피 피부염) 비임상 효능 평가	❖ NGS기반 유전체 발현 패턴 분석을 통한 네트워크 약리 작용점 분석	❖ CMC 기초 자료 ❖ 유효 및 지표 성분 분석 및 프로파일링 ❖ 유용성 최적화	❖ Kiom32의 IND 파일링 완료 ❖ 임상승인 준비
선도소재		후보소재	



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감사합니다.

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PRESENTATION

Vitaly Napadow
Harvard University

THE ROLE OF NEUROIMAGING IN UNDERSTANDING BRAIN MECHANISMS OF ACUPUNCTURE

The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture

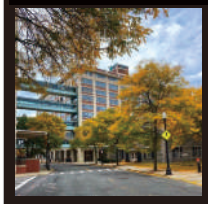
- Vitaly Napadow I Harvard University

KIOM 30th Anniversary Symposium
The KIOM / Mass General Brigham Collaboration: 12 years of success

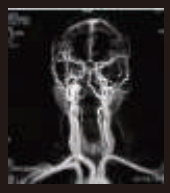
Vitaly Napadow, PhD LAc

Schoen and Adams Discovery Center for Chronic Pain Recovery
Spaulding Rehabilitation Hospital, Harvard Medical School
Martinos Center for Biomedical Imaging, Mass General Hospital, HMS

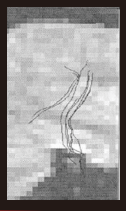
Martinos Center for Biomedical Imaging
Timeline of Innovation – Many Firsts!



First MRA
1984



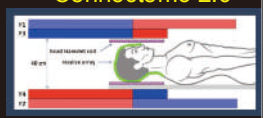
First Diffusion Tractography
1994

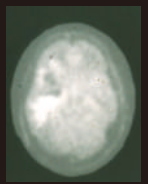


First Human Connectome
2008

2023

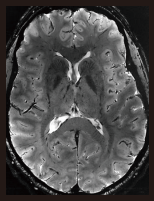
Connectome 2.0



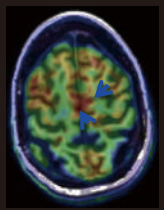


First MRI
USA
1980

First fMRI
1991



First 7T
Clinical Scanner
2000



First Human
PET/MRI
2009

The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture

- Vitaly Napadow I Harvard University

Highlighting KIOM / MGB Collaboration

- **2012:** MOU signed by *Seung-hoon Choi*, President of KIOM, and *Bruce Rosen*, Director of Martinos Center for Biomedical Imaging, MGH
- Subsequent KIOM administrations support the KIOM/MGB collaboration to apply neuroimaging to explore brain mechanisms of acupuncture and chronic pain
- Supporting KIOM's new MRI scanner – coming in 2025?

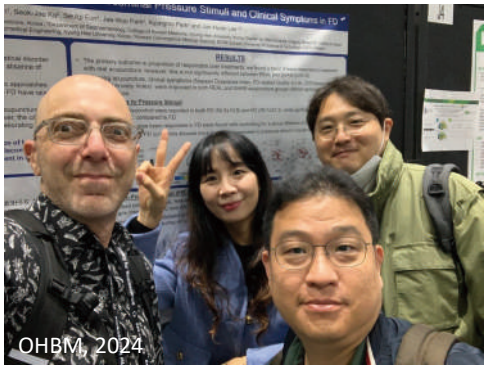
2012

2016

KIOM Trainees in the Napadow Lab

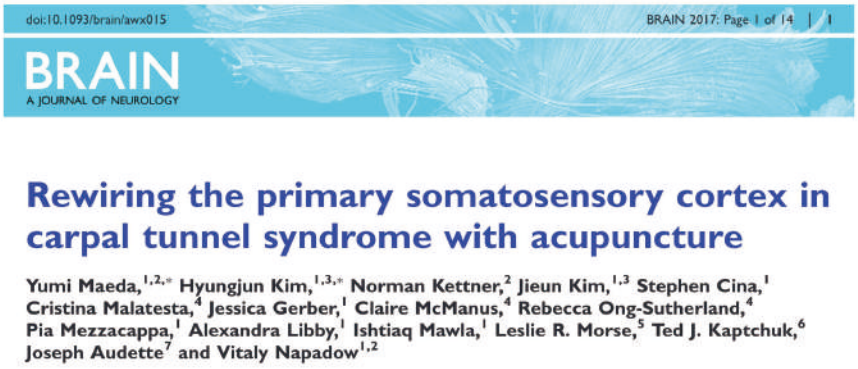
- **Hyungjun Kim** (*Returned as researcher with KIOM neuroimaging team*)
- **Changjin Jung** (*Returned as researcher with KIOM*)
- **Kyungsun Han** (*Returned as researcher with KIOM neuroimaging team*)
- **Junhwan Lee** (Will *return as researcher with KIOM neuroimaging team*)

2016


OHBM, 2024

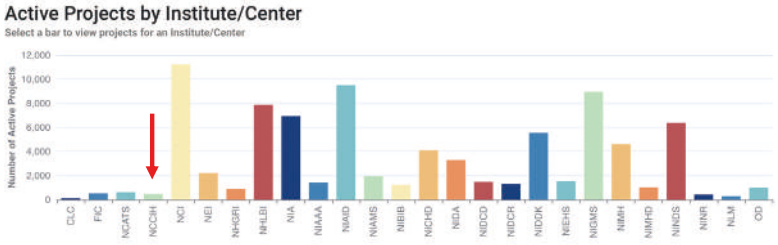
High Profile Publications from KIOM / MGB Collaboration

- **19 publications** co-authored by KIOM and Napadow Lab researchers
- Many publications in high impact factor journals such as *Brain, Science Advances, Pain, PNAS, etc.*



Acupuncture Research in US at NIH

- National Center for Complementary and Integrative Health (NCCIH) funds most acupuncture research in the US
- However, NCCIH is a small fraction of overall NIH funding
- NCCIH currently funds a total of 24 research and training grants related to acupuncture



Administering Institute/Center	Projects	Total Funding
NCCIH	24	$13,588,976
NCI	9	$3,107,458
NIDA	4	$4,054,338
NIA	3	$1,597,007
VA	3	
NICHD	2	$911,656
NINR	2	$1,443,412
NINDS	2	$1,272,990
NIAAA	1	$1,230,560
NIMHD	1	$3,752,243
NIDCR	1	$691,750
Total	52	$31,650,390

The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture

- Vitaly Napadow I Harvard University

Overview

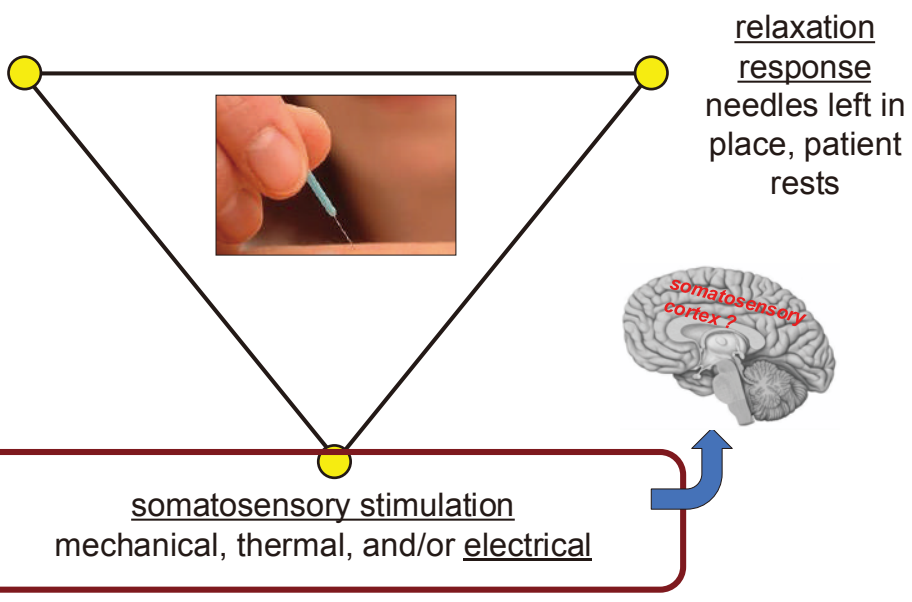
- ***Researching the Components of Acupuncture***
  - *Somatosensation* and brain plasticity with needle stimulation
  - Patient / acupuncturist *therapeutic alliance* and brain-to-brain concordance
- Topological Atlas and Repository for Acupoint research (*TARA*)
  - NCCIH-funded "Research Resource Center to Build an Open-Access Repository and Database for Anatomical and Physiological Correlates of Acupoints" → ***largest acupuncture-dedicated grant at NIH***

Martinos Center

TARA Topological Atlas & Repository for Acupoint Research

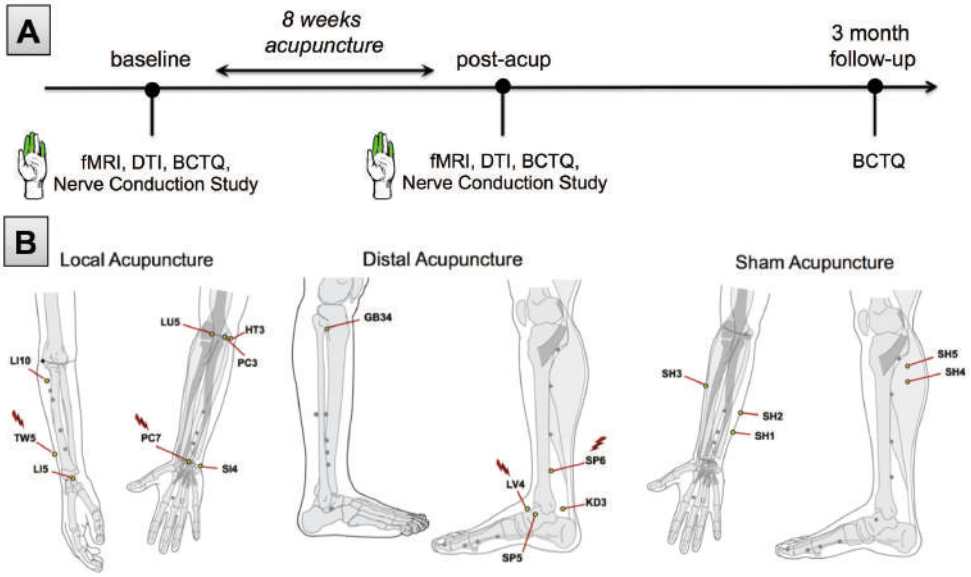
Components of acupuncture

TCM ritual
history, palpation, diagnosis, therapeutic alliance



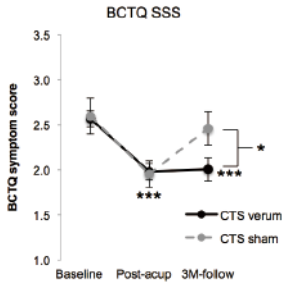
relaxation response
needles left in place, patient rests

Randomized single-blind trial with MRI outcomes



Results: symptom severity & nerve conduction latency

- *Symptom severity:* No verum vs. sham difference following therapy… however, symptom reduction retained for verum at 3-months followup
- *Median nerve conduction latency:* reduced (improved) for verum vs. sham, significant improvement for both local & distal



Maeda, Kim et al., Brain 2017

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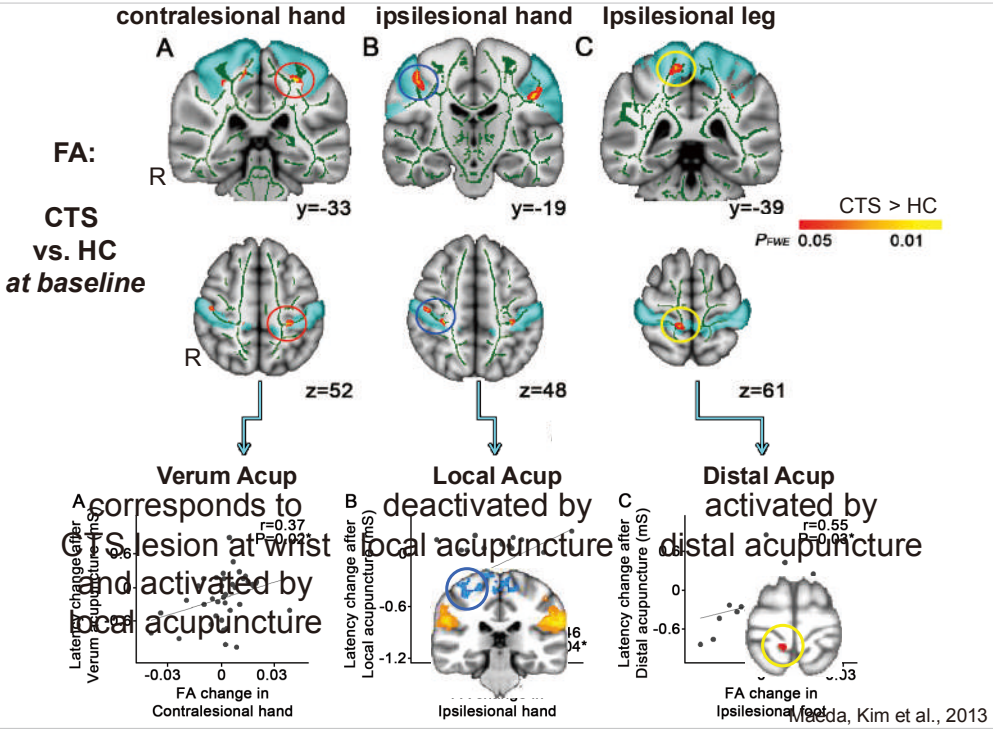
Structural Plasticity: Diffusion Tensor Imaging (DTI)

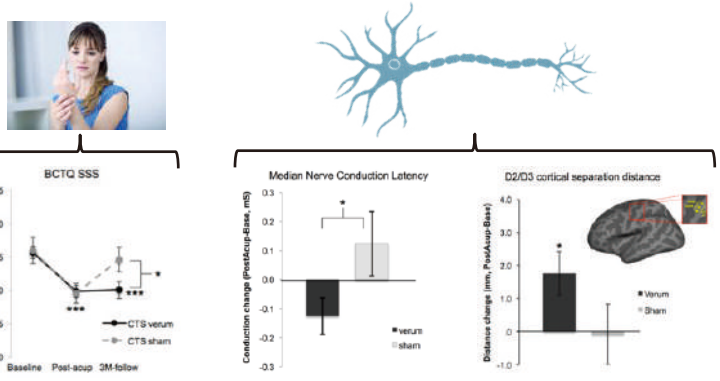


CTS lesion at wrist corresponds to deactivated by local acupuncture and activated by distal acupuncture activated by local acupuncture

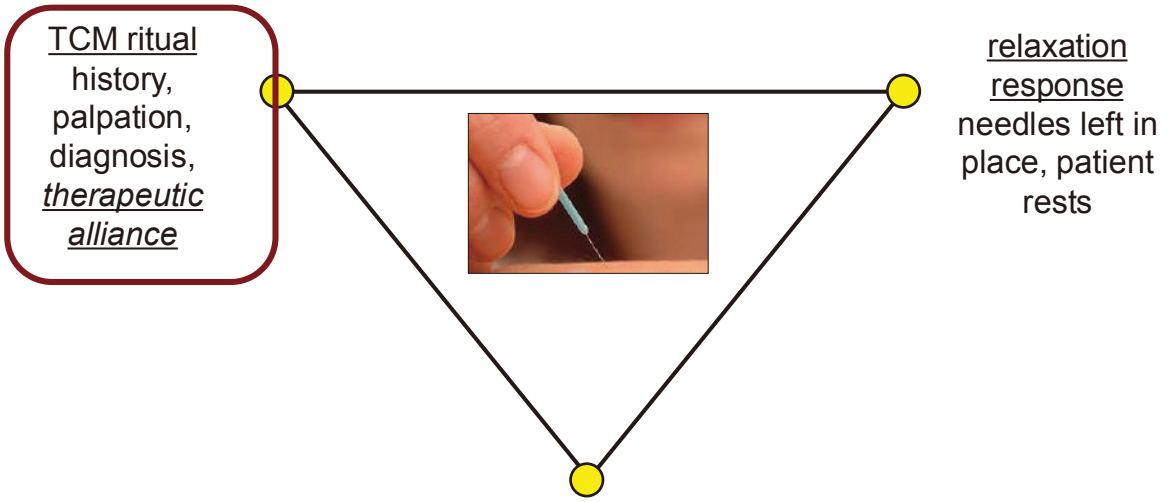
Maeda, Kim et al., 2013

Summary

- *Take Home Message: Both verum and sham acupuncture improve subjective/psychological outcomes, while only verum acupuncture improves objective/physiological outcomes (nerve conduction latency, D2/D3 cortical separation).*

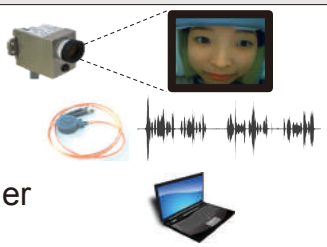


Components of acupuncture

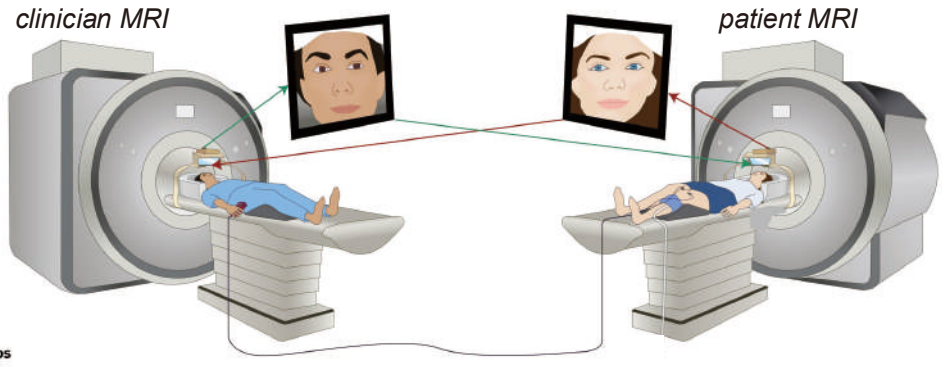


Hyperscan fMRI Set-up

- Video / Audio link:
  - MRI-compatible video cameras
  - MRI-compatible audio microphones



- 2 MRI scanners synchronized via external trigger



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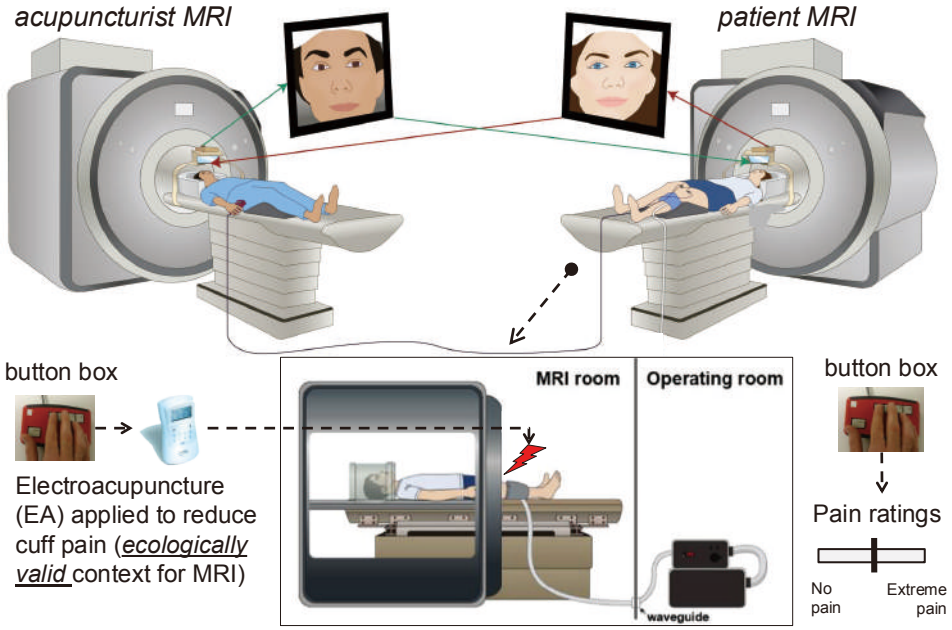
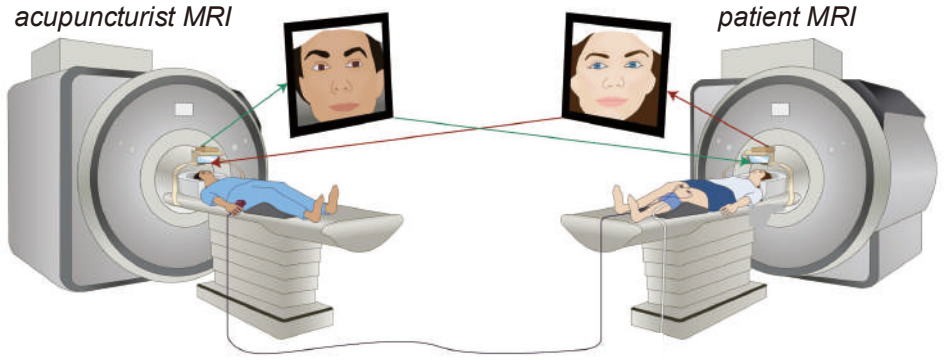
Hyperscan fMRI Set-up



Electroacupuncture (EA) applied to reduce cuff pain (*ecologically valid* context for MRI)

Hyperscan fMRI Set-up



fMRI collected synchronously from both MRI scanners

Clinicians treating

Patients Being treated

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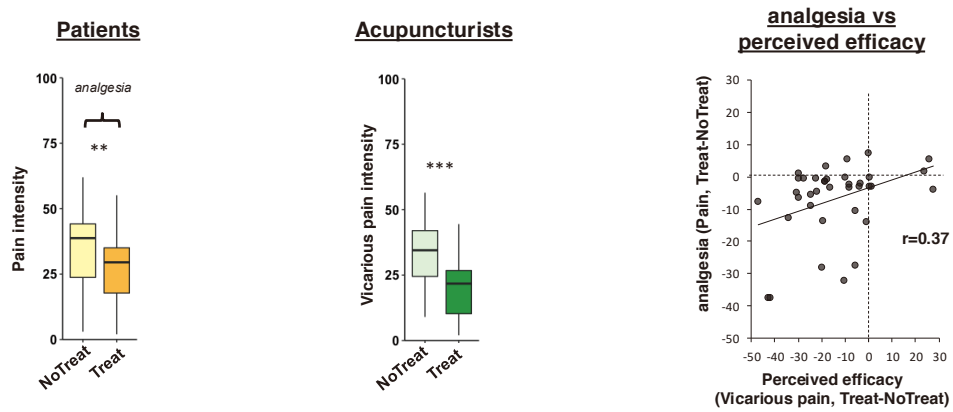
Treatment reduces cuff pain ratings



how might acupuncturists accurately perceive efficacy?

… maybe through video transfer of facial expression?

