



BeyondSpring

Plinabulin DUBLIN-3 NSCLC Topline Data



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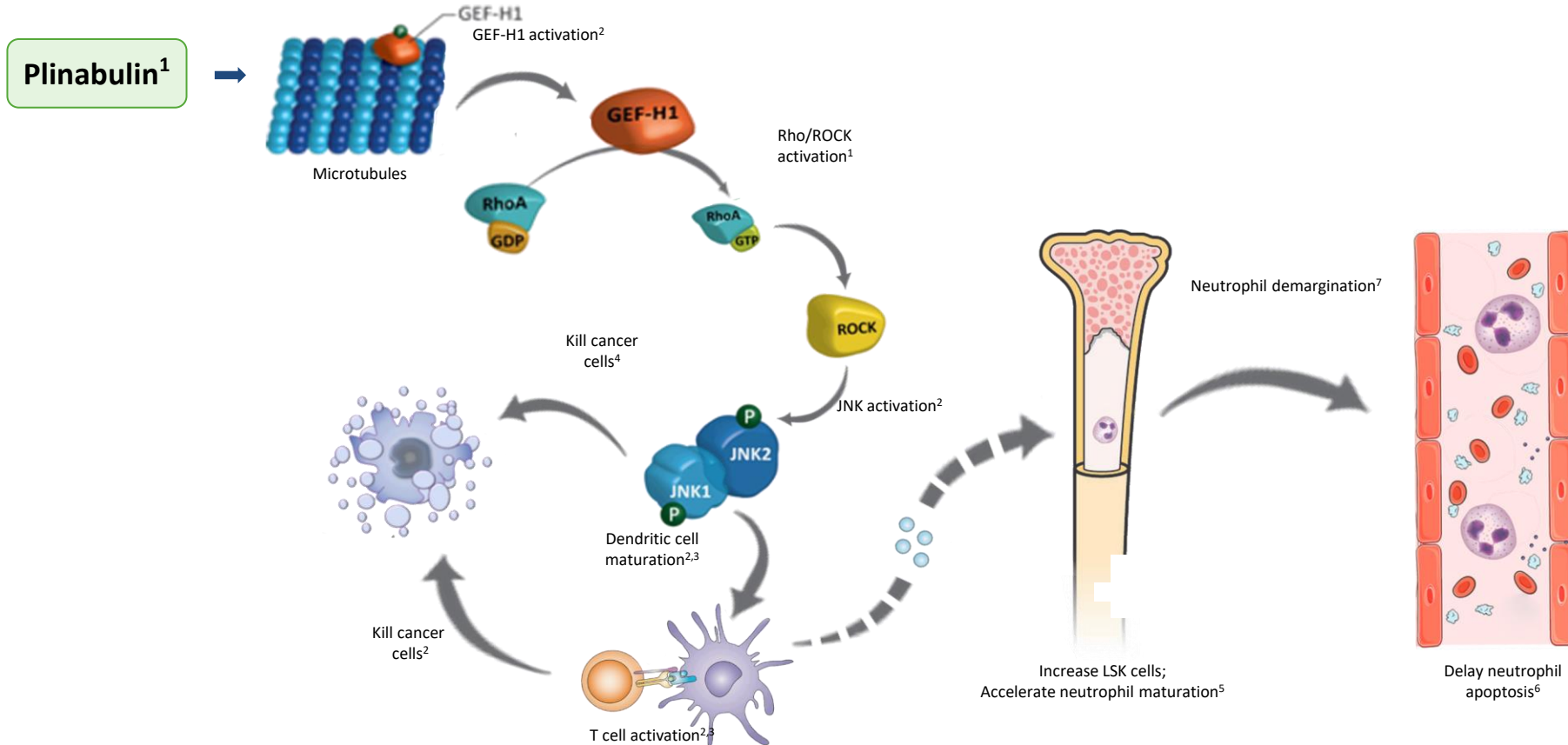
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Plinabulin: First-in-Class, Selective Immunomodulating Microtubule-Binding Agent (SIMBA) - Potent Antigen Presenting Cell (APC) inducer



