

How University Researchers Start Companies:

Observations that can...

- (1) Guide your transition from postdoc to entrepreneur*
- &*
- (2) Help you leverage Berkeley's innovation ecosystem*

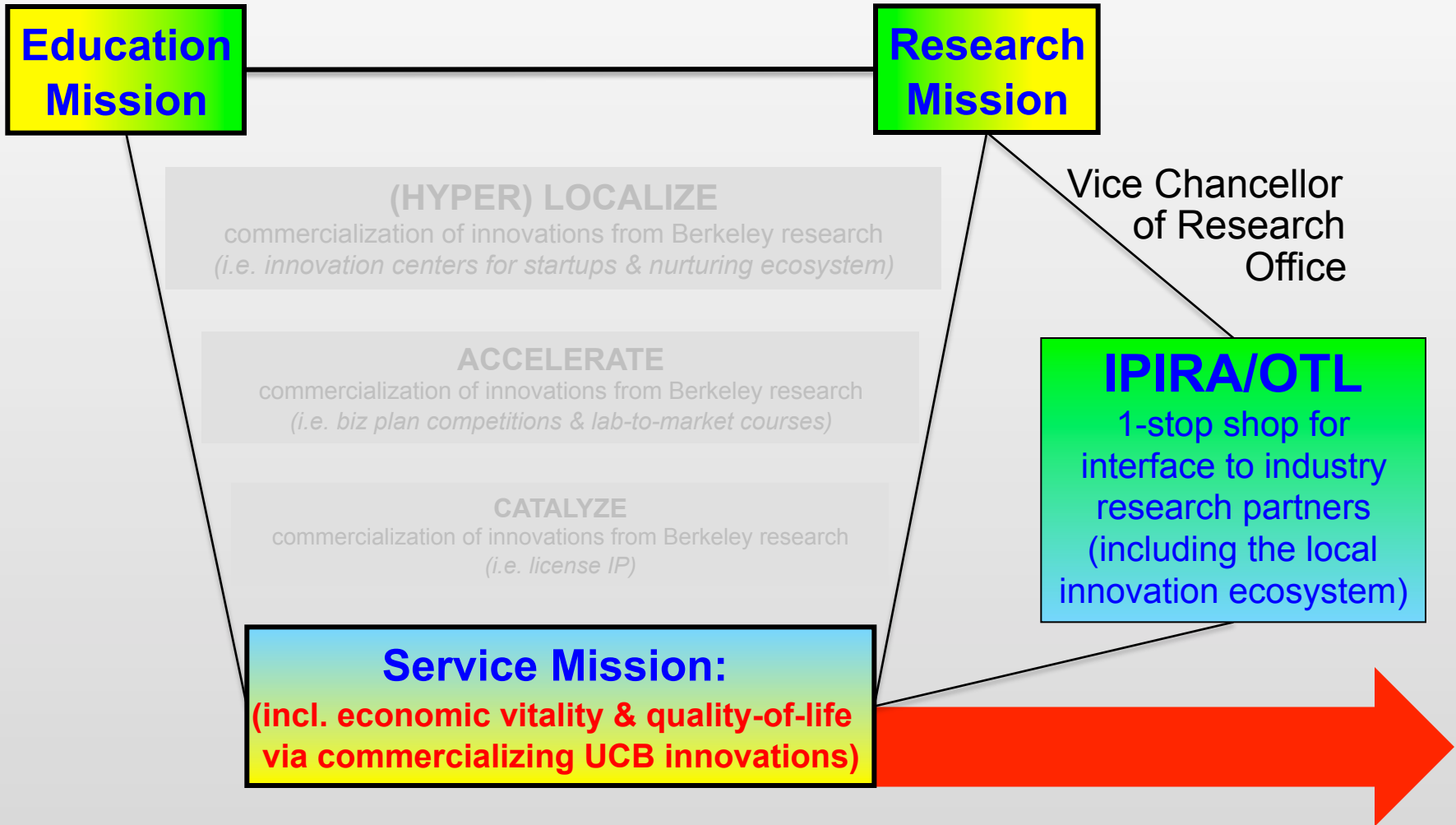


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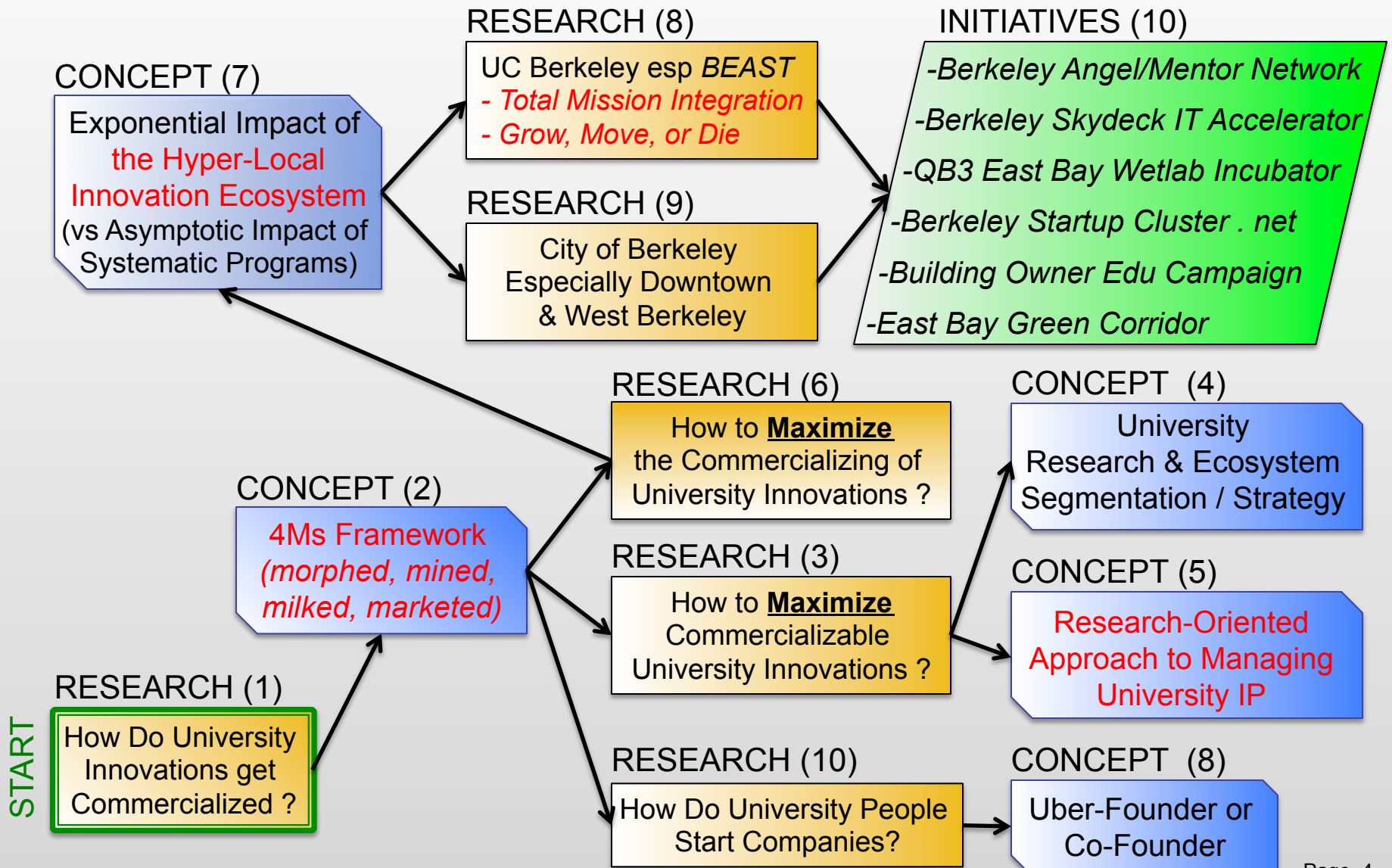
Agenda: *Big Picture Perspective (not factoids)*

1. Brief Background: *HP, HBS, Sun, Mips, Silicon Graphics, Netpulse, PD, Cal*
2. How University People Start Companies
 - Commercialization pathways: *the 4Ms*
 - Leveraging the ecosystem: *uber-founders, co-founders, early employees*
3. IP Licensing
 - Catalyzing the commercialization of innovations
 - Managing the risks associated with commercialization
4. Patentable Inventions & Copyrightable Software
 - Disclosing to UC Berkeley
 - Patenting
5. Q & A (but ask questions during the presentation!)

Background: *Bio & IPIRA/OTL Role*



Background: *Research, Concepts & Initiatives*



Research: *How Univ Innovations Get Commercialized?*

❑ **Questions:** How do university innovations get commercialized?

- Conventional answer is linear (research=>invention=>license =>commercialize)
- What and/or who catalyzed the commercialization?
- How are universities involved in the process?
- How can universities increase innovation commercialization?

