

# UNLOCK R&D PRODUCTIVITY

# COST OF MISSING SCIENTIFIC INFORMATION IS HIGH



**>\$1B** Lost Market Leadership  
MARKET SHARE LAG: >6% <sup>1</sup>

**>\$31M** R&D Spend Inefficiency  
TIME LOSS: >3 MOS <sup>2</sup>

**>\$4B** Reputational Risk  
LOSS OF EXCLUSIVITY: >6 YRS <sup>3</sup>

# POORLY MANAGED SCIENTIFIC INFORMATION AFFECTS R&D EFFICIENCY



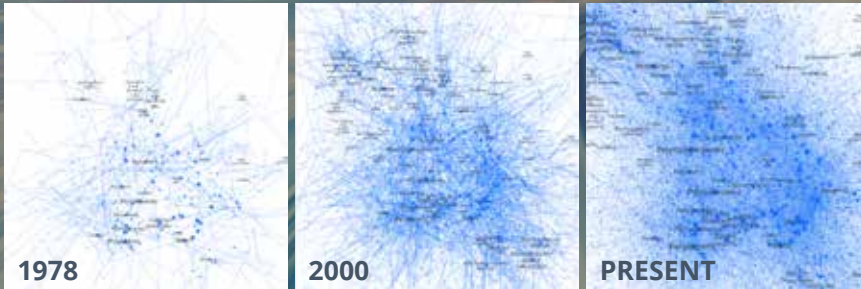
**18% Time Spent**  
IN SEARCH VS. RESEARCH <sup>4</sup>

**\$15K-\$20K**  
COST PER YEAR, PER SCIENTIST <sup>5</sup>

**R&D cycles are too long and costly**

# COST TO MANAGE SCIENTIFIC INFORMATION CONTINUES TO ESCALATE

## Scientific Information Trends <sup>6</sup>



○ Volume

○ Complexity

○ Interconnectedness

# YET, INVESTMENT IN EXTERNAL SCIENTIFIC INFORMATION SOURCES REMAINS LOW



# CAS HAS INVESTED > \$1B IN SCIENTIFIC INFORMATION SOLUTIONS OVER THE LAST 5 YEARS. INTRODUCING A NEW CALIBER IN CHEMICAL INTELLIGENCE...

INTRODUCING A NEW CALIBER  
OF CHEMICAL INTELLIGENCE



**SCIFINDER<sup>n</sup>**  
A CAS SOLUTION

NOW WITH A NEW  
**SYNTHESIS PLANNER**

**63%**

of researchers say SciFinder<sup>n</sup> allows them to **work more quickly**<sup>10</sup>

**63%**

of researchers say SciFinder<sup>n</sup> allows them to **be more innovative**<sup>10</sup>

**62%**

of researchers say SciFinder<sup>n</sup> allows them to **be more confident**<sup>10</sup>

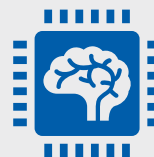
## The blueprint of chemical intelligence



**DIRECT ACCESS** to the unmatched CAS content collection, patent documents and step-by-step synthetic procedures and methods



The most advanced Chemical **RELEVANCE SEARCH ENGINE** shows you where to start and what to focus on



Platform for machine learning & AI, **COMPUTER-AIDED SYNTHETIC DESIGN**, patent search and workflow enhancement

# Insights

## SciFinder<sup>®</sup> halves the time taken to perform literature reviews<sup>10</sup>

In today's competitive landscape, your research team needs to quickly gain knowledge and insights from relevant discoveries. You can't afford to spend hours sifting through extraneous content in patents and journals. That's why we designed SciFinder<sup>®</sup> with the most chemistry-aware relevance engine in the industry. It doesn't just search faster, it helps you search smarter, anticipates your information needs and accelerates your work.

