

Interdisciplinary Research Ecosystem

A classical University connects ‘Students, Scholars, and Subjects’. A 21st-century university should, however, connect ‘Students, Scholars, Subjects, and Society’. While maintaining generational memories of scholars and scholarly traditions in the pursuit of knowledge and disseminating that knowledge among students, the core purpose of the 21st-century university is also to challenge the existing body of knowledge, push its boundaries, and create new knowledge to solve society's real problems.

The real problems of humanity in general and society in particular are not confined to formal, rigid university disciplines. These problems are often complex and require multidisciplinary approaches to understand them. Unless scholars from a wide range of disciplines come together and pursue interdisciplinary research, they are less likely to find solutions to these complex problems.

Universities normally organize themselves in ‘verticals’ – Departments of Physics, Computer Science, Medicine, Psychology, Performing Arts, Agriculture, Engineering, Economics, Management, Commerce, etc. But many emerging societal problems are ‘horizontal’: climate change, AI in education, cyber-security, terrorism, aging, sustainable agriculture, mental health, urban mobility, energy transition, public health, etc.

If the current organization of research activities in a university is confined within the boundaries of rigid disciplines, entry into interdisciplinary research demands a major cultural change. It is difficult to bring about cultural changes in organizations through formal strategies and administrative SOPs. “Culture eats strategy for breakfast.” – a statement widely attributed to Peter Drucker. Drucker observed, “Culture, no matter how defined, is singularly persistent.”

Strategy says what the organization intends to do. Culture determines what people actually do every day. So, top management must bring about cultural change gradually. It has to consciously invest in nurturing an ‘Interdisciplinary Research Ecosystem’ through a variety of informal settings over a longer period of time. In such settings, scholars from diverse disciplines gradually start mixing and sitting, meeting and eating with each other informally. They experience the gradual process of their ‘depart’ment (!) from their

‘compartments’! Eventually, some interdisciplinary breakthroughs may occur through their discussions! At times, there emerges interesting ‘serendipity’ in such unplanned, informal but scholastic encounters.

Rabindranath Tagore writes in his poem, *The Gardener*: “**The lotus blooms in the sight of the sun, and ...**” The **lotus bud** represents a life, a person, or an organization whose potential is still folded within itself. The sun represents love, warmth, trust, illumination, or, in organizational parlance, the enabling presence or enabling conditions. The lotus does not have to be forcibly opened. In the presence of the sun, it **unfolds from within**. Tagore develops almost exactly this idea elsewhere, in another poem, *Fruit-Gathering*: “**No: it is not yours to open buds into blossoms.**” He warns that shaking or striking the bud cannot make it blossom. Instead, the one capable of opening it (the sun) does so gently: “**He gives it a glance, and the life-sap stirs through its veins.**” Then the flower opens naturally, revealing its colorful beauty and fragrance! The colorful beauty and the fragrance of a fully blossomed flower are an outcome, and the carefully cultivated garden is an output. Outcome is something that ‘comes out’ effortlessly, and output is something that one ‘puts out’ effortfully! Outcome is a product of the ecosystem. The sun represents the ecosystem. The ‘bud and the sun’ is a powerful metaphor for nurturing **interdisciplinary research**. Management cannot manufacture interdisciplinary research output by pulling open the petals of researchers confined to their disciplines. Management can instead become the sun - creating enabling conditions full of warmth, trust, stimulation, and an intellectually exciting atmosphere so that the researchers’ latent capacities for interdisciplinary research begin to unfold from within.

Thus, the interdisciplinary research may not be conceived as an output but as an outcome. As a result, top management will not have to force faculties to engage in interdisciplinary research. Instead, the management should continuously invest its creative energy to enrich the Interdisciplinary Research Ecosystem or the ‘Serendipity Ecosystem’!

There are some remarkable cases in the history of interdisciplinary research where physical proximity, an informal conversation, a conference encounter, lunch, a photocopier, or even a library meeting brought together people whose expertise would otherwise have remained separated. The resulting collaborations sometimes created entirely new research directions.

Illustrative examples of unexpected encounters and innovation: Curitiba, Brazil: Mayor Jaime Lerner introduced an unconventional approach to addressing the city's garbage problem by encouraging citizens to bring waste to designated locations in exchange for value. As the city became cleaner, attention shifted towards beautification, and ideas from different parts of the world contributed to the development of the city's distinctive Japanese Garden.

Scottish Café in Lwów: Mathematicians informally discussed difficult mathematical problems in the café and recorded them on the café's marble tables. These discussions eventually contributed to the famous *Scottish Book*.

