2025 Retreat Report on the PALM group

Physics of Active and Living Matters

After KT's retirement talk

Keng-hui Lin

2025/12/19

Current members

full

1. Chia-fu Chou (64), nano-bio, tissue engineering
2. Keng-hui Lin (51), mechanobiology
3. Chien-jung Lo (49), molecular motor, bacteria
4. Chin-lin Guo (57) tissue morphogenesis

untenured

5. Jih-chiang Tsai (55), granular materials [under review]
6. Tetsuya Hiraiwa (42), theoretical physical biology
7. Hong-yan Shih (39), theory on pattern formation on physical and biological systems.
8. Ryota Sakamoto (31), artificial cells (start in Sep. 2025)
9. Specialist: Jung-ren Huang (54), rheology









Historically, we have about 8 PIs + 1 specialist at the maximum. We don't feel that we have the critical mass. We are still under staffed because most of Taiwanese physics department do not have biological physics or soft matter programs.

Mission of the PALM group

➢ **Research themes**

- Uncover the physical principles hidden in living and non-equilibrium systems.
- Creating physical tools to probe living and non-equilibrium systems.
- Utilize known physical principles/rules of living and active matters to engineer novel functional materials.

➢ **Community building**

- Push the new frontier - physics of life research in Taiwan.
- Becoming the hub for biological physics community in east Asia.

➢ **Cultivate next-generation researchers in this field**

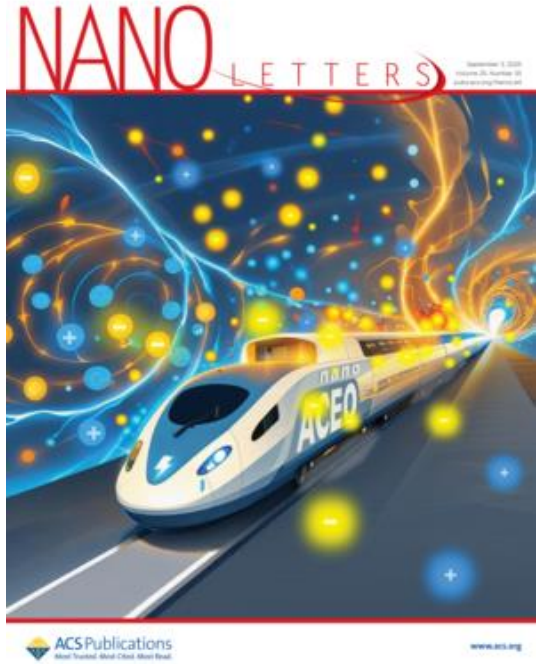
Publications highlight in 2025

Corresponding authors: 13 papers including papers in 1 Nano Letters (cover), 2 Physical Rev. Research, 2 Smalls, 1ACS Applied Materials & Interfaces, 1 Biomaterials, 1 PLOS Computational Biology, 1 Biomolecules, 1 Soft Matter, …

Almost everyone has corresponding author paper.

Co-authors: 6 papers including papers 1 Nature Cell Biology, 1 Nano Letters, 2 Cell Report, 1 ACS Applied Materials & Interfaces, 1 Journal of Biomed. Sci., ..

Our productivity is decent.



International visibilities

- 17 invited talks in important international conferences: GRC meeting, KPS meeting, APPC16, JPS meeting, CSWNST16, the Flagella Meeting, Mechanobiology meeting, the 10th IDMRCS, the 14th International Conference on Advanced Materials and Devices, …
- 10 seminars in the top universities/research institutes in the world: Harvard, Brandeis, Boston University, John Hopkins, U. of Maryland, EPFL, UCLA , Otto von Guericke University Magdeburg, Hiroshima U, National Institute for Materials Science (NIMS), Japan
- 7 meeting organization at the international level (outside Taiwan): APS session organization, Asian conference for mathematical biology, frontiers in theoretical and quantitative biology, international workshop on bacterial flagella
- 1 serve at American Physical Society committee.