Plinabulin Novel Target: Immune Defense Protein GEF-H1

Chem | **CellPress**

Article
Structure, Thermodynamics, and Kinetics of Plinabulin Binding to Two Tubulin Isotypes

Highlights
Plinabulin is a phase 3 anticancer and antiangiogenesis drug candidate. We report crystal structures of plinabulin in complex with β II and β III tubulin isotypes. We performed thermodynamic and kinetic studies on plinabulin selectivity and mechanism of action.

Plinabulin is a novel tubulin-binding agent that is currently in phase 3 clinical trials for cancer treatment and prevention of chemotherapy-induced neutropenia. Plinabulin binds within a distinct tubulin pocket, which differentiates it from other tubulin binders. Aimed at dissecting structural and energetic details of plinabulin binding to tubulin, we combine X-ray crystallography and computational modeling. We compare the plinabulin residence time with that of colchicine and combrestatine A4. Our study helps understand potential mechanisms underlying differential effects of this family of anti-tubulin drugs.

La Sala et al., *Chem* 5, 1-8, November 15, 2018 © 2018 Elsevier Inc. <https://doi.org/10.1016/j.chem.2018.08.007>

Cell Reports | **Article**

GEF-H1 Signaling upon Microtubule Destabilization Is Required for Dendritic Cell Activation and Specific Anti-tumor Responses

Graphical Abstract
Immature DC → MDA → GEF-H1 → RhoA → JNK → CTL → tumor killing. Mature DC → MDA → GEF-H1 → RhoA → JNK → CTL → tumor killing.

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In Brief
Certain chemotherapeutics elicit potent anti-tumor immunity. Kashyap et al. demonstrate that microtubule-destabilizing chemotherapeutics induce maturation of dendritic cells through activation of microtubule-associated protein GEF-H1. This leads to effective priming of CD8 T cells against tumor antigens. GEF-H1 is critical for anti-tumor immunity of microtubule-targeting chemotherapy.

Highlights
• Microtubule destabilization in dendritic cells drives DC maturation and T cell activation
• GEF-H1 is released from microtubules, leading to its activation
• GEF-H1 release triggers the RhoA-JNK-c-Jun signaling axis and AP-1 transcriptional response
• GEF-H1 is critical for DC maturation, antigen cross-presentation, and anti-tumor immunity

Kashyap et al., 2019, *Cell Reports* 28, 3307-3320, September 24, 2019 © 2019 The Author(s). <https://doi.org/10.1016/j.celrep.2019.08.037>

