

Academia Meets The Market



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► By William Looney

NEW DRUG DEVELOPMENT IS AN INCREASINGLY COMMUNAL ENTERPRISE. *In Vivo* examines how one major US academic institution – the University of California at Los Angeles (UCLA) – is expanding its range of research contacts to open new areas of therapy and shorten the transition from bench to the bedside. Its commercial impact is considerable: over the past two decades, private-sector VC's have invested more than \$2bn in UCLA-backed innovations, with 26 start-ups launched through the university in 2019 alone. Amir Naiberg, UCLA's point man on technology transfer, explains the factors that have made the university a successful advocate for partnerships that produce results for patients.

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Collaborations between industry and academia are a common feature of today's biopharma R&D landscape. Well over half of FDA-approved new chemical entities rely on externally generated research at some point in the journey from discovery to development. Factors driving this trend include academic scientists' focus on the complex biology that underpins pathogenic expression of disease; high costs of in-house industry R&D coupled with financial pressures on universities due to declining public funding support; more transparency on intellectual property standards for tech transfers involving industry



and academia; and a relaxation of industry concerns about "open innovation," resulting in a greater tolerance for risk, on both sides. More important, new studies published in the past year on drug industry trends in R&D productivity cite growth in external partnering as one explanation for an uptick in the rate of return on capitalized R&D investment, after decades of decline.

To cast some fresh light on how academia and biopharma are working together to speed the translation of research from bench to bedside, *In Vivo* has profiled one of the academic community's leading sources of technology transfer with industry, the University of California at Los Angeles (UCLA) Technology Development Group (TDG). Now five years old, TDG has unique legal status within the university as an external 501(c)(3) corporation with dedicated responsibility for managing UCLA's IP and licensing portfolio consisting of more than 1,000 active patents, a trove that generated a record \$183m in income for UCLA in 2019. In the first three quarters of 2020, UCLA had secured \$1.4bn in new research funding, a 20% increase over 2019. More than half – \$754m – will be spent on bioscience and other health-related projects at UCLA's Geffen School of Medicine. The federal National Institutes of Health (NIH) is the largest single funding contributor, awarding grants worth \$565m to projects in AIDS, cancer, neurosciences, cardiovascular disease, COVID-19 and mental health. Industry sponsored research adds another \$53m. Overall, UCLA ranks in the top five US academic institutions in research funding, and is first among public universities.

UCLA has a proven record as an innovator in drug discovery. Its research faculty played key roles in the development of three blockbuster cancer drugs: Herceptin (trastuzumab), the first targeted therapy for breast cancer; Gleevec (imatinib), another targeted therapy for leukemia, which evolved from UCLA researchers' discovery that genetic alterations could cause cancer; and, most recently, Xtandi (enzalutamide), approved by the FDA in 2012 and again in 2019, and now the global market leader in new hormonal therapies for advanced metastatic prostate cancer. Erleada (apalutamide), a drug from Janssen (a division of Johnson & Johnson) approved for the same indication in 2018, also originated in UCLA Professor Michael Jung's biochemistry lab.

On the entrepreneurial side, UCLA has a flourishing start-up culture, with 26 start-ups launched by faculty and associates in 2019 alone. Its commercial relevance is demonstrated by the fact that the private-sector VC community has invested \$2bn in UCLA companies during the past two decades. The business focus is reinforced by TDG's board of directors, whose 21 members include seven executives from big pharma and biotech.

To get a closer look at the priorities of this mainstay of tech transfer in the US top-ranked public university, *In Vivo* spoke with TDG's CEO and associate vice chancellor, Amir Naiberg. Having joined TDG in 2016, Naiberg is a veteran of Israel's start-up culture, serving as CEO of Yeda Research & Development Co., the commercial arm of the Weizmann Institute of Science and as co-chair of the Israel Technology Transfer Organization, which helped solidify the country's reputation as the "Start-Up Nation." He remains a strong advocate of moving research more quickly from the lab to the marketplace, and is particularly focused on helping positioning the Los Angeles region as a leader in global life sciences innovation (see "Building the Biotech City," *In*



Amir Naiberg

Vivo, July 2019). Naiberg is joined by *In Vivo* Editorial Advisory Board member, Dr. Ken Schultz, CEO and chair of Trethera Corp., an early-stage biotech based in Los Angeles whose pipeline has also benefited from some of the science conducted in UCLA labs.