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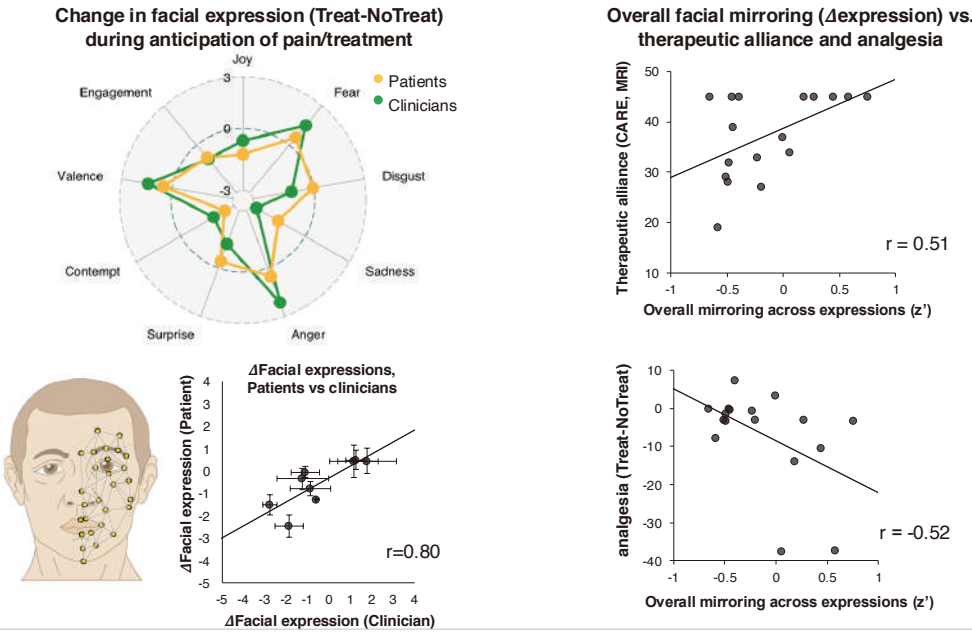
Ellingsen et al. ***Science Adv*** 2020; Ellingsen et al. ***Trans Psych*** 2022; Ellingsen et al. ***PNAS*** 2023

Acupuncturists mirror patients' facial expression



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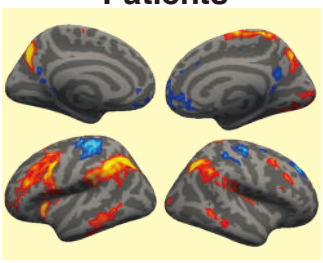
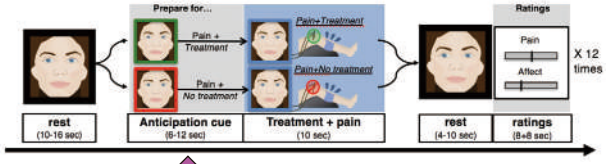
Brain response overlaps between patients and clinicians

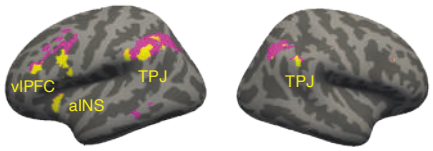
Anticipation of pain

Patients

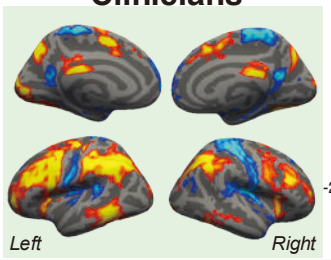


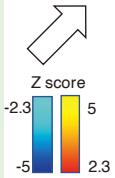


Patients ∩ Clinicians



Clinicians





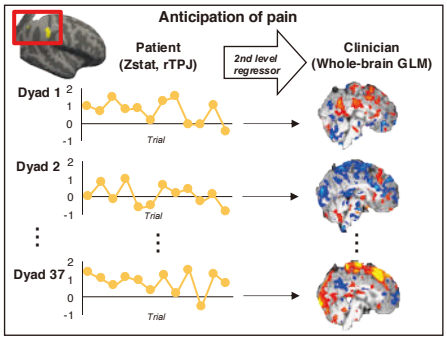
Conjunction (Patients ∩ Clinicians)

Conjunction intersected with *a priori* anatomical ROIs of social mirroring circuitry

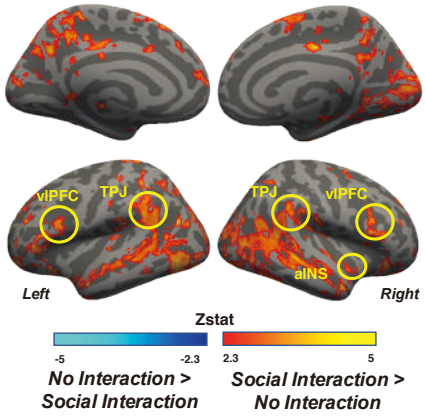
How to assess brain concordance?

Trial-by-trial dynamic concordance: social mirror circuitry

Dyad-wise analysis pipeline for dynamic brain concordance: Patient's right TPJ



Group Analysis: Clinicians' dynamic concordance with patients' rTPJ (Social interaction – No interaction)



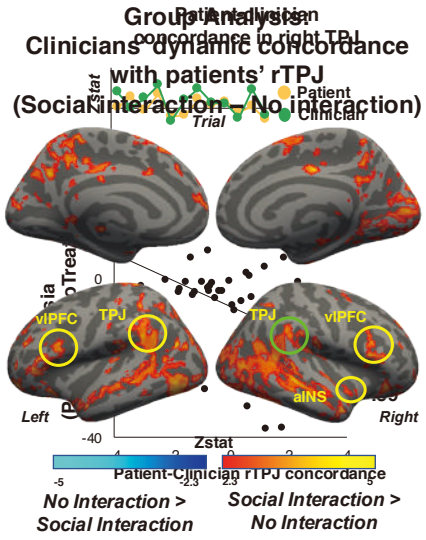
Martinos Center

Ellingsen et al. ***Science Adv*** 2020; Ellingsen et al. ***Trans Psych*** 2022; Ellingsen et al. ***PNAS*** 2023

The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture

- Vitaly Napadow I Harvard University

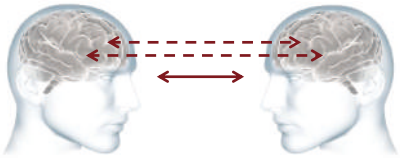
Trial-by-trial dynamic concordance: social mirror circuitry



Ellingsen et al. ***Science Adv*** 2020; Ellingsen et al. ***Trans Psych*** 2022; Ellingsen et al. ***PNAS*** 2023

Summary

- Therapeutic alliance and TPJ concordance is enhanced by patient-clinician interaction, ↑ alliance linked with facial mirroring
- Greater TPJ-to-TPJ concordance and facial expression mirroring associated with greater analgesia → Is there a link with Theory of Mind processing?



The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture

- Vitaly Napadow I Harvard University

Topological Atlas and Repository for Acupoint research (TARA)

(*currently largest acupuncture research grant at NIH*)

TARA.Admin-Core

Vitaly Napadow, PhD LAc
SRH, Harvard Medical School

Richard Harris, PhD LAc
UC Irvine

Karl Helmer, PhD
MGH, Harvard Medical School

Project Manager: Laura Triplett, Society for Acupuncture Research

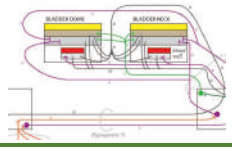
NCCIH NIH

TARA.TEAM-Core
Lead: Richard Harris, PhD LAc
U Michigan, SAR President

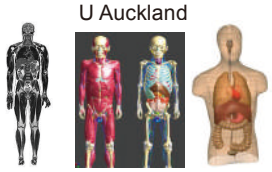
針灸

TARA.DAT-Core
Lead: Karl Helmer, PhD
MGH, Harvard Med School

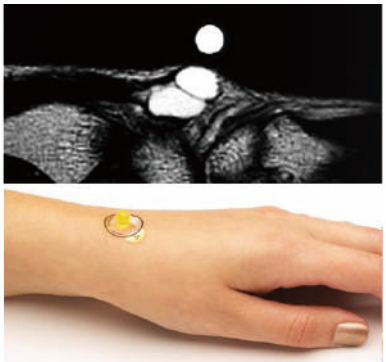
TARA.K-Core
Lead: Maryann Martone, PhD
UCSD



TARA.MAP-Core
Lead: Peter Hunter, PhD
U Auckland



TARA Acupoint Atlas – Whole Body MRI



- Hope to add ***ultrasound datasets*** to the Atlas → collaboration with Sanghun Lee at KIOM

The Role of Neuroimaging in Understanding Brain Mechanisms of Acupuncture

- Vitaly Napadow I Harvard University

Acknowledgements

Martinos Center for Biomedical Imaging / Spaulding Rehabilitation Hospital, HMS

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Jieun Kim, PhD
Junhwan Lee, MD/PhD

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Logan University, Chesterfield, MO

Norman Kettner, DC

Karolinska Institute, Sweden

Karin Jensen, PhD

Pain Management Center, BWH

Robert Edwards, PhD

NIH National Center for Complementary and Integrative Health

NIH, NCCIH (R61/R33-AT009306, P01-AT002048, R01-AT004714); KIOM (K15050); COFUND/FRIPRO (240553/F20)

The Research Council of Norway

KIOM

Martinos Center

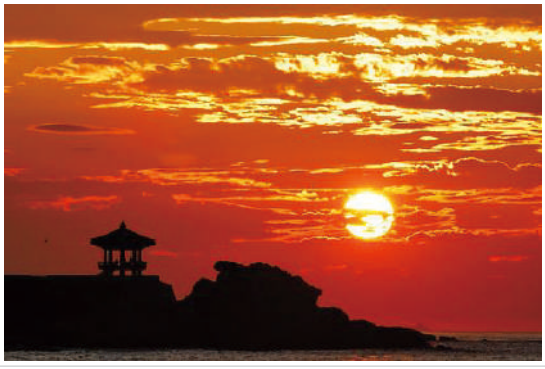
CiPNI Center for Integrative Pain NeuroImaging

Bright Future for KIOM / MGB Collaboration

Martinos Center

Mass General Brigham Spaulding Rehabilitation

KIOM



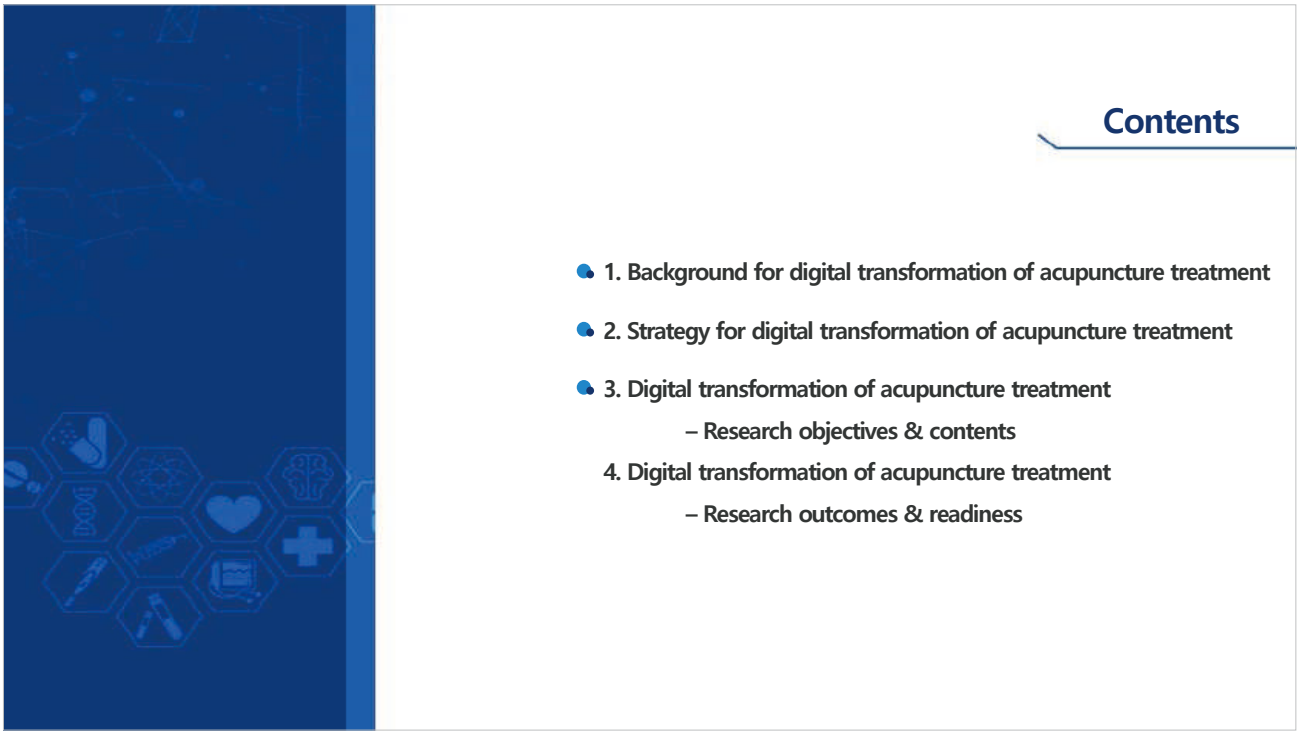
PRESENTATION

Jaeuk KIM
KIOM

NEUROSCIENCE-BASED RESEARCH STRATEGY FOR ACUPUNCTURE MERIDIAN ICT CONVERGENCE TECHNOLOGY

Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

- Jaeuk KIM I KIOM



Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

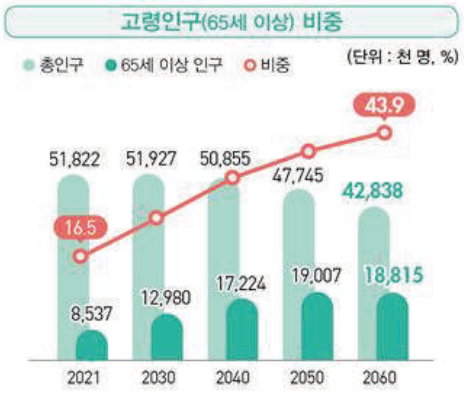
- Jaeuk KIM I KIOM

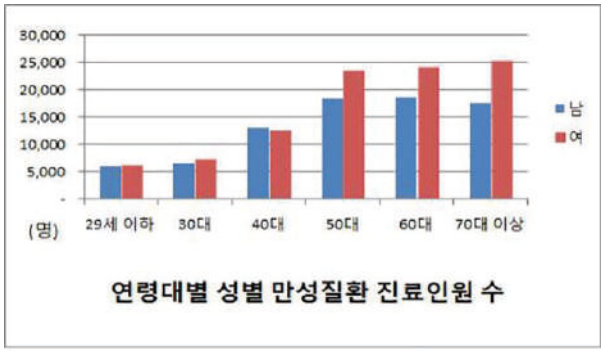
Chapter 1

Background for digital transformation of acupuncture treatment

I Background

Increase in chronic and multi-factorial diseases & adverse effects with drug overdoses



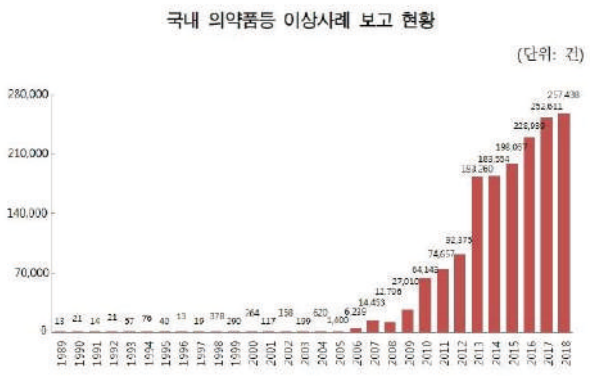


In Korea, 68.7% of people in their 50s, 83.7% of people in their 60s, and 91.3% of people in their 70s or older have a chronic disease. www.eptimes.co.kr

3

I Background

Increase in chronic and multi-factorial diseases & adverse effects with drug overdoses



Adverse effect reported due to drug overdose in Korea
(KFDA, https://doi.org/10.23000/TRKO201700017744)

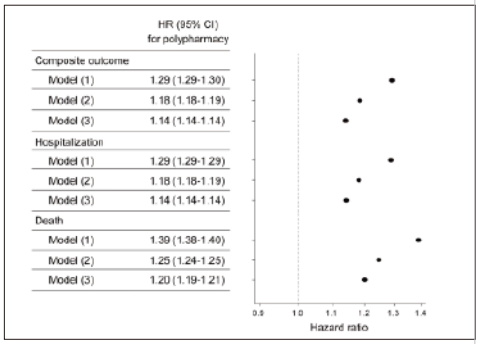
4

I Background

Increase in chronic and multi-factorial diseases & adverse effects with drug overdoses

Due to the population increase with chronic complex diseases, the number of medications prescribed per patient is gradually increasing, and taking polypharmacy carries a high risk of drug-drug interactions or various side effects.

- If a person aged 65 or older takes 5 or more drugs, the risk of hospitalization increased by 18% and the risk of death increased by 25%, compared to the cases with 1~4 drug intake.
- According to the 2017 Survey on the Elderly, Korean seniors are taking an average of 4.1 medications, and about 40% of senior citizens are taking more than 5 medications.
- In several foreign observational studies, in the case of polypharmacy with more than five drugs prescribed for one individual, inappropriate prescriptions become more frequent and the risk of drug side effects, hospitalization, and death increases.



2017 노인실태조사

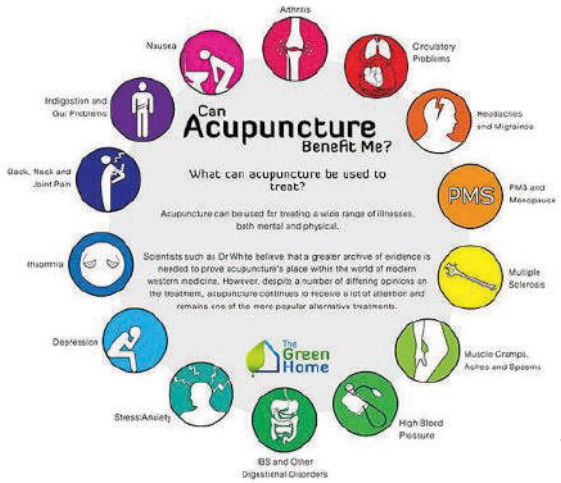
5

Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

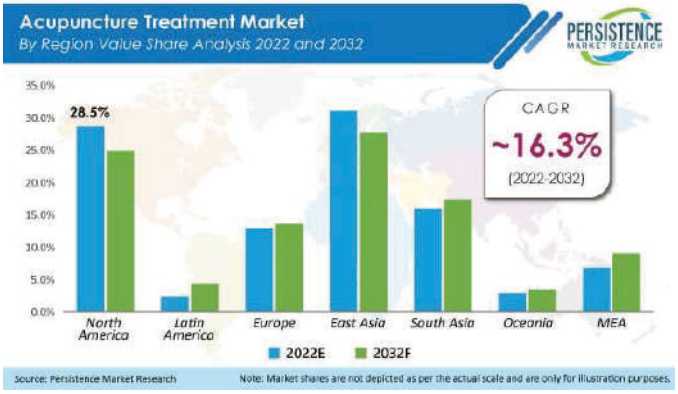
- Jaeuk KIM I KIOM

I Background

Acupuncture : Clinical efficacy & Market size



https://www.lifepointacupuncture.com

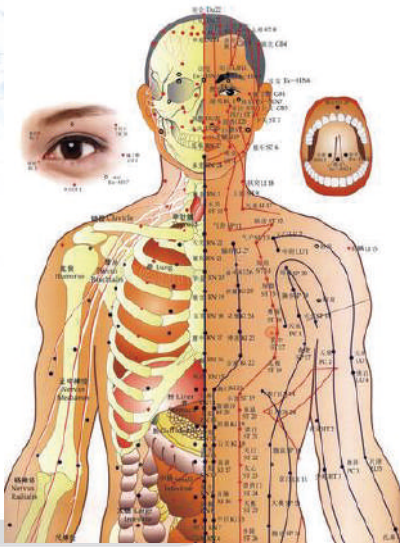


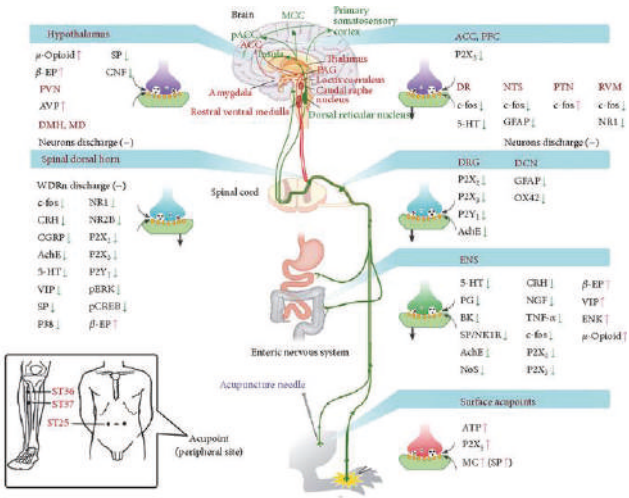
Worldwide revenue from the acupuncture treatment market reached US$ 2.7.1Bn in 2021, with CAGR of 16.3% to reach US$143.6 Bn by 2032 (/www.persistencemarketresearch.com)

6

I Background

Acupuncture : Neurobiological Mechanism Reveals





Zhang, F.L., et al., (2017). Neurobiological Mechanism of Acupuncture for Relieving Visceral Pain of Gastrointestinal Origin. Gastroenterology research and practice.

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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

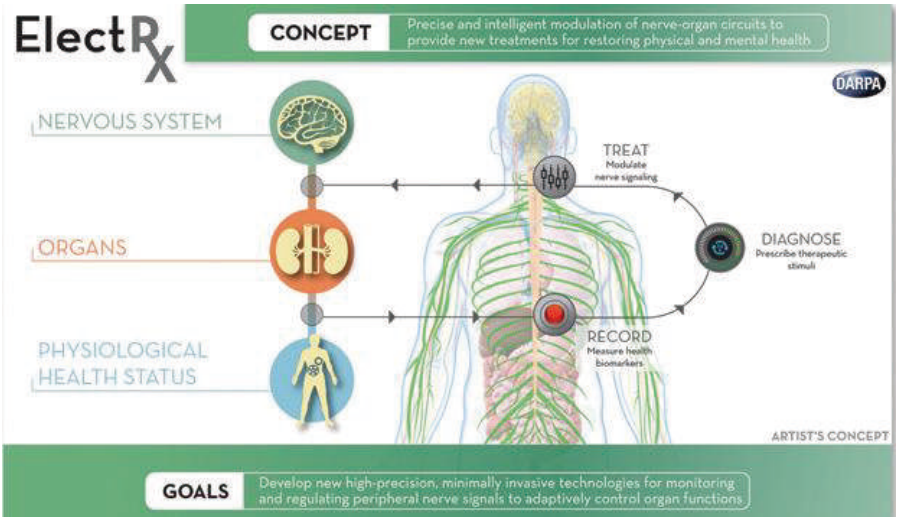
- Jaeuk KIM I KIOM

I Background

Electroceuticals

- Electroceuticals, which were selected as one of the World Economic Forum's (WEF) 'Top 10 Promising Technologies' in 2018, are increasing market demand as a medical alternative to existing chemical and biopharmaceuticals thanks to their safety.