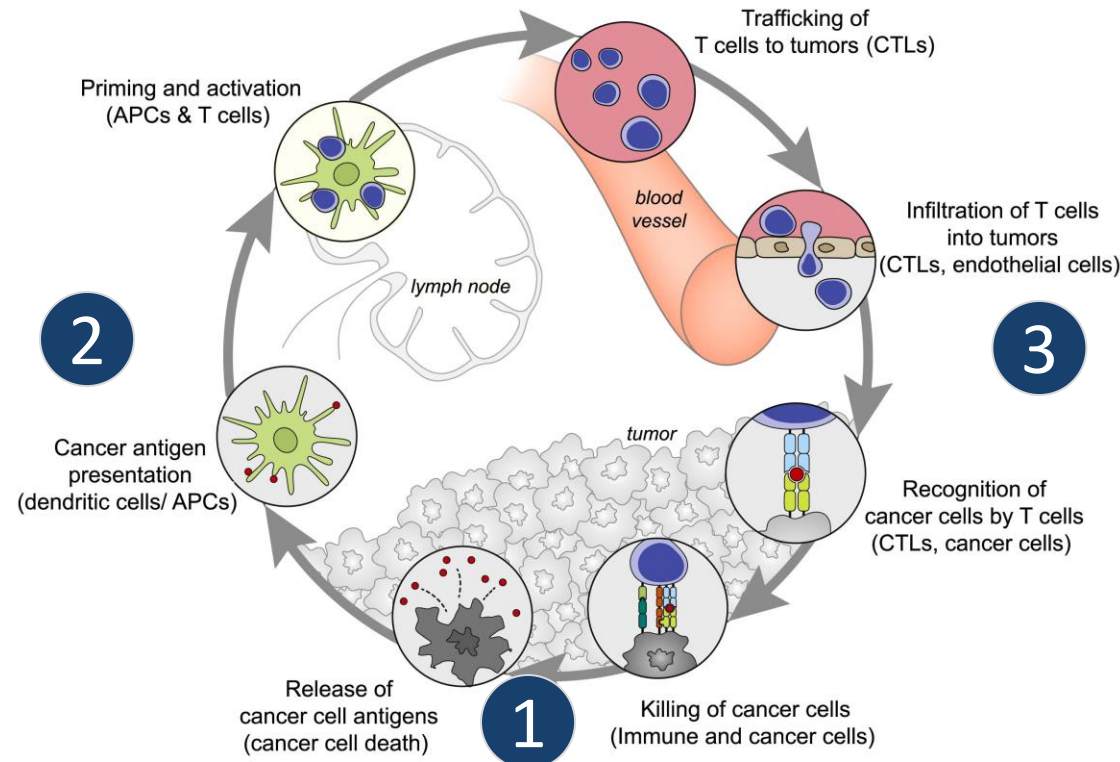
CellPress

Plinabulin Induces Dendritic Cell Maturation (the most potent APC), a Key Step in Initiating Anti-cancer Durable Response