In Vivo: *Translational research – turning insights from academic science into clinical advances for patients – is widely seen as the most important change in medical practice of the century thus far. Do we still have further to go in reducing the time lag from*

the bench to the bedside? How is the UCLA Technology Development Group helping to foster collaborations that really move the needle on new product innovations?

Amir Naiberg: Differences between academia and industry in their approach to research are well documented. There will always be some gaps due to the structure of funding, whereby the federal government supports the basic discovery work of universities while industry relies on private capital to defray the high costs of development. What matters is the incentives that now exist for both groups to collaborate in moving from a knowledge-driven organization to a commercial enterprise.

The Technology Development Corp., the 501(c)(3) established six years ago to oversee TDG's mission, helps UCLA's research faculty bring its life-changing discoveries to the market faster, creating economic value and advancing the standard of care for patients. Of course, making this happen in real-time required some creativity. It was necessary to tie what was a disaggregated flow of research expertise into a coherent framework that would allow us to match this expertise to the best external opportunities. It required a cultural change in that our most productive faculty had a history of pursuing start-up ventures on their own, without leveraging the partnering capabilities embedded within the vast UCLA ecosystem. This year alone, UCLA scientists have received a record \$1.4bn in research grants, nearly half of which is earmarked for

medicine and the life sciences. Making the world outside our labs aware of that is the essence of what we do.

In Vivo: *Describe the mission and structure of the TDG enterprise.*

Naiberg: We are a central, campus-wide hub with a mission to help faculty move their research from the lab to the marketplace quickly, for the patient, and ultimately for the benefit of UCLA and society at large. We don't drive the research; we facilitate its translation into products or services that people need. That way, our faculty can pursue their creative ambitions; their innovations are valued and monetized, generating more income for university's research budget; and supporting scholarships and fellowships so our graduates can find jobs. It's a robust ecosystem of knowledge.

TDG consists of three functional pillars. The first is business development, where our people work with faculty to identify innovations and develop external applications for their research, arrange contacts with interested parties and facilitate deals. The second is industry-sponsored research, where we support everything from material transfer agreements to long-term collaborative research activities. We also have a central function role, such as managing business and tech transfer operations, such as marketing and licensing inventions; prosecuting patents; distributing royalties and other income to inventors and various UCLA departments and labs; educating the UCLA student body and community about tech transfer issues; and evaluating the commercial value of new technologies. Third is New Ventures, which involves managing the UCLA Innovation Fund, which seeks to fill the funding gap between basic research at UCLA and commercial development through modest grants that cover those interim steps like proof-of-concept and clinical validation studies.

UCLA is highly diversified in the life sciences so our work ranges from physical sciences and engineering to medical devices and diagnostics, drug therapeutics, and advanced software like artificial intelligence. We spend much of our time bringing to the table external partners with background to secure, value and monetize inventions developed across the UCLA campus. One of our more

exciting recent examples of the Innovation Fund is the licensing of an AI algorithm for spine MRI evaluations to a local, faculty founded start-up, Theseus AI Inc.

In Vivo: *Do you have any recent examples of innovative collaborations that merit the attention of the In Vivo readership?*

Naiberg: In June, we launched a strategic collaboration with Autobahn Labs, a newly formed virtual life sciences investment incubator backed by the VC firm Samsara BioCapital; Evotec SE, a global drug discovery and development alliance company, based in Germany; and KCK Ltd., a US family office investment fund. UCLA is the first university to work with Autobahn on its mission to identify, fund and de-risk early-stage, preclinical research projects in academia that have significant therapeutic potential for patients. TDG will help Autobahn pursue its model of building joint ventures with university start-ups, accelerating the discovery and development process with strategic guidance as well as access to Evotec's network of 3,000 scientists and clinical trial logistics experts.

We like it because it brings a structured, "baked-in" process to academic-industry collaborations, minimizing a lot of the transactional friction that can occur when business partners try to negotiate financing, licensing/IP rights and due diligence on their own. Despite the COVID-19 distractions, Autobahn has already had discussions with 80 UCLA faculty members to share project ideas and I expect this to result in several brokered agreements on new start-ups by the beginning of 2021. I think the relationship with Autobahn is an important precedent that puts UCLA in the lead in bridging the translational science gap you just mentioned.

