Targeting fibrosis

2018: Terns to

develop and

commercialize

Eli Lilly's three

NASH assets

Fibrosis-related diseases, such as nonalcoholic steatohepatitis and idiopathic pulmonary fibrosis, have generated a wave of deal and funding activity over recent years. Here, we highlight a selection of these deals.

BioPharma Dealmakers

2018: Promethera acquires Baliopharm and its TNF-R1-targeted drug candidate

2018: AstraZeneca licenses Ionis's antisense NASH drug candidate

> 2018: Regeneron and Alnylam to discover therapeutics for NASH using an RNAi platform

Nonalcoholic steatohepatitis deals

Idiopathic pulmonary fibrosis deals

2017: Yuhan to develop Bioneer's siRNA-based program for COPD and IPF

> 2017: MiNA Therapeutics and Boehringer to develop saRNA-based treatment approaches to target NASH

> > 2017: BMS and Nordic Bioscience to develop biomarkers for the diagnosis of fibrotic diseases including NASH

2017: NorthSea Therapeutics to license Pronova's icosabutate and a library of SEFAs for NASH

2016: Novartis to acquire an option to develop and commercialize Conatus Pharmaceuticals' emricasan

2017: Takeda to develop

diseases and NASH using

HemoShear's platform

therapeutics for liver

2016: BMS to develop and commercialize Nitto Denko's ND-L02-s0201 to target NASH

2017: Bpifrance to support the clinical development of Cerenis's CER-209 for NAFLD and NASH

2016: Guangdong Zhongsheng Pharmaceutical and WuXi PharmaTech to develop 7SP-1603 for IPF

2016: Boehringer Ingelheim and Inventiva to develop therapeutics for IPF and fibrotic diseases

2016: Arcturus and Takeda to develop RNA-based therapeutics to target NASH

2017: NuMedii and Three Lakes Partners to develop IPF therapeutics

2017: Gilead Sciences and Cedars-Sinai Medical Center to research anti-MMP mAb for IPF

2017: Dicerna and Boehringer to develop GalXC RNAi therapeutics for NASH

2017: Janssen

Pharmaceuticals to

develop Bird Rock

Bio's namacizumab

Phase 2 deals Phase 1 deals Discovery/early-stage deals

Fig. 1 | Selected fibrosis deals between 2016 and 2018. Deals are positioned based on the stage of development of candidate products at which the deal was signed. BMS, Bristol-Myers Squibb; COPD, chronic obstructive pulmonary disease; FXR, farnesoid X receptor; IPF, idiopathic pulmonary fibrosis; mAb, monoclonal antibody; MMP, matrix metalloproteinase; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; RNAi, RNA interference; saRNA, small activating RNA; siRNA, small interfering RNA; SEFA, structurally engineered fatty acid; TNFR1, tumor necrosis factor receptor 1. Source: Clarivate Analytics Cortellis database 2018.

Fibrosis—the excessive accumulation of extracellular matrix—leads to progressive organ dysfunction in some metabolic and/or inflammatory diseases, including nonalcoholic steatohepatitis (NASH) and idiopathic pulmonary fibrosis (IPF). NASH is a type of nonalcoholic fatty liver disease that is expected to become the most common reason for liver transplantation within the next decade. It currently has no approved drugs, but pioneering therapies could capture part of a forecasted \$25

billion market in 2025 (Nat. Rev. Drug Discov. 15, 745-746 (2016)). A few drugs have recently been approved for IPF, a progressive and lethal lung disorder, but these can only slow the progression of the disease (Nat. Rev. Drug Discov. 15, 755–772 (2017)). Given the major unmet medical needs and the large markets associated with these two diseases, major pharma companies and biotechs are vying to develop new drugs for them, driving deals such as those shown in Fig. 1.