❑ **Answers:**

- Researched commercialization of >50 UCB & LBNL innovations
- Research revealed 4 common patterns/pathways
- Developed a useful framework based on 4 patterns
- Developed strategies for optimizing the 4 pathways

Research: *Partial List of >100 Start-ups* (with IP Rights)

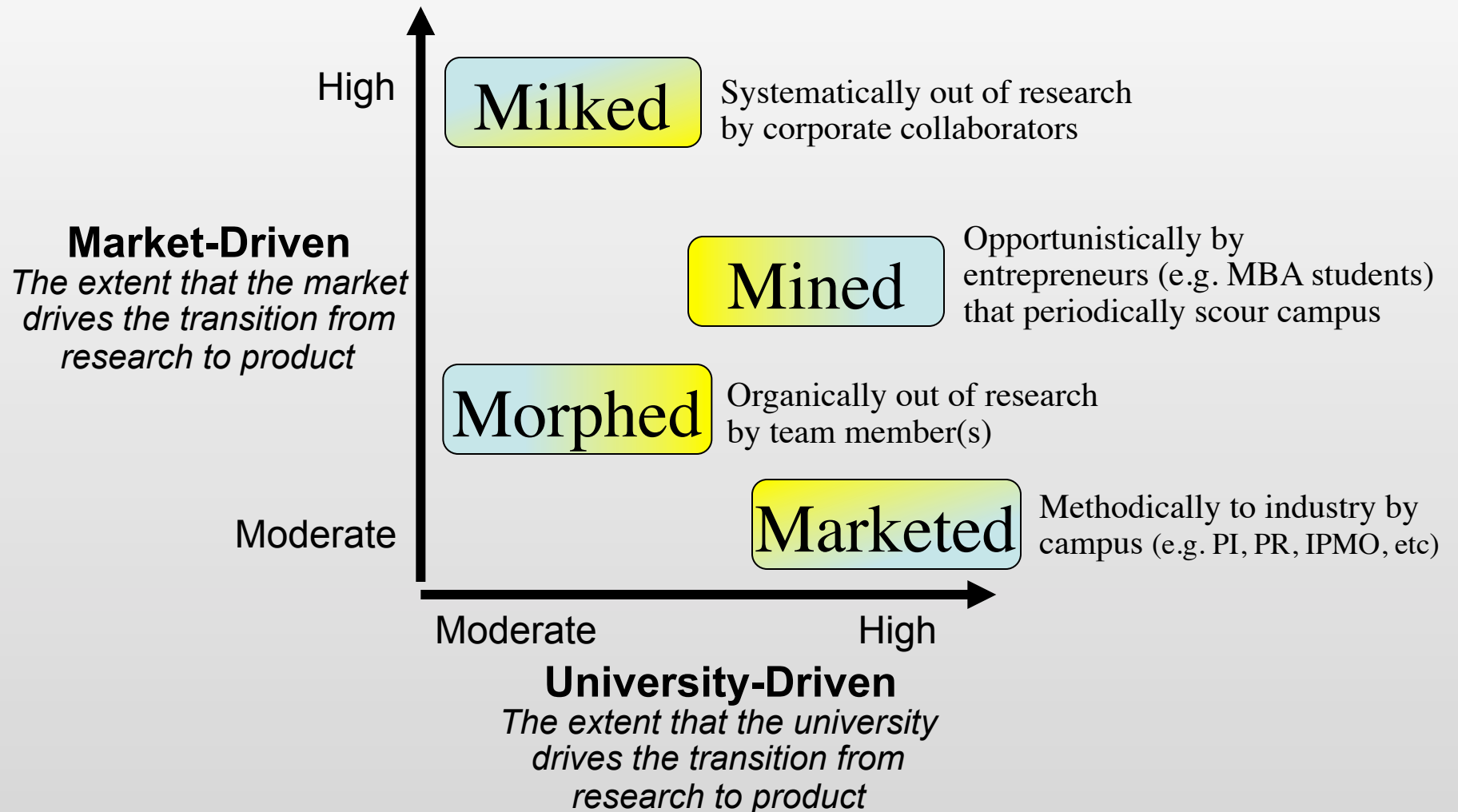
This is a list of the over 100 start-ups that have leveraged UC Berkeley intellectual property rights (i.e. patentable inventions and copyrightable software) since about the mid 1990s.

These start-ups have used UC Berkeley's intellectual property (IP) rights to strengthen their business plans and thereby improve their prospects for obtaining the venture capital or other funding needed to pursue the commercialization of Berkeley innovations.

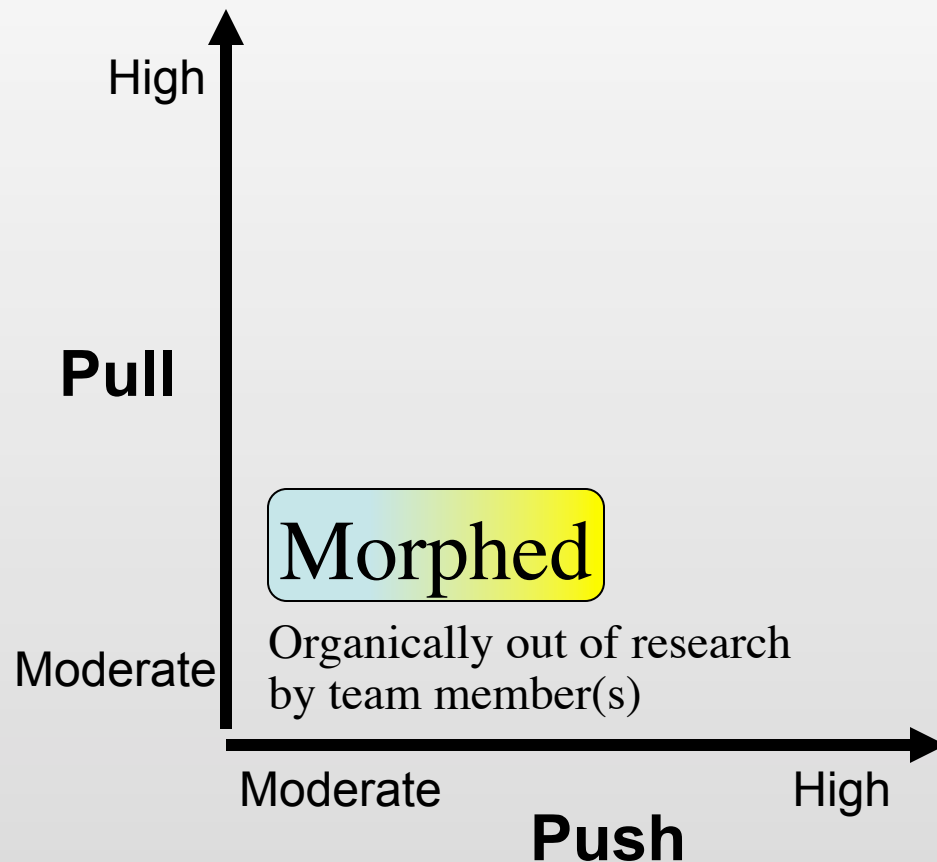
Note that this list does not include the numerous start-ups that have commercialized UC Berkeley innovations but did not leverage any UC Berkeley IP rights (because the innovations don't have associated IP rights – such as UNIX, SPICE, RAID, etc).

Acacia Biosciences	DNA Sciences	Libraria	Protiveris
Adura Technologies	Ecoprene	Light Stage	Q-Chem
Alien Technologies	Euclid Media	Lumiphore	Quadrant Imaging
Ambrx	EscharaX Medical	Luminus Devices	Receptron
Amyris Biotechnologies	Excellin Life Sciences	Medifuel	Redwood Biosciences
Arkal Medical	Exelixis	Mendel Biotechnology	Renovis
Aurora Biofuels	Filgen Biosciences	Mercator Medical	RHA Technology
Bandwidth9	FLX Micro	Microchip Biotechnology	Rubicon Digital Mapping
Berkeley Bionics	Fluxion Biosciences	Micro Climates / Aptility	Secured Streams
Berkeley Biosciences	Fuel FX	MicroFab Biosystems	SenSys Networks
Berkeley Madonna	Genocea Biosciences	MicroReactor Systems	Silicon Basis
Berkeley Microinstruments	Gold Mountain Research	Mimesyn	Silicon BioDevice
BeThere	Goodguide	Modulus Video	Silicon Clocks
Biomangement Group	Harmonic Devices	Molecular Dynamics	Silicon Genesis
Bioscale	Covarium/Heath Interactive	MOR Innovations	Similix
BPS	HFTA	NanoGripTech	Solexel
Calimetrics	iMedd	NanoNerve	Solidix Biosciences
Calisolar	Inktomi	NanoRay	SpectruMedix
CellASIC	Integrated Diagnostics	NanoSys	Stressmarq Biosciences
Ceres	IntelliOne	NanoVasc	Sunesis Pharmaceuticals
Chiron	International Energy	Neomorphic Software	Symyx Technologies
CNNSuperChip	InVino Sense	nPrint	Target Analytics
Cognitive Wearable Technologies	Iris Micromedical	OmniOx	Thuris
Cooler	Isatis	Oncobionic	TruVideo
CommandCAD	Joule Biotechnologies	ON Diagnostics	Tularik
Colusa Software	Juvenon	Onix Microsystems	Two Blades (Foundation)
Cyberpac	Kaiwood Technologies	OnWafer Technologies	Urban Scan
Davis Allergy Research	Kalinex	Oswald Green	Ventria Biosciences
Digital Mosaic Systems	KineMed	Photoswitch Biosciences	Videnda
Discera	Leucadia Technologies	Preference Metrics	Vitapath Genetics
			Wireless Industrial Tech
			Xenometrix