Leadership within Taiwan

- TPS: council member, meeting organization/PBBP, WIP officers (KH, JC, Tetsuya)
- Taiwan Biophysical Society: council member, meeting organization (CJ, KH, Tetsuya)
- Taiwan Society for Mechanobiology and Taiwan Stem Cell Society (KH)
- NSTC review panel (CJ)
- TG of NCTS (HY, Tetsuya)
- Editor of CJP (JC)

Trainees

Total: 40 people: 12 postdocs, 10 PhD students, 8 master degree students, 8 research assistants, 2 undergrads.

Interns: 4

17 out of 40 are foreigners.

Median # of group members is 4 people (excluding PI).

We need to increase the group size to reach 6~8 people per group if we would like to have more collaborative efforts. We also need to improve trainee's quality. Teach them how to communicate effectively, think critically, and collaborate with each other.

External grants in 2025

- Thanks to the recommendation from IOP, we secured the AS instrumentation fund (11M) to purchase the new confocal microscope. It was sent out for 5 reviewers and we did need to write rebuttal. That is the first big grant our group wrote together (KH, RS, CF, CL, CJ, and TH).
- Excluding the AS instrumentation fund, we have about 30M external funding (NSTC, AS, Japan, ..). The median funding per group is between 3M.

AAC meeting slide

Foster new culture by the following changes.

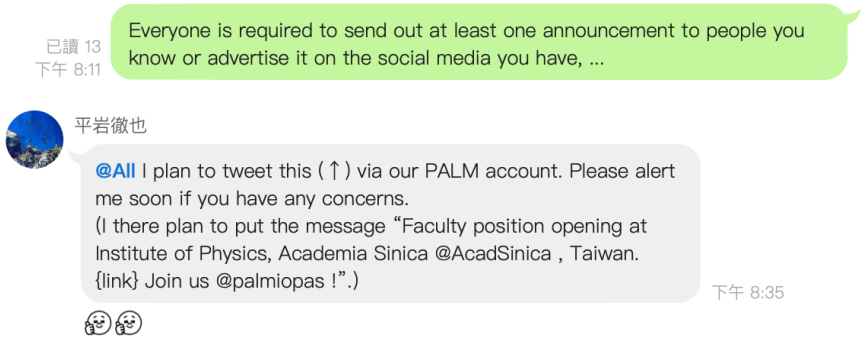
- Shared responsibility
- Transparency on group business
- Open discussion on critical issues and assessment.
- More scientific meetings to be run regularly
  - seminars
  - trainee seminars
  - Brainstorming Informal Gathering (BIG) events
  - Physics of Life Group Gathering
- Trainee recruitment
- Common facility reform

New culture in PALM group

- Everyone contributes whenever there are events.

For recruitment, most of us sent out at least two announcement either on some forums or people we know. We received highest number of applicants (20) and 6 of them pass the line.

- Almost everyone is in charge of one group activities – trainee talk, BIG discussion, PoL talk, … and so on.



- Punctuality!

- We submitted 12 grants besides NSTC personal grants. 7 are joint grants. Currently, 5 are funded, 2 under review, and 5 are rejected.

Our 2026 external total grant: 3.8 M, medium ~ 3.4 M (~20% increase from 2025)

- Transparency on the group business (everything is on the google drive).