Another example where we innovate is our growing focus on the convergence between the tech sector and the life sciences. In June, UCLA signed a three-year research partnership with Apple Inc. as part of the university's inter-disciplinary Depression Grand Challenge project geared to finding objective, evidence-driven metrics for diagnosis and treatment of this disease. It is notable that major depression, which afflicts an estimated 300 million people worldwide, still relies on the old tool of personal

observation to track symptoms. Under the agreement with Apple, which TDG helped execute, the company will supply more than 3,000 study participants with smart watches and the Beddit sleep monitor to record individual behaviors in real time. With Apple's help, we are able to

do all this research remotely, which represents a practice model that has resonance during a pandemic. I see the Apple agreement as a milestone for TDG as it enables us to diversify around key industries of the future outside of medicine.

UCLA Activities In Life Sciences



Ken Schultz, chair and CEO Trethera Corp.: *The largest translational licensing life sciences deal to date was signed in November 2019 between Takeda Pharmaceuticals and the MD Anderson academic medical center. It involves the development of drugs from Anderson's novel platform of chimeric antigen receptor-directed natural killer-cell (CAR-NK) therapies, to treat B-cell lymphoma malignancies and other cancers. The project will launch in early 2021 with a Phase-1 cancer trial whose enrollment will also break records. Is TDG considering similar tech transfers with biopharma partners of this scale and scope? Is there an appetite on campus for this kind of precedent?*

Naiberg: Leadership in tech transfer relations with industry as well as other health providers is definitely something we aspire to. UCLA has the foundational capabilities to bring an asset forward, from high throughput screening at the discovery stage, clean rooms for manufacturing, right up to the clinical trial phase. However, whether we have the

resources to manage those last crucial steps to the clinic is an open question. It certainly raises some issues relating to our priorities as a public university.

That's why right now we are putting the emphasis on partnering. I can point to a recent precedent where UCLA professor of medicine Dennis Slamon initiated the clinical trials that led to approval of Genentech's Herceptin (trastuzumab), one of the first targeted monoclonal drugs for cancer. He also collaborates with Brian Stoltz's chemistry lab at the California Institute Technology (Caltech) on a novel molecular construction for the treatment of cancer. Together with Caltech and some local investors, we spun a company from their joint work that continues to generate new compounds which can be evaluated quickly and efficiently for therapeutic potential and then moved to a clinical trial network affiliated with UCLA. I believe that to this day it is one the best models of how translational research delivers clinical results to many

thousands of cancer patients. Although the present crisis around COVID-19 is certainly a setback, the example of this long-standing collaboration gives us a useful set of tools that we can replicate once campus life resumes.

In Vivo: *Many VC investors assert that it has become more difficult to assess opportunities among the growing number of start-ups launched from major academic research centers like UCLA. Do you agree and, if so, what is TDG doing to help raise the curtain on deal-making?*

Naiberg: We definitely see more academic start-ups operating in “stealth” mode. Arranging private capital is a competitive sport. It’s understandable that a new start-up will seek to control what it shares with prospective investors. What TDG has done is build a data base that serves as an up to date resource on all the spin-offs from UCLA’s faculty and lab ecosystem, which a VC or biopharma company can access to find a match. All this is conducted in an open and transparent manner, freely available to all interested parties. We also strive to relate to the motivations of our different stakeholders: entrepreneurs want us to help them relate to the “next big thing,” while VC firms are looking for projects that complement their own capital allocations and investments. And then there are our industry partners, most of whom want relationships that expose them to the diversity and range of our research interests. Most important, TDG has staff with the therapeutic area expertise to facilitate and progress these contacts. As the middleman, we strive to ensure everything works seamlessly and without friction.

Finally, TDG relies on UCLA’s large alumni network as a rich source for new business development opportunities. Here in Los Angeles, there is a large group of affluent alumni outside biotech in areas like finance and entertainment who are personally familiar with UCLA’s world-class medical institutions and may have benefited from that care. These business “angels” are proving useful in filling some of the gaps in start-up financing, especially for that initial seed round.