Framework: 4 Pathways for Commercialization

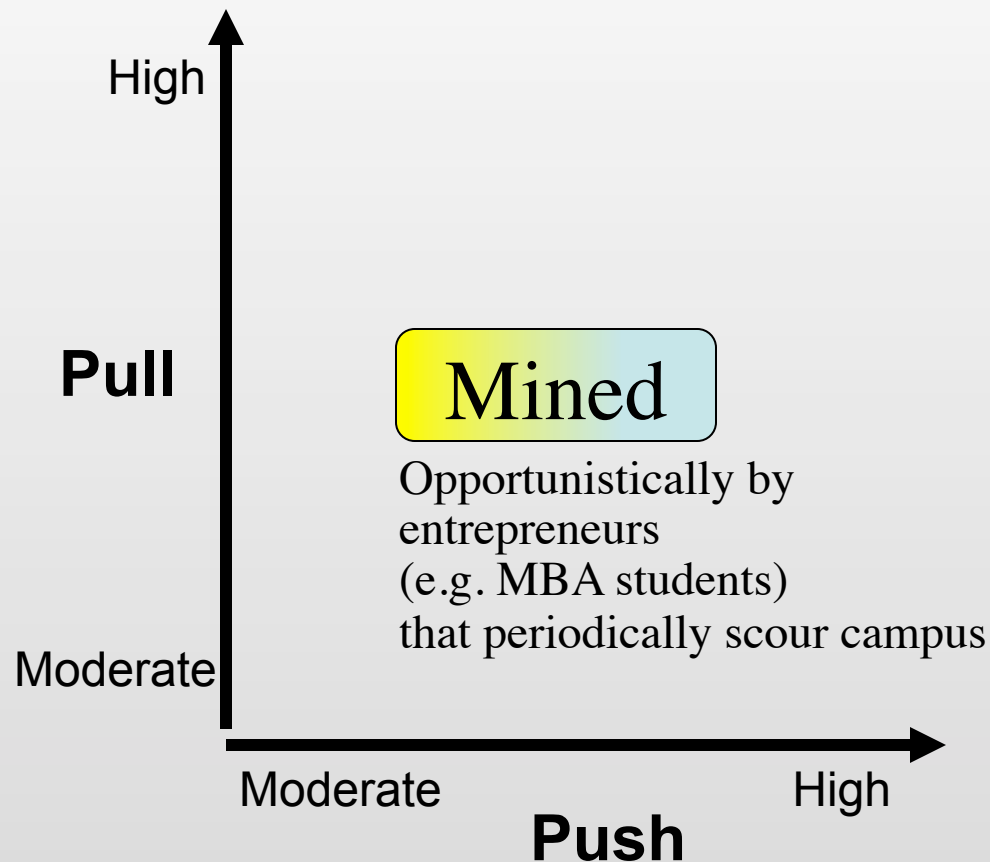


Framework: 4Ms - *Morphed*, *Mined*, *Milked*, *Marketed*



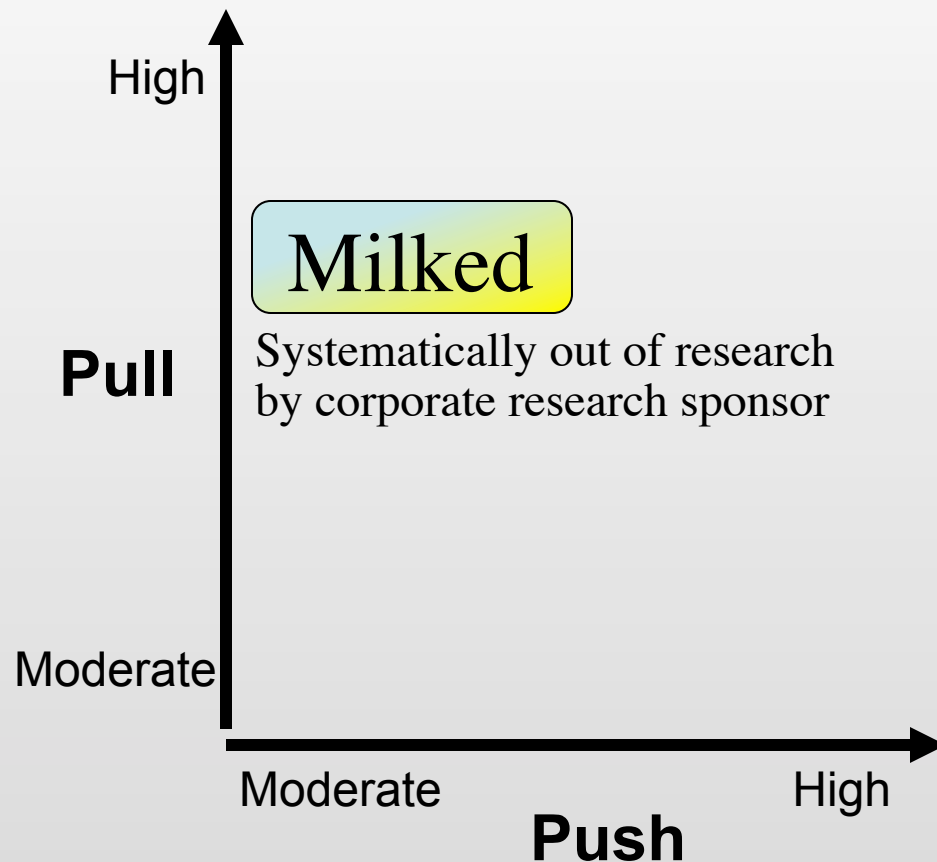
- ❑ Examples: Amyris, Calimetrics, CaliSolar, CellASIC, Chiron, Ensighta Security, Excellin, Fluxion Biosystems, GoodGuide, Harmonic Devices, Hybrid Wisdom Labs, Inktomi, Integrated Diag, IntelliOne, Kalinex, Lumiphore, Mercator Med, MicroClimates, MicroFluIDX, OnWafer, ON Diagnostics, PhotoSwitch Bioscience, Redwood Bioscience, Safely, SiClocks, TheraFuse, Urban Scan, Verimetra Med, Wireless Industrial Tech, Dust Networks, Iris AO, SiTime, NanoGripTech*
- ❑ Drivers:
 - Quantity & Quality of Research
 - **Ecosystem: Spin-out vs Blast-out**
- ❑ IP:
 - Some obtain exclusive license to improve biz plan & attract investors
 - Some ignore or abscond with IP

Framework: 4Ms - *Morphed*, ***Mined***, *Milked*, *Marketed*



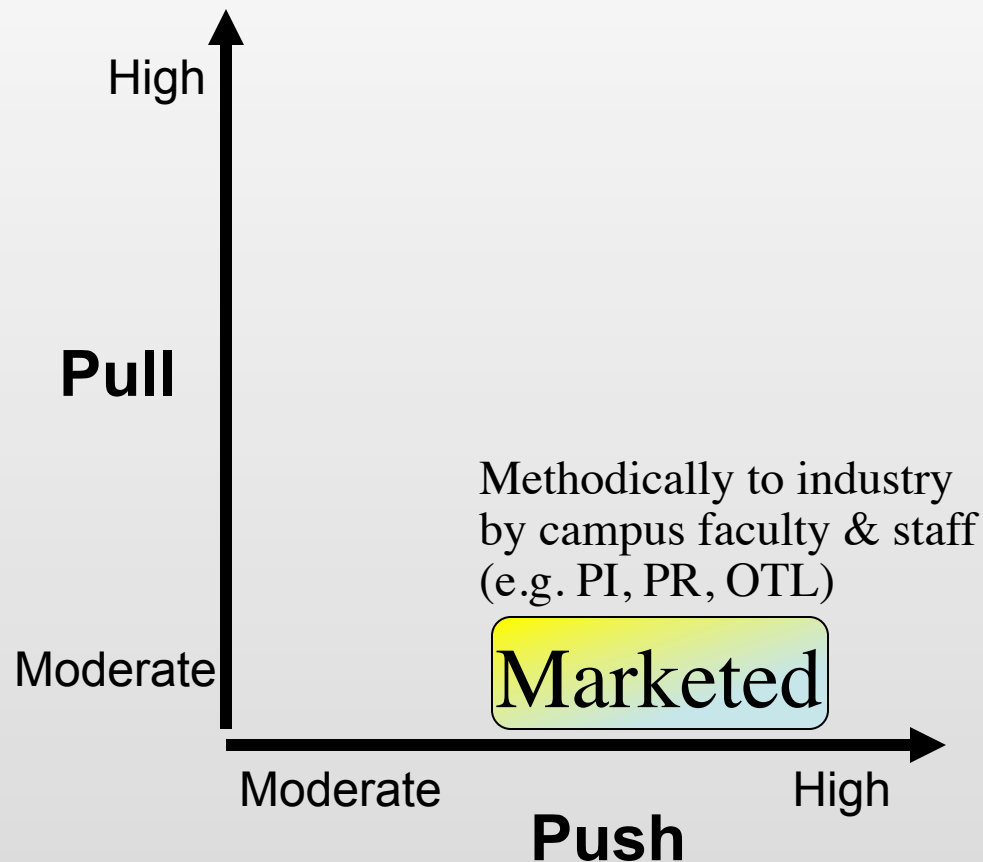
- ❑ Examples: **Adura Tech**, **Aurora Biofuels**, CommandCAD, Euclid Media, **MediFuel**, NanoRay, nanoPrint
- ❑ Drivers:
 - Quantity & Quality of Research
 - MBAs, Biz plan comp, OTL mrktg
- ❑ IP:
 - Many obtain exclusive license to improve biz plan & attract investors
 - Some ignore or abscond with IP
- ❑ Comments:
 - **Pathway with highest growth rate**
 - MBAs are the campus' s EIRs

Framework: 4Ms - *Morphed, Mined, **Milked**, Marketed*



- ❑ Examples (*that licensed IP*):
Analog Devices, **Nueprene** (XL Tech), **Google**, Honeywell, Intel, Berkeley Bionics (first morphed then milked)
- ❑ Drivers:
 - Great sponsored research with optimized terms (i.e. 1st access, NERF, open source, etc)
 - Off-campus corporate labs (i.e. BWRC, Intel, Cadence, Yahoo, Starkey, etc)
- ❑ IP:
 - Some jointly own IP
 - Some obtain a license to legally use IP or thwart competitors
 - Some ignore or abscond with IP