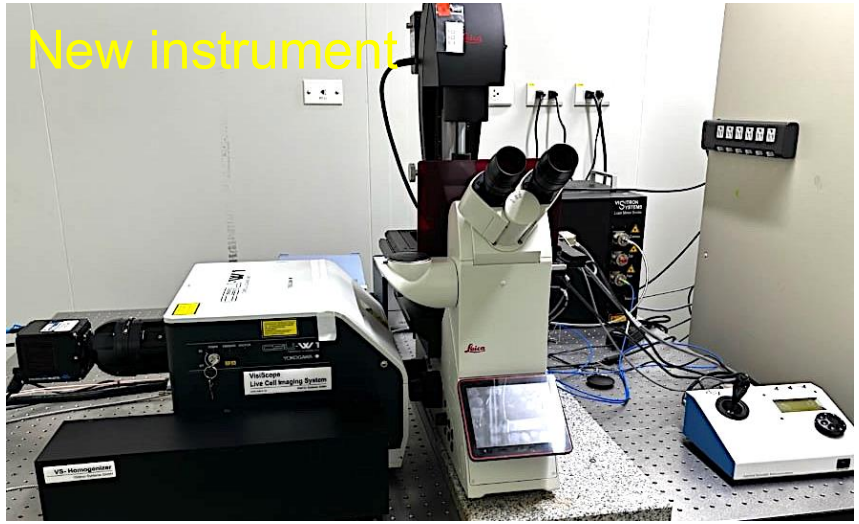
Seminars/Student events

This year we have (mostly in the later half of the year)

- 16 seminars
- 5 trainee seminars
- 4 Brainstorming Informal Gathering (BIG) events
- 3 Physics of Life Group Gathering
- TPS practice talk for trainees

Core Facilities Reform

We move low-usage instrument out of the core facilities.
Keng-hui Lin and Ryota Sakamoto will take over the responsibility to oversee the core facilities.



Shi-shuan will take over the position. There will be some changes in regulations in next year. https://www.phys.sinica.edu.tw/~bssf/

Rules for group instrument funding

Priority

1. Common interests from PIs.
2. Necessity for the lab built-up (especially for the new faculty member.)
3. Impact on science
4. Accountability of the PI
5. Improvement on the common facilities
6. Potential benefit for other PIs
7. Possibility for getting the bigger grant

Rules for group instrument funding

Accountability:
1. Proposal report
2. Progress report (After installation, an open-house demo and an open lecture to all PALM members within 1 year and then a progress report one year later.)
3. Result report (Before the next round of the proposal, we need to evaluate the results from the prior purchased instrument usage.)

Giving back
1. Contribute 10% of the budget from next year from personal budget for 5 years, 12% for 4 years, 15% for 3 years, or 20% for 2 years. [For non-tenured PI, the giving back is 50% off.]
2. The giving-back term can end earlier if the proposed equipment money is highly used for more than one group.
3. If the proposed item wins the matching fund from AS, there is no need to give back because it will be the facility for Academia Sinica.

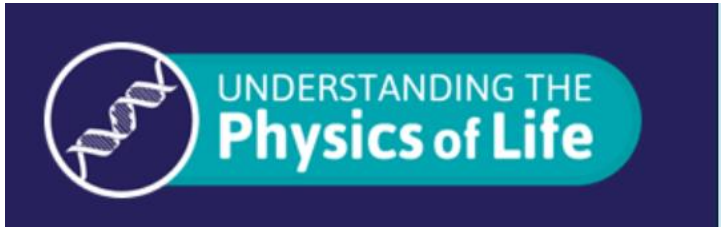
Guideline for operational fund

Invest on the future of the group development

- Recruit more international interns (50% covered by the group fund): Japan, Malaysia, Philippine, …
- Invest on trainee education.
- Invest on inviting speakers on topics which may be collective big projects.
- Invest on AI-related lectures/hand-on practice.
- Invest on efforts which can build the Center for Physics of Life
- Invest on possible synergy with biology institutes leading to research projects.
- Individual request on the operational fund will be based on “quality service performance”.

Possible high-impact leadership work

- Organize Physics of Life Workshop with Mark Leake at UK (CJ's mentor); UK Physics of Life Network (PoLNET)



- Organize Mechanobiology Conference with Mechanobiology Institute, NUS (KH, TH)
- Establish DBIO at AAPPS. (KH)

Build the reputation for better recruitment on postdocs/faculty.

Grand challenge: collaborative projects/efforts

- How does energy flow and dissipate within cells? (eg. use microrheology to probe viscoelastic properties within cells)
- How do patterns emerge in cells? (eg. microridges/microvilli in epithelial cells, epithelial cell organizations, ..)
- Finding a peculiar niche at the interface of bioengineering and biophysics. (spherical microwells)
- Identifying the underneath universality between active non-equilibrium systems and biological systems.