Oak Ridge, Tennessee: During the Manhattan Project, many young women operated Calutron machines without initially knowing the larger purpose of their work. This example highlighted the importance of helping individuals understand the larger purpose and significance of their contribution. These examples show how unexpected encounters, diverse ideas, and a sense of larger purpose can drive innovation and meaningful outcomes.

In 1997 at the University of Pennsylvania, biochemist **Katalin Kariko**, deeply interested in messenger RNA, happened to meet immunologist and physician **Drew Weissman** while they waited to photocopy scientific papers. Kariko began telling Weissman about her mRNA work. Weissman was trying to develop an HIV vaccine and was studying dendritic cells. Their knowledge was strikingly complementary: Kariko said, "I know how to make and manipulate mRNA." Weissman responded, "I understand how the immune system responds to it." The central problem was that synthetic mRNA provoked excessive inflammatory responses. Their collaboration eventually showed that modifying particular nucleosides could greatly reduce that unwanted immune reaction while retaining mRNA's usefulness. Their 2005 work became a critical scientific foundation for later mRNA vaccines, including the COVID-19 vaccines. They received the 2023 Nobel Prize in Physiology or Medicine.

The institutional-design lesson: had Kariko possessed a photocopier in her own laboratory, one of the most consequential scientific conversations of recent decades might not have occurred!

The really interesting lesson is not simply that *luck matters*. Such examples reveal an institutional architecture for nurturing interdisciplinary research. The deeper principle is:

Don't merely fund interdisciplinary research. Engineer opportunities for interdisciplinary 'accidents'! The most productive research infrastructure for it in a university is not a laboratory but the space between two laboratories!! Therefore, one could deliberately create a “**Serendipity Ecosystem**”. Serendipity, like entrepreneurship, cannot be systematized, but the conditions in which serendipity occurs can certainly be designed.

Design Ideas:

- Shared cafeterias rather than departmental ones;
- Interdisciplinary faculty lounges;
- randomized research lunches;
- five-minute “My unsolved problem” presentations;
- cross-disciplinary sabbaticals;
- common instrumentation centers;
- problem walls on which researchers post questions they cannot solve;
- Rs. 2 to 5 lakhs ‘unexpected collaboration grants’ that can be approved rapidly when two researchers from unrelated departments discover a promising common problem.

The objective should *not* be to *plan collaborations*, but to increase the frequency of unexpected encounters among scholars from diverse disciplines around problems, methods, and design ideas.

Design Ideas with illustrative examples:

1. ‘Unsolved Problem Café’

Once every fortnight, invite 8–12 researchers from completely different departments for tea or lunch. One rule: *Nobody presents their achievements. Everyone presents a problem they cannot solve.*

- Example:
- Agriculturist: “Can we detect crop stress three days before it becomes visible?”
- Computer Scientist: “We have an image-recognition technique. We are looking out for a useful application.”
- Psychologist: “Why do farmers ignore some scientifically valid advisories?”

Suddenly a new research triangle may emerge.

This reverses the normal seminar culture from “*Here is what I know*” to “*Here is what I don't know*”!!

2. 'Random Researcher Coffee'

Every month, a simple computer program randomly pairs faculty members from unrelated disciplines:

Professor of Sanskrit *meets* Professor of NLP

Civil Engineer *meets* Sociologist

Agricultural Scientist *meets* Drone Engineer

Economist *meets* Neuroscientist

Musicologist *meets* Signal-processing researcher

The university provides coffee and asks for nothing more than a 30-minute conversation. Initially, there should be *no proposal, minutes, presentation, or report*. Excessive administrative requirements can precisely destroy the desired informality.

3. 'My Problem—Your Method' Sessions

This can be a highly structured 90-minute event. About 10-20 researchers participate. During the first round, each gets *three minutes to describe one problem*. During the second round, participants respond: "*I don't work in your discipline, but a method we use might help you.*"

Examples:

- archaeology problem computer vision method
- cancer problem - fluid-dynamics method
- traffic problem - swarm-intelligence method
- Indian language text automated proofreading problem - generative AI method
- student dropout problem – epidemiological modeling method

This matters because researchers often don't know another discipline already has a method that can solve *their problem*.

4. Create 'Physical Collision Spaces'

Architecture matters. Instead of every department having isolated cafeterias, meeting rooms, libraries, and equipment, create attractive *shared spaces located between departments*. University of Berkeley has a common parking place for several Nobel laureates working at the University.

A shared café near laboratories may sometimes produce more interdisciplinary interaction than another formal conference room.

