

Literature access and destruction

To the Editor:

I read with great interest the article by Stuart Lyman about industry access to the literature¹. But I would like to point out that at least two of his solutions are unlikely to be feasible.

As Lyman notes, the problem of lack of access is most acute for small- to medium-sized enterprises (SMEs). As multinational pharmaceutical corporations scale back their own R&D operations², it is becoming clear that they are also cutting back on subscriptions to biomedical journals. Thus, Lyman's suggestion¹ that biotech SMEs could negotiate online access to big pharma's electronic subscriptions as part of research-collaboration deals seems unlikely to work.

Another solution proposed by Lyman¹ is to form some type of cooperative or consortium that would buy journal access. However, certain publishers now sell access to journals as bundles—forcing libraries to pay for access to more prominent and highly used journals as well as to journals consulted far less frequently. This has substantial implications for librarians; for example, the cost of electronic-journal subscriptions for the Consortium of Swiss Academic Libraries doubled in 2011, owing to a bundled

subscription with Elsevier³. And in April 2012, the Harvard Library warned its faculty and students that it could no longer afford the high prices of journal subscriptions and called for specific actions⁴.

Yet another development threatening access to the literature relates to the destruction at some big pharma facilities of physical collections of journals that were issued decades ago (that is, before 1980). Many of these journals, especially in the field of chemistry, have still not been made electronically available. And yet, the information in these journals continues to be valid and useful for present-day research.

COMPETING FINANCIAL INTERESTS

The author declares no competing financial interests.

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Publications and patents in corporate venture-backed biotech

To the Editor:

Biotech startups increasingly turn to corporate venture capital (VC) arms for funding, rather than to traditional venture capitalists. The innovation implications for these startups remain unexplored. Here, we present evidence that the shift in funding patterns is associated with a greater output of scientific publications as well as patenting.

In recent years, life sciences ventures have witnessed a growth in strategic investments by established corporations^{1,2}. As yet, few studies have analyzed whether the increasing funding by corporate VC arms is associated with changes in publication and intellectual property strategy. To fill this gap, we undertook a detailed study of startups' publication and patent output to see if there was any correlation with corporate VC funding. Both are widely accepted indicators of knowledge creation, yet differ in the legal

and commercialization rights they afford^{3,4}.

Our research draws on the universe of US-based biotech companies that have received investment from corporate and/or traditional venture capitalists over a two-decade period. Specifically, we constructed a comprehensive sample of 572 US-based biotech companies founded between 1990 and 2003, and their innovation output through 2011. During the 1990–2003 period, the biotech sector saw substantial activity and startup formation, as well as two waves of VC investment that involved both traditional and corporate investors. Given the lag between the time of patent application and ultimate grant date, we included startups founded up to 2003 and continued to document their innovation output through 2011. This practice allowed us to capture startups' overall patenting output, as the mean application-grant lag was 4 years, with a standard deviation of 2 years.

Our goal was to shed light on the impact of investor type on biotech startups' innovation output as measured by patents and publications. To that end, we constructed a unique data set that integrates four different sources: Standard & Poor's Compustat, the US Patent and Trademark Office (USPTO; Alexandria, VA, USA), VentureXpert (currently part of Thomson One Banker) and Web of Knowledge (formerly ISI). Specifically, we identified biotech startups founded between 1990 and 2003 that received one or more VC investment rounds through VentureXpert. Next, investors were classified as corporate venture capitalists building on VentureXpert categories and subsequent expert coding. For example, publicly listed corporations that pursued VC investments as a means of diversifying their financial holdings (e.g., the insurance company SunAmerica) were not classified as corporate venture capitalists.

After patent information was collected from the USPTO, an automated, matching algorithm followed by human verification was used to match patents' assignee information with biotech startups. The procedure took into consideration the location of the startup as noted in the patent, verified when necessary whether the startup had research laboratories in other locations and compared the inventors across different patents to ensure the accuracy of the matches. Only granted patents were included in our sample, and we used the date of application as it signifies the date of innovation and is unaffected by potential delays in the patent granting process. Similarly, information on scientific publications was assembled from the Web of Knowledge database. A publication was attributed to a biotech startup if listed as the affiliation of one of the authors.

Of 572 biotech startups in our sample, 66% raised funding solely from traditional venture capitalists (that is, 374 were solely VC-backed startups) and 34% were backed by a syndicate that included a corporate venture capitalist (that is, 198 corporate VC-backed startups). The startups raised a total of \$20.01 billion, including \$6.76 billion in corporate rounds (dollar amounts are adjusted to constant 2012 dollars). In seed or startup rounds, the average investment amounts were \$4.75 million and \$3.79 million in rounds that do or do not include corporate VC investors, respectively. For later rounds with or without corporate VC investors, the average investment amounts were \$11.07 million or \$6.90 million, respectively. The number of scientific publications produced