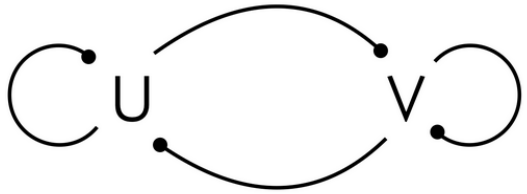
Investment on optical tweezers, nanoindenter, …

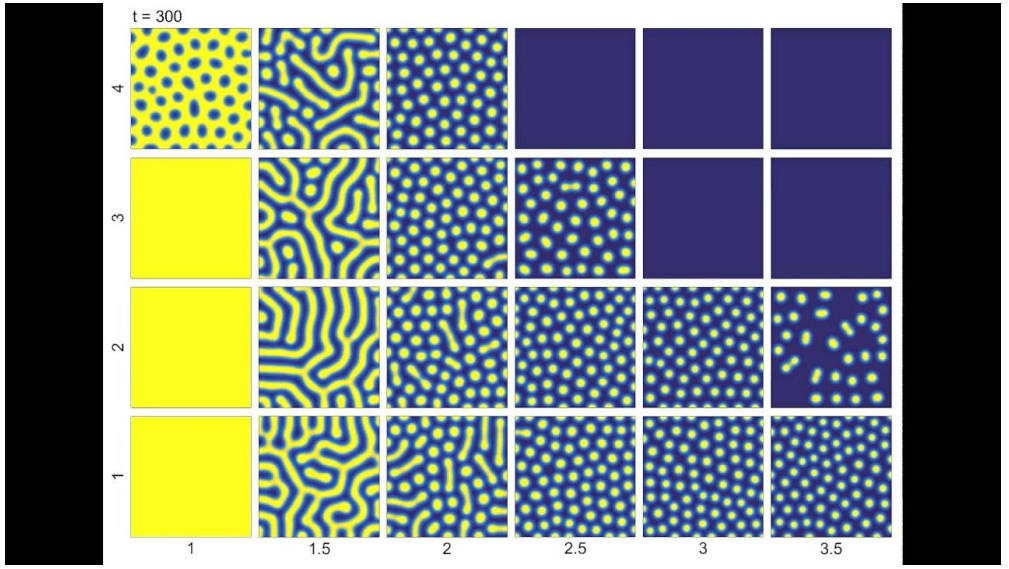
Dots and stripes (Turing Patterns)

$$\frac{\partial u}{\partial t} = D_u \nabla^2 u + f(u, v)$$

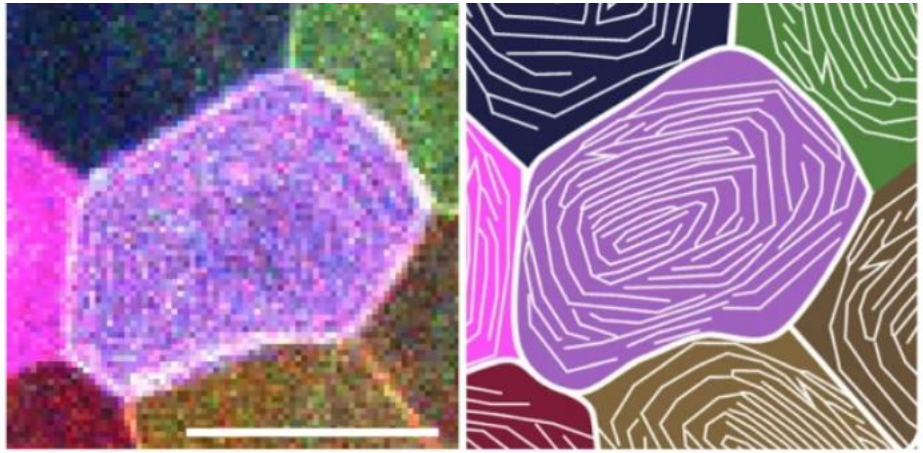
$$\frac{\partial v}{\partial t} = D_v \nabla^2 v + g(u, v).$$