Electroceuticals are broadly defined as medical devices that provide neurostimulation for therapy, but it is often used as a term to reference ultra-miniature and/or injectable implants.
Electrical stimulation therapy has been gaining momentum in the recent past since researchers believe that it could prove to be more efficient compared to drugs [38].
With the rise of electroceuticals, there are a number of research groups working on implantable neurostimulators for pain relief and hearing loss, among other ailments.



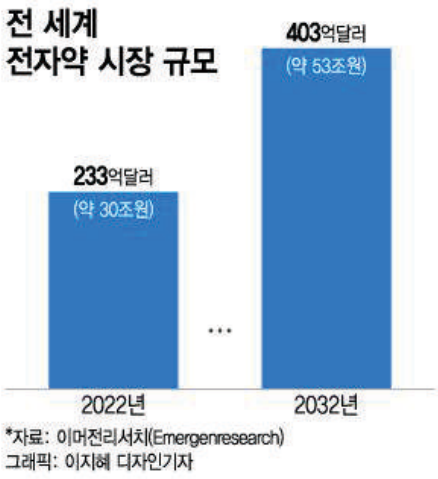
E.Y. Chow, ... V. Ramesh, in Wireless MEMS Networks and Applications, 2017

Image courtesy of DARPA

I Background

Electroceuticals : technological categories and market size

Image courtesy of [NRF R&D Brief-2024-17호] 전자약



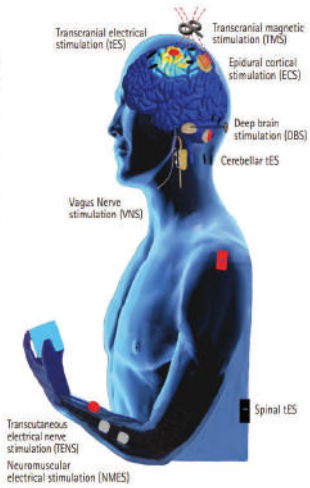
https://news.mt.co.kr/mtview.php?no=2024022518061364367

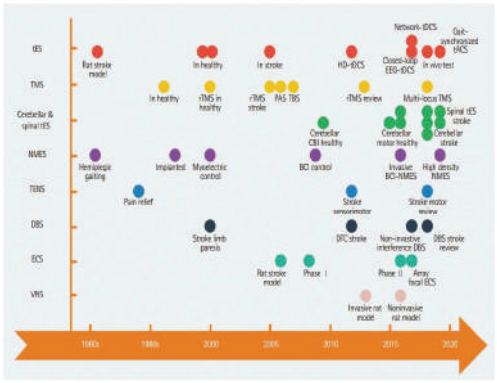
Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

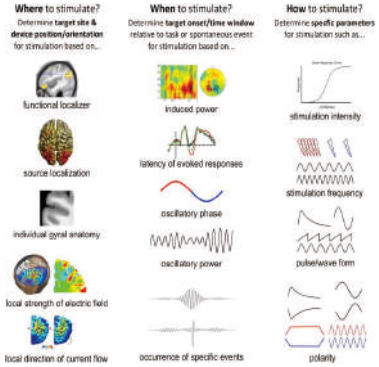
- Jaeuk KIM I KIOM

I Background

Electroceuticals : R&D trends







S. Bao et al., J. Stroke 22(1), 47-63 (2020)
T.O. Bergmann et al., NeuroImage 140, 4-19 (2016)

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I Background

Electroceuticals : products

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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

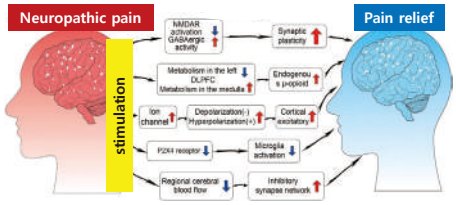
- Jaeuk KIM I KIOM

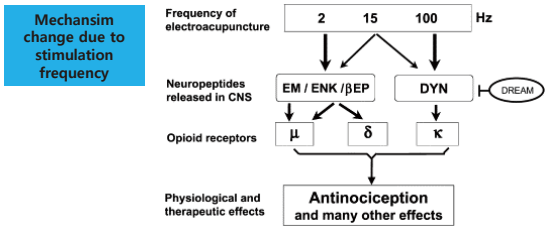
I Background

Electroceuticals : Pain control mechanism

Electric stimulation

[Stimulation condition]
· frequency:2-100 Hz
· duration: 1-60 min
· type: patch, microneedle
· Current: 0.2-17 mA

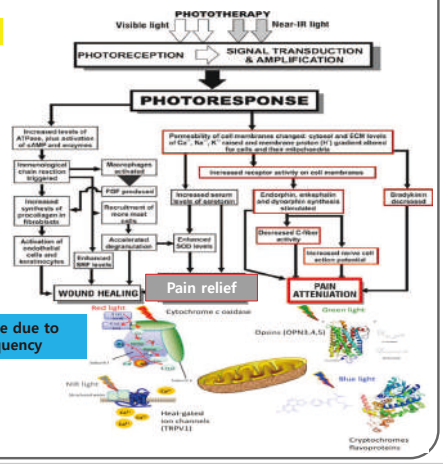




Optic stimulation

[Stimulation condition]
· Frequency: 0.5-5 Hz
· duration: 30-60 min
· wavelength: visible, infrared
· Power: 10-500 mW

Optic stimulation



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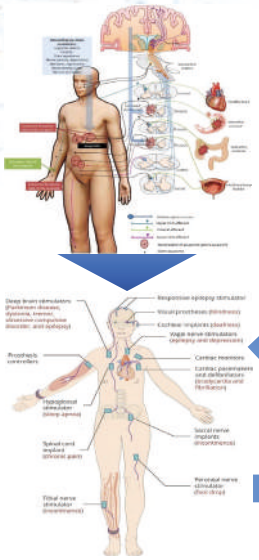
I Background

Acupoints for neuromodulation (침)



Electroceuticals for neuromodulation (전자약)

Electroceuticals with acupoint stimulation

Relief band: PC6(내관혈) stimulation Acu-Ex

SP6(삼음교) stimulation Ex "Urgent PC PTNS (Percutaneous Tibial Nerve Stimulation)" OAB

NEXT ?

미국 국방연구원
Electrical Prescriptions (ElectRx)
신경병증성 통증 치료 실험적·광유전학적 방법 개발

- 신경 조절을 위한 비침습적 표적 초음파
- 미주 신경 자극 염증성 장 질환
- 염증성 장 질환의 근본 메커니즘과 전골 신경 자극 연구
- 부신과 그 기능을 관장하는 내장 신경 회로.
- 신경망에 결합할 수 있는 능력이 있는 나노 입자를 개발
- 위장관의 염증과 묵을 통한 미주 신경 자극에
- 외상 후 스트레스 치료를 위해 신경 가소성을 유도하기 위해 미주 신경 자극

미국 국립보건원
NIH Stimulating Peripheral Activity to Relieve Conditions (SPARC) 신경자극 기술 활용
신경-장기 상호작용 치료

- 난치성 위마비 환자 미주신경 자극
- 미주신경 – 천식
- 위마비를 위한 스마트 척수 자극
- 부정맥 조절을 위한 피하 신경 자극
- 당뇨병 혈당조절을 위한 미주신경 자극

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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

- Jaeuk KIM I KIOM

Chapter 2

Strategy for digital transformation of acupuncture treatment

II Strategy

SPARC program & TATA project

美, Big investment fund: SPARC program

美 NIH(국립보건원) investment : ('17~) $ 240M for 7 yrs (approx. ₩ 320B)

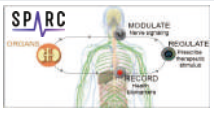
NIH National Institutes of Health
Office of Strategic Coordination–The Common Fund

SPARC(Stimulating Peripheral Activity to Relieve Condition) Program

(美) National Goal

Investment on association/interaction between PNS and organs

》Leading and preempting the technological hegemony by developing next generation medical treatment methods



Gold to develop nerve connectome map, electroceuticals, implantable devices effective for hypertension, heart failure, gastrointestinal disorders, inflammatory disorders etc.

('~'01) Human Genome → ('15) BRAIN Initiative → Brain function → ('17~) SPARC → Peripheral – Brain – Organ → ?

美, 경혈 기반 말초자극 치료기술 혁신

- 美, Acupoint database collection which can be linked to SPARC program
- Digital acupoint research on body surface acupuncture points – securing national strategic technology through TARA-SPARC linkage

《美 NIH TARA (Topological Atlas and Repository for Acupoint research)》

Initiated in 2023 with the goal of integrating acupoint locations standardization and previously published acupoint research data into SPARC's neural connectome project

TARA Topological Atlas & Repository for Acupoint Research

경혈 말초자극 치료기기

SPARC

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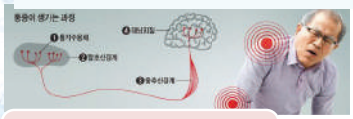
Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

- Jaeuk KIM I KIOM

II Strategy

Our approach: Acu-Electroceuticals (경혈 전자약, Acu-Ex)



의학신문 한국

'국내 마약성진통제 사용 의존성 21%'

진통제 사용량 높은 국가들 오남용 발생률과 비슷해...사용장애 평가 필요
서울대병원, 만성비암성 통증환자 마약성진통제 사용관련 의존성 조사

- 염증성 통증(inflammatory pain) 조직 손상으로 염증 일으켜 통증
- 침해수용성 통증(nociceptive pain) 상해를 입은 조직에서 통증신호가 계속됨

Acute pain

- 침해수용성통증(chronic nociceptive pain) 상해를 입은 조직에서 통증신호가 계속됨
- 신경병증성통증(chronic neuropathic pain) 상해는 더 이상 없는데도 통증 전도로의 흥분이 지속됨
- 심인성통증(chronic psychogenic pain) 심리적인 원인으로 통증 기억을 지우는 회로에 지장이 생긴 경우

Chro nic pain

Pharmaco-therapy

NSAIDs, salicylic acid, Acetaminophen + Caffeine + Ethenzamide

Tramadol+acet aminophen, Pregabalin,

Adverse effect, Ceiling effect

dependency addictive
Narcotic analgesics

Opioid Crisis

Acu-Electro-Ceutical

Device stimulating acupoint

Nonpharma coligical treatment technology

BACK TO BASIC

[한의 의료 현장]
1침2구3복약
(一鍼二灸三服藥, [침구대성])
: 361 혈의 97% 주치 효능에 통증(痛)이 있음

- 불통즉통, 통즉불통(不通卽痛 通卽不痛)
- 통(通) HOW? : 기(氣) 순환, 식적(食積), 육음(六淫), 어혈(瘀血), 담음(痰飮) 해결, 보허(補虛)

[Scientific Evidence]

- 침술은 통증을 개선함(Am Fam Physician. 2019)
- 침술은 만성 통증 치료에 효과적이며 치료 효과는 시간이 지남에 따라 지속됨(J Pain. 2018)
- 수술 전후 통증관리 및 아편유사제 요구량을 줄임(Curr Pain Headache Rep. 2022)
- 침술이 아편유사제의존성 회복을 촉진할 수 있음(Front Psychiatry. 2021)
- 통증 관리와 오피오이드 사용 장애에 대한 다학문 접근 방식의 일환으로 침술을 치료 프로토콜에 통합하는 것이 제안됨 (Glob Adv Health Med. 2021)

미국 NIH HEAL(Helping to End Addiction Long-term) Initiative – 국가 오피오이드 공중 보건 위기를 막기 위한 과학적 솔루션

Clinical Devices to Treat Pain(통증치료 임상기기) 개발, 통증관리 임상연구 –PRISM(Pragmatic and Implementation Studies for the Management of Pain to Reduce Opioid Prescribing : 경피적 전기 신경 자극, 침술, 원격중재, EMR 내 의사결정시스템 탑재

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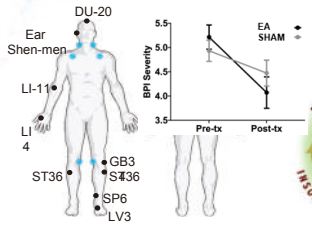
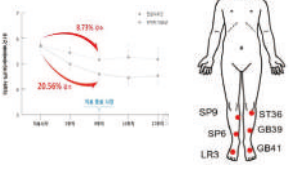
II Strategy

Target conditions

Fibromyalgia
Acu Ex that can provide continuous treatment to multiple acupoints with a mind-body therapy approach that treats anxiety, depression, sleep disorders, and gastrointestinal disorders that accompany pain.



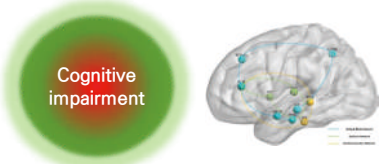
Electric acupuncture treatment result for fibromyalgia (Malwa, AnR 2021)



Electric acupuncture treatment result for diabetic neurophatic pain (Shin, Diabetes Care, 2018)

Diabetic Neurophatic Pain
Noninvasive Acu-Ex that can treat circulatory disorder and inflammatory pain

Mild cognitive impairment
The effect of acupuncture on MCI may play a role in regulating the default mode network, central executive network, and salience network.



Acupuncture on mild cognitive impairment: A systematic review of neuroimaging studies (Yin, 2023)

Major Depressive Disorder and PSD
Acupuncture therapy is safe and effective in treating MDD and PSD, and could be considered an alternative option for the two disorders.

The effectiveness and safety of acupuncture therapy in depressive disorders: Systematic review and meta-analysis (Zhang, 2010)

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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

- Jaeuk KIM I KIOM

Chapter 3

Digital transformation of acupuncture treatment – Research objectives & contents

III Research objectives

Research Theme: Neuroscience-based Acupuncture-Meridian-ICT Convergence Research
Goal: Digital transformation of traditional acupuncture treatment to develop a world-class nonpharmacological treatment technology

1) Identification of neuroscience-based treatment mechanism and establishing "acupuncture point (acupoint) – nerve – brain – organ" functional connectome
2) Development of acupoint stimulation technology (acupoint electroceutical; Acu-Ex) and biosignal-based monitoring and smart control technology
3) Verification of clinical effectiveness and evidence of Acu-Ex, and KFDA medical device approval

- Target conditions: (intractable) pain, cognitive impairment, mood disorder
- Acu-Ex source: electric, optic, photo-thermal, electo-thermal, HIFU etc
- Device type: wearable, pad type

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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

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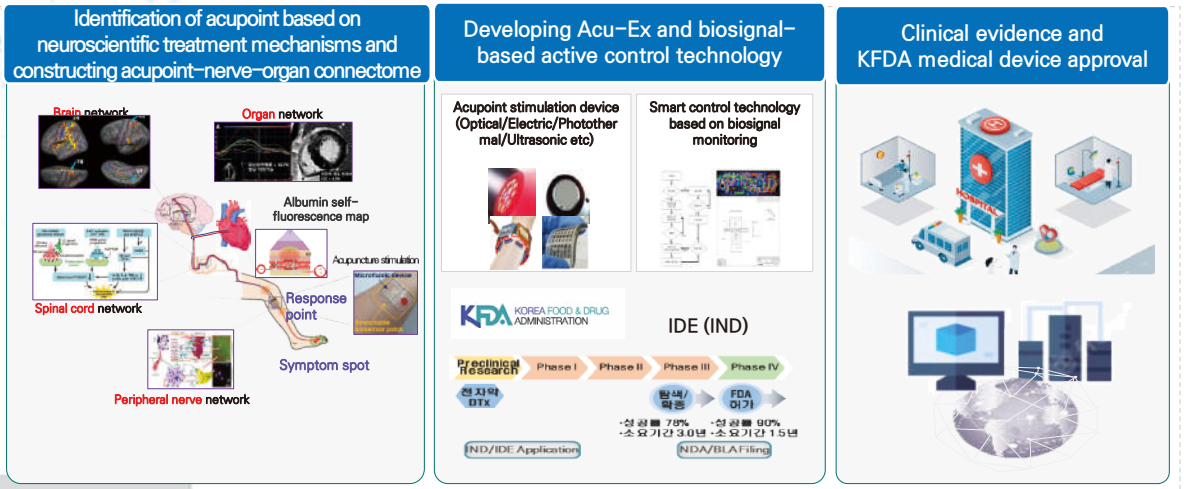
III Research objectives

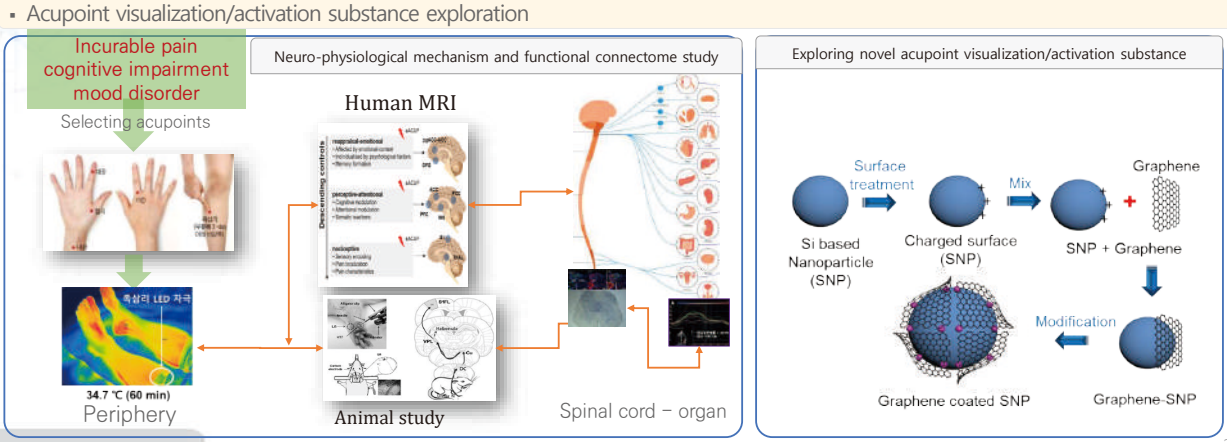
1) Identification of neuroscience-based treatment mechanism and establishing " acupoint – nerve – brain – organ" functional connectome
2) Development of Acu-Ex and biosignal-based monitoring and smart control technology
3) Verification of clinical effectiveness and evidence of Acu-Ex, and KFDA medical device approval



III Research Contents

Neuroscience and neurotransmission pathway-based acupoint connectome research

- Neuro-physiological mechanism study of symptom relief by acupoint/surface response point stimulation based on animal model and human MRI study
- Establishing "acupoint - peripheral nerve – brain - spinal cord - organ" functional connectome
- Acupoint visualization/activation substance exploration



Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

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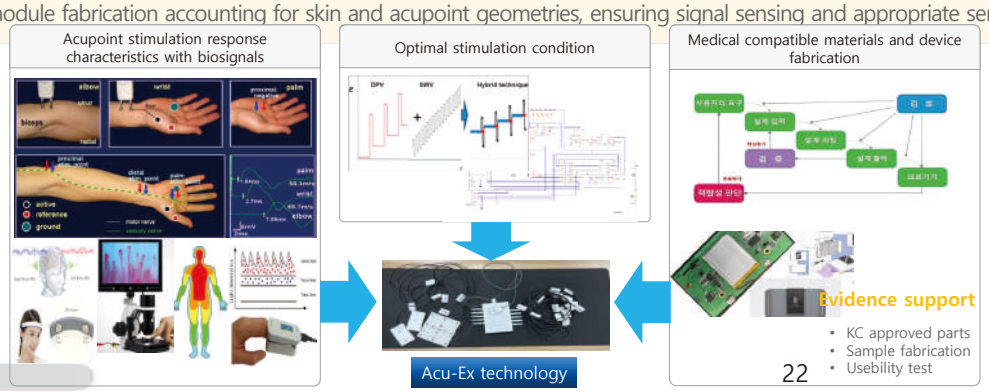
III Research Contents

Development of minimally irritative acupoint stimulation technology with equivalent acupuncture effects

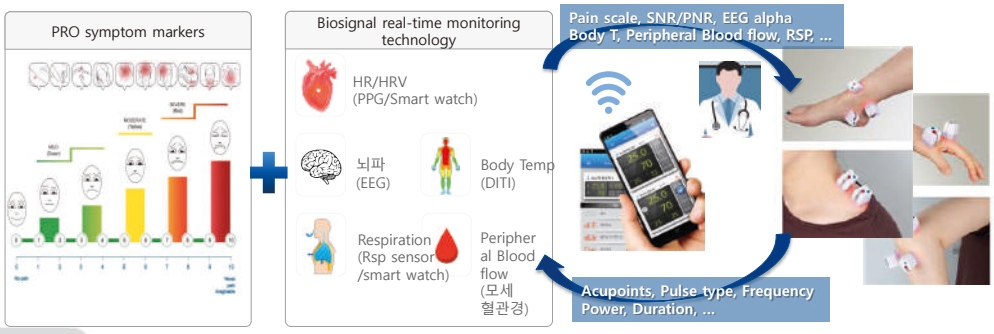
- Study of response characteristics according to optical/electrical stimulation at acupoints whose efficacy and mechanism for the target symptoms is verified
- Derivation of stimulation optimization methods for representative acupoints such as pulse type, stimulation frequency/intensity, filter, and stimulation duration
- Sensor module fabrication accounting for skin and acupoint geometries, ensuring signal sensing and appropriate sensor housing



III Research Contents

ICT converge technology for smart control of Acu-Ex

- Symptom monitoring technology based on Patient Reported Outcome (PRO)
- Patient monitoring technology based on multi-modal biosignals (HR/V, EEG, Peripheral Blood flow, Body temp, Respiration etc)
- Smart control technology of Acu-Electroceutical linked to patient monitoring information
- Remote prescription and patient management station technology



Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

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III Research Contents

		Institute	Product	Characteristics			Pro/Cons	
				Stimulus condition	Medical symptom	Stimulus location		
Ex	electric	Electro Core (2018)		60 mA 25 Hz	Migrane	electrode Peripheral nerve	• 손으로 잡고 있어야 하므로 장기간 지속 착용이 어려움 • 전문적인 진찰/모니터링 기반 피드백 시스템 부재 • 다중 부위 동시 자극 어려움	
		Ybrain (2021)		2.32 mA 5-10Hz	Migrane/ Stress	Pad type Trigeminal nerve	• 머리 통증 특화&신경자극 (타부위 적용불가) • 젤 기반 전기패드 사용	
		Nerivio (2019)		1.76 mA 0.1-0.5 Hz	Migrane	Band type Nerve	• 무선제어/두통 최적화 세기 및 시간 프로그램 • 환자 상태 실시간 모니터링 및 원격 진료 한계	
		Color seven (2019)		Red, continuous (610-630nm)	Menstrual cramps	Pad type Acupoint (smooth muscl)	• 2개 광원으로 인한 경혈 자극 부위 개수 제한 • 연속형 광자극으로 인한 치료 효과 제한 • 분자생물학적기전 부재 • FDA 승인, 유럽의료기기 인증 ISO13485/CE1639	
	Optic	Aalok (2019)		Red/Infrared dual wave, continuous (625, 830nm)	Myalgia	Pad type Muscle	• 광원 크기 및 개수로 인한 특정 부위 적용 어려움 • 환자 모니터링 시스템 부재 • 만성통증/신경통 효과 미미 • 분자생물학적기전 부재	
Acu-Ex	Electric&Optic	KIOM (electric)	[Electric Acu-Ex] 	Low current sti compared to patch Type	General Pain Chronic pain: Fibromyalgia	Microneedle Acupoint subcutaneous layer	• 진피층에 직접 접촉하여 장시간 안정적 사용 • 최소침습형 전기자극으로 낮은 전류값 및 전원사용	• 바이오피드백 시스템: 호흡 결맞음 유도 치료자극으로 치료효과 극대화 • 급성 및 만성 다부위 통증 조절 • ICT 융합 비대면 의료 모드 제공 • 다중경혈자극 가능 • 배터리를 활용한 전기적 안전성 및 높은 휴대성
		KIOM (optic)	[Optic Acu-Ex] 	White light, pulse type (400-750nm)	General Pain Chronic pain: Diabetic neuropathic pain	Pad type Acupoint	• 백색 펄스광: 열감없음/심장박동 동기화/장시간 사용 • 경락 특이적 색온도 미세조정 • 광물필터를 활용한 치료효과 극대화 • 혈류순환 개선을 통한 통증완화	

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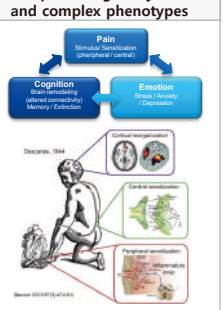
III Research Contents

Identification of the efficacy and mechanism of Acu-Ex in animal models of medical symptoms

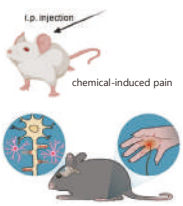
- Establishment of animal model and selection of complex phenotypic evaluation index through behavioral test
- Comparative studies on the effects of acupuncture stimulation and Acu-Ex stimulation for representative acupuncture points and stimulation conditions
- Identification of the efficacy of Acu-Ex at multiple levels of biological systems (neurological/gut-brain axis regulation mechanism, pain-cognition-emotion regulation mechanism)

Multiple biological systems and complex phenotypes



Establishment of animal model and behavioral test

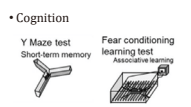
- Diabetic neuropathy
- Fibromyalgia
- ...