2 Plinabulin

Stimulate maturation of dendritic cells to increase antigen presentation

Dendritic cells are the most important antigen-presenting cells



3 Checkpoint Inhibitors

Optimize T cell response

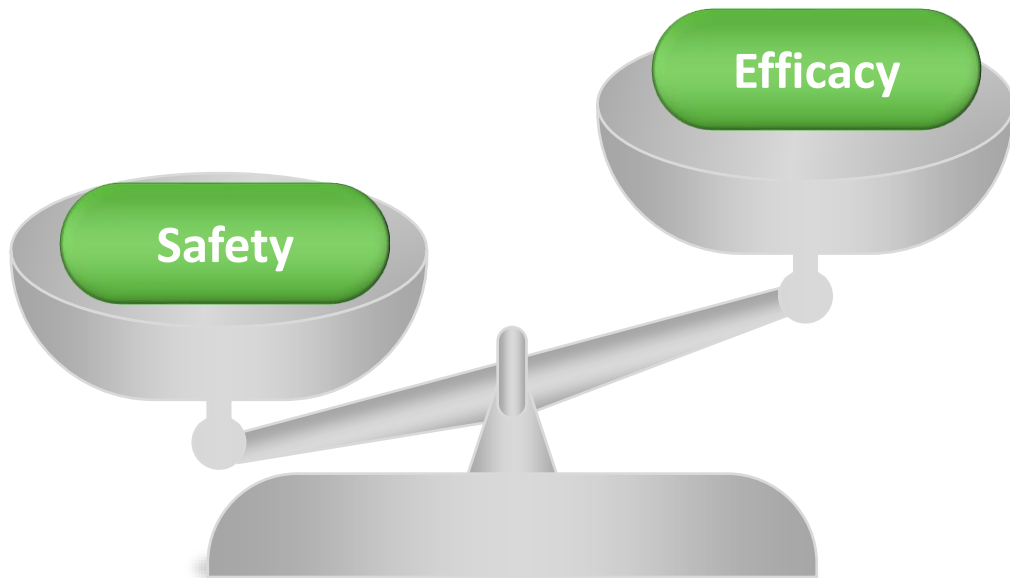
1 Radiation/Chemotherapy/Plinabulin

Release Tumor Antigens

For more potent anti-cancer effect

1 + 2 + 3 → Optimal Immuno-Oncology Response

Severely Unmet Medical Need – 2nd/3rd Line NSCLC, EGFR Wild Type



- Large patient population with limited treatment options
 - EGFR wild type: ~85% western NSCLC and ~70% of Asian NSCLC patients
 - With immunotherapies moved to first line, Docetaxel-based therapies are the mainstay therapy
 - TKIs are worse than docetaxel¹
- Docetaxel-based Therapies (SOC)
 - Limited efficacy
 - >40% severe neutropenia

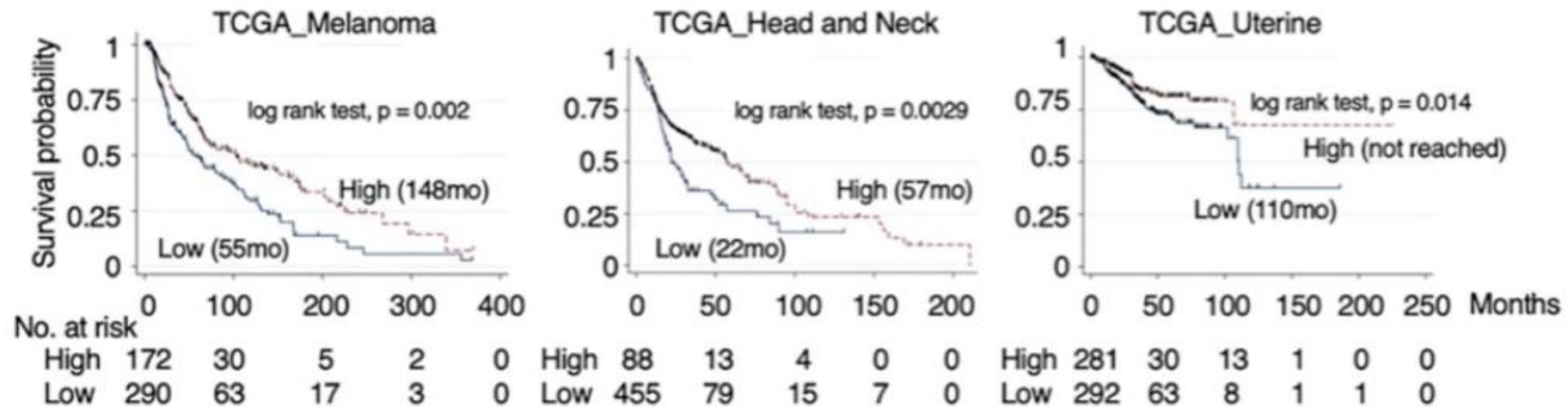
Since nivolumab was approved 6 years ago, no new agent with novel mechanism has been approved in this indication.



Plinabulin Activates GEF-H1¹

Patients with High GEF-H1 Immune Signature Live Longer in Various Cancers¹

Upper OS curve: GEF-H1 immune signature high **Lower OS curve:** GEF-H1 immune signature low