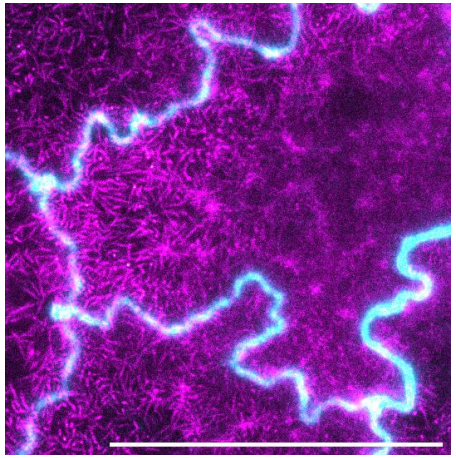
Reaction-diffusion equation

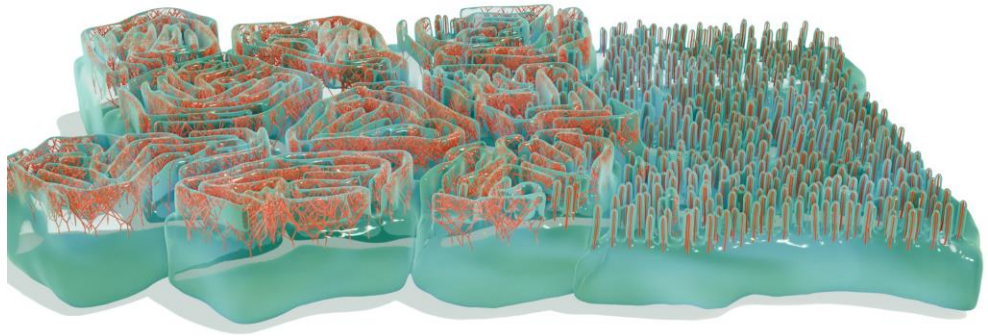


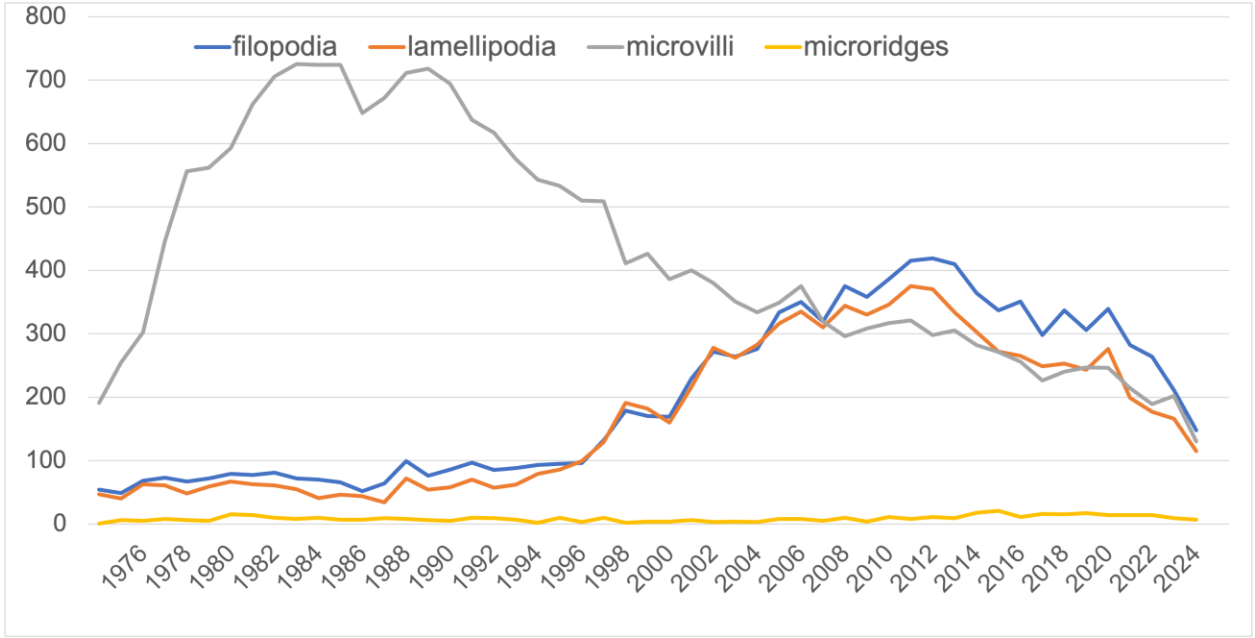


On the apical surface of epithelial cells, there are “dots” and ”stripes”

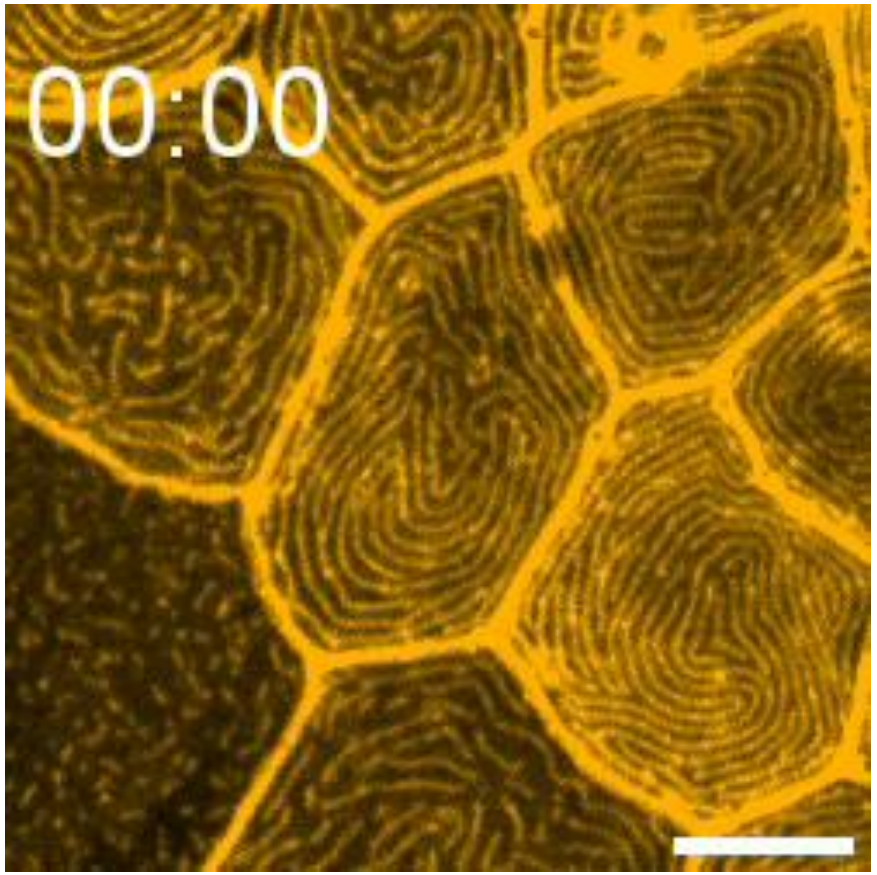








We can induce stripes-and-dots transition



Literature research

- We found only a handful of papers on microridges
- There is one theoretical model explaining the formation of microridges. However, it doesn't have any experimental measurement on mechanical properties, especially tension.
- Combining the expertise of Hong-yan and Tetsuya, we aim to combine quantitative experimental measurements to construct theoretical models to understand stripe-dots transition.