- Pain-like behavior

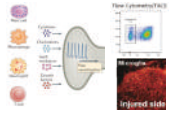
- Emotion(depression/anxiety)

- Cognition



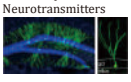
Molecular biology & neuroscience mechanism identification

- Non-neuronal cells (Immune and glial cells)

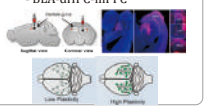


- Gut microbiota

- Pro-inflammatory immune factors
- Neuronal cells (Neuroactive signal factors)
  - Structural & Functional synaptic plasticity
  - Neurotrophic factors
  - Neurotransmitters



- Neural circuit
  - BLA-dHPC-mPFC



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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

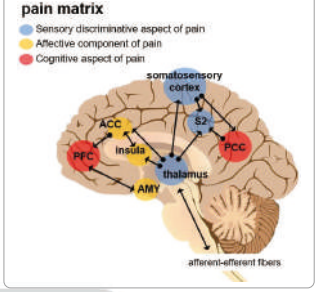
- Jaeuk KIM I KIOM

III Research Contents

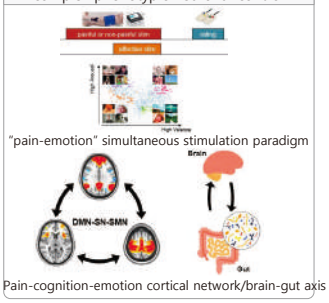
Identification of clinical treatment mechanism based on brain imaging of Acu-Ex compared to acupuncture treatment

- Establishment of a brain-based "pain-cognition-emotion" complex phenotypic pain control evaluation method
- Establishment of analysis method based on brain functional processing, cerebral network, and gut-brain axis
- Evaluation of the brain scientific mechanism of symptom control of Acu-Ex

Complex phenotype in cerebral cortical mechanisms

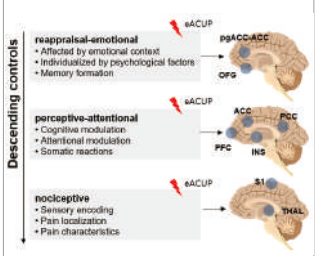


Establishment of analysis method for complex phenotypic neuronal control



Pain-cognition-emotion cortical network/brain-gut axis

Evaluation of the brain scientific mechanism of symptom control of Acu-Ex



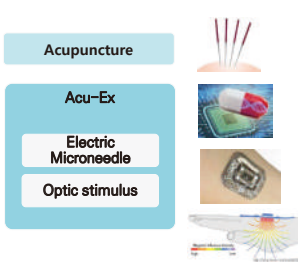
III Research Contents

Clinical study for Acu-Ex based on randomized comparative clinical trials

- Development of Acu-Ex clinical trial protocol and conduct of IDE medical device clinical trials (exploratory/confirmatory)
- Conduct clinical trials including safety/efficacy evaluation, optimized for pain, cognitive impairment, and mood disorder
- Conduct profitability evaluation of Acu-Ex compared to acupuncture treatment

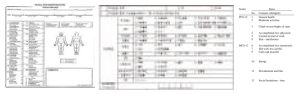
Clinical test for medical device developmental stage

Comparative clinical study of Acu-Ex with acupuncture treatment



Safety, efficacy, economic test

- **안전성 평가 지표**
  이상반응 증상 및 조치, 발현 기간, 관련성 및 중증도
- **유효성 평가 지표**
  VAS, NRS, McGill 통증 설문지, 진통제 사용 빈도 혹은 휴식시간의 길이, 변화에 대한 포괄적 평가 등
- **경제성 평가 지표**
  EQ-5D-5L, EQ-VAS, SF-12 외 비용 효과 지표



Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

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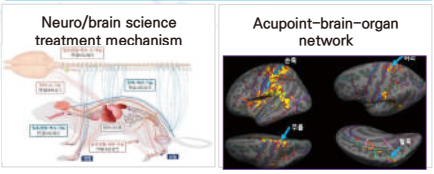
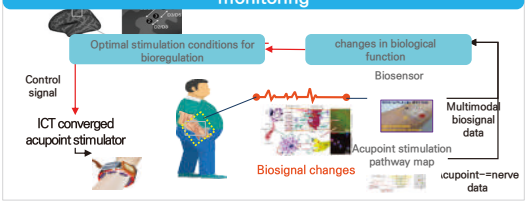
IV Final Outcomes

Expected Outcomes

Acupoint-nerve-brain-organ functional network



Acupoint stimulation integrated system based on biosignal monitoring



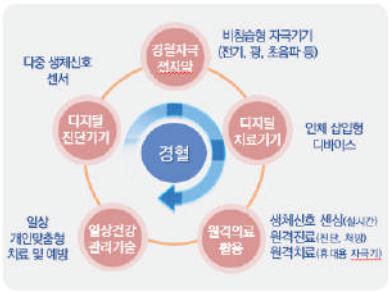
FDA approval

Electroceutical medical device approved by KFDA

식품의약품안전처

Expected effect

- Dominate the digital healthcare market through the development of next-generation treatment technology that converges TKM technology and ICT
- Create super-gap technology for measurement, stimulation, and monitoring devices by utilizing unique acupoint-nerve-brain-visceral networks
- Provide non-pharmaceutical treatment methods to treat/care for various diseases at home



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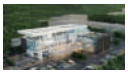
V Executive Plan

Based on “KIOM Global ICT Acupuncture Meridian Convergence Center”, establishing a collaborating network with top domestic and foreign research institutes

KIOM 글로벌 침구경락 ICT 융합연구센터

- (미션) 글로벌 침구경락 공동연구 허브('25년 준공)
  - 침구경락 기전효과 규명 및 ICT 융합연구
  - 글로벌 석학들과 기초·원천 융합연구 추진
  - ICT·뇌과학 등 융합연구 위한 대형 연구장비 구축



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Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

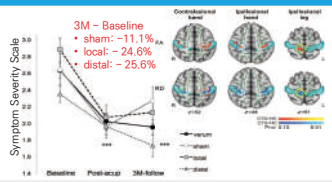
- Jaeuk KIM I KIOM

Chapter 4

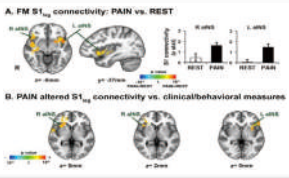
Digital transformation of acupuncture treatment – Research outcomes & readiness

VI Research readiness

Neurological acupuncture treatment mechanism

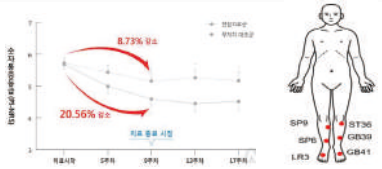


Neurological treatment mechanism for pain relief with acupuncture stimulation

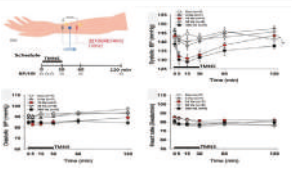


Neurological treatment mechanism for fibromyalgia

Clinical effectiveness



The clinical effectiveness of electroacupuncture treatment on diabetic neuropathy



Blood pressure lowering effect with PC6 (Neiguan) acupoint stimulation

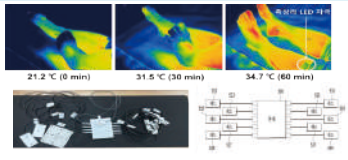
31

Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

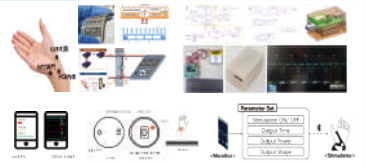
- Jaeuk KIM I KIOM

VI Research readiness

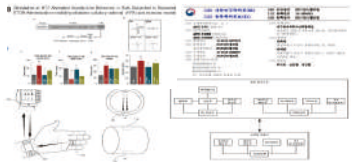
Precision stimulation technology



Improvement of peripheral blood circulation through optic acupoint stimulation

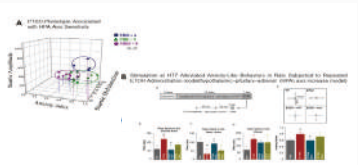


Developed electrothermal acupuncture stimulation technology



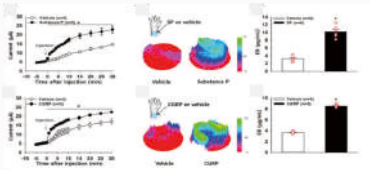
Stress control mechanism by HT7 (Shen Men) acupoint stimulation and biosignal monitoring

Neurological mechanism



Biological control mechanism verification for PTSD

Brain functional network with acupuncture stimulation



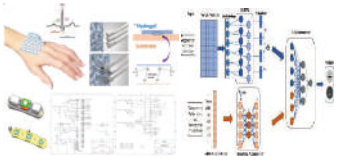
Mechanism verification with body surface response point

VI Research readiness

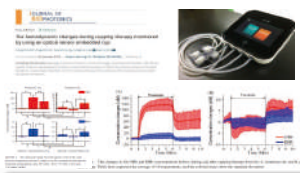
Biosignal-based patient monitoring research

Prediction model for cognitive impairment with only prefrontal EEG

Smart band pulse measuring/monitoring device

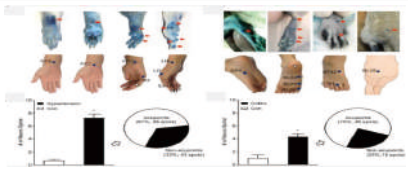


Development of biosignal sensors and analysis algorithms

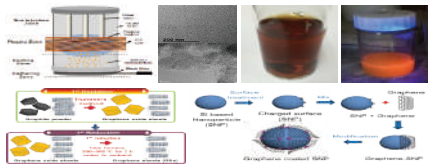


Smart cupping with real-time blood flow monitoring

Acupoint visualization / Nanoparticle-based visualization technology



Association between acupoint and surface response point of albumin eminence



Silicon/graphene nano-particle as candidate contrast medium

Neuroscience-based Research Strategy for Acupuncture Meridian ICT Convergence Technology

- Jaeuk KIM I KIOM

감사합니다

jaeukkim@kiom.re.kr

KOREA INSTITUTE OF ORIENTAL MEDICINE
INTERNATIONAL SYMPOSIUM

PRESENTATION

Sanghun LEE
KIOM

DEVELOPMENT OF AN AI-READY, HIGH-QUALITY CLINICAL BIG DATA PLATFORM FOR THE DIGITAL TRANSFORMATION OF TRADITIONAL KOREAN MEDICINE

AI-ready High-quality Clinical Bigdata Platform for the Digital Transformation of Traditional Korean Medicine

Principle Researcher of KM data division
Sanghun Lee

한국한의학연구원
KOREA INSTITUTE OF ORIENTAL MEDICINE

Stroke Diagnosis, Artificial Intelligence vs. Scholars··· AI Wins

Reporter Isulbi | Posted 2024.10.14 17:46

(From left) Professor David Schellingerhout of MD Anderson Cancer Center, Professor Kim Dong-eok of Dongguk University Ilsan Hospital, and Professor John Wen-Yue Chen of Harvard Medical School are competing against artificial intelligence. / Photo = Provided by JLK

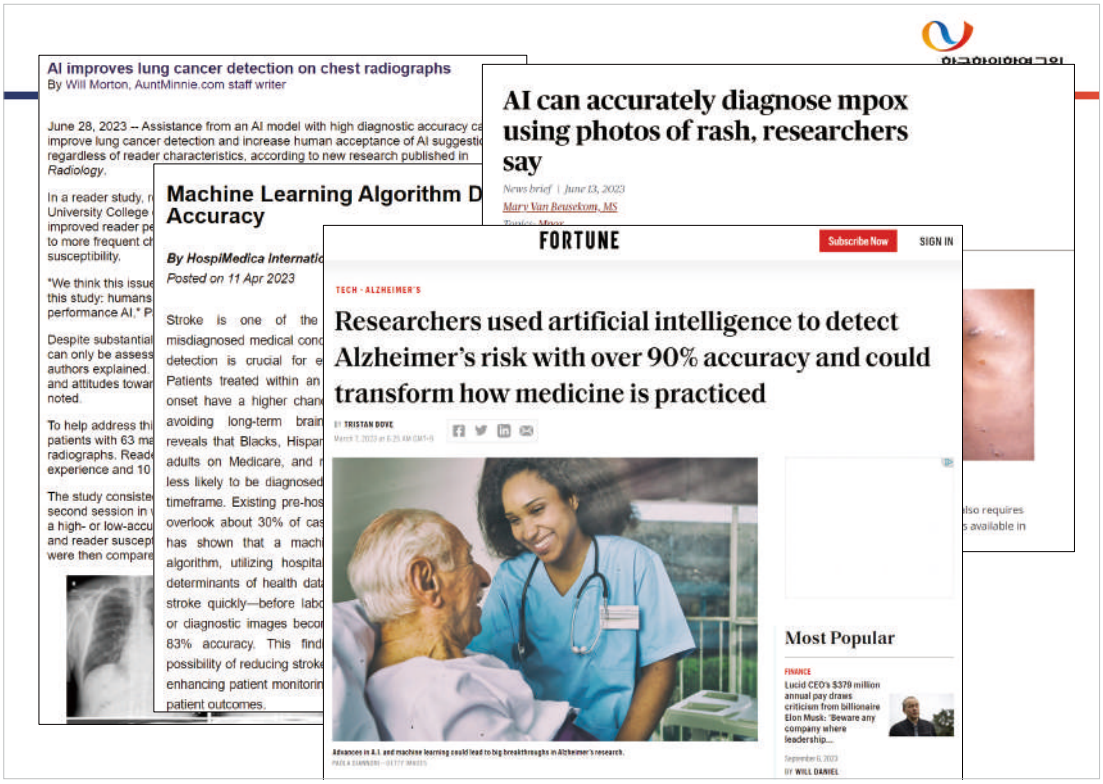
A stroke expert and an AI competed to determine the prognosis of extremely difficult patient video cases. The AI won with an average score of 72 to 50.

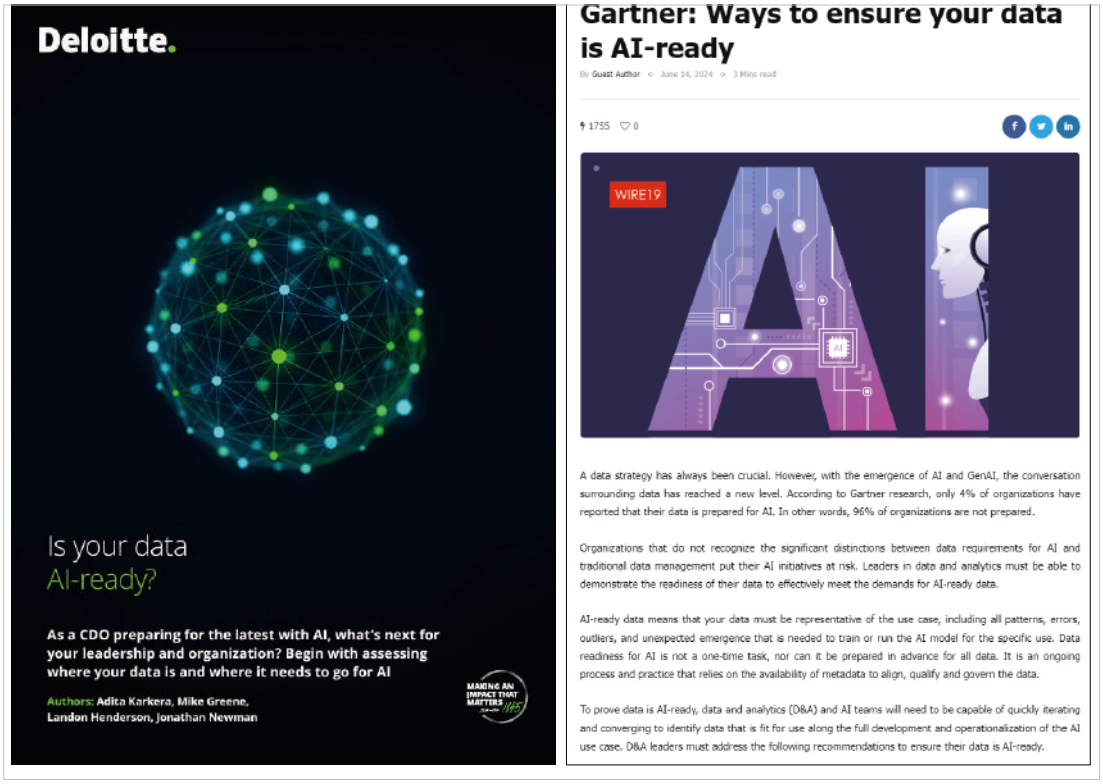
2

PRESENTATION

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

- Sanghun LEE I KIOM





What is AI-ready Data?

AI-ready data is

structured,

high-quality information that can be easily used to train machine learning models,

and run AI applications with minimal engineering effort.

5

What is AI-ready Data?

Big Data Saves Small Babies by Detecting Nosocomial Infections Earlier Than Clinicians

Published 19/11/2014 By • Shiva Gopal Reddy, M.Sc. • 0 comments

Read later Favourite

Shiva Gopal Reddy, M.Sc.

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Subscribe

Project Artemis, a Big Data analytics platform developed jointly by IBM and the University of Ontario's Institute of Technology, can detect nosocomial infections in premature babies 24 hours before the symptoms appear.

Big data is getting bigger in healthcare. It promises to herald a new age of data-driven care wherein healthcare professionals will be able to improve the effectiveness of care by analyzing huge amounts of data derived from millions of cases and use it to define the needs of subpopulations. This will enable more personalized decisions tailored to individual needs, and help to identify and intervene for population groups at risk.

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

- Sanghun LEE I KIOM

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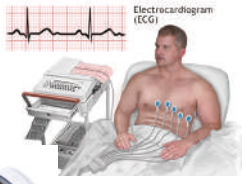
KOREA INSTITUTE OF ORIENTAL MEDICINE

Source:

1. ECG(electrocardiogram)
2. pulse rate
3. respiration rate
4. blood oxygen level
5. Medical chart(includes Prognostic information)



7

What is AI-ready Data?

Source:

Device	Data type		
ECG	time series raw data file	doctor's daily reading results in EMR (P-R: 1000ms, QRS:80ms, Q-T:500ms)	doctor's daily reading results in EMR (Long QT Syndrome)
Pulse rate	time series raw data file	doctor's daily exam results in EMR (60bpm)	doctor's daily exam results in EMR (bradycardia)
Respiration rate	time series raw data file	doctor's daily exam results in EMR (30bpm)	doctor's daily exam results in EMR (tachypnea)
Blood oxygen level	time series raw data file	doctor's daily exam results in EMR (96%)	doctor's daily exam results in EMR (insufficient)

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

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What is AI-ready Data?

Source:

Device		Data type	
ECG	If measurement method or file format differs for each device	doctor's daily reading results in EMR (P-R: 1000ms, QRS:80ms, Q-T:500ms)	doctor's daily reading results in EMR (Long QT Syndrome)
Pulse rate		doctor's daily exam results in EMR (60bpm)	doctor's daily exam results in EMR (bradycardia)
Respiration rate		doctor's daily exam results in EMR (30bpm)	doctor's daily exam results in EMR (tachypnea)
Blood oxygen level		doctor's daily exam results in EMR (96%)	doctor's daily exam results in EMR (insufficient)
AI ready	Almost Impossible	Bad	Almost Impossible

9

What is AI-ready Data?