In Vivo: *You spent your early career in Israel as an expert in tech transfer. Is there a difference in the entrepreneurial culture around innovation there compared to what you see at UCLA today?*

Naiberg: I once believed that in tech transfer size did not matter. Back in Israel, everything was small and decisions could be made easily and very quickly. Here in the US, the processes take longer and more care and planning must be taken in building relationships. But the slower pace is outweighed by the sheer scale of a vibrant life sciences ecosystem and the amazing insights and collaborations to be found here at UCLA alone – from the medical, engineering, and scientific disciplines to computers, technology and management. The UCLA campus is probably host to more tech transfer activity than in the entire nation of Israel.

Schultz: *With so many resources available at UCLA, how does TDG set priorities in finding the best opportunities?*

Naiberg: It starts with a screening process we call the TDG IP and Commercial Scorecard. When a new opportunity comes up, we have TDG’s business development team work it through a series of three “gates” to determine whether to seek patent protection for the asset. The first and most important step is to consider a list of 12 criteria ranging from the novelty of the technology itself to defining the market potential, including such items as barriers to entry and that “wow factor” (see *Exhibit 1 - New Invention IP and Commercial Scorecard*). The process ends with a prospective long-term revenue estimate for the asset, assuming the criteria are met. Our rationale is to move beyond the question of whether it’s great science to the practical value the opportunity it might bring to clinical practice – and if there is no new business angle, we will pass on it.

In addition, TDG manages an annual group exercise where we ask our Business Development team to review their portfolio and present the ten most promising projects for the year ahead. TDG has been doing this for four years now and so there is a robust data base inventory of projects that could feature in a partnership. We’ve found the likelihood of commercializing this technology increases dramatically as it circulates off the shelf and gets needed attention.

In Vivo: *How does UCLA fit into the larger University of California (UC) system and its academic research programs in life sciences?*

Naiberg: Each of the 10 university locations act independently in the conduct of research. Nevertheless, all of the people like me who do tech transfer meet every month to exchange views and best practices. In addition, I am a member of the UC Knowledge Transfer Advisory Committee,

where we discuss our work and larger issues related to policy on research practices, talent development and budgeting. Together, Committee members are developing a long-term “road map” to support more knowledge transfers with industry and other private-sector entities.

New Invention IP & Commercial Scoreboard

12 categories are evaluated to guide the provisional patent application decision

IP	BARRIERS-TO-ENTRY	ENFORCIBILITY	MARKET OPPORTUNITY	MARKET POTENTIAL	UNMET NEED	WOW FACTOR	COMMERCIAL READINESS	COMPETITIVE LANDSCAPE	COMPETITIVE ADVANTAGE	PI ENGAGEMENT	IP OWNERSHIP	SCORE
Platform / Patent Portfolio	Low	High	>1 Defined Market	>\$1 Billion	High & Well Defined	Paradigm Shift	High	Minimal Competition	Novel Proprietary Position	Experienced Entrepreneur, Engage & Well Funded	Solely UC Owned	5
Composition-Of-Matter Patent	Medium But Manageable	Medium	1 Defined Existing Market	\$500M - \$1 Billion	High-Medium	Major Advance / Improvement	Medium	Indirect Competition	Shared Proprietary Position	Engaged And Well Funded	Joint Ownership w/IIA	4
Design Patent / Know-How	Medium And Challenging	Challenging	Market Not Well Defined	<\$100M	Low	Incremental Advance	Low	Direct Competition In Market	First Mover Advantage Only	Engaged But Not Well Funded Invention	Joint Ownership w/o Agmt	2
Method Patent	Unknown	TBD	1 Defined New Market	\$100M - \$500M	Medium	Alternative Or Improvement	Medium With Partner	Competitive R&D (No Market)	Operational / Cost Improvements	Well Funded	Joint Ownership Agmt w/Co.	3
Minimal IP	High / Difficult	Low	TBD	TBD	TBD	Me-Too	TBD	Highly Competitive Market	Minimal	This Invention Not A Priority	Third Party Revenue Sharing	1

Maximum Score = 60

For each of the categories, a “5 score” is best. As an example, under the “Competitive Landscape” category, “Minimal Competition” is rated as a “5” vs. “Highly Competitive” receives a “1” score. With twelve categories, the highest score achievable is 60 (5 x 12).

IIA, “Inter-Institutional Agreement”, is executed when the inventors for a particular patent application are located at different institutions.