Simple Principle: *Reduce the physical distance between intellectually distant people!*

5. Rs. 2 to 5 lakhs ‘Serendipity Grants’

Suppose two researchers meet at one of these events and say: *“We have no idea whether this will work, but we could test it in three months.”* Give them a small grant *with a two-page application and a decision within seven days.*

Eligibility could require: *Two investigators + two substantially different disciplines + a genuinely new collaboration.*

The grant finances only the *first experiment/prototype*. This has a strong international analogue. Stanford Bio-X runs interdisciplinary seed grants specifically designed to catalyze high-risk collaborative research. Since 2000, its program reports funding 277 interdisciplinary projects involving more than 440 faculty; it also reports that these projects subsequently attracted over \$400 million in external funding.

6. University's ‘Problem Wall’

Create both a physical wall and a digital platform containing only unanswered questions.

- Not: *Department of Chemistry Research Projects*. Instead: *Problems looking for collaborators.*
- “Can somebody help us predict which village water sources will fail during summer?”
- “We have 30 years of handwritten Marathi manuscripts that cannot be searched.”
- “Our hospital has thousands of X-rays but insufficient radiologists.”
- “We cannot understand why 35% of students stop using our learning platform after a week.”

Beside every problem, put a button: *“I may have a method that can help.”*

This changes the philosophy behind a typical university organization *“from the department to the problem”*.

7. Organize five-day ‘Research Camps’

For important societal problems, bring together perhaps 25 carefully selected researchers, with a highly multidisciplinary mix, and take them away from their normal workplaces for five weekdays. Do not ask them to arrive with research proposals. Instead, gradually expose them to the problem, allow teams to form and dissolve, stimulate lateral or out-of-the-box thinking and radical approaches, and let proposals emerge during the event.

Example:

Water 2040, Aging Maharashtra, Women Safety, Future of Farming, Marathi in the AI Age, Urban Mobility, Global Warming Resilience, Forced Migrations, Rural Healthcare, etc. Researchers from engineering, medicine, economics, sociology, psychology, agriculture, design, and AI could work together.

8. ‘Cross-Departmental Sabbaticals’

A professor need not leave the university for a sabbatical.

Example: A computer scientist may spend three months in medical college. Give each visiting scholar a desk, but don’t give a predetermined project.

The initial assignment is simply: “Spend the first four weeks understanding problems that people here consider difficult.” The collaboration may emerge afterward.

9. Create “Serendipity or Free Radical Fellowships” for students. Faculty structures can be rigid. Students cross boundaries more naturally. Select, say, 20 undergraduate, postgraduate, and doctoral students every year, deliberately mixing disciplines. Create teams such as: Engineering + Medicine + Psychology + Design + Economics and give each team one social problem rather than one academic subject. For example: “Reduce falls among elderly citizens living alone.”

This single challenge could require:

- Sensor Engineering
- Biomechanics
- Behavioral Psychology
- Product Design
- AI
- Economics
- Public Health Ethics

Students then become *human bridges between departments, moving across like free radicals in chemistry and forming a variety of ‘compounds’ with ‘molecules’ in various departments!*

10. The Annual ‘Festival of Unlikely Ideas’

Universities normally reward research that already looks credible. Have one day every year for precisely the opposite. Invite proposals such as: “What can termite colonies teach us about city planning?” or “Can classical Indian music help us detect neurological disorders?” or “Can epidemiological models predict misinformation?” or “Can ancient manuscripts improve contemporary water-management practices?” or “Can AI discover patterns in 500 years of Marathi literature?”

The audience should vote not for the best research, but for: *“The idea that sounds strange today but could become obvious ten years from now.”* That is precisely the intellectual behavior a serendipitous university should encourage.

11. Constructive Irreverence, Digital Detox and Interdisciplinary Retreats:

Constructive irreverence means respectfully questioning established assumptions rather than accepting existing approaches without examination. Researchers should be encouraged to challenge conventional thinking constructively and consider unconventional approaches to complex problems.

Digital detox and interdisciplinary retreats can give researchers opportunities to step away from routine digital distractions and create space for deeper reflection, discussion, brainstorming, and intellectual exploration. Such environments can help researchers look beyond established disciplinary boundaries and encourage new ways of thinking.

12. Local to Global:

Researchers should begin by identifying problems affecting their own communities and local environments while also considering whether locally developed solutions could have wider national or global relevance.

The principle of “Local to Global” connects institutional research with real community needs while creating possibilities for broader social impact.

13. Data Science as the Lingua Franca:

In addition to English, researchers from diverse disciplines may find it easier to communicate effectively if they regularly practice using Data Science jargon.

14. Use of AI as an Other Discipline Buddy and a Challenger Buddy:

AI can help researchers find meaningful connections between their discipline and expertise and problems and solutions across diverse disciplines by leveraging deep prompt-engineering expertise.

AI can also sharpen researchers' disciplinary and interdisciplinary intellect by serving as a challenger buddy, like playing chess with AI!

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