The screenshot shows the SciFinder interface for a reference. The title is "Chroman-4-one and Chromone-Based Sirtuin 2 Inhibitors with Antiproliferative Properties in Cancer Cells". The authors listed are By Seifert, Tina; Vele, Matus; Jankola, Taro; Enger, Karo; Fiedler-Szom, Maria; Walek, Erik A.; Lantosa-Romonen, Marja Jarmo; Bink M.; Luchman, Anshu. The journal is "Journal of Medicinal Chemistry" (2014), 57(23), 9870-9888. The abstract states: "Abstract: Sirtuins (SIRT) catalyze the NAD<sup>+</sup>-dependent deacetylation of histone (lysine) on various protein substrates. SIRTs are interesting drug targets as they are considered to be related to important pathologies such as inflammation and aging-associated diseases. The authors have previously shown that chroman-4-ones act as potent and selective inhibitors of SIRT2. Herein the authors report novel chroman-4-one and chromone-based SIRT2 inhibitors containing various heterofunctionalities to improve pharmacokinetic properties. The compounds retained both high SIRT2 selectivity and potent inhibitory activity. Two compounds (L and II) were tested for their antiproliferative effects in breast cancer (MCF-7) and lung carcinoma (A549) cell lines. Both compounds showed antiproliferative effects correlating with their SIRT2 inhibition potency. They also increased the acetylation level of  $\alpha$ -tubulin, indicating that SIRT2 is likely to be the target in cancer cells. A binding mode of the inhibitors that is consistent with the SAR data was proposed based on a homol. model of SIRT2." A chemical structure of a chroman-4-one derivative is shown below the abstract.

The screenshot shows the SciFinder Substances page with 222 results. It displays a grid of chemical structures, each with a unique SciFinder ID and associated data. The first row includes:

- 1190882-42-8: 1 Reference, 2 Reactions, 2 Suppliers
- 1057649-28-1: 3 References, 6 Reactions, 2 Suppliers
- 1089662-03-2: 1 Reference, 1 Reaction, 2 Suppliers

The second row includes:

- 1057649-30-5: 1 Reference, 3 Reactions, 2 Suppliers
- 1089662-47-4: 1 Reference, 1 Reaction, 2 Suppliers
- 1057649-32-7: 1 Reference, 3 Reactions, 2 Suppliers

Each entry includes a chemical structure, a "View Detail" link, and icons for references, reactions, and suppliers.

The screenshot shows the SciFinder Reactions page with 14 results. It displays three reaction schemes, each with a chemical structure and associated data. The first scheme is labeled "Scheme 1 (1 Reaction) View" and shows a chemical reaction with a yield of 94% and 1 step. The second scheme is labeled "Scheme 2 (1 Reaction) View" and shows a chemical reaction with a yield of 94% and 1 step. The third scheme is labeled "Scheme 3 (1 Reaction) View" and shows a chemical reaction with 2 suppliers for the starting material and 15 suppliers for the product. Each scheme includes an "Expand Scheme" link and a "Suppliers" button.

# Synthetic Planning

## SciFinder<sup>n</sup> halves the time required for synthetic planning<sup>10</sup>

Being successful in the lab requires a great synthetic plan. Your chemists are juggling many variables especially when devising routes to novel compounds with no literature-based precedent. For both known and unknown molecules, SciFinder<sup>n</sup> will perform a full retrosynthetic analysis fueled by the renowned CAS collection of reactions. The best potential synthetic routes are determined based on steps from both the literature and predicted steps generated by our synthetic chemistry engine. The plan is easily navigated to evaluate alternative routes and also offers quick access to information on material suppliers, step-by-step methods curated by experts, product yields, and more.

Experimental Protocols	
MethodsNow™	
Products	p-Terphenyl, Yield: 100%
Reactants	Iodobenzene 4-Biphenylboronic acid
Reagents	Potassium carbonate
Catalysts	Palladium Graphene
Solvents	Dimethylformamide Water
Procedure	1. Mix a DMF solution of iodobenzene (0.25 M) and arylboronic acid (0.30 M) with isopyknic aqueous solution of K <sub>2</sub> CO <sub>3</sub> (0.75 M). 2. Pump the mixture into the reactor with a controllable flow velocity. 3. Integrate the reactor with Pd/GN catalysts pre-heated to 90 °C for 6 min in an oil bath. 4. Extract the products of the reaction with ethyl acetate. 5. Purify the product by a microcolumn filled with silica gel to obtain the product.