Schultz: Does TDG have any specific examples of UCLA research that ended up as commercial breakthroughs that yielded a monetary return while advancing the standard of care for patients?

Naiberg: Our faculty discovered of the gene expressions that led to the development of Herceptin, one of the top-selling cancer drugs in history, now with multiple indications. UCLA has had other successes in cancer as well. Biochemist Michael Jung from the School of Physical Sciences and Charles Sawyer of the Geffen Medical School applied their complementary backgrounds in synthetic molecule design and the signaling pathways that stimulate cancer cells to develop the first anti-androgen receptor drugs to treat prostate cancer. Xtandi (enzalutamide) was

approved by the FDA in 2012 and Erleada (apalutamide) was approved in 2018 and again in 2019 for the most aggressive form of the disease. Sawyers lab was also a co-originator of the drug Gleevec (imatinib), approved by the FDA in 2001 and the first molecularly targeted drug to treat cancer. In reference to the two drugs for prostate cancer, UCLA licensed them out at the pre-development phase to two California-based start-ups that conducted the clinical trials and basically de-risked the assets so that they could eventually be acquired by big pharma: Pfizer, in the case of Xtandi, and Erleada by J&J's Janssen Pharmaceuticals. Over time, the financial payoff to UCLA has been significant; in 2016, for example, UCLA through its royalty partner sold the global commercial rights to Xtandi for slightly more than \$1.1bn in cash.

I also think there is a larger story here concerning the conventional wisdom about how innovation takes place in biopharma. The dogma for R&D right now is “fail fast, fail early.” Yet looking at the cumulative record of compounds that became blockbusters, you see it’s all really a tale about persevering. Back in Israel, when I was at the Yeda commercial unit of the Weizmann Institute, I observed firsthand the work of entrepreneurs who just pushed on when challenged and made it happen. There was less of the risk-avoiding cultures that tend to cause hesitation and slow things down in big pharma.

In Vivo: *What is your relationship with the other key academic centers of life sciences research in the Los Angeles area? Is the relationship competitive or cooperative?*

Naiberg: UCLA, Caltech and the University of Southern California (USC) each have different cultures and skills sets. This is to be expected in a region so vastly spread out as well as being home to more than 10 million people. Caltech is strong on physics and materials science; it does not have a medical school. USC is more similar to us but smaller. In a region so dependent on commuting by automobile, UCLA stands out as a densely populated urban campus with a small real estate footprint. It’s a five-minute walk between the medical, engineering and business schools which means contacts that foster collaboration tend to happen spontaneously. That’s a true distinction in the Los Angeles context.

That said, all three institutions, as well as the City of Hope and Cedars-Sinai medical centers, realize there is strength in synergy. UCLA is host to an annual conference called “UCLA Bioscience Innovation Day,” which we developed in close collaboration with Amgen, based in neighboring Thousand Oaks, CA. Now it is called “LA Best” and we deliberately include top-level executives and researchers from all regions of southern California. In addition, we now have a number of regional advocacy organizations, such as the Alliance for SoCal Innovation, presenting a single unified message about Los Angeles as a distinctive “hub” for life sciences research. We know that to grow we have to address the competition from other geographic centers of innovation, not just in the US but internationally as well. In the past two years, Bioscience LA, an advocacy group

also backed by Amgen, and BioCom’s Los Angeles chapter have been launched to promote the Los Angeles area as a “go to” destination for biopharma investment capital. As markets become global, the necessity is to collaborate to achieve more than what we can do individually.

In Vivo: *How has the coronavirus pandemic affected TDG’s work? What are the broader implications for the business of tech transfer?*

Naiberg: We moved out of our offices along with the rest of the UCLA community on 16 March. I was quite concerned that TDG and the tech transfer operation – which has always relied on intensive personal contacts – would be forced to shut down. But the opposite has happened: through our team’s dedication and commitment we’ve been able to carry on the momentum, as the last fiscal year has proven to be a record in terms of industry engagement and number of deals signed. That’s because in this remote environment people have more time to think, read and thoroughly evaluate the latest trends in basic science and drug discovery. The shutdown also fostered a sense of urgency. In the first and second quarter, deals that had been stuck in negotiations suddenly moved to close. April and May 2020 actually proved to be the most productive two months in TDG’s history, in terms of new deals signed.