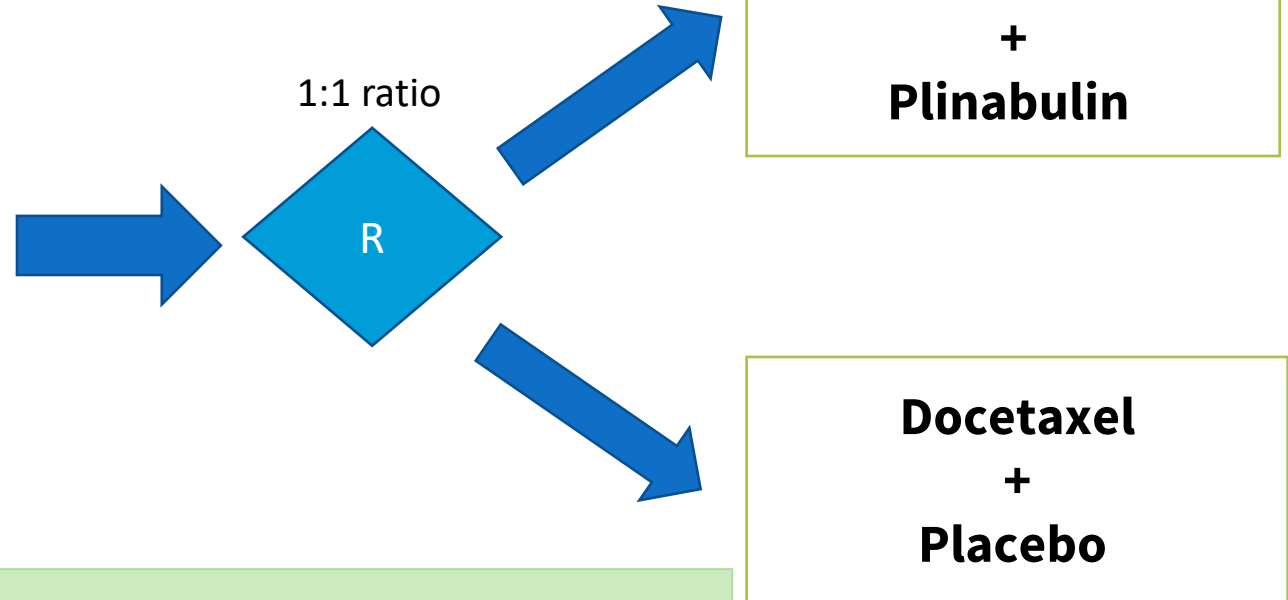
Based on Plinabulin's Immune MOA, patients with measurable lung lesion were selected prospectively for Dublin-3 Study.

Docetaxel + Plinabulin Compared to Docetaxel + Placebo in Patients With 2nd/3rd line NSCLC, EGFR wild type (DUBLIN-3)



Global, Randomized, Single-Blinded (blinding for patients only)
Stratified for: Region (Asia/non-Asia), Prior Line, ECOG score
60 sites: U.S., China, and Australia

- Non-squamous or squamous **NSCLC**
- Stage IIIb/IV
- ECOG performance status ≤ 2
- Progression during or after treatment with one or two treatment regimen containing platinum
- Must have at least one measurable lung lesion
- Prior checkpoint inhibitor therapy allowed



Primary Endpoint: Overall Survival

Secondary Endpoints:

- ORR, PFS
- Percent of patients without severe neutropenia on Day 8 of Cycle 1
- Month 24 OS rate, Month 36 OS rate
- DoR
- Q-TWiST
- QoL
- Proportion of patients who received docetaxel >8 cycles, >10 cycles, and >12 cycles

Dublin-3 Phase 3 Topline Data

- Significant Improvement in OS, PFS, ORR, 24 M, 36 M OS Rate (Combo vs. Docetaxel)
- Significant Reduction in Grade 4 Neutropenia (Combo vs. Docetaxel)

Primary Endpoint	Docetaxel (75 mg/m ²) N=281	Plinabulin (30 mg/m ²) + Docetaxel (75 mg/m ²) N=278
OS (months or M)		Mean OS, p=0.03 OS Log-rank p<0.04; HR = 0.82

Doubling OS rate in 24 M, 36 M, and 10.6% >48 M OS rate – Plinabulin Immune Durable Anti-cancer Benefit

