Investigating the origins of recent pharmaceutical innovation

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The School of Science and Engineering (SSE) at The Chinese University of Hong Kong, Shenzhen (CUHK-Shenzhen) sincerely invites applications for multiple positions in the Department of Chemistry. This opens an opportunity to be part of a team aiming to significantly impact the development of new technologies and solutions for human health.

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Located in the beautiful coastal city of Dalian, surrounded by mountains and sea, DICP seeks all heart of Germany. As a university covering a Friedrich Schiller University is a traditional university with a strong research profile rooted in the

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2 be a key challenge for the leading biopharma companies. How to intensify early biotech–pharma interactions, thereby feeding into the BIPCO model. How to predict the future based on the past is fraught with uncertainty. However, there are cross-

Takeda, and Biogen focusing fully on externally invented new drugs (Table 1). Breaking down these analyses on a single company level (Supplementary Table 5), 15 of the

innovation primarily by M&As, whereas Bayer, Amgen, Novo Nordisk and Biogen focused on

origin of innovation (47% of new drugs) for the top 20 companies. In addition, the internal
drugs were invented and developed internally. Biotech companies were the most important

years has largely been built on external innovation, as only 28% of recently FDA-approved
drug discovery to commercialization, and thus are 'fully integrated' per se, the

Table 4). Of these new drugs were gained through M&As and 34 (25%) were in-licensed (Supplementary

Institutions (7%) or were the output of other third-party drug discovery collaborations (6%)

Classifying companies as pharma or biotech based on their foundation date, the majority of

discovered collaboratively, and the remaining 2% include other special cases (Fig. 1a, Table 1).

Biologics (NTBs) approved between 2015 and 2021 by the Center of Drug Evaluation and

Research (CDER) of the US Food and Drug Administration (FDA) for the top 20 biopharma

approvals for innovative drugs by agencies such as the FDA are granted to the company

cation through to drug marketing, and thus have been termed

pharmaceutical innovation