Framework: 4Ms - *Morphed, Mined, Milked, Marketed*

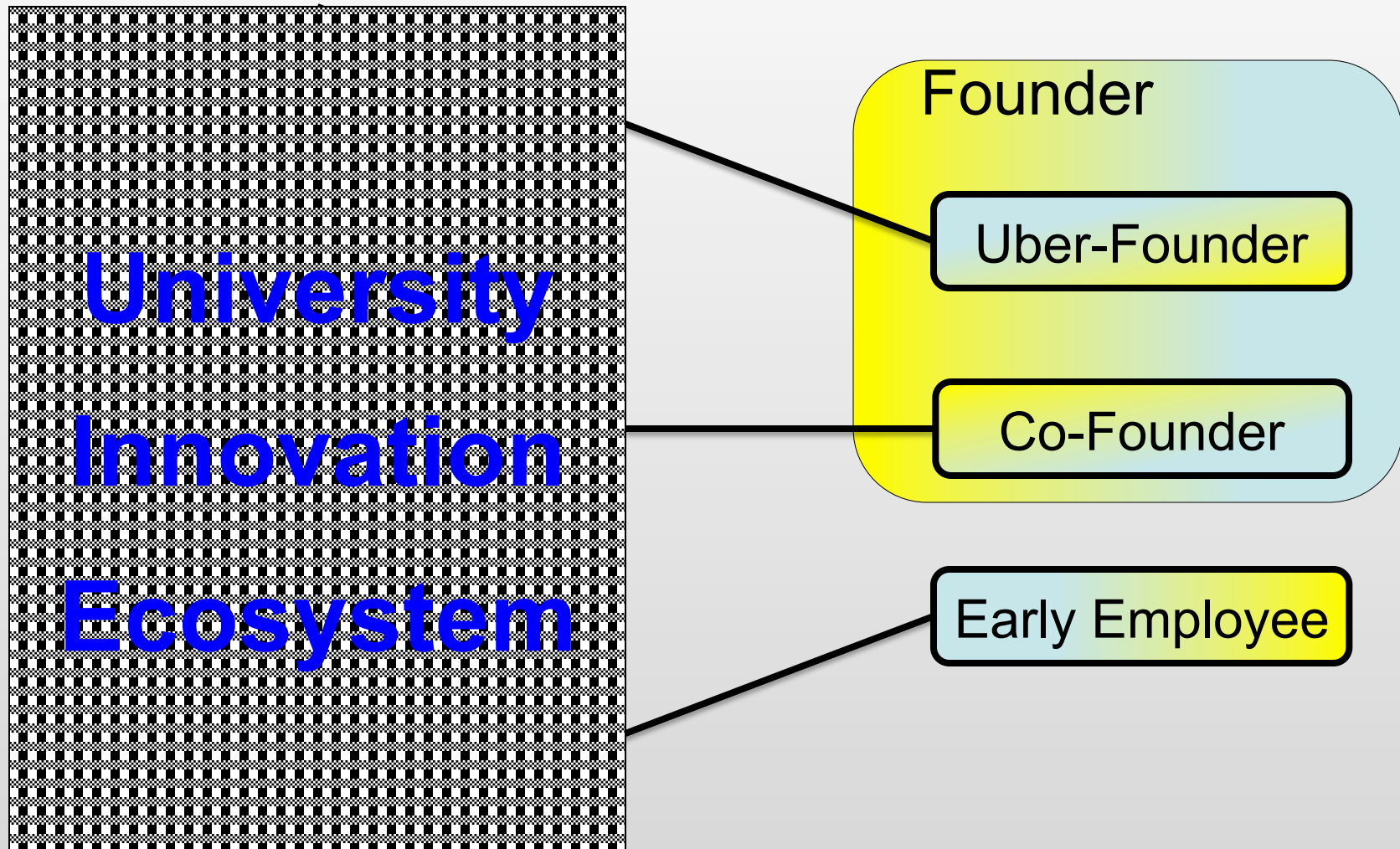


- ❑ Examples: [Arkal Medical](#), Cisco, [ClimateCooler](#), [FuelFX](#), [Luminus Devices](#), Honeywell, Microchip Biotech, Renovis, [Sand9](#), Silicon Basis, [Solexel](#), Vitesse, 3M
- ❑ Drivers:
 - Quantity & Quality of Research
 - Marketing (i.e. IP Licensing offices, University PR programs, Faculty pubs & ppts, Patent pubs, etc)
- ❑ IP:
 - Most obtain exclusive license to stay legal, improve BP, attract investment, or thwart competitors
 - Some ignore IP or abscond with IP
- ❑ Comments: Didn't get *morphed, milked or mined* because tech or market too nascent when invented

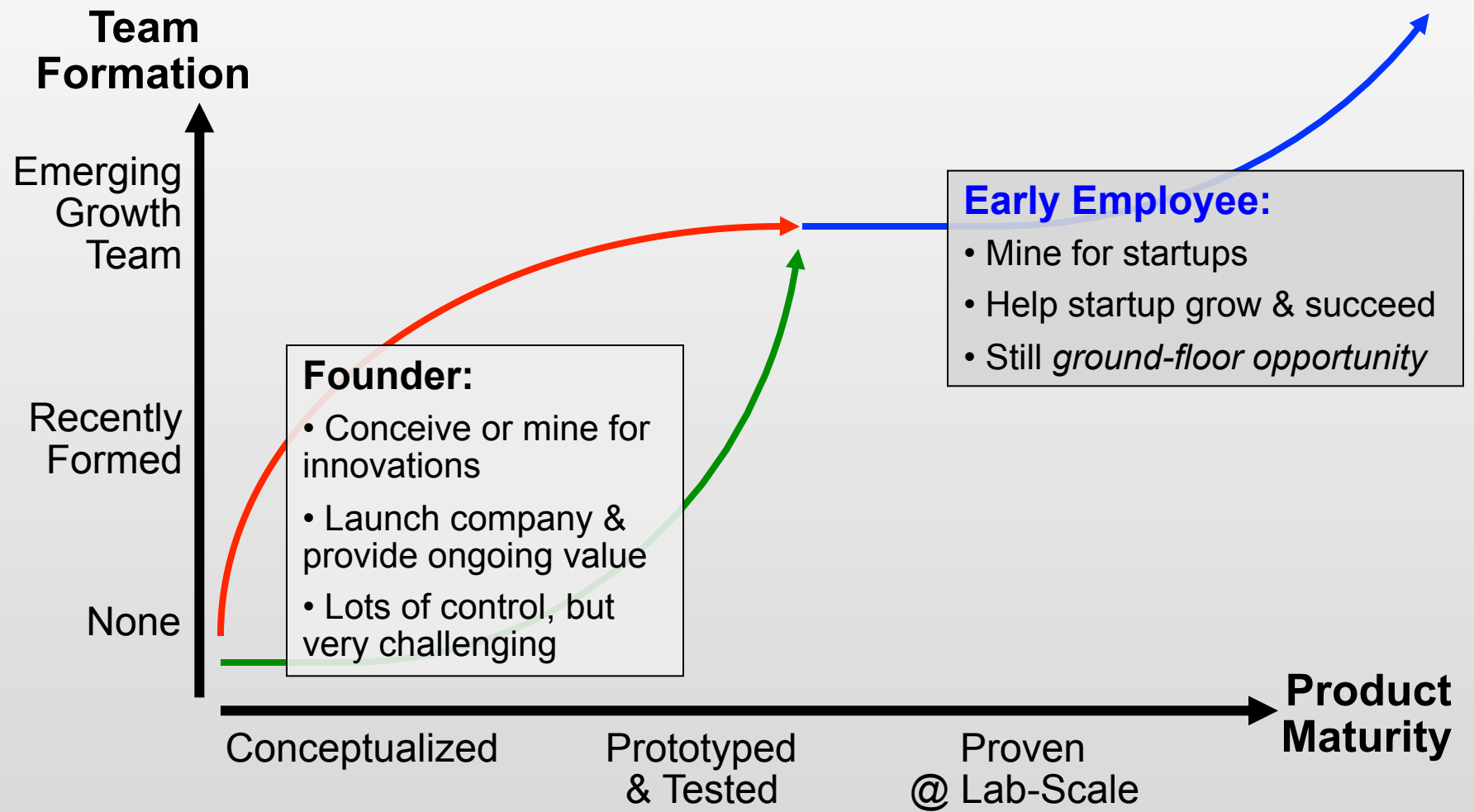
4Ms: *Ecosystem of Activities, Programs, Resources*

Pathways (4Ms)	Activities, Catalysts, Programs, Initiatives	Recent Progressive Approaches	Offices	Ideas & Comments
Morphed	<ul style="list-style-type: none"> •Entrepreneurship classes •On-campus Incubators •Entrepreneurial Admissions •Entrepreneurial Culture 	<ul style="list-style-type: none"> •University startup •Incubators & accelerators 	<ul style="list-style-type: none"> •CET (CoE) •Haas (Lester) •OTL 	<ul style="list-style-type: none"> •SBIR/STTR help center •Berkeley Startup Cluster
Mined	<ul style="list-style-type: none"> •Entrepreneurial MBA Program (EIRs) •Biz Plan & Tech Competitions •Research-to-Market Courses (C2M) •Seminars & Poster Sessions (YAPS) •Haas Speaker Series & VC Office Hours 	<ul style="list-style-type: none"> •Cleantech-2-Market Course 	<ul style="list-style-type: none"> •Haas (Lester) •OTL •CoE •CITRIS •QB3 •Student Clubs (BERC) 	<ul style="list-style-type: none"> •Berkeley Startup Cluster •Berkeley Center for Growth Companies
Milked	<ul style="list-style-type: none"> •Institutional response to RFPs •Opportunistic PIs •Sponsored Research Agreements •Visiting Industrial Fellows •Faculty Consulting & Student Hiring 	<ul style="list-style-type: none"> •Research-Oriented Approach to Managing IP rights (e.g. NERFs, BIP, SRA IP grants, etc) 	<ul style="list-style-type: none"> •VCRO •IPIRA (IAO & OTL) •CoE •CITRIS •QB3 	<ul style="list-style-type: none"> •Adjacent R&D Office Parks/Buildings •Research Enterprise Marketing
Marketed	<ul style="list-style-type: none"> •Newsletters & Press Releases •Searchable Web Listings •Serial Entrepreneur & VC Discussions •Scholarly Publications & Presentations 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •CoE •VCRO •OTL •NewsCenter 	<ul style="list-style-type: none"> •EBGC Customer Cred Program •EBGC Cluster Clubs •Email Marketing