Individual excellence vs. collaborative success

- AAC caution: It should continue to preserve individual excellence. faculty can resist the temptation to spread research areas randomly, which may only serve to dilute effort and confuse recognition." In line with this, if experimentalists collaborate, it should be very sharply focused. On the other hand, if theorists can identify something ‘universal’ across collaborating experimentalists, that would be valuable.
- Recruitment on the visiting scholar: Greg Huber (theorist, UCSF).
- We invest on things which increase cooperativity. More BIG talks, more trainee talks, more collective grant writing, more scientific dialogues, …

Our team spirits

We help each other to be successful.

International competitiveness:
recruitment in students, grants, advanced instrument, research combined with experiments and theoretical models..

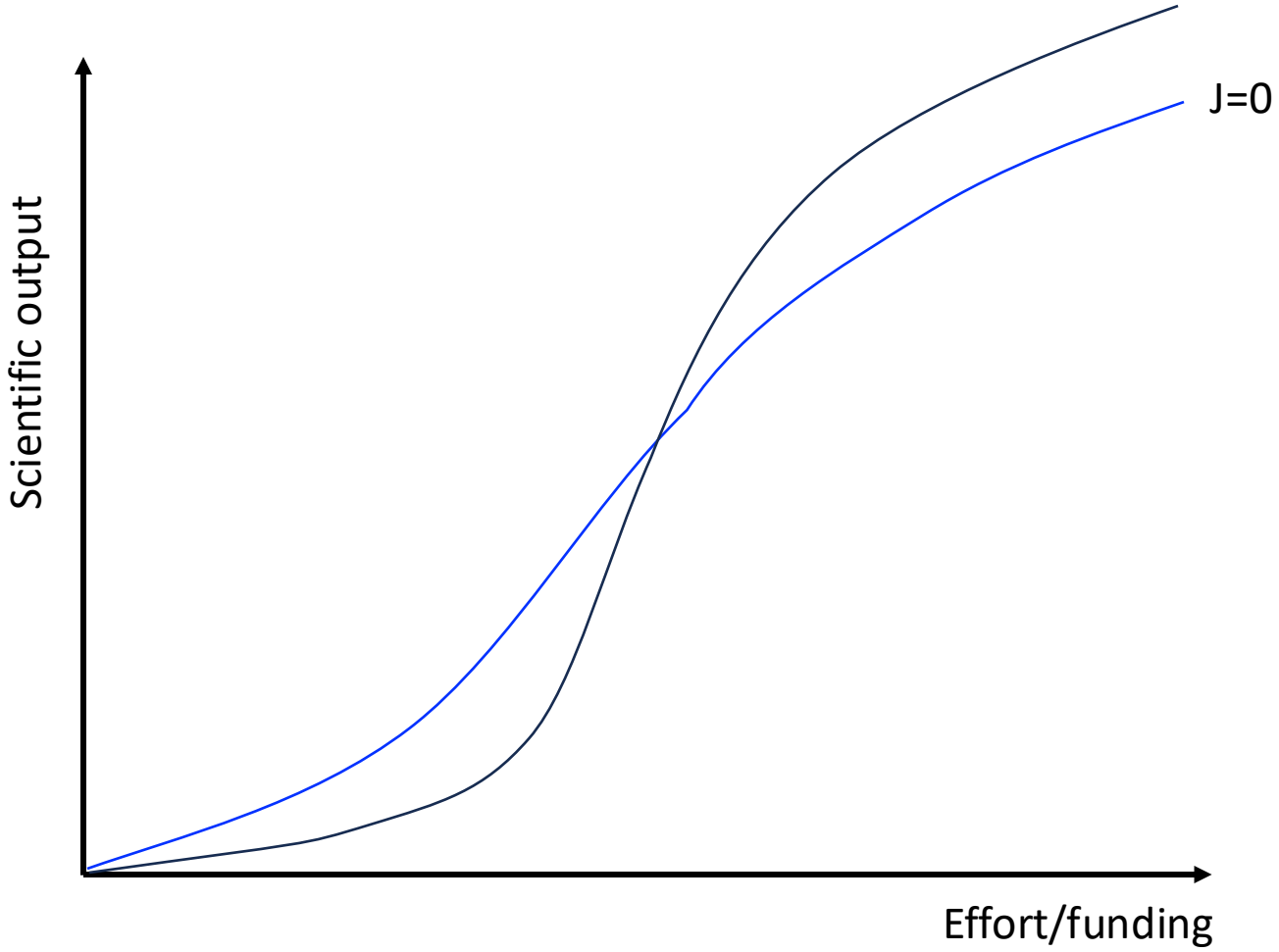
Conclusion

- The new culture reform – everyone contributes.
- We can be critical building upon transparency, trust, and support.
- Be more aggressive on funding application.
- The bottleneck for research output is manpower. We should recruit and mentor trainees as a team.
- Emphasize on originality and quality of the research, which is key to stand out.
- Build the infrastructure to facilitate collaboration and generate synergy.
- Make data-driven decision
- Invest during the efforts during the progress making, not after external recognition.
- Besides personal success, we help each other to make a successful team.

Next year’s work focus

- Continue all the scientific talks.
- Increase the recruitment effort by provide additional funding to support interns. [Group effort to recruit international interns: Japan, Malaysia (ad will be initiated by Tetsuya.]
- Increase mentoring on students and postdocs.
- Convince Benny to join us! :D
- New lab space for Benny!
- Collective grant writing
- Collective theme
- Collaborative effort with Life science