Source:

Device		Data type	
ECG	If SOP (Standard Operation Protocol) differs for each device, or each doctor	doctor's daily reading results in EMR (P-R: 1000ms, QRS:80ms, Q-T:500ms)	doctor's daily reading results in EMR (Long QT Syndrome)
Pulse rate		doctor's daily exam results in EMR (60bpm)	doctor's daily exam results in EMR (bradycardia)
Respiration rate		doctor's daily exam results in EMR (30bpm)	doctor's daily exam results in EMR (tachypnea)
Blood oxygen level		doctor's daily exam results in EMR (96%)	doctor's daily exam results in EMR (insufficient)
AI ready	Almost Impossible	Bad	Almost Impossible

10

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

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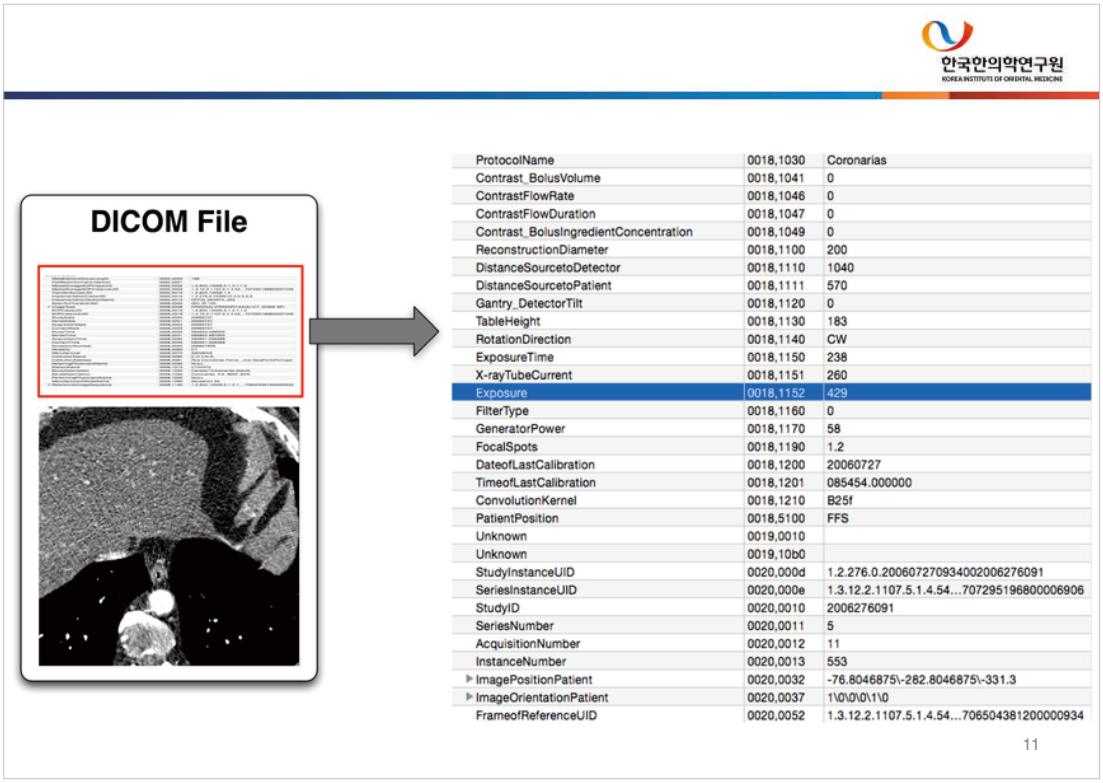
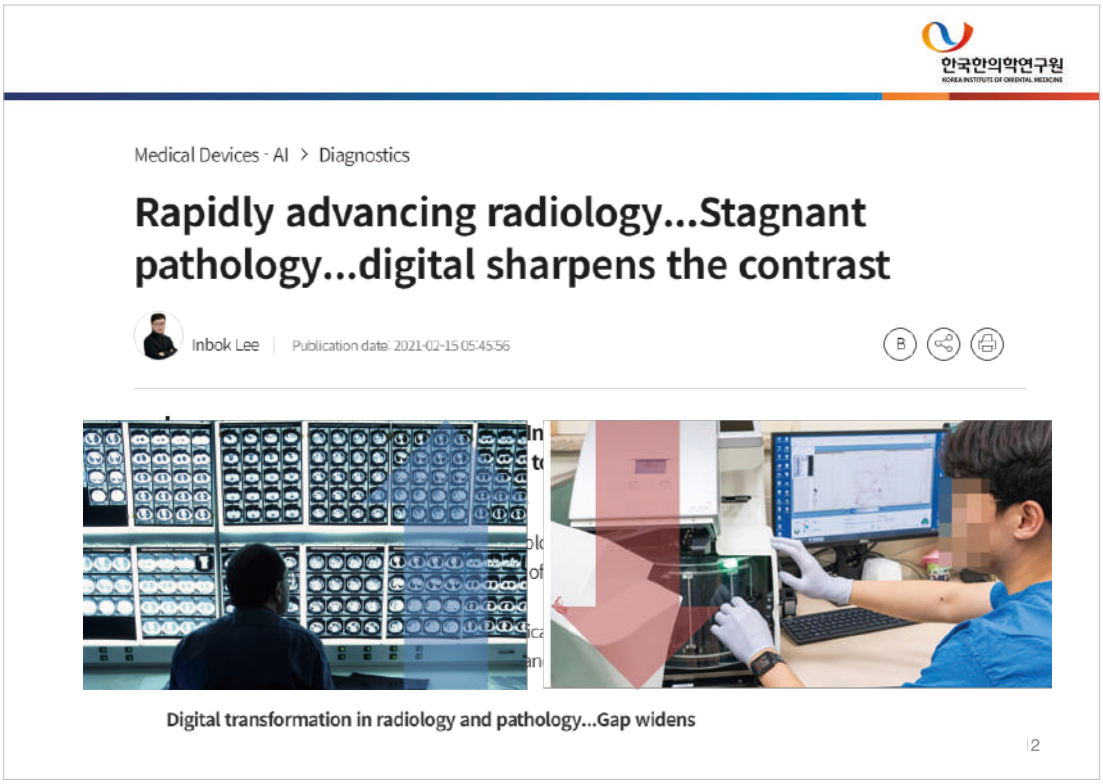




What is AI-ready Data?

AI-ready data is structured, high-quality information that can be easily used to train machine learning models and run AI applications with minimal engineering effort.

1.Clear lineage and validation

2.Clean and well-structured

3.Comprehensive metadata and documentation

What is AI-ready Data?

Clear lineage and validation

To ensure data accuracy. The sources of the data must be traceable and the measurements must be consistent with relevant standards and be capable of validation.

Clean and well-structured

To increase data utilization and interoperability, data components should be clearly and specifically defined and well-structured.

Comprehensive metadata and documentation

To ensure both human and AI understanding of the data, the data should be well described and documented.

15

Characteristics of TM's Clinical Data

四診(Four examinations)

Observation(望診), Listening(聞診), Palpation(切診)

- Recording the doctor's subjective judgments using the five senses
- Measured by the sensory organs like eyes, nose, ears
- Classified, defined and recorded by subjective judgment
    - Ex. 目赤 面紅 躁急易怒 脈弦數

Inaccuracy of Human Sensory Organs, Judgmental Subjectivity

Characteristics of TM's Clinical Data

四診(Four examinations)

Asking(問診)

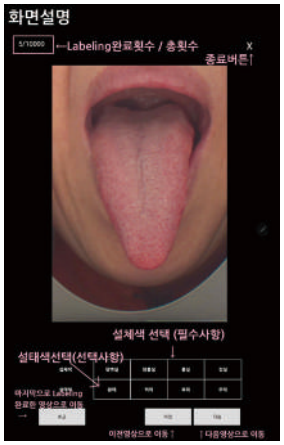
- Recording the content of questions and answers using everyday terms for diagnosis
- Inconsistency between word meaning of doctor and word meaning of patient
- Ex. 惡熱 vs 多汗 , 食滯痞滿 vs 排便
- Unit mismatch
- Ex. Soju, baijiu Beer

Intra-Rater Reliability of Tongue Color Classification

Subject
- 10 doctors selected by 10 major academy of TKM

Tongue image preparation
- 2000 tongue images captured by KIOM Tongue diagnosis device that complies with ISO international standards was used.

Acquisition of labeling data
- The data was acquired 5 times randomly by the SW developed for this study on a Samsung Galaxy Tab S7, which was color calibrated in advance.



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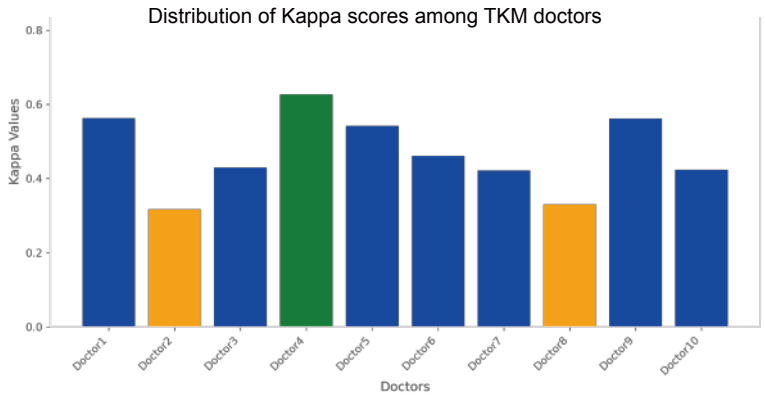
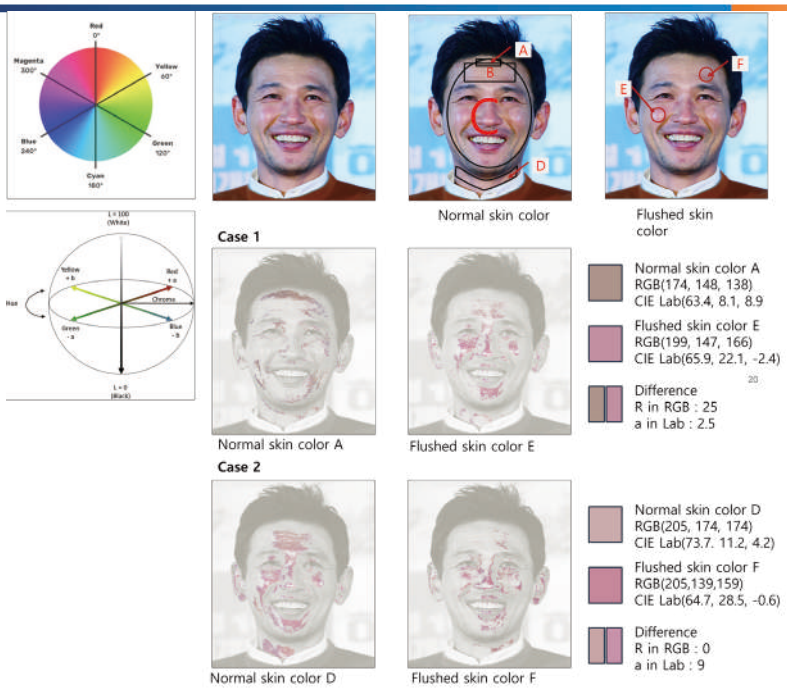
Intra-Rater Reliability of Tongue Color Classification

The average value of intra-rater agreement for all 10 doctors is 0.47 which is a moderate agreement.
Only 1 TKM doctor shows good, while 2 doctor shows Fair.



Value of κ	Strength of Agreement
< 0.20	Poor
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Good
> 0.80	Very Good

Problems on facial color labeling



Variablization of TM clinical data

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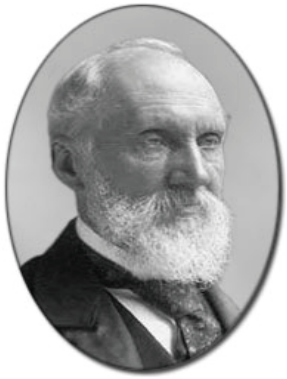
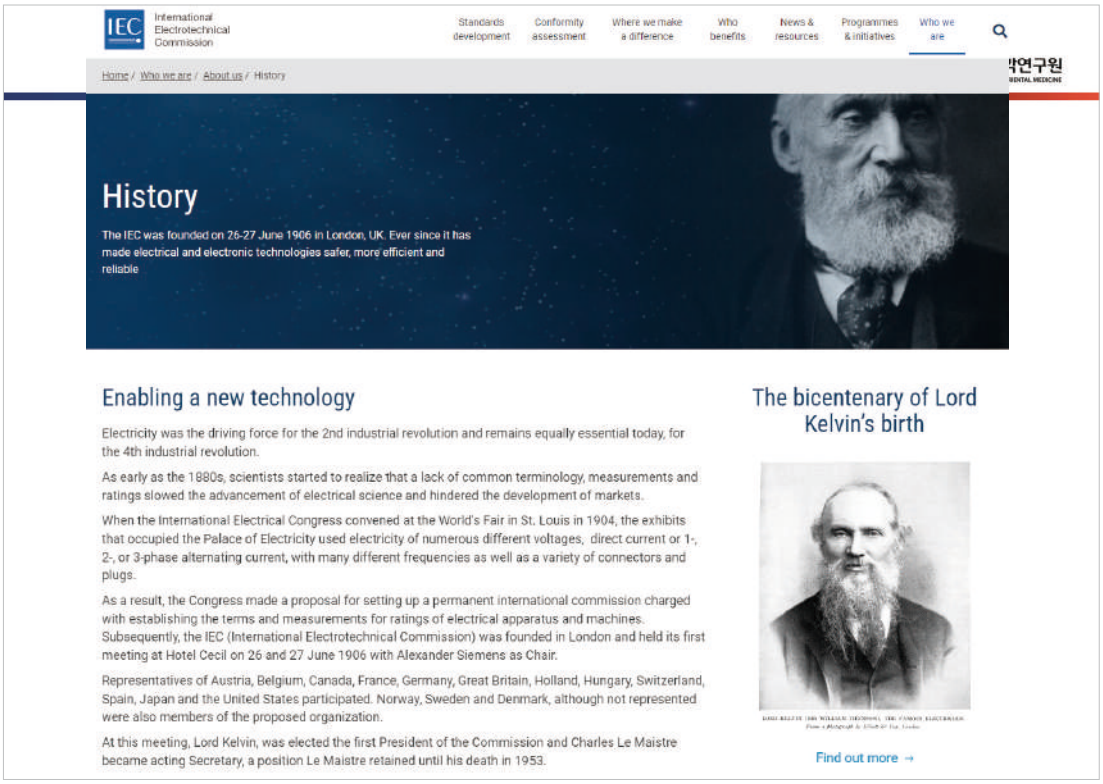
If we don't express what we know
in the form of numbers,
we really don't know much about it.

If we don't know much about it,
we can't control it.

If we can't control it,
we are at the mercy of chance.



Lord William Thomson Kelvin
(1824-1907)



Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

- Sanghun LEE I KIOM

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

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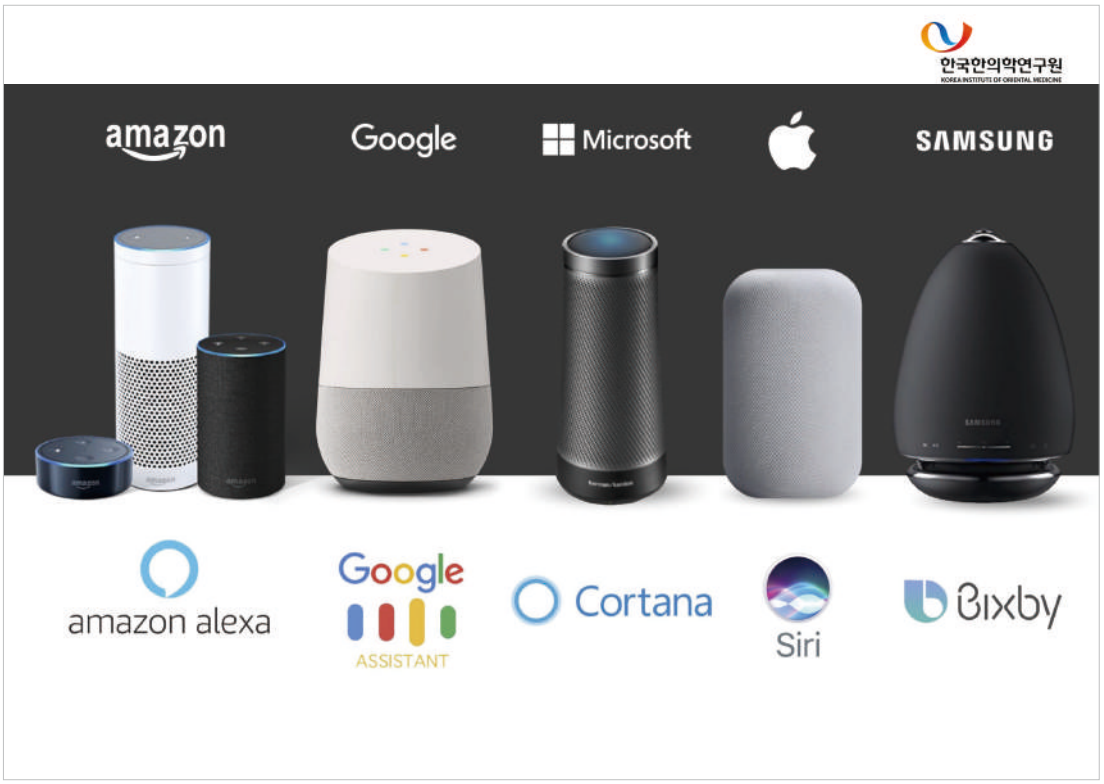

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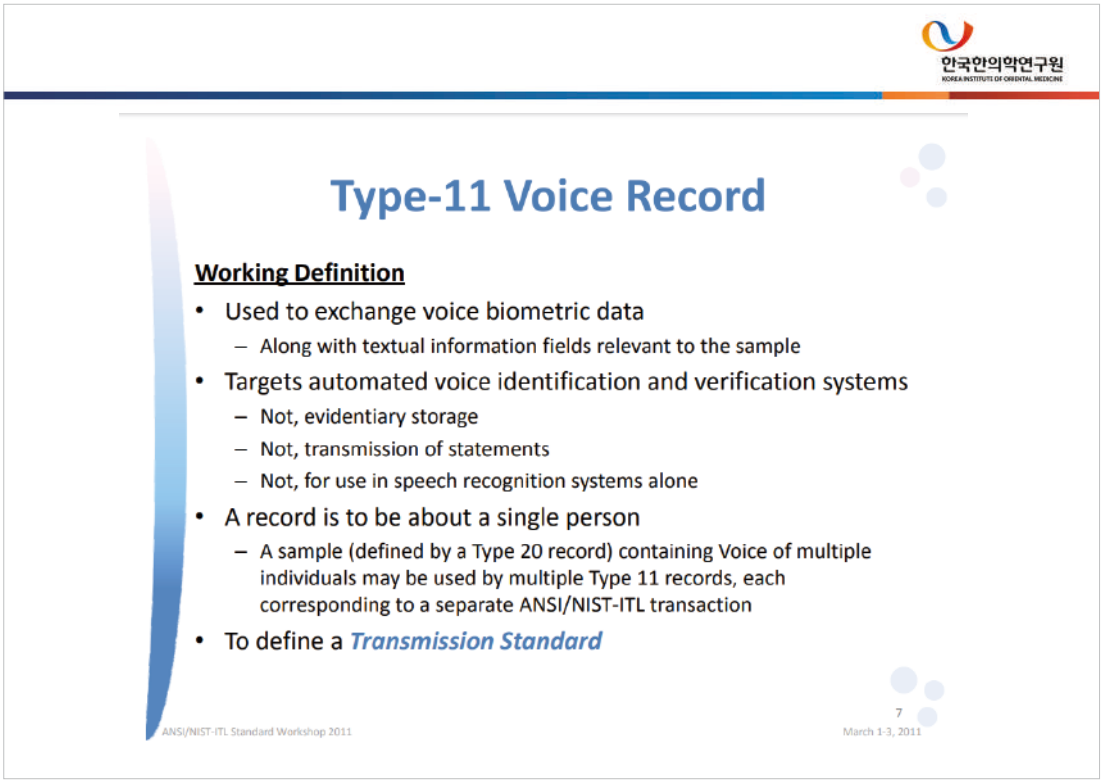

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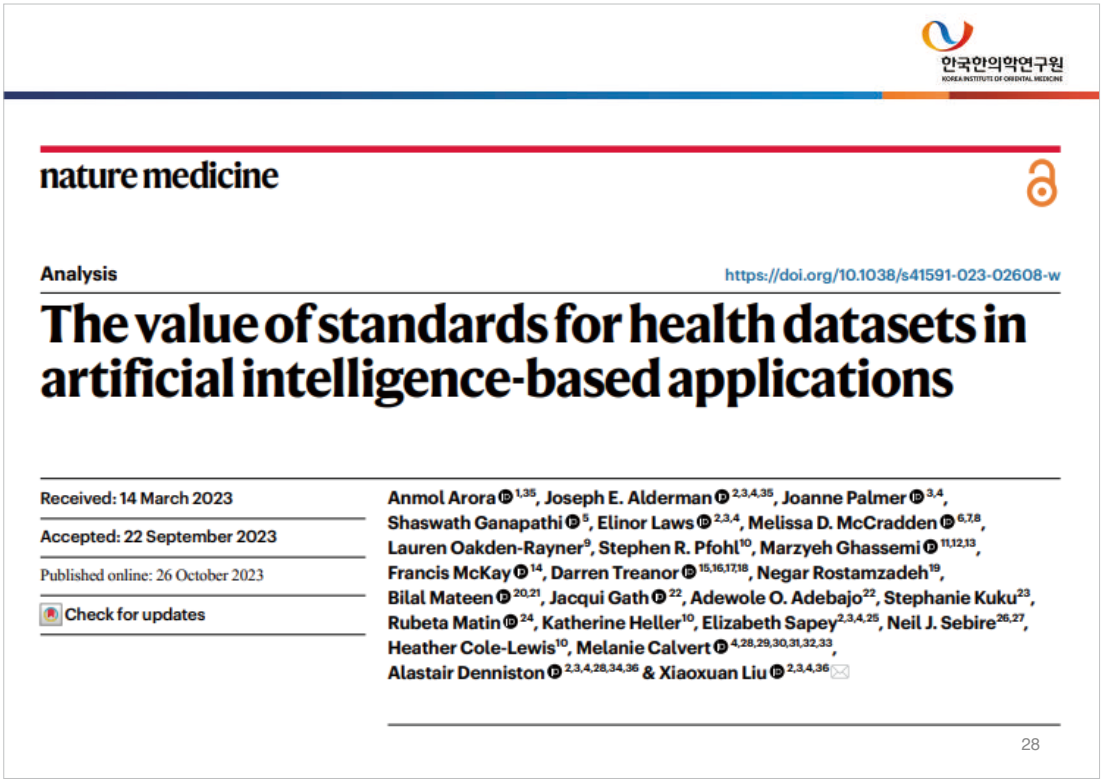
Type-11 Voice Record

Working Definition

- Used to exchange voice biometric data
  - Along with textual information fields relevant to the sample
- Targets automated voice identification and verification systems
  - Not, evidentiary storage
  - Not, transmission of statements
  - Not, for use in speech recognition systems alone
- A record is to be about a single person
  - A sample (defined by a Type 20 record) containing Voice of multiple individuals may be used by multiple Type 11 records, each corresponding to a separate ANSI/NIST-ITL transaction
- To define a *Transmission Standard*

ANSI/NIST-ITL Standard Workshop 2011 7 March 1-3, 2011



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nature medicine

Analysis

https://doi.org/10.1038/s41591-023-02608-w

The value of standards for health datasets in artificial intelligence-based applications

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Published online: 26 October 2023

Check for updates

Anmol Arora[1,35], Joseph E. Alderman[2,3,4,35], Joanne Palmer[3,4], Shaswath Ganapathi[5], Elinor Laws[2,3,4], Melissa D. McCradden[6,7,8], Lauren Oakden-Rayner[9], Stephen R. Pfohl[10], Marzyeh Ghassemi[11,12,13], Francis McKay[14], Darren Treanor[15,16,17,18], Negar Rostamzadeh[19], Bilal Mateen[20,21], Jacqui Gath[22], Adewole O. Adebajo[22], Stephanie Kuku[23], Rubeta Matin[24], Katherine Heller[10], Elizabeth Sapey[2,3,4,25], Neil J. Sebire[26,27], Heather Cole-Lewis[10], Melanie Calvert[4,28,29,30,31,32,33], Alastair Denniston[2,3,4,28,34,36] & Xiaoxuan Liu[2,3,4,36]

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Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

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Variablization of TM clinical data

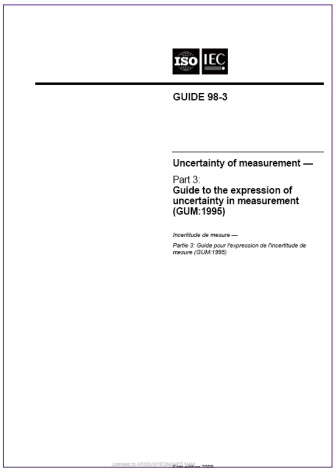
Vocabulary

VIM
2007, 2nd ed.

Unit

SI
2006 (8th Ed.)