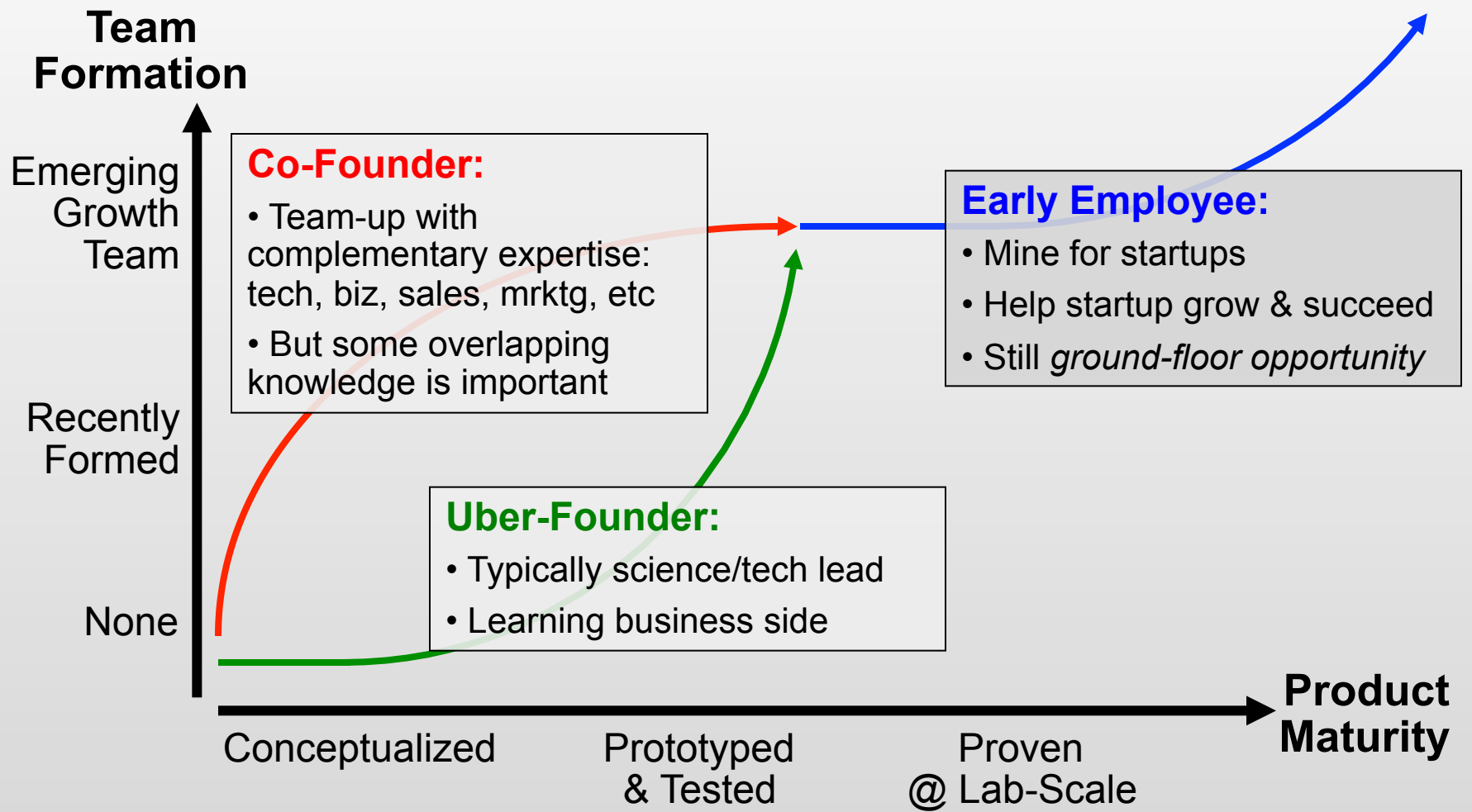
Ecosystem Navigation: *3 Approaches*



3 Approaches: *Founder vs Early Employee*



3 Approaches: *Uber-Founder vs Co-Founder*



Ecosystem*: *Entrepreneurship Training for Uber-Founders*

*Not a comprehensive list; just 1 page of examples

☐ Courses

- Haas: Cleantech-to-Market (C2M) ei.haas.berkeley.edu/c2m
- CoE: Center for Entrepreneurship & Technology cet.berkeley.edu
- Other: ChemE Product Development Program cheme.berkeley.edu/PDP

☐ Business Seminar Series

- Berkeley Entrepreneurs Forum
entrepreneurship.berkeley.edu/BEF/index.html
- Best Practice Series
entrepreneurship.berkeley.edu/resources/bestpractices.html
- QB3 Series qb3.org/startups/QED-QB3

☐ Workshops & Boot-camps

- Bench to Market: Idea Evaluation & Research Commercialization for Scientists
- See Skydeck website for events

Ecosystem*: *Innovation Mining for Founders*

*Not a comprehensive list; just 1 page of examples

- ❑ Available IP: IPIRA.berkeley.edu “Available Technology”
- ❑ Faculty Research: VCresearch.berkeley.edu/faculty-expertise
- ❑ Information Technology: CITRIS-UC.org/initiative
- ❑ IdeaLabs: BigIdeas.berkeley.edu/idealabs
- ❑ Technology Seminar Series:
 - CITRIS Seminar Series CITRIS-UC.org/news/spring_2012_i4energy
 - QB3 Series QB3.org/startups/QED-QB3
 - LBNL EETD noon-time seminars EETD-Seminar@dante.lbl.gov
- ❑ Clubs:
 - Berkeley Postdoc Entrepreneurs Program QB3.org/startups/bpep
 - Nanotech club nano.berkeley.edu/people/berkeleyClub.html
 - Berkeley Energy & Resources Collaborative BERC.berkeley.edu

Ecosystem*: *Startup Mining for Early Employees*

*Not a comprehensive list; just 1 page of examples

❑ Startup & Business Plan Competitions

- Berkeley Startup Competition bplan.berkeley.edu/
- Global Social Venture Competition entrepreneurship.berkeley.edu/business_competitions/gsvc.html
- CET Venture Lab CET.berkeley.edu/vlab
- Big Ideas BigIdeas.berkeley.edu/
- Intel Global Challenge at Berkeley www.entrepreneurshipchallenge.org/

❑ Local Startup Cluster Organizations

- Berkeley Startup Cluster: BerkeleyStartupCluster.net
- East Bay Green Corridor: EBGreenCorridor.org

Ecosystem*: *Resources for Startups*

*Not a comprehensive list; just 1 page of examples

☐ Startup Accelerators

- [Skydeck.berkeley.edu](http://skydeck.berkeley.edu)
- [QB3.org/startups/qb3-garage](http://qb3.org/startups/qb3-garage)
- CITRIS manufacturing accelerator (TBD)

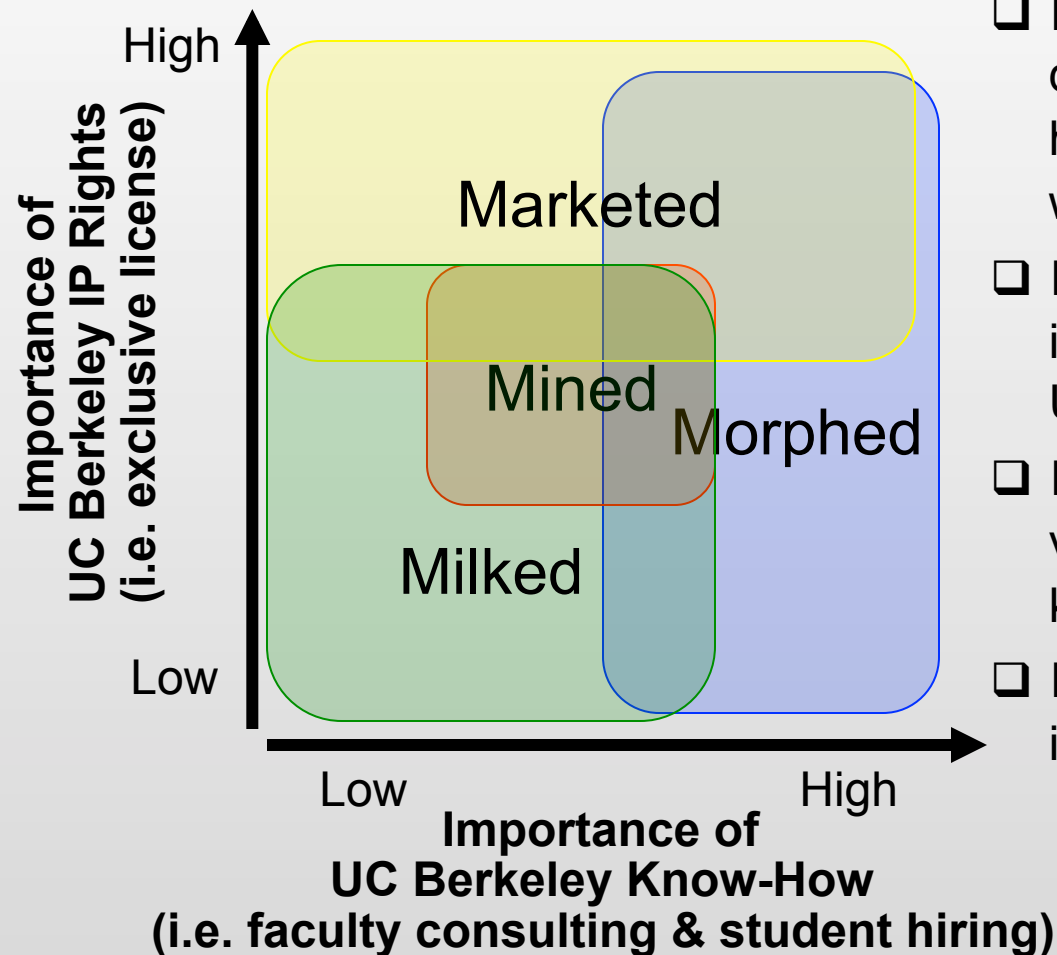
☐ Mentor & Angel Investor Networks

- Entrepreneurs Corner Office Hours
entrepreneurship.berkeley.edu/students/mentoring.html
- Berkeley Angel Network BerkeleyAngelNetwork.com
- East Bay Green Corridor Mentor Program EBGreenCorridor.org
- Berkeley Startup Cluster Advisory Committee BerkeleyStartupCluster.net

☐ QB3 Startup In a Box: QB3.org/startups/box

☐ Legal Resources: BerkeleyStartupCluster.net/Business-Resources

Commercialization: *Pathways, IP & Know-How*



- ❑ **Morphed** commercialization, by definition, depends on UCB know-how, that is sometimes augmented with UCB IP
- ❑ **Marketed** commercialization usually involves UCB IP but frequently not UCB know-how
- ❑ **Milked** commercialization widely varies in how it involves UCB IP and know-how
- ❑ **Mined** commercialization usually involves a mix of UCB IP & know-how

IP Licensing: *Top Generating IP (note variety)*

This is a list of of 47 UC Berkeley patented inventions and copyrighted software that have generated the most IP licensing revenue for UC Berkeley.

This list doesn't include patentable inventions and copyrightable software developed at UC Berkeley that did not result in substantial licensing revenue but did create industries, market segments, and large companies – such as UNIX (scientific computing), SPICE (electronic design automation), and RAID (redundant disk storage).