Retrosynthesis Edit Plan Options

Overview Steps

Step Key: Experimental

Plan Information: Estimated Yield: 33%, Overall Price: \$57.48 (USD per 100 grams), Commercially Available: C, D, E, F

# IP Strategy

## SciFinder<sup>n</sup> reduces the time taken to analyze the IP landscape by nearly 10%<sup>10</sup>

In order to successfully manage your research portfolio and bring your innovation to market, it's essential to first understand the technology landscape. SciFinder<sup>n</sup> can help answer a host of IP-related questions such as: Where are the opportunities for innovation? Are there infringement risks? Who else is working in this space? SciFinder<sup>n</sup> gives you access to industry leading capabilities like patent Markush searching and content such as chemically annotated patents, so you can stay on top of the technological landscape.

Patent Markush Match: As Drawn (6)

Substructure (151)

Filter by: Patent Office: World Intellectual Property Organization (5), Korea, Republic of (1)

Patent Markush (6)

References: KR2010125109

Patent claim 1: 54: alkyl<containing 1-10 C> (opt. subst. by G2), 119: alkyl<containing 1-10 C> (opt. subst. by G2)

Key Substances in Patent: CAS RN: 47036-17-3, CAS RN: 160207-24-9, CAS RN: 581907-29-4

Step 2: 5 [0078] Dry K<sub>2</sub>CO<sub>3</sub> (10 g, 0.072 mol) in NMP (60 mL, 0.626 mol) was heated to 165°C for 1 hr under nitrogen. N-(2-Methoxy-4-nitrophenyl)pyrrolidine (20 g, 0.090 mol) and thiophenol (28 mL, 0.272 mol) were added with stirring at 165°C. Stirring was continued for 2 hr at 150°C. The mixture was cooled to room temperature, neutralized with 1.5 N HCl and extracted with ether. The ether layer was washed with water, brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated. The dark red product obtained was purified by column chromatography using petroleum ether-ethylacetate (9:1) as eluent. Yield: 11.5 g, 61.5%.

Step 3: 15 [0079] N-(2-Hydroxy-4-nitrophenyl)pyrrolidine (5 g, 0.024 mol), racemic-epichlorohydrin (40 mL) and catalytic amount of tetrabutylammonium bromide (60 mg) in 100 mL 3N flask was heated at 50 °C with stirring for 30 min. NaOH (2.3 g, 0.058 mol) in water (5 mL) was added slowly over 15 min. Stirring was continued at 50°C for 15 hr. Water (100 mL) was added, extracted with chloroform, washed with water, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated. The crude epoxide was purified by column chromatography using 9.5:0.5 petroleum ether:ethylacetate as eluent. Yield: 2.7 g, 43%.

## Sources

1. <https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/pharmas-first-to-market-advantage>
2. Drug Discovery World Fall 2004, Failure rates in drug discovery and development: will we ever get any better?
3. <https://www.hhrjournal.org/2017/11/patent-fighters-taking-on-big-pharma>
4. SciFinder user survey of top discovery research organizations
5. Average hourly cost for fully-loaded, full-time researcher
6. CAS Proprietary data, CAS Analytics & Insights
7. Tufts Center for the Study of Drug Development
8. Tufts Center for the Study of Drug Development
9. CAS Market Analysis
10. Research Report, "SciFinder<sup>®</sup> Improves R&D Productivity", <https://www.cas.org/resources/whitepapers/scifinder-n-improves-productivity>
11. Pharm Exec's Top 50 Companies 2017
12. The Top Biotech Companies of 2017
13. C&EN's Global Top 50
14. WIPO IP Facts and Figures 2018
15. Shanghai Ranking's Global Ranking of Academic Subjects 2017 – Chemistry

# INDUSTRY LEADERS ACROSS R&D ORGANIZATIONS RELY ON CAS SOLUTIONS

## Pharma

48 of the top 50 <sup>10</sup>

## Biotech

20 of the top 25 <sup>11</sup>

## Chemical

48 of the top 50 <sup>12</sup>

## Government

10 of the top 10  
global patent offices <sup>13</sup>

## Academic

100 of the top 100 <sup>14</sup>



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STRATEGY CONVERGE

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