In addition, the fact that the traditional method of conducting due diligence has been upended means the tech transfer business has been forced to innovate. For example, we acted quickly to make the IP and licensing process more predictable with standardized pre-negotiated templates and other tools designed to keep transactional costs for deals as low as possible. I think the pandemic offers a great opportunity for TDG to identify new ways of getting our message across to our UCLA stakeholders and business partners.

So, the model is changing. People now realize that you don’t necessarily have to fly to another city to interact in person; video conferencing, in most cases, has emerged as an acceptable alternative. We have had great success so far in presenting our scientists to investors live through Zoom. We have created pre-recorded pitch decks. We’ve

been able to expose and educate larger audiences on our work in the basic sciences through a stepped-up program of webinars, including a six-part series we began in May on start-up innovations that address COVID-19. Of course, it hasn't hurt that there remains a lot of investment capital looking for a home in the life sciences. If anything, the swift shock of COVID-19 has emboldened scientists and entrepreneurs to reach higher for solutions that are truly game-changers. One example here at UCLA is the October approval by the FDA of a novel COVID-19 diagnostic platform, SwabSeq, which allows for high-volume rapid testing with a 12-hour turnaround time. The invention comes from a UCLA start-up, Octant Bio Inc. Although approved for limited use at UCLA facilities, Octant hopes to scale the platform for nationwide distribution in the near future.

In Vivo: *How do you spend most of your time as UCLA vice-chancellor and TDG's CEO? What do you envision as the major areas of focus for TDG heading into the future?*

Naiberg: Day to day, I am thinking strategically about the future business of tech transfer. I came of age in an era where translational research and tech transfer was a contact sport. You needed to spend time in the lab, keep in regular touch with the researcher and faculty members, circulate with corporate leaders in industry and reach out to new entrepreneurs.

Obviously, this model has been disrupted – a boundary on interacting in person was crossed this year. Will that continue to be the case for the foreseeable future? If so, how do we raise our game around the new technology of communicating so that we don't fall behind? I am working hard with colleagues to reimagine the policies and practices we have in place so that the work we do on commercializing research will be easier for everyone, including industry. As we move into 2021, I am aware of "Zoom fatigue" and so we are reviewing everything we do from an ease of communicating standpoint – our messaging has to be short, targeted, concise, accessible and, above all, engaging. In the last few months, we have established a unique TDG channel on YouTube and are now planning for the next medtech conference in March 2021, followed by the **LA Best** conference scheduled

virtually for 21 May, 2021. Whatever the format, TDG will remain in close touch with our constituencies. There will be metrics to evidence we are doing that.

It's also important to consider whether we are making optimal use of UCLA's vast stores of information. Our team is spending a lot of time thinking about software, data retrieval and analytical capabilities based on machine learning and AI. I don't believe there is any playbook on how to cope with the kinds of data now emerging in the high-tech economy. Efficiency and ethics are central to the discussion. TDG is systematically reviewing the vast array of software and data bases in use across the UCLA campus so that we can integrate this resource in our tech transfer activities.

With further regard to our future, we will be looking to partnering in new areas of growth like the arts and humanities, which reflect LA's status as a cultural center with significant philanthropic outside funding resources. Currently, roughly two-thirds of our work is in life science, including med tech and diagnostics, pharmaceuticals and related health care products. It's a reflection of the size and excellence of UCLA's Geffen School of Medicine and the research collaborations it has with our colleges of physical sciences and engineering.

Although I don't expect that ratio to change in the near future, TDG's goal is to expand into other advanced technology segments. One example of that is the collaboration we announced earlier this year with Starburst, a leading aerospace and defense investment accelerator funded partly by the federal government, to create Scale Aerospace Ventures, with a mandate to grow start-up companies based on "disruptive" technologies developed through the UCLA Samueli School of Engineering, TDG and innovators outside UCLA. Scale Aerospace Venture aims to source at least 45 new start-up companies, mostly in the LA region, by 2023. It's an exciting new chapter for TDG as it gives us more reach to create inventions that transcend traditional academic boundaries. Most scientific challenges that await a commercial solution require an interdisciplinary approach, and TDG intends to be a leader in fostering such collaborations in the years ahead.

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