- Transfer primers for genetic analysis
- Spacers for primers in genetic analysis
- Laser confocal fluorescence microscanner
- Capillary confocal fluorescent microscanner
- Calcium primers for genetic analysis
- Search engine software
- Network router scheduling software algo
- Method of transforming barley genotypes
- Irreversible electroporation tissue ablation
- 3D modeling software
- Hydrodynamic transport for RFID mfg
- Gene reporter matrix for drug discovery
- Separation of thin film LEDs
- Monoclonal antibody mouse
- Microfabricated fluidic reactors
- Elimination of DNA artifacts
- Dehalogenation in toxic groundwater
- Improved fluorescence energy transfer
- E.coli detection in water DNA
- Recombination in eucaryotic cells
- Blockade of regulation from CTLA-4 signals
- resonant microstructure
- BMP antagonists / morphogenic proteins
- capillary array micro electronics
- Rotary confocal scanner
- Electrophoresis devices
- Mevalonate biochemical pathway
- Double-gate transistors
- Biosensor using filter & laser
- Tall microstructures
- Scanning micromirrors
- travel probe software algo
- Rejuvenating mitochondria
- Q-chem software
- hybridomas materials
- Identifying mutagenic changes
- Organocatalysis
- Heterologous proteins
- Pavement rehab analysis
- CA4PRS software
- Dectection in large doc sets software algo
- Methods for defining cell type
- Genetic markers breast/ovarian cancer
- TLA1 gene in algae for biofuels
- Intracellular delivery vehicles
- In-situ groundwater aquifer
- Treatment to reduce edema
- Capacitorless double-gate DRAM

IP Licensing: *UC Berkeley Objectives*

Leverage the University's Intellectual Property (IP) rights to **Catalyze** (not just facilitate or “transfer technology”):

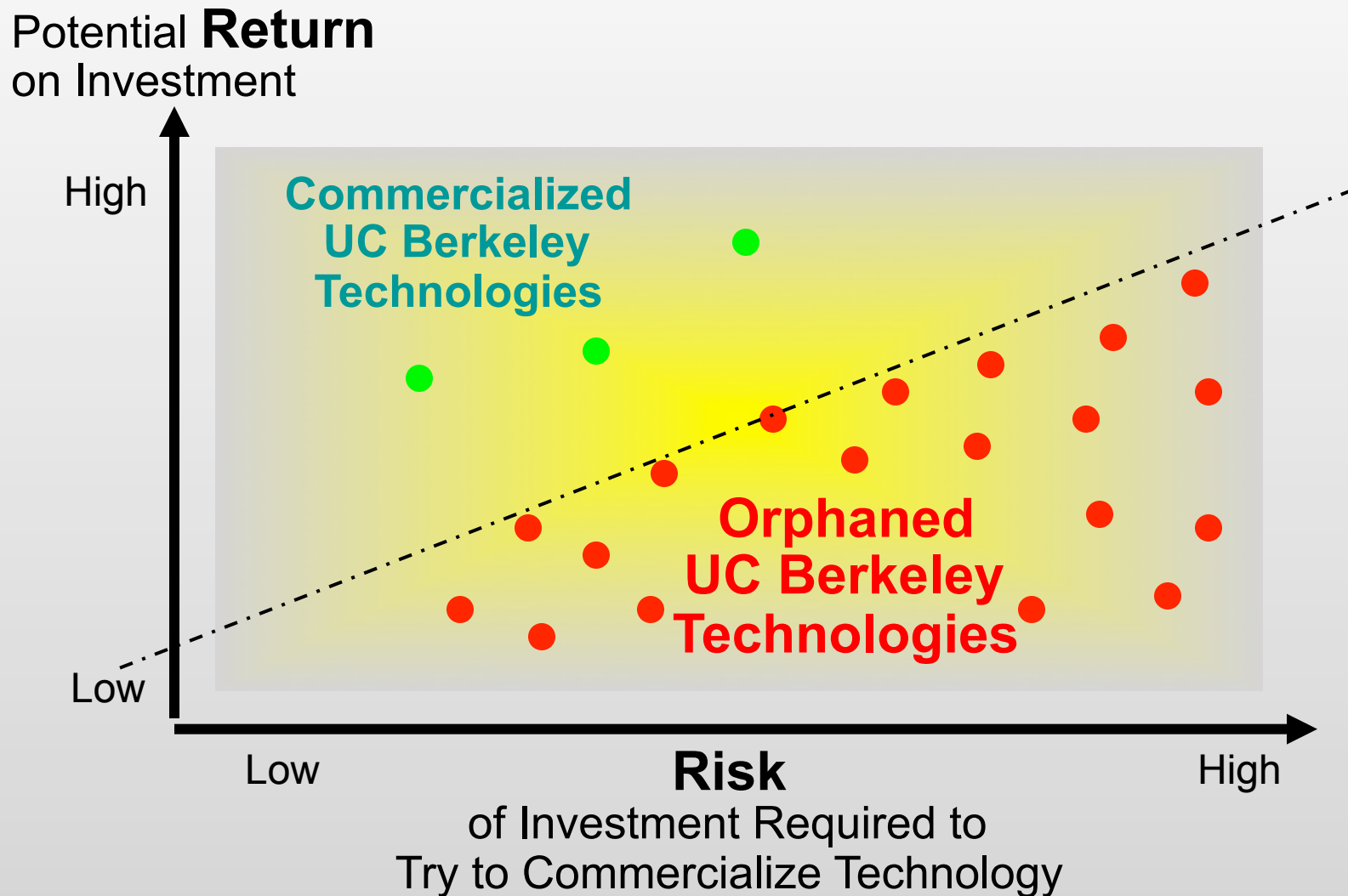
1) The Commercializing of UC Berkeley Innovations – quickly & broadly to:

- Benefit the regional economy & society at large
- Fund research & education on campus
- Reward researchers for their ingenuity*

2) The Funding of UC Berkeley Research by –
Reconciling the IP needs of sponsors
with the IP policies of the University

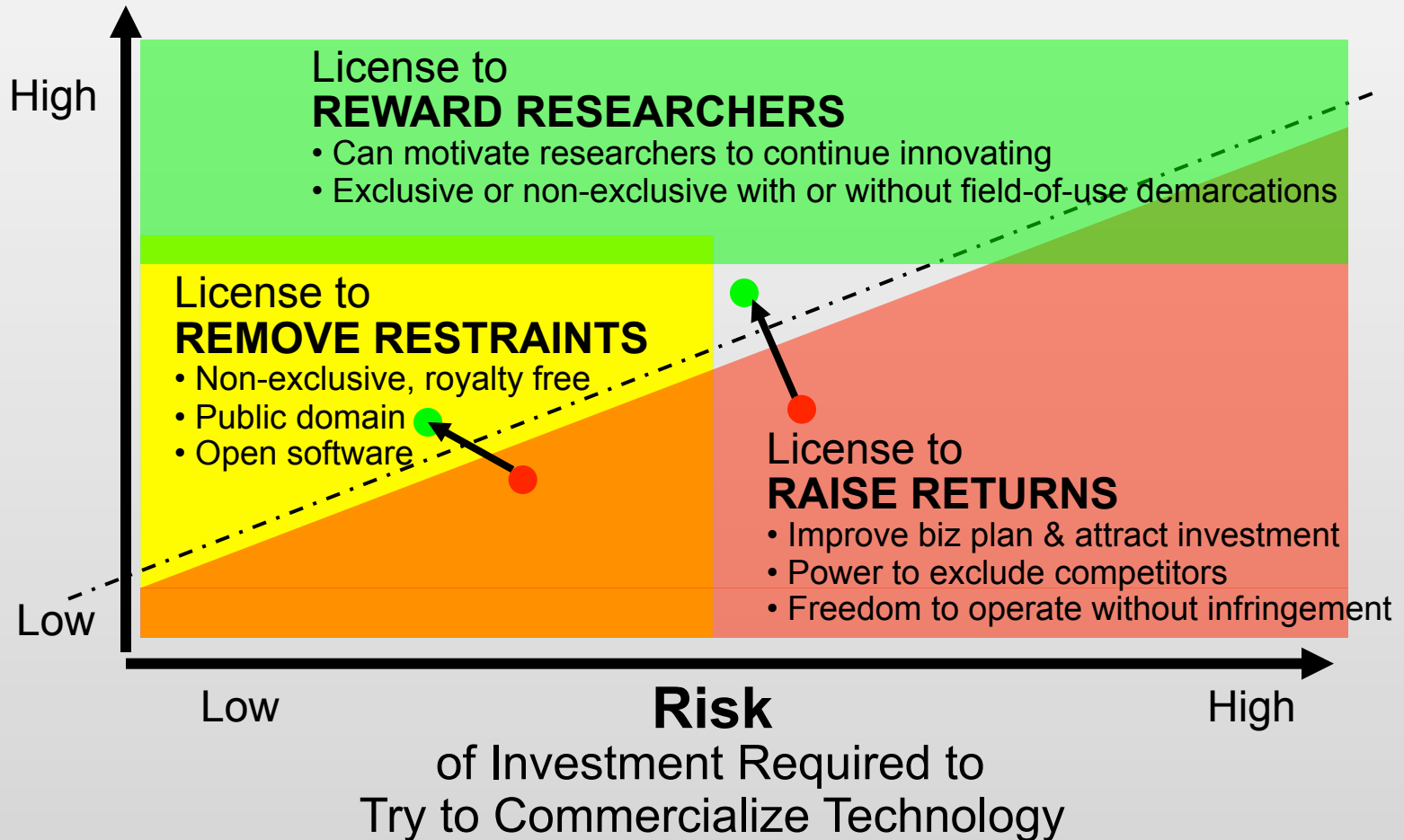
* Depending on the circumstances, inventor rewards can vary and for example range from licensing income (typically 35%), to attribution and recognition, to the personal satisfaction of developing technology that has been successfully commercialized.