Secondary Endpoint - Hierarchy Order	Docetaxel N=281	Plinabulin (30 mg/m ²) + Docetaxel (75 mg/m ²) N=278
ORR (%)		P <0.03
PFS (months or M)		P<0.01
Grade 4 neutropenia, cycle 1 Day 8 (%)	27.8%	5.3%; p<0.0001
24 Month OS Rate (%)	12.5%	22.1%; p<0.01
36 Month OS Rate (%)	5.3%	11.7%; p<0.04
48 Month OS Rate (%) - exploratory	0%	10.6%; p value cannot be calculated

OS Analysis Method Based on Relevance



1. Mean OS p value – Most Relevant for immune agent with more longer survival patients

- Analysis method stated in Statistical Analysis Plan (SAP); the data will be included in Clinical Study Report (CSR)

Mean OS takes into consideration all patients' overall survival time and censoring time. It is stated in SAP to use restricted mean survival time (RMST) methods to analyze the mean OS; the expected survival time for the two treatments were compared, restricted to the maximum follow-up time for the study.

2. OS Log-rank p value – Relevant as it takes into account the whole OS K-M curve

- Analysis method stated in SAP; the data will be included in CSR
- OS log-rank p value needs to be $p < 0.046$, 2-sided test, to meet statistical significance due to adjustment for prespecified interim looks

OS Log rank method is one of the most popular methods of comparing the survival for treatments, which takes the whole follow-up period into account. It is a nonparametric method and has the considerable advantage that it does not require knowing anything about the shape of the survival curve or the distribution of survival times.

3. OS Hazard Ratio (HR) – Not Relevant for immune agent with more longer survival patients

- Per the SAP, HR would not be presented in the CSR if it fails Cox proportional hazard ratio assumption. Since Plinabulin is an immune agent with treatment effects that vary over different time points, the assumption failed; thus, the HR will not be included in the CSR.

Hazard ratio (e.g., hazard under active treatment/hazard under control) is often used to characterize the treatment effects for survival data. It is derived under Cox proportional hazard ratio (HR) assumptions. Under this assumption, the HR is the same at all timepoints (i.e., the treatment effect in terms of improving hazard is the same at all timepoints). The assumption fails to hold if the HR varies over timepoints (i.e., the treatment effects vary over different timepoints). In fact, Cox proportional hazard ratio assumption often fails for immune anticancer treatments, including plinabulin, as these treatments have greater effects in the later part of the survival curve than in the earlier part. Clearly, in this situation, the single HR number derived under Cox proportional hazard ratio assumption is not relevant to consider.

Product Profile (Plinabulin + Docetaxel for 2nd/3rd line NSCLC, EGFR wild type)

Next steps: Discuss filing plan with FDA & NMPA in 2021 with potential filing 1H 2022

Docetaxel (Current SOC)

- Modest survival benefit
- Severe safety concerns, e.g., CIN
- Poor Quality of Life

Plinabulin - Docetaxel Combination

- Survival benefit, with longer survival due to GEF-H1 I/O MOA
- Favorable safety profile, including significant CIN reduction
- Improved quality of life

- **Lower Grade 4 AE frequency and a shift to lower grade AE**
- **No unexpected AE concerns were identified**

Plinabulin: potential as the “Cornerstone” Therapy to Add onto Current IO Therapies to Address Severe Unmet Medical Needs



PD-1/PD-L1 Inhibitors
- \$30 B global annual sales

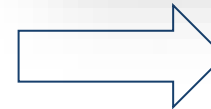


Potential to greatly expand
the addressable market

Current Severe Unmet Medical Needs

- PD-1/PD-L1 resistant patients need later line therapies
- PD-1 + chemo double efficacy of PD-1, but with CIN risk
- PD-1 or PD-1+CTLA-4 with high ir-SAE
- PD-1/PD-L1 non-responsive tumor;
- Patients who cannot use PD-1/PD-L1