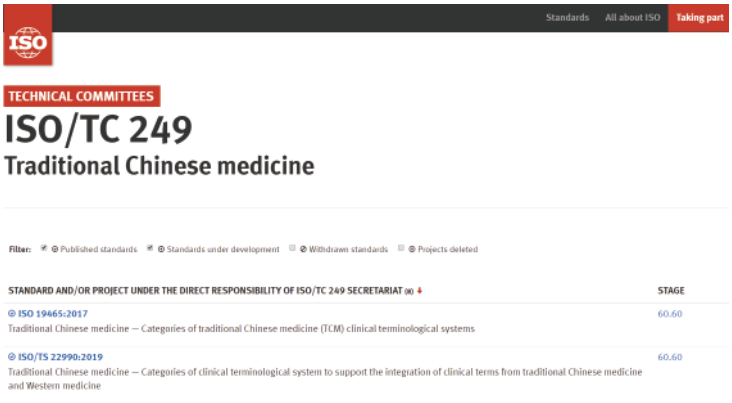
Uncertainty

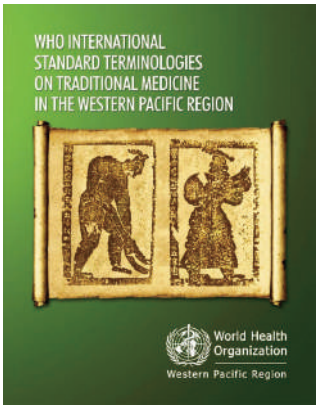


GUM
2008

Standardization status of TM clinical data

Terminology





Standardization status of TM clinical data

Coding rule

Standards | All about ISO | Taking part

...itional Chinese medicine

Filter: ☑ Published standards ☑ Standards under development ☐ Withdrawn standards ☐ Projects deleted

STANDARD AND/OR PROJECT UNDER THE DIRECT RESPONSIBILITY OF ISO/TC 249 SECRETARIAT	STAGE
ISO 18668-1:2016 Traditional Chinese medicine — Coding system for Chinese medicines — Part 1: Coding rules for Chinese medicines	60.60
ISO 18668-2:2017 Traditional Chinese medicine — Coding system for Chinese medicines — Part 2: Codes for decoction pieces	60.60
ISO 18668-3:2017 Traditional Chinese medicine — Coding system for Chinese medicines — Part 3: Codes for Chinese Materia Medica	60.60
ISO 18668-4:2017 Traditional Chinese medicine — Coding system for Chinese medicines — Part 4: Codes for granule forms of individual medicinals for prescriptions	60.60
ISO 20333:2017 Traditional Chinese medicine — Coding rules for Chinese medicines in supply chain management	60.60
ISO 20334:2018 Traditional Chinese medicine — Coding system of formulae	60.60

Standardization status of TM clinical data

Measurement device

Standards | All about ISO | Taking part

...CAL COMMITTEES

ISO/TC 249

Traditional Chinese medicine

Filter: ☑ Published standards ☑ Standards under development ☐ Withdrawn standards ☐ Projects deleted

STANDARD AND/OR PROJECT UNDER THE DIRECT RESPONSIBILITY OF ISO/TC 249 SECRETARIAT	STAGE
ISO/TS 20758:2019 Traditional Chinese medicine — Abdominal physiological parameter detectors	60.60
ISO/FDIS 18615 Traditional Chinese medicine — General requirements of electric radial pulse tonometric devices	50.00
ISO 20498-1:2019 Traditional Chinese medicine — Computerized tongue image analysis system — Part 1: General requirements	60.60

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

- Sanghun LEE I KIOM

CDM

1. Development of oriental clinical data quantification and standardization collection technology

Protocol

1. Developing standard protocol based on ready-to-use technology

1.1 Development and optimization of protocols for key indicators of Korean medicine

- Composition of expert advisory committee of the Korean Medical Association and 15 sub-society
- Defining 12 items (middle class) of universal key indicators in Korean medicine
- Development of standard measurement protocol for selected key indicators (30 quantitative indicators, 23 qualitative indicators, 4 Korean medical diagnoses) and optimization

1.2 Development and Optimization of Clinical Key Indicator Measurement Protocols for Disease

- Selection of target diseases and clinical diagnosis key indicators through consultation with related societies Neuropsychiatric disease (2019), Lung system disease (2020)

- Optimization through development of standard measurement protocol for disease-specific clinical indicators of neuropsychiatric diseases (sequelae of cerebrovascular disease, facial nerve palsy) and pulmonary diseases (atopic dermatitis, allergic rhinitis) and application of actual clinical environment

TKM Clinic

Development of oriental clinical data collection system and utilization service

Personel

1. Development of clinical data collection platform and service development for sustainable collection

Health check-up data collection system

< 건강검진 데이터 수집 시스템 개발 >

< 건강검진시스템 운용 및 고도화 (2021년 건강검진 현황표) >

- 한의 검진 기기 및 건강 검진 데이터 관리 시스템 개발
- "한의건강관리" 모바일앱 연동 (설문 및 결과지 관리)
- 현재 5개 한방병원에서 건강검진 데이터 수집에 활용 중

Clinical data collection system

- 임상 데이터 수집 및 관리 시스템 개발
- 정신신경계 질환 (중풍, 안면신경마비) 진료 템플릿 설계
- 향후 근골격계, 소화기계, 부인과 템플릿 추가 예정

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Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

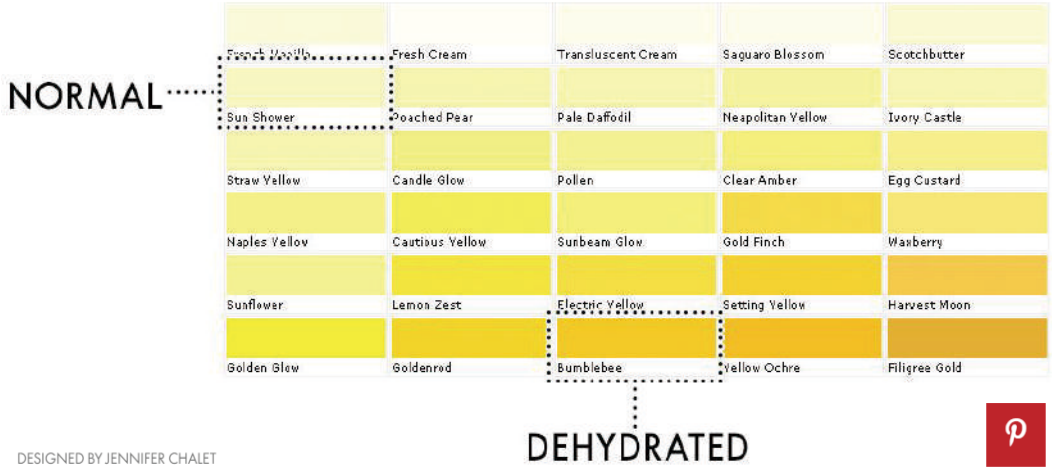
- Sanghun LEE I KIOM

Remaining tasks

한국한의학연구원 KOREA INSTITUTE OF ORIENTAL MEDICINE

examples

Concept	Variableization	Measuring method



DESIGNED BY JENNIFER CHALET

TKM Clinic

Development of oriental clinical data collection system and utilization service

Personel

2. Development of Lifelog data collection platform and service development for sustainable collection

Lifelog data collection App	Literature based Life coaching service	Clinical data based Life coaching service
1차년도 (2019년)	2차년도 (2020년)	3차년도 (2021년)
개인 생성 데이터 수집 모바일앱 구현	생활 관리 추천 모바일앱 업데이트	라이프로그 및 병원진료 연동 업데이트
• "한의건강관리" 모바일앱 (iOS, Android) • 일별, 주간, 월간 운동량 및 수면량 • 한양방 건강검진 수집 시스템 • 체질 판별 서비스 모바일 버전 구현	• 한의 문헌 기반 효능 및 식치 데이터 구축 • 문헌 기반 맞춤 건강관리 추천 (자각 증상에 대한 음식, 식재료, 약재 추천) • 스마트폰 기반 3차원 경혈 증강 현실 서비스	• 모바일앱과 진료지원 시스템 상호 연동 - 진료를 위한 개인 라이프로그 전송 - 진료결과에 대한 일상관리 Teaching 전송 • 일상 생활 건강관리를 위한 한의 콘텐츠 구축 - 체질별 운동, 요가, 음식 콘텐츠 구축 - 건강 정보 카드 뉴스 구축

Development of an AI-ready, High-quality Clinical Big Data Platform for the Digital Transformation of Traditional Korean Medicine

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TKM Clinic

Development of oriental clinical data collection system and utilization service

Personel

1. Establishment of reference dataset of clinical key indicators in Korean medicine based on health examination

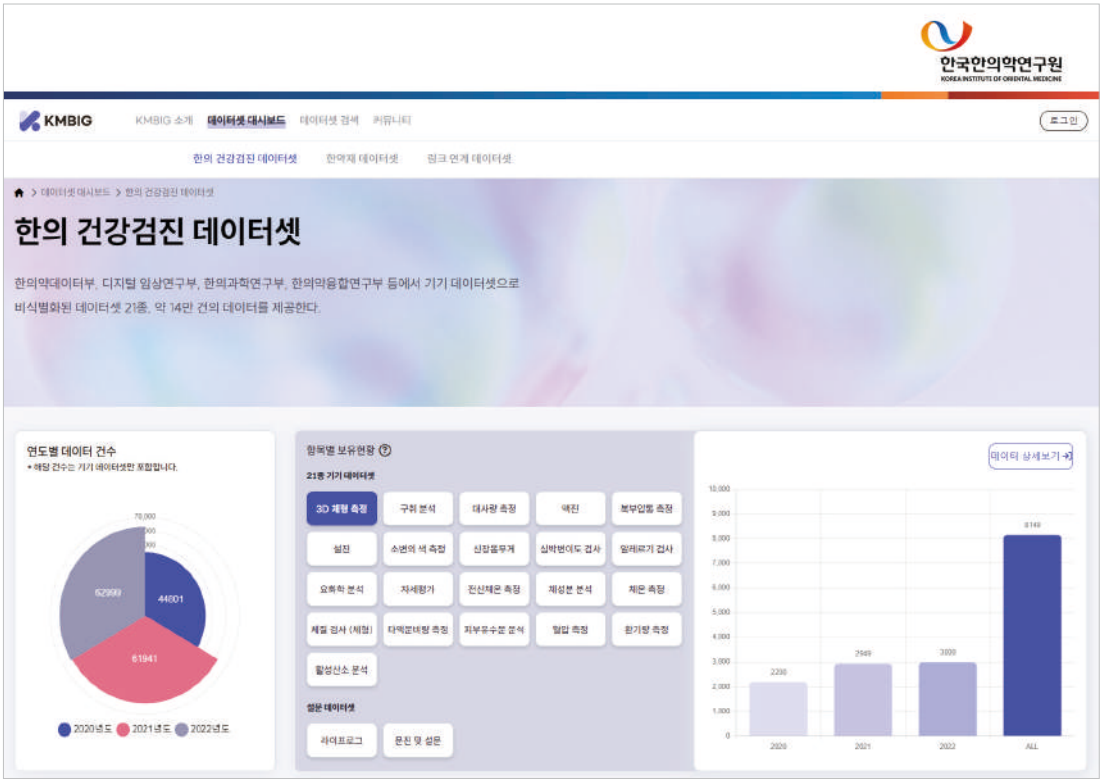
- For the first time in the Traditional medicine field, to establish normal reference data for clinical indicators in Korean medicine, through medical examinations at 5 oriental hospitals, it is aimed to establish approximately 10.8 million data for 43 questionnaires and 785 types of instrumental measurement variables for 13,000 people over 5 years.

<건강검진 프로토콜(SOP) >

<건강검진 eCRF>

Institutions (KM hospitals)	2020 (Completed)	2021 (Implemented/target)
Dong-Shin Univ.	600 persons	450/600 persons
Gachon Univ.	400 persons	391/600 person
Pusan Nat'l Univ.	400 persons	423/600 persons
Dongguk Univ.	-	357/700 persons
Daejeon Univ.	-	241/500 persons
	1,400 persons	1,862/3,000 persons

Status of clinical research implementation by institution (as of Oct.14)



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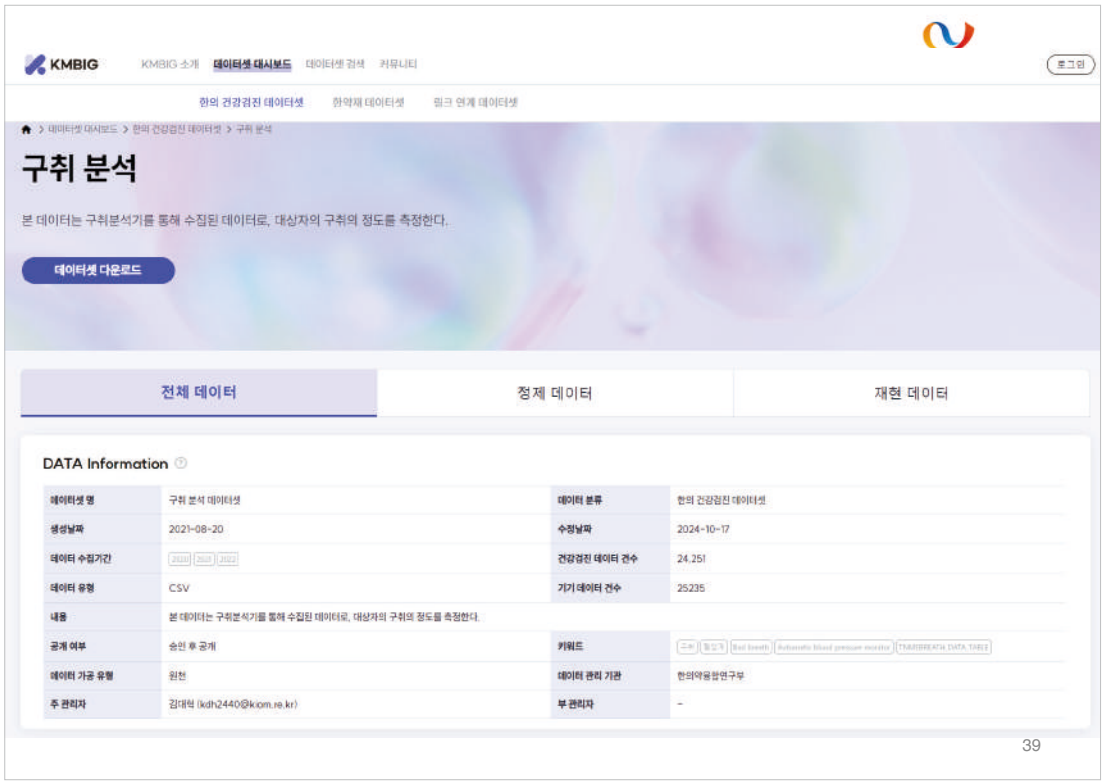

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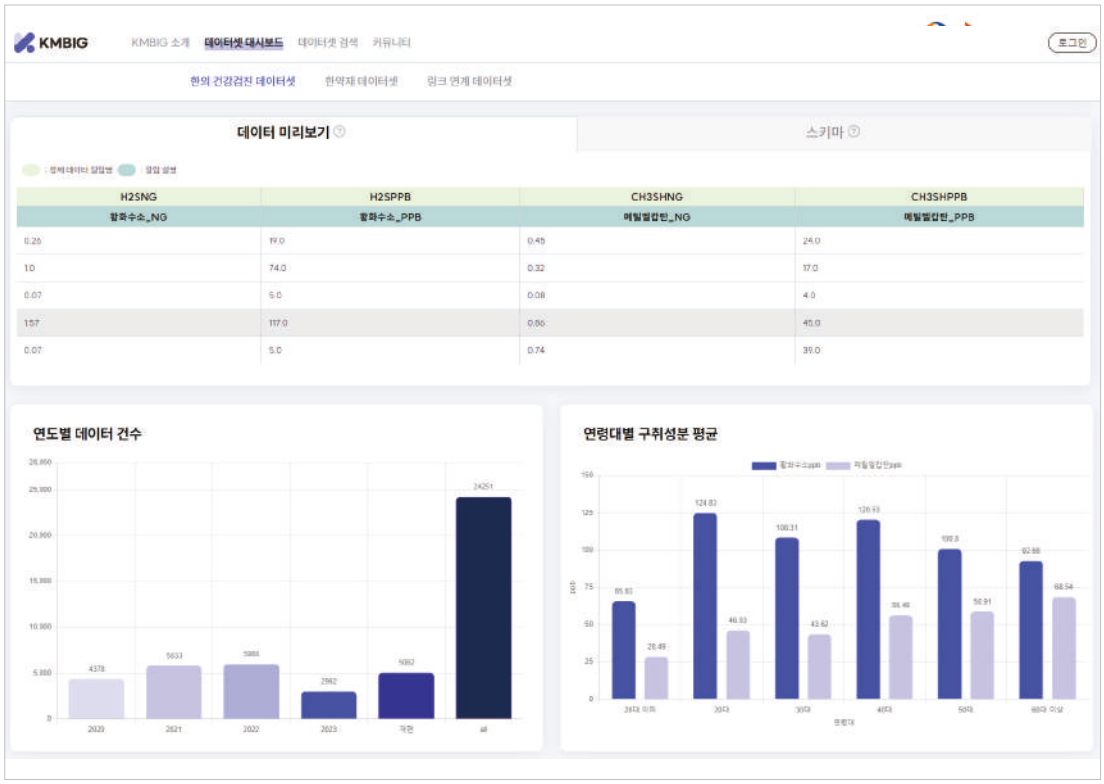

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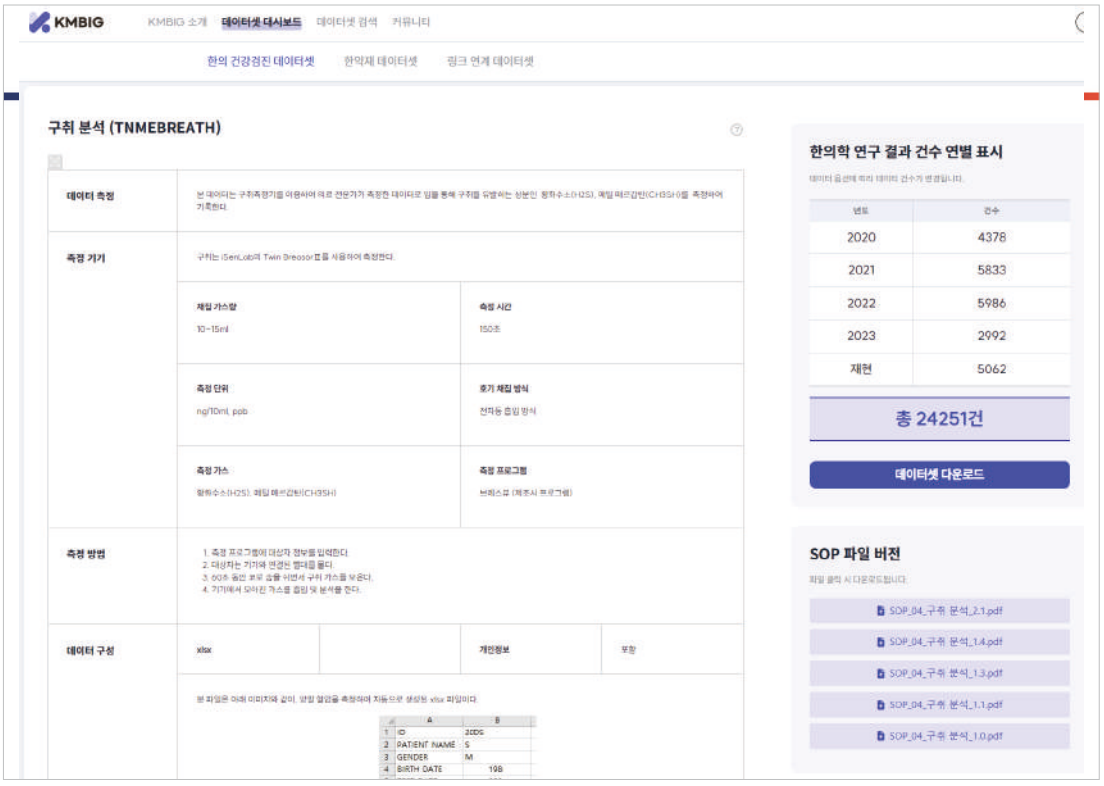

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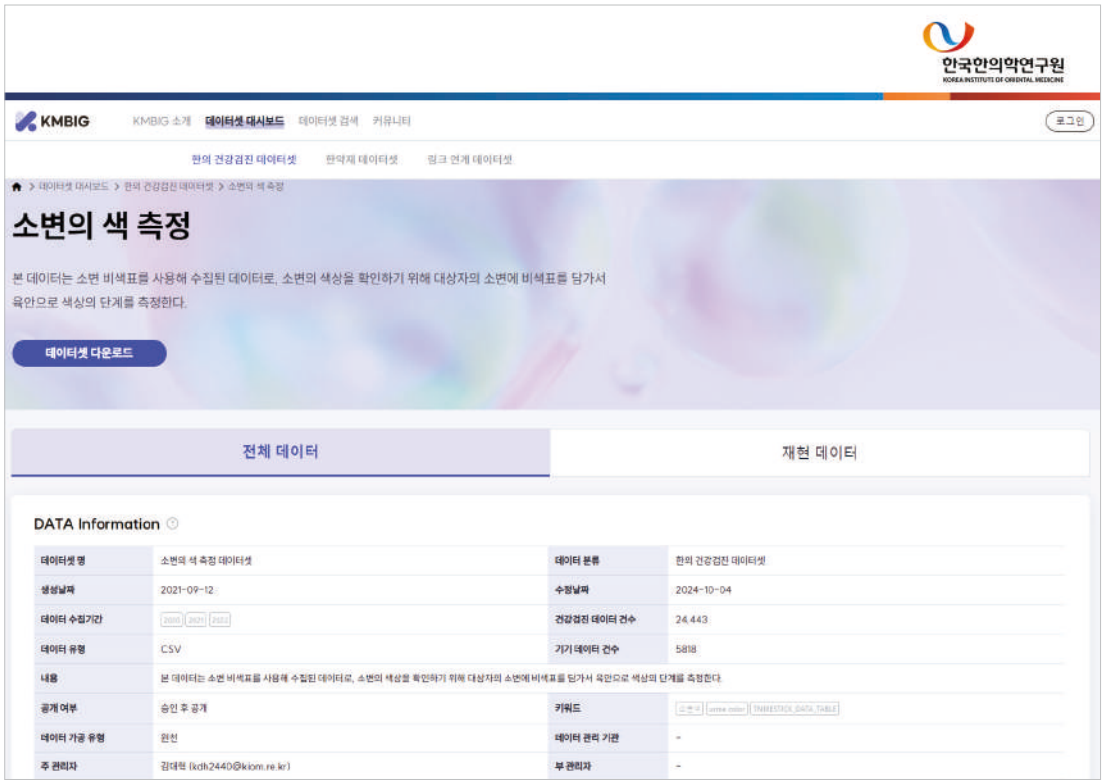