IP Licensing: *Commercialization Challenges*



IP Licensing: *Catalyzing Commercialization*

Potential **Return**
on Investment



IP Licensing: *Value to Companies*

Exclusive License



1. Used as **competitive barrier** & thereby **improves return on (risky) investment**
 - New feature, point-product, product-line, or multi-segment product family
 - Conducive to startup, midsize or large company
2. Used to **impress investors** & thereby **improve funding, acquisitions, valuation**
 - IP on which start-up is founded
 - IP that strengthens portfolio of emerging growth company or established company
3. Used (with know-how, etc) to implement sublicense **solution** (fab-less IC corp)
4. Used (with other IP) to **cross-license** with competitors & gain freedom-to-operate
5. Used to **discourage infringement claims** & thereby lower company's legal costs
6. Used (with other IP) to **promote industry standard**
7. Used to prevent companies from **nefariously controlling technology's market**

Non-Exclusive License

IP Licensing: *Overview of IP Agreements*

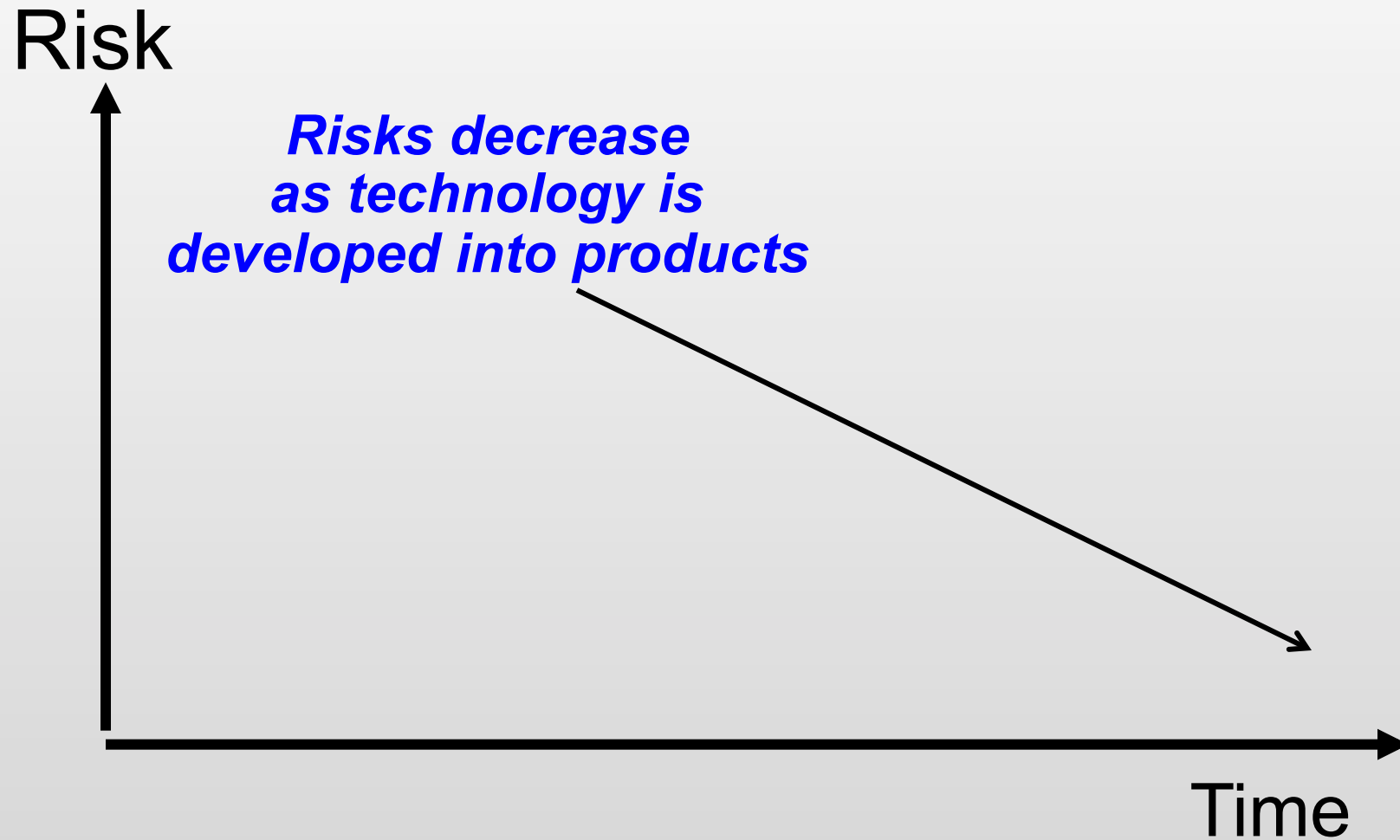
- ❑ Purpose: Legal agreement in which licensor gives licensee the right to use the licensor's patented technology or copyrightable software (note that IP is not sold)
- ❑ Types
 - License agreement (decades) vs option agreement (years) vs letter agreement (months)
 - Patent rights vs copyrights vs data rights licenses
 - Exclusive vs Non-exclusive
 - Field-of-use demarcation, sublicensing, etc
- ❑ Terms
 - Financial: royalties, license fees, patent costs, etc
 - Legal: Warranties, indemnification, confidentiality
 - Operational: Performance milestones (require progress or the license can be terminated)
- ❑ Price (royalty rate, fees, etc)
 - Nature of IP: revolutionary vs incremental / method vs device
 - Risks to commercialize IP: time, capital, regulatory, etc
 - Economics of IP's market: pharmaceuticals, semiconductors, software, **energy**

IP Licensing: *Common Steps**

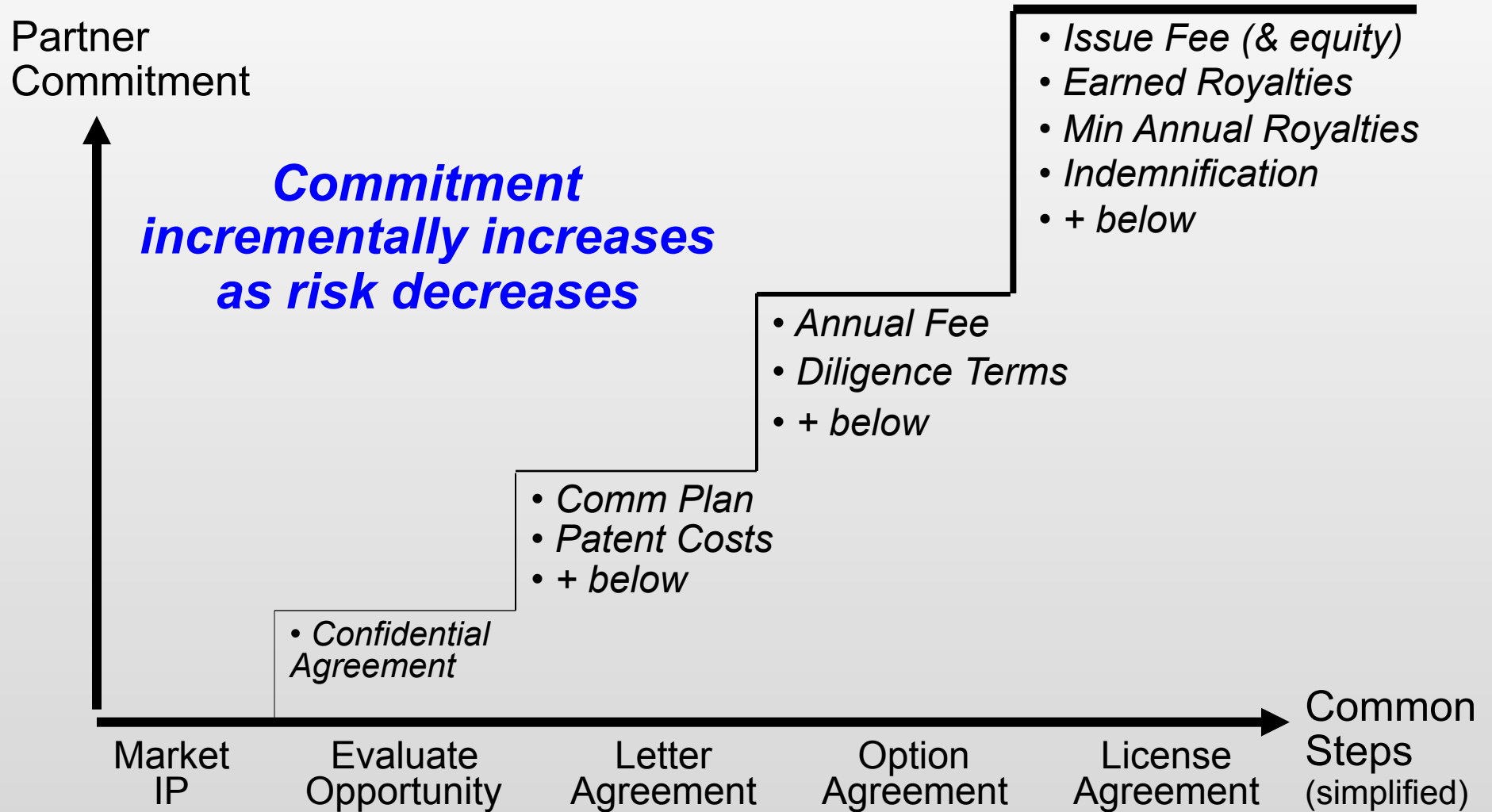
- ❑ Objectives: commercialize IP broadly, quickly, beneficially
- ❑ Challenges
 - Manage uncertainty & risk of commercial success
 - Understand & reconcile different perspectives (corps, inventors, univ)
- ❑ Approach
 - Entrepreneurial (flexible, creative)
 - Principled (win-win)
 - Transparent (no conflicts of interests)
- ❑ Process: **Incremental**