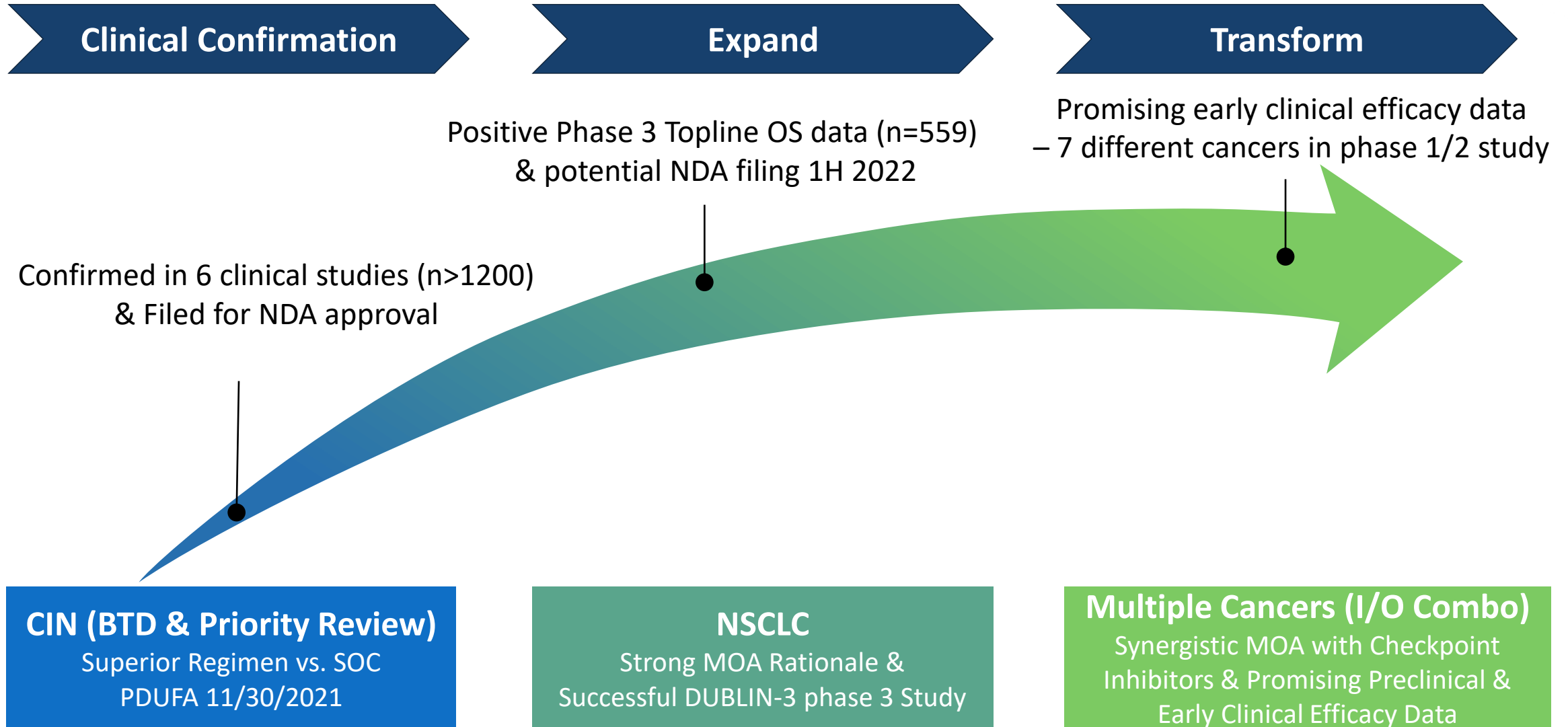
+“Easy-
to-use”
APC
Inducer



Plinabulin Clinical Development

- Plinabulin + I/O + chemo/radiation
- Plinabulin is developed as a CIN prevention agent (pan cancer, pan chemo)
- Plinabulin+PD-1+CTLA-4 in SCLC
- Plinabulin+ I/O + chemo/radiation
- Plinabulin + chemo

Plinabulin Franchise: Pipeline in a Drug





thank you!

www.beyondspringpharma.com