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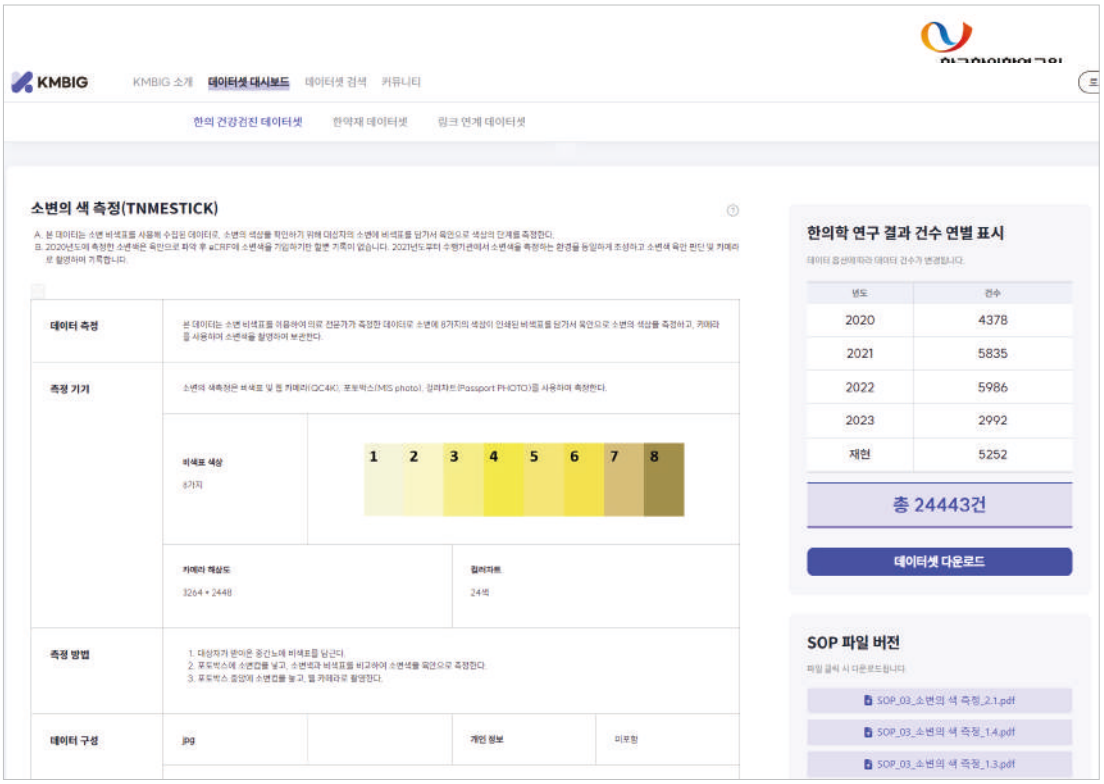

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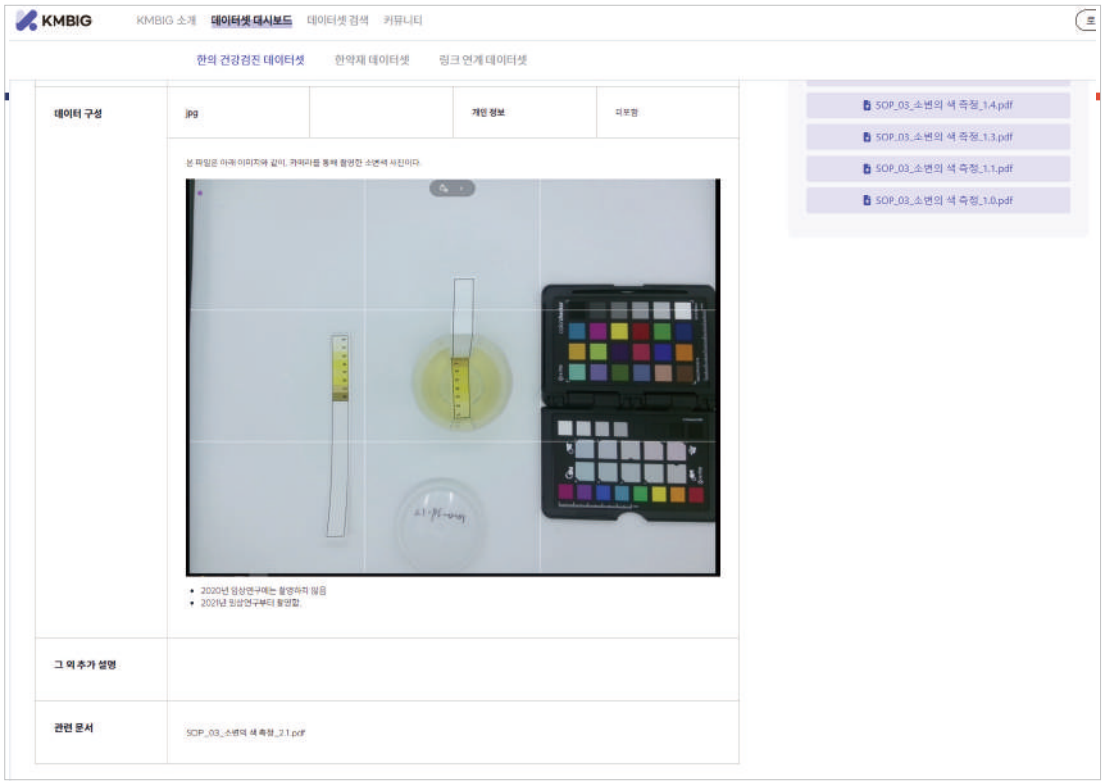

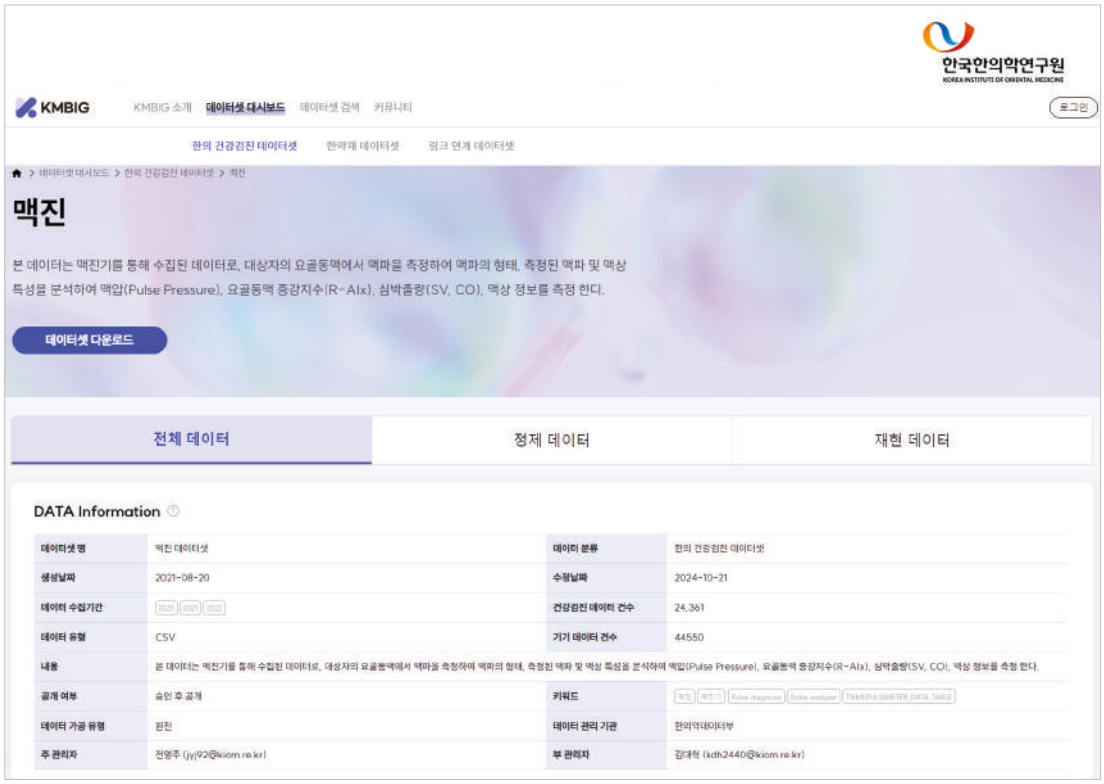

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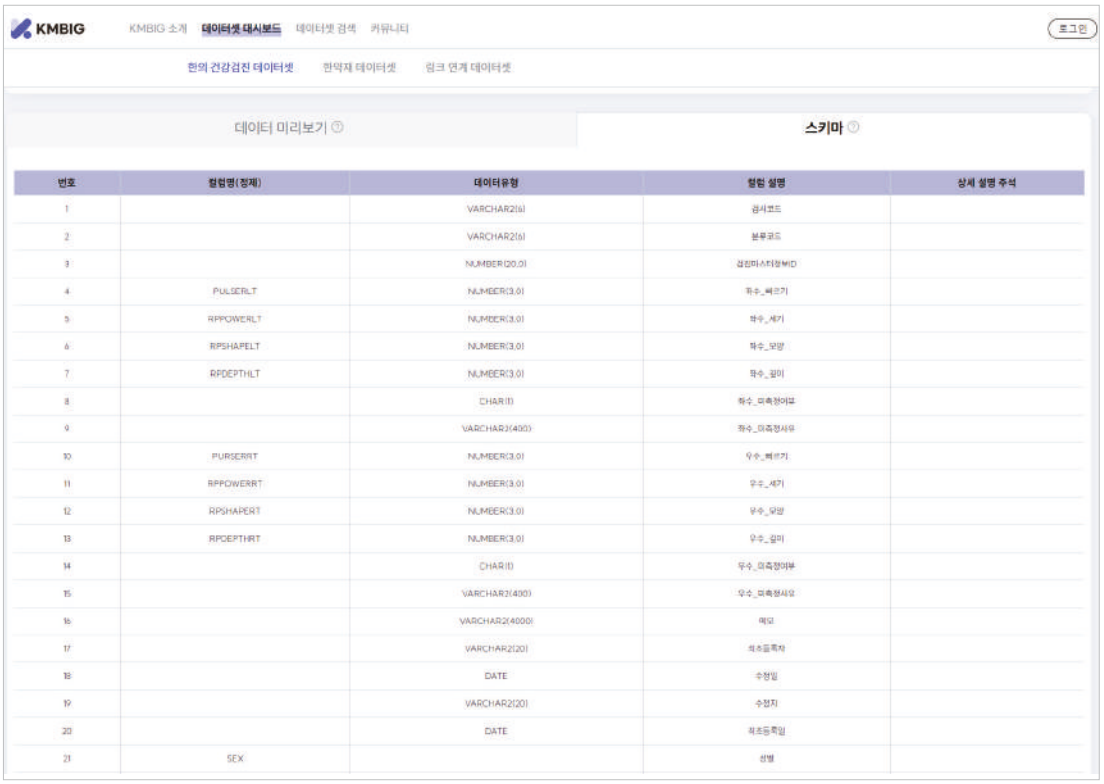
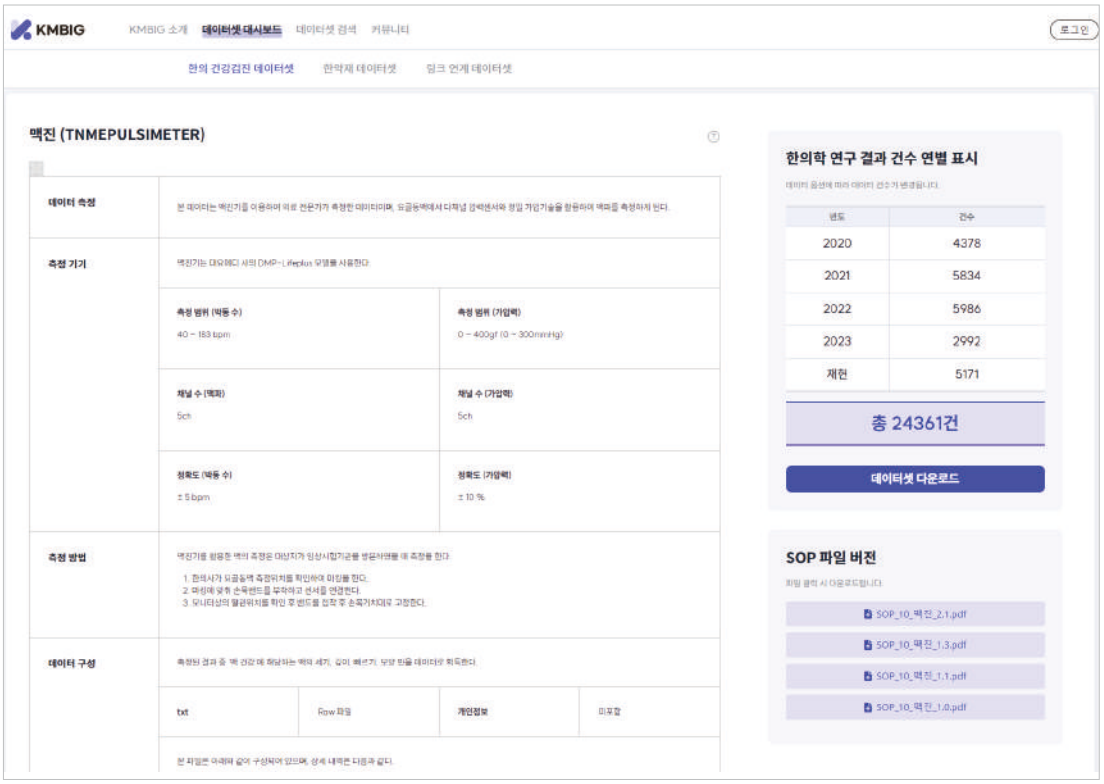


번호	컬럼명(정제)	데이터유형	컬럼 설명	상세 설명 주석
1		VARCHAR2(6)	검사코드	
2		VARCHAR2(6)	분류코드	
3		NUMBER(20,0)	검진마스터정보ID	
4	PULSERLT	NUMBER(3,0)	맥수_빠르기	
5	RPPOWERLT	NUMBER(3,0)	맥수_세기	
6	RPSHAPELT	NUMBER(3,0)	맥수_모양	
7	RPDEPTHLT	NUMBER(3,0)	맥수_깊이	
8		CHAR(1)	맥수_미측정여부	
9		VARCHAR2(400)	맥수_미측정사유	
10	PURSERRT	NUMBER(3,0)	우수_빠르기	
11	RPPOWERRT	NUMBER(3,0)	우수_세기	
12	RPSHAPERT	NUMBER(3,0)	우수_모양	
13	RPDEPTHRT	NUMBER(3,0)	우수_깊이	
14		CHAR(1)	우수_미측정여부	
15		VARCHAR2(400)	우수_미측정사유	
16		VARCHAR2(4000)	메모	
17		VARCHAR2(20)	최초등록자	
18		DATE	수정일	
19		VARCHAR2(20)	수정자	
20		DATE	최초등록일	
21	SEX		성별	



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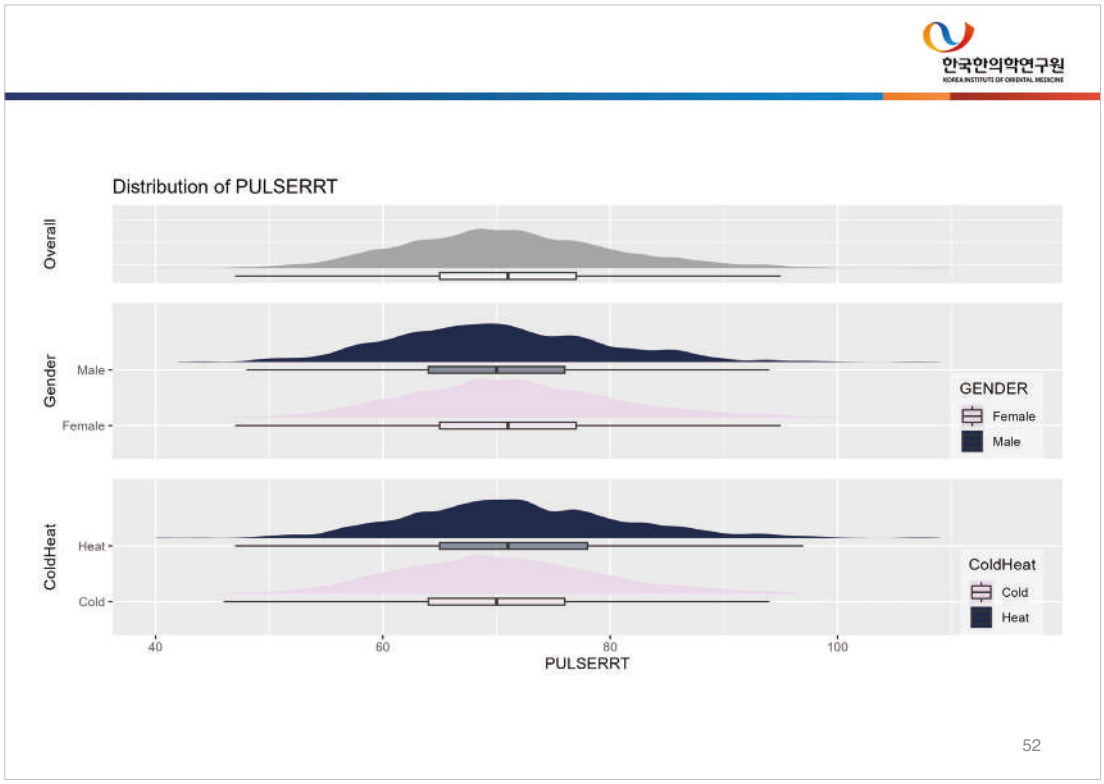

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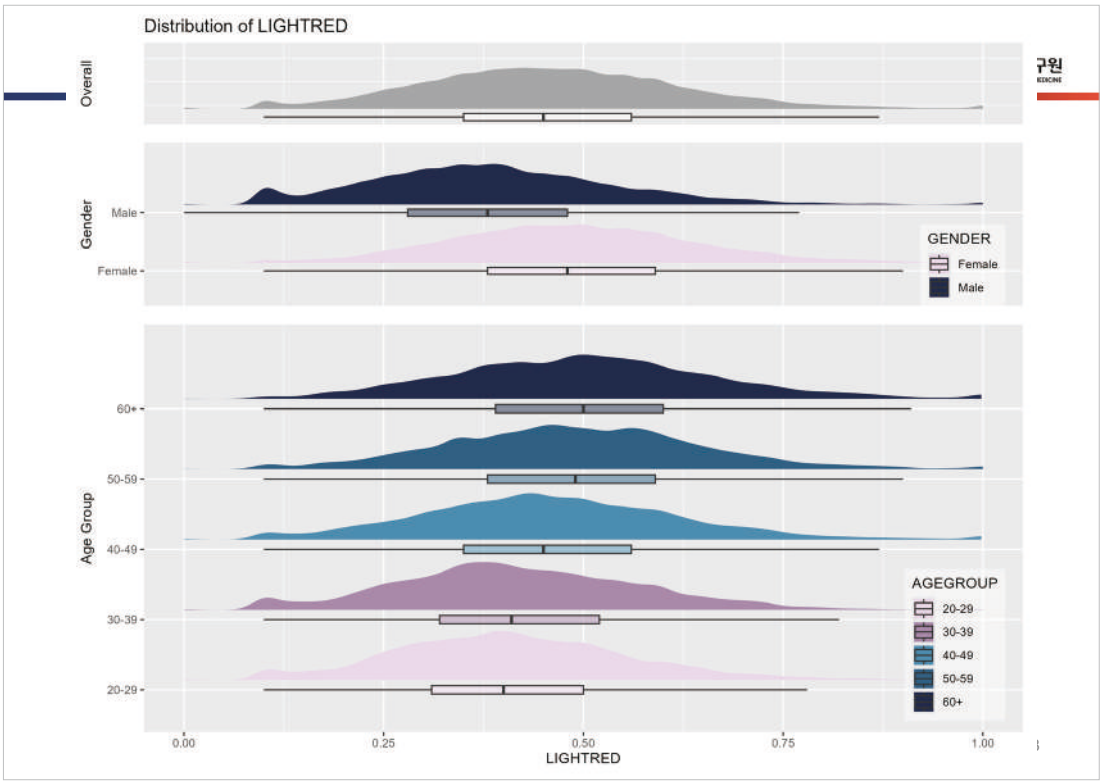
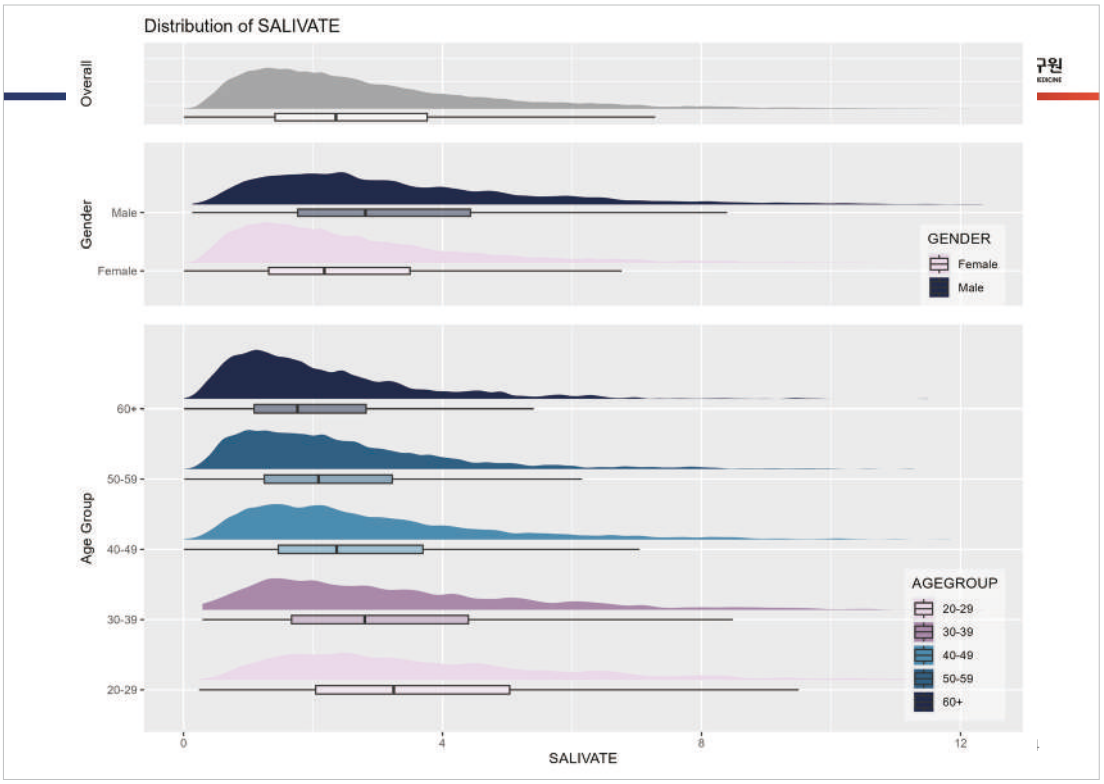
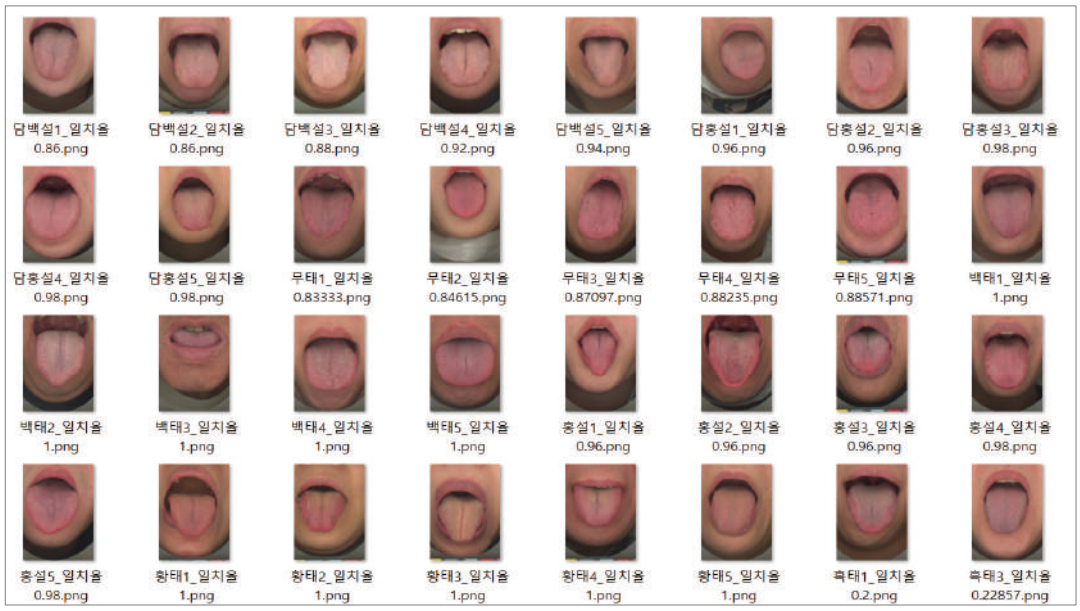