- Efforts to employ AI in our research beyond chatting with ChatGPT
- Build Center for Physics of Life

Cooperativity (J)



Core Facilities Reform

BSSF facility Usage Rate

Lab	The Bio-sample Preparation Lab (BCSL)[1]	The Biochemistry Shared Lab (BSPL)[2]	The Soft Materials Structure and Rheology Laboratory (SMSR Lab)[3]	The Advanced Optical Microscopy Lab (AOML)	
Equipment	Benches	BSC-A,B,C	MCR301+MCR302	Profilm 3D[4]	Dragonfly200[5]
2022	75%	15%	28%	-	-
2023	75%	29%	27%	0.4%	101%
2024	100%	28%	79%	4.5%	156%
2025(1/1~6/20)	100%	45%	25%	2.1%	185%
User Lab	Chou, Chia-Fu、Chen, Peilin、Wen, Yu-Chieh、Chang,Yi-Ren (NTNU)、Wu, Maw-Kuen、Guo, Chin-Lin	Chou, Chia-Fu、Hwu, Yeu-Kuang	Chou, Chia-Fu、Wu, Maw-Kuen、Huang, Jung-Ren、Chen,Jyh-Yih (ICOB)、Hu, Yu-Feng(IBMS)、Huang,Jen-Tse (IoC)、Juang,Jia-Yang (NTU)	Chou, Chia-Fu、Lin, Keng-hui、Tsai, Jih-Chiang	Chou, Chia-Fu、Lin, Keng-hui、Guo, Chin-Lin、Chao,Pen-hsiu (NTU)

[1]:Based on bench rental rate: total 11 benches, 3 shared-use, 8 rentable. Usage rate = 100% if all 8 benches are used.

[2]:Based on paper logbook: Annual usage hours = (Total annual usage counts × avg. time per use of 2 hours) / (250 working days × 8 hrs/day)

[3]:No logbook data; 2022–2024 based on machine data: Annual usage = (Total air-check counts × avg. use of 6 hrs) / (250 × 8 hrs/day)
2025 based on reservation system: Usage = (total reserved hours) / (working days from Jan 1 to June 19 × 8 hrs/day)

[4]:2023–2024 based on reservation system; 2025 based on logbook: (Total usage hours) / (working days from Jan 1 to June 19 × 8 hrs/day)

[5]:Based on paper logbook: (Annual usage hours) / (250 working days × 8 hrs/day)

Currently, only BCSL is charged by the table. The usage rate is calculated by rental rate, not actually head count.

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- Punctuality! Punctuality!
- We submit 12 grants besides NSTC personal grants. 7 are joint grants. Currently, 5 are funded, 2 under review, and 5 are rejected.
- Transparency on the group business (everything is on the google drive).