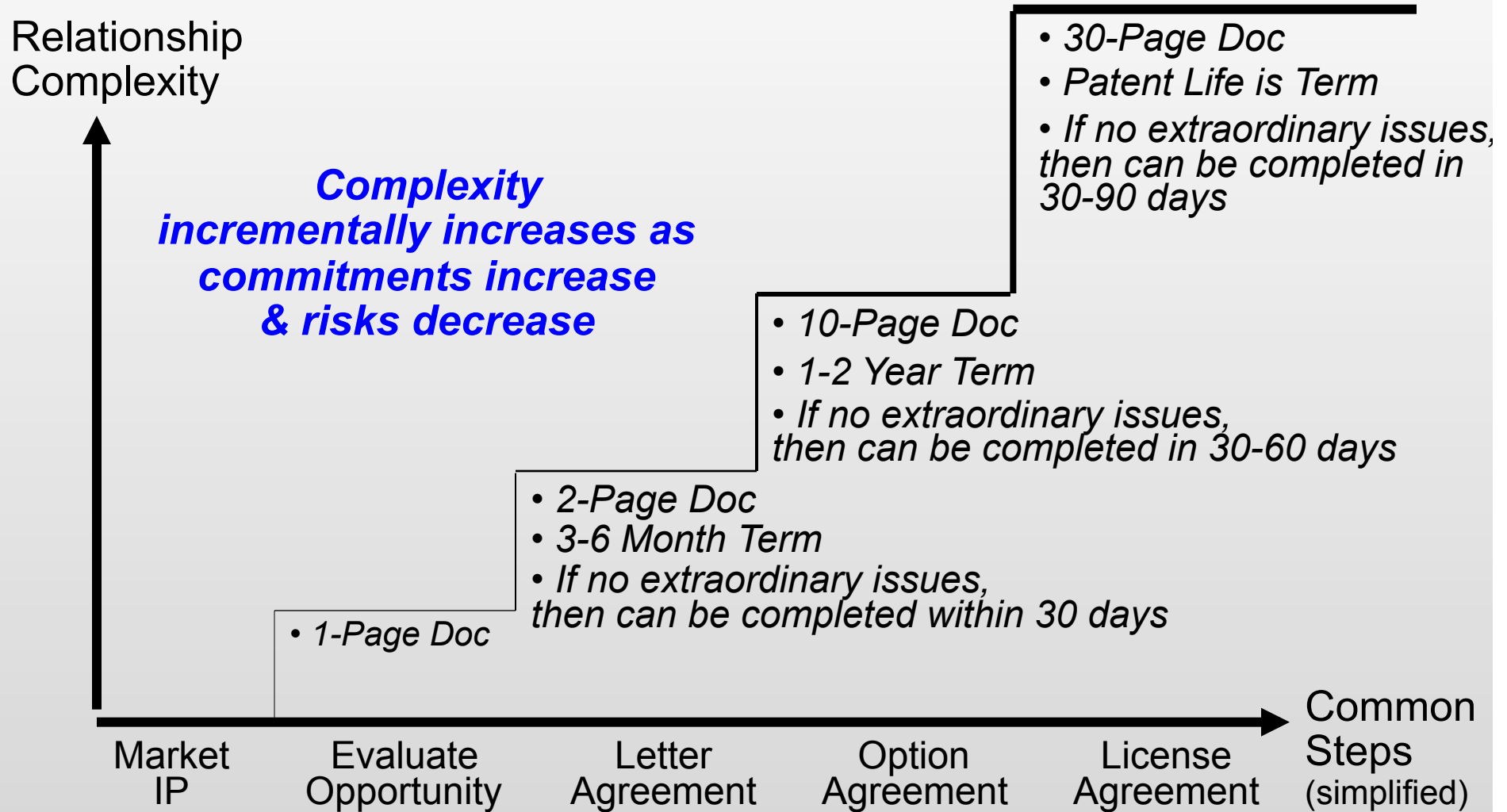
IP Licensing: *Managing Risk*



IP Licensing: *Commitment = f (Risk)*



IP Licensing: *Complexity*



Patents: Overview of IP

- ❑ Intellectual Property (IP): Includes patents, copyrights, trademarks, trade secrets
 - Patentable invention is a new & useful process, machine, article of manufacture, or composition of matter
 - Copyrightable work protects the expression of an original work of authorship (i.e. software)
 - UC Berkeley doesn't keep trade secrets
 - Researchers own their know-how
- ❑ Purpose: A patent is a legal monopoly that gives the patent owner the right to exclude others from making, using, or selling an invention for a limited time (20y)
- ❑ Creation: Patents & copyrights granted & enforced by governmental authorities in each country (in return for full disclosure of inventions to enrich public knowledge)
- ❑ Timing: A US patent must be filed within a year after the invention has been publicly disclosed; & most international patents must be filed before the invention is publicly disclosed; a patent *filing* is not a patent; it can take 1-3+ years for a patent to *issue*; once issued the patent term is 20 years from the *filing* date
- ❑ Costs: **Utility** US filing-only can cost > \$15K, & international patent filings are even more expensive (translation charges, etc); **Provisional** US filing can cost ~\$1K
- ❑ Value: It's not difficult to get a patent, but it's challenging to get a useful patent

Invention & SW Disclosures: *Responsibilities*

❑ Disclosures Required By

- Many funding agreements -- especially US Government funding
- UC Employment agreement (Patent Policy and associated Patent Acknowledgement)
- Note that UC employees own their own “know-how”

❑ Disclosure Forms Purpose (not a useless bureaucratic exercise)

- Describe specific invention to clarify novelty & value (i.e. patentability)
- List funding source(s) to check for encumbrances & obligations related to patent rights
- List public enabling disclosure(s) to determine patent deadlines (bar dates)
- List inventorship to determine ownership, distribution of proceeds, patenting help, etc

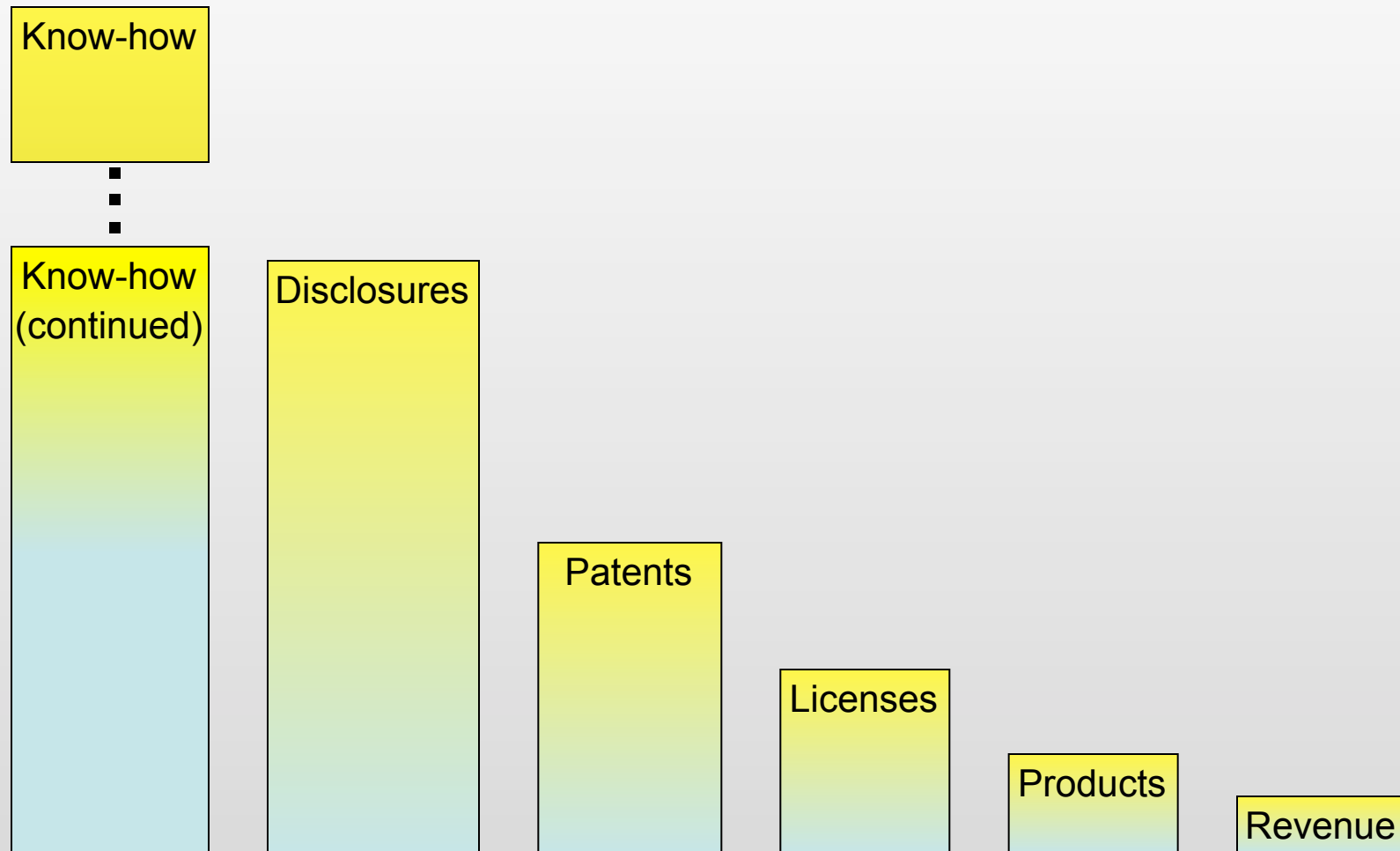
❑ Inventorship on Disclosure Form

- If contributed to 1 claim, then co-inventor on patent (this is law not UC policy)
- Can change from disclosure to patent depending in claims in actual patent issued
- If co-inventor from another university or company, then IP jointly owned
 - Each owner has rights to the entire patent rights
 - Often joint owners establish an agreement on how to collaboratively manage IP

Invention & SW Disclosures: *Opportunities*

- ❑ UCB inventors (hired after 1997)
 - Get 35% of licensing proceeds (after costs)
 - Proceeds split evenly among co-inventors unless another split is agreed to in writing
- ❑ UCB researchers that spin-out companies can license patent rights
 - Inventors have the most know-how to commercialize inventions
 - Therefore inventor start-ups are best candidates to meet objectives of exclusive license
- ❑ Ownership of IP
 - Invention disclosure doesn't automatically give title to UC
 - UC owns if (a) use UC resources, (b) fund via UC, or (c) scope of employment with UC
 - Inventors can request UC DISCLAIM or WAIVE ownership of invention
 - If in doubt about ownership, then it's better to disclose invention to UCB OTL
- ❑ If UCB doesn't want to pursue patent for an invention, then
 - Funding agency can pursue the patent
 - If funding agency doesn't want to pursue patent, then inventors can pursue patent

Invention Disclosures: *Statistics (not to scale)*



Summary & Questions

□ Key points

- Commercialization pathways: *morphed, mined, milked, marketed*
- Leverage ecosystem: *uber-founder, co-founder, early employee*
- Leverage IP rights to catalyze commercialization

□ Follow up

- <http://IPIRA.berkeley.edu>
- Mike Cohen; mike.c@berkeley.edu