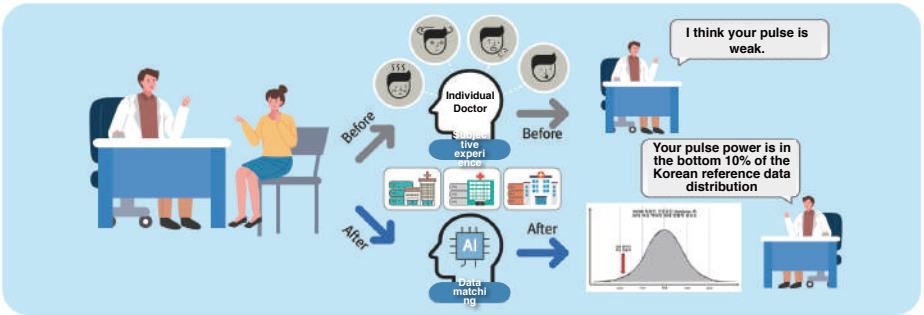




Usability and ripple effect of research results

Establishment of infrastructure for data-based clinical treatment in TKM

Based on standardized, high-quality oriental clinical big data, we aim to build an infrastructure that can support treatment based on objective data rather than subjective memory by comparing 'patient data' and 'standard reference data'



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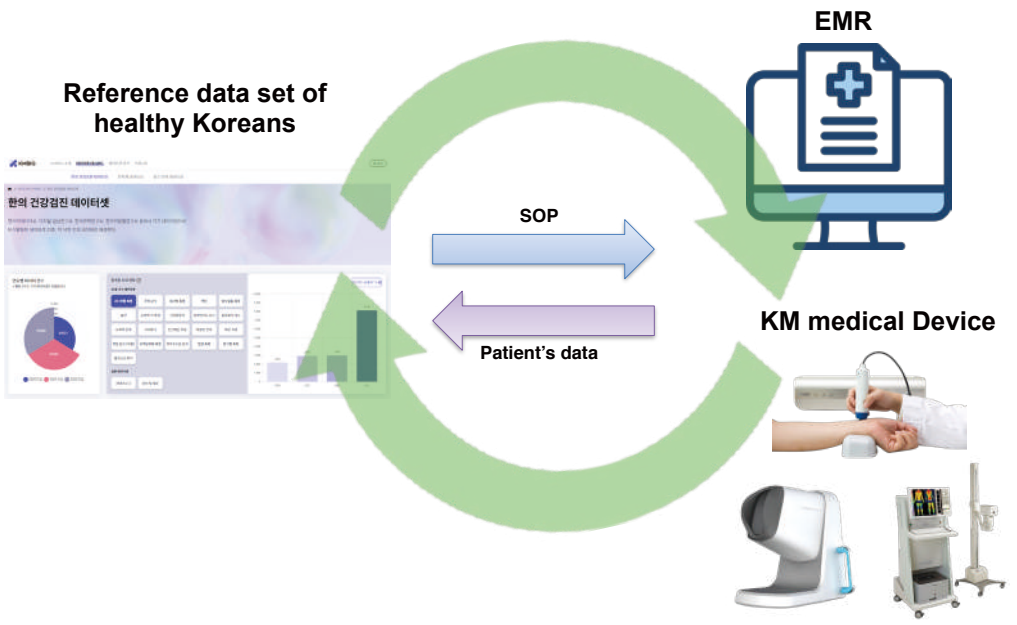
Sustainable AI-ready Data eco-system



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THANK YOU

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PRESENTATION

Claudia Witt
University of Zurich

INTEGRATIVE HEALTH & AI: STRATEGIC APPROACHES FOR THE FUTURE OF MEDICINE

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Integrative Health & AI
Strategic Approaches for the Future of Medicine

Claudia M. Witt, MD, MBA
Professor of Medicine
Co-Director Digital Society Initiative
University of Zurich
Director Institute for Complementary and Integrative Medicine
University Hospital Zurich

"I care deeply about life - that's why I'm passionate about Health & AI"

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AI IS DIFFERENT

AI can handle every task that involves human thinking,
no limits, it is impossible to fully oversee.

developing faster than anything we've
ever seen in medicine

vast scope: there will be no singular AI
experts,
only collective
community knowledge

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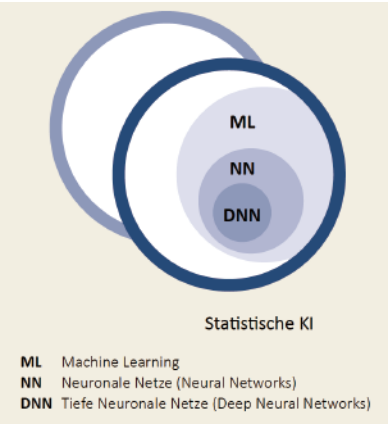
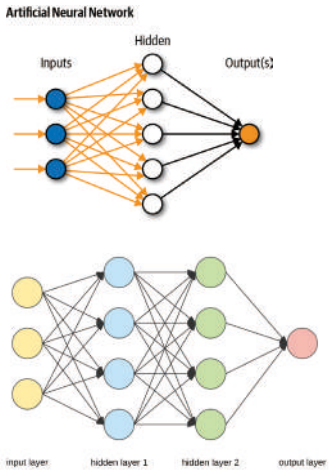
AI Basics





Supervised Learning:
- Labelled data
- Direct Feedback
- Output prediction

Unsupervised Learning:
- No label
- No Feedback
- Clustering

Reinforcement Learning
- Decision process
- Reward system
- Interaction with environment

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Research Examples

32 studies mainly:
1) acupuncture treatment,
2) tongue and lip diagnoses
3) herbal medicine.
other included: music therapy, meditation, pulse diagnosis, and TCM syndromes.
Majority AI models to predicted certain patterns

frontiers | Frontiers in Pharmacology

SYSTEMATIC REVIEW

The Use of Artificial Intelligence in Complementary and Alternative Medicine: A Systematic Scoping Review

Hongmin Chu[1], Seunghwan Moon[2], Jeongsu Park[3], Seongjun Bak[3], Youme Ko[4] and Bo-Young Youn[5]*

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Digital Transformation of Health Care

- (Almost) everything could one day be mapped in an information system:
- **All medical data collected about patients.**
- **Also other data that only becomes »health data» by being related to health issues.**
- The way you analyze this data to arrive at diagnoses and therapies.
- **»Digital twins" of people for purposes of prevention, diagnosis/early detection, therapy testing.**

Integrative Health[1]

- ..a state of well-being in body, mind and spirit that reflects aspects of the individual, community, and population; affected by: (1) individual biological factors and behaviors, social values, and public policy, (2) the physical, social, and economic environments, and 3) an **integrative healthcare system that involves the active participation of the individual and the healthcare team in applying a broad spectrum of preventive and therapeutic approaches.**
- ..encourages individuals, social groups, and communities to develop ways of living that promote meaning, resilience and wellbeing across the life course.

[1]*Witt et al Am J of Preventive Medicine 2017*

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Future Scenario (fictive)

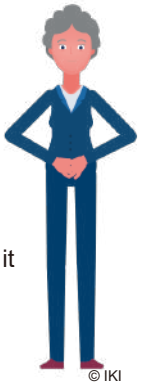
Mary Miller's Case: Managing Chronic Low Back Pain

- Persistent low back pain for over 3 months
- Uses health insurance app with chatbot: personalized suggestions (physiotherapy, psychotherapy, medication)
- Previous relief from acupuncture; asks app's chatbot about incorporating it into her treatment
- Chatbot response:

  Recommends the other treatments based on data

  Can't recommend acupuncture due to insufficient data

  => Acupuncture not covered by insurance



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Witt CM, Graca S, Lee YJ, JOURNAL OF INTEGRATIVE AND COMPLEMENTARY MEDICINE 2024

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Biases in AI Algorithms

1. **Lack of fair data**
2. Absence of guidelines or recommendations
3. Limited awareness in the existence of biases in AI
4. **Challenges in data integration**
5. Inherent biases in research data (e.g. selection bias)
6. Healthcare Disparities

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AI from an Integrative Health Perspective

- **AI should augment human well-being rather than diminish it**
  - Roles of health professionals and patients will change
  - Need for user-centric design (UX Designs) of AI contributions
  - Trust is a core aspect for integration[1]
- **Algorithms can only recommend (predict) what they have learned**
  - Availability of data (bias)[2]
  - Standards for data (meta-data & interoperability)[2]
  - More data sources increase precision[3]

[1]Gille. What Is Public Trust in the Health System? Insights into Health Data Use, Policy Press 2023
[2]Witt et al. AI and Acupuncture Journal of Integrative and Complementary Medicine 2024
[3]Muse &Topol Cell Metab 2024

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THE SOCIETY FOR ACUPUNCTURE RESEARCH
ARTIFICIAL INTELLIGENCE (AI) & DIGITAL HEALTH

Artificial Intelligence (AI) and Digital Health SIG

Current tasks:

1) Recommendations for the field
2) Core data standards for routine care

If you are a SAR member and you are interested in joining this SIG, contact the SIG Leaders:

Claudia M. Witt; Sandro Graca; Ye-Seul Jennifer Lee.

Witt CM, Graca S, Lee YJ, JOURNAL OF INTEGRATIVE AND COMPLEMENTARY MEDICINE 2024

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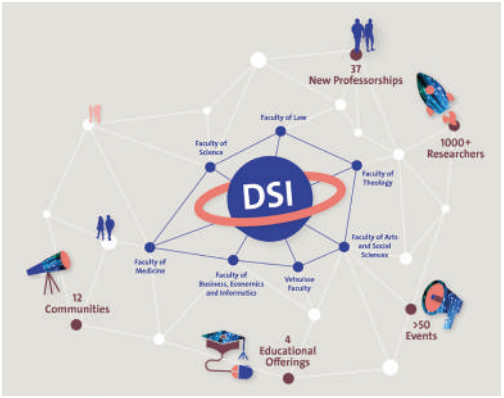
Digital Society Initiative (DSI)

University of Zurich's competence center for digital transformation.
Shapes the digital transformation of society and science.



www.dsi.uzh.ch

Strategy Lab

Responsible Integration of AI in Medicine

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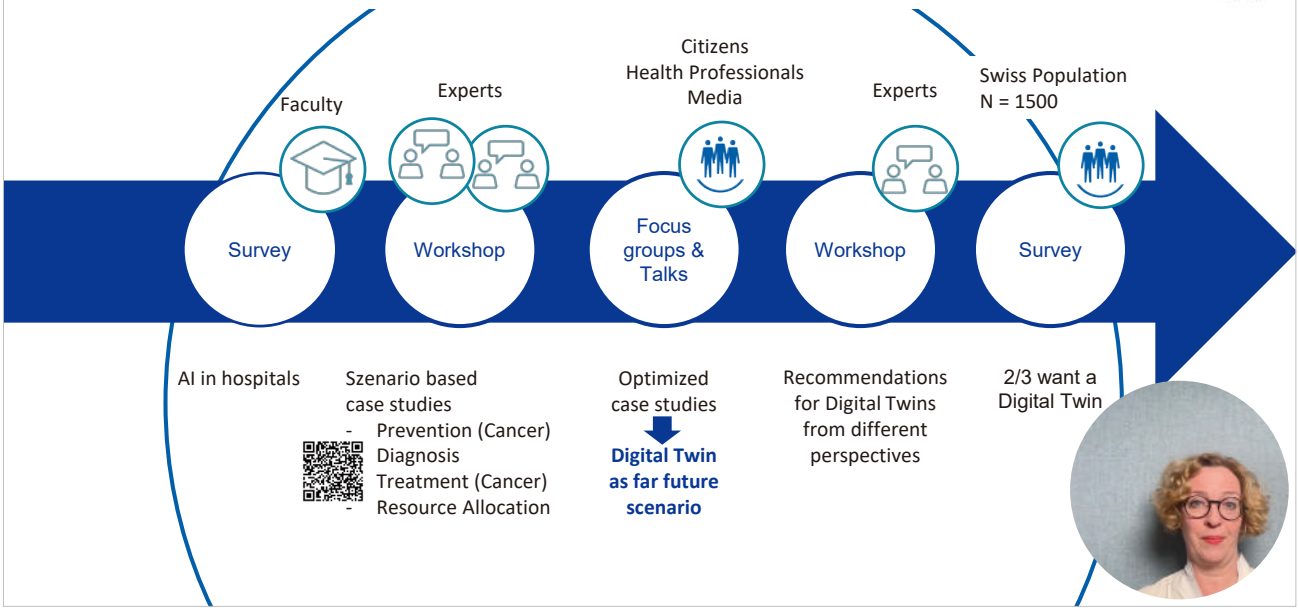
AI in Medicine – Participatory Process



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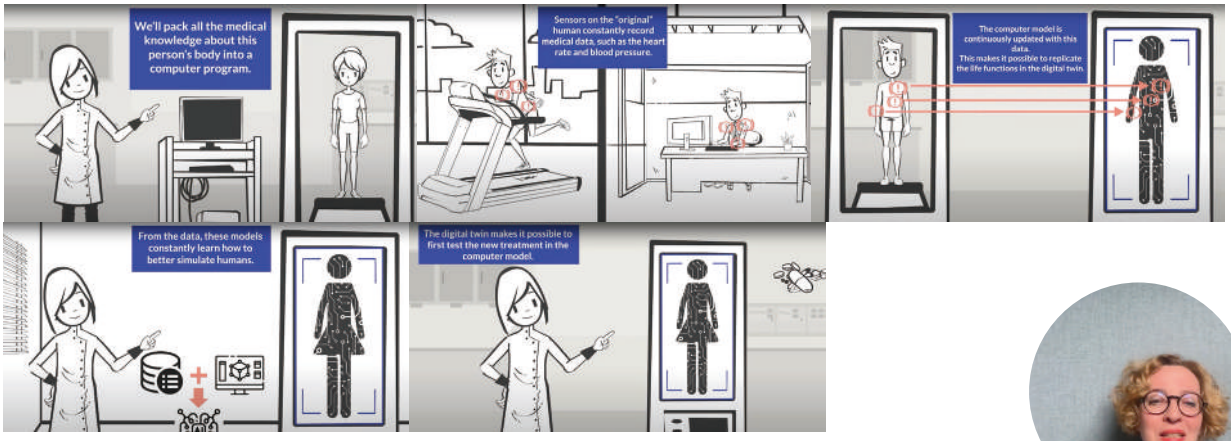
«Digital Twin»



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Scoping Reviews on Digital Twins Applications

Table 1 | Various types of DTs in healthcare

Physical Entity	Entity	Mechanism	Endpoint
Lung	Lexma[12]	Runs simulations of blood and oxygen flow	Predict ventilation requirements
Heart	Dassault[13], Medtronic, Boston Scientific, FDA;	Simulates the structure and physiologic function of the heart	Customization and optimization of cardiac devices
Heart	Siemens Healthineers[23]	Simulates the structure and physiologic function of the heart	Cardiac resynchronization
Heart	Heart Navigator[40]	simulated TAVR implantations with different aortic prosthesis	Surgical planning
Spine	Ahmadian et al.[42]	Predict Vertebral Fracture after Stereotactic Body Radiotherapy	Optimal radiation plan to minimize treatment side effects
Alzheimer's disease	Unlearnai[14]	Predicting the individual outcome in neurological diseases	DT of controls of clinical trial and ultimately clinical interventions
Breast lesions	VICTRE trial[51]	Image based virtual patients comparing digital mammography to tomosynthesis	Determine which imaging tool is better at detecting breast lesions
Oropharyngeal cancer	Tardini et al.[51]	Optimal treatment selection	Determine optimal treatment plan for oropharyngeal cancer
Type 2 Diabetes	Cleveland Clinic Twin Health NCT05181449[88]	Disease reversal in type 2 diabetes	Randomized control trial examining twin precision treatment vs. standard of care
Mental health	MindBank AI[85], IBM[86], Babylon[87], DigiTwin[88]		Wellness

Katsoulakis et al npj digital medicine 2024

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Position paper

Artificial Intelligence in Medicine – Objectives and Recommendations for the Responsible Use of Digital Twins

Editorial team:
Nikola Biller-Andorno, Markus Christen, Michael Krauthammer, Claudia Witt

Introduction

In the next few years, the use of artificial intelligence (AI) in medicine will influence the possibilities in prevention, diagnosis and therapy as well as the associated processes and responsibilities in healthcare to a large

This position paper was produced in a systematic and participatory process as part of the Digital Society Initiative's "Strategy Lab Artificial Intelligence in Medicine". The process extended from early 2022 to mid-2023 and included, among other things, a survey of medical subject matter ex-

12 Recommendations from 4 perspectives

for a more meaningful digital transformation

- People/ patients
- Health professionals
- Manufacturers/ providers
- Regulators/ payors

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Choice of and Access to Health Care

- People decide on the generation, data sources, design, type of use, and lifetime of their personal digital twin services.
- People are empowered through measures in education to understand personal digital twins in the best possible way and to be able to use them in accordance with their values and interests.
- Healthcare continues to enable care for individuals who do not want to use digital twin services.

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Collaboration & Communication
Integrative Health Human-AI-Teams

Digital Twin?

- Digital twins are integrated into interprofessional treatment teams, where the necessary competencies are available, and responsibilities are clarified.

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What do we know about Human – AI Teams from Economics Research

Replacement (AI only) vs. Augmentation (AI Assistance)

COMBINING HUMAN EXPERTISE WITH ARTIFICIAL INTELLIGENCE:
EXPERIMENTAL EVIDENCE FROM RADIOLOGY

Nikhil Agarwal
Alex Moehring
Pranav Rajpurkar
Tobias Salz

Working Paper 31422
http://www.nber.org/papers/w31422

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
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Abstract

Full automation using Artifical Intelligence (AI) predictions may not be optimal if humans can access contextual information. We study human-AI collaboration using an information experiment with professional radiologists. Results show that providing (i) AI predictions does not always improve performance, whereas (ii) contextual information does. Radiologists do not realize the gains from AI assistance because of errors in belief updating – they underweight AI predictions and treat their own information and AI predictions as statistically independent. Unless these mistakes can be corrected, the optimal human-AI collaboration design delegates cases either to humans or to AI, but rarely to AI assisted humans.

Demir et al.

- Worse coordination in Human-AI teams compared to Human-only teams
- Less proactive communication (anticipation)
- Generally less communication in teams with AI

Dell'Acqua et al.

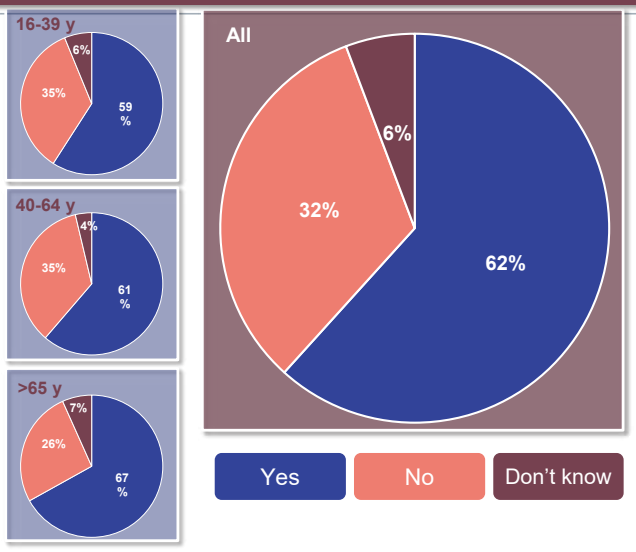
Working with AI...

- More coordination errors
- Worse performance
- Less effort

Dell'Acqua et al. (2023). Super Mario Meets AI: Experimental Effects of Automation and Skills on Team Performance and Coordination. Review of Economics and Statistics.
Demir et al. (2017). Team coordination dynamics in human-autonomy teaming. Proceedings of the Human Factors and Ergonomics Society Annual Meeting

Suppose there were already digital twins: Would you yourself welcome the existence of a digital twin so that your health could be maintained and any illnesses could be better treated?

Almost two-thirds of Swiss people would welcome a digital twin:
Older people more often than younger people
Men more often than women
ChatGPT users more often than non-chatGPT users



UZH DSI – Representative Population Survey in Switzerland 2023

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Digital Health Affinity

High or low preference for healthcare provided by integrative health (IH) professionals

% or (mean ± SD)	High IH preference (n=154)	Low IH preference (n= 461)
Female	62	42
Digital literacy	18.67 ± 5.35	20.85 ± 5.46
Digital twin (DT) yes*	54	60
DT healthy lifestyle*	2.55 ± 1.01	2.59 ± 1.00
DT replacement doctor*	2.04 ± 0.92	1.87 ± 0.92

4-point Likert scale from 1: unimportant" to "4: very important

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«Role of Digital Twins»

They could support:

- Medical diagnosis
- Prognosis of a disease
- Therapy of a disease
- Prevention of diseases

+ integrative health perspective:

- Traditional medicine diagnoses
- Life-style aspects (e.g. meditation, yoga)
- Traditional therapies
- Strong field for integrative health

Need for additional concepts and frameworks
how to add this to "conventional digital twins"

Integrative Health & AI: Strategic Approaches for the Future of Medicine

- Claudia Witt I University of Zurich

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Important Next Steps

- Increasing the availability of integrative health routine care data from different sources that can be integrated (core standards)
- Everyone needs more digital skills: to improve quality and efficiency in healthcare
- Learning from other disciplines/ fields of research
- Concepts that support a future medicine that includes Traditional Medicine

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We need a future where healthcare is not only centered around human needs and values but also fosters **a meaningful, symbiotic relationship between humans and AI**. Therefore, we must contribute to a healthcare ecosystem **that leverages technology to enhance well-being, without losing the essence of what makes us human.**