

Biotechnology Entrepreneurship Boot Camp

Session 5: Regulatory Planning for the US Market - Implications for Strategy and Financing

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FDA Organization

Office of the Commissioner

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graph TD; A[Office of the Commissioner] --> B[Office of Medical Products and Tobacco]; B --> C[Center for Biologics Evaluation and Research]; B --> D[Center for Drug Evaluation and Research]; B --> E[Center for Devices and Radiological Health]; B --> F[Center for Tobacco Products];
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Office of Medical Products and Tobacco

**Center for Biologics
Evaluation and Research**

**Center for Drug
Evaluation and Research**

**Center for Devices and
Radiological Health**

Center for Tobacco Products

FDA Organization (cont.)

Office of the Commissioner

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graph TD; A[Office of the Commissioner] --> B[Office of Foods and Veterinary Medicine]; B --> C[Center for Veterinary Medicine]; B --> D[Center for Food Safety and Applied Nutrition];
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Office of Foods and Veterinary Medicine

Center for Veterinary Medicine

Center for Food Safety and Applied Nutrition

FDA Organization (cont.)

Office of the Commissioner

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graph TD; A[Office of the Commissioner] --- B[Office of Global Regulatory Operations and Policy]; B --- C[Office of International Programs]; B --- D[Office of Regulatory Affairs];
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**Office of Global Regulatory Operations
and Policy**

Office of International Programs

Office of Regulatory Affairs

FDA Organization (cont.)

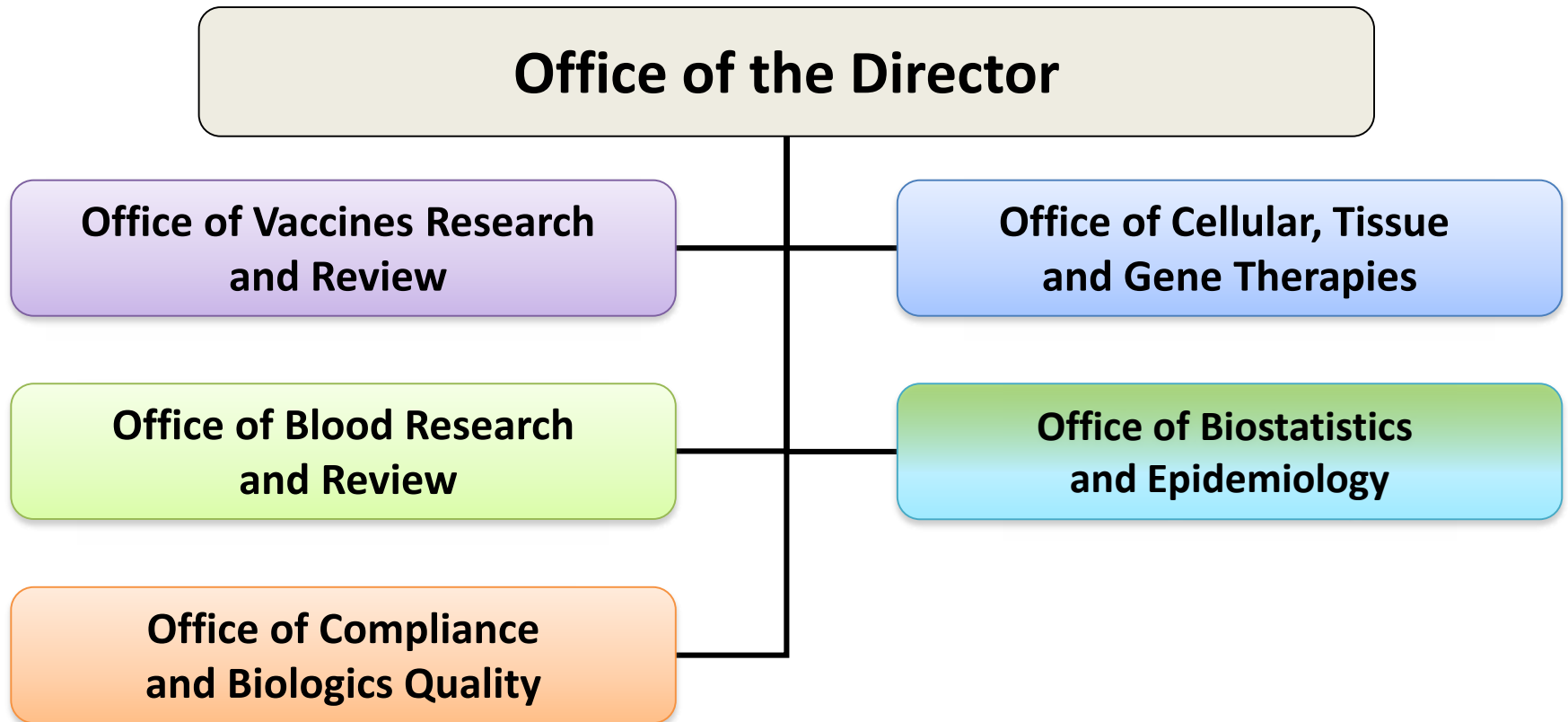
Office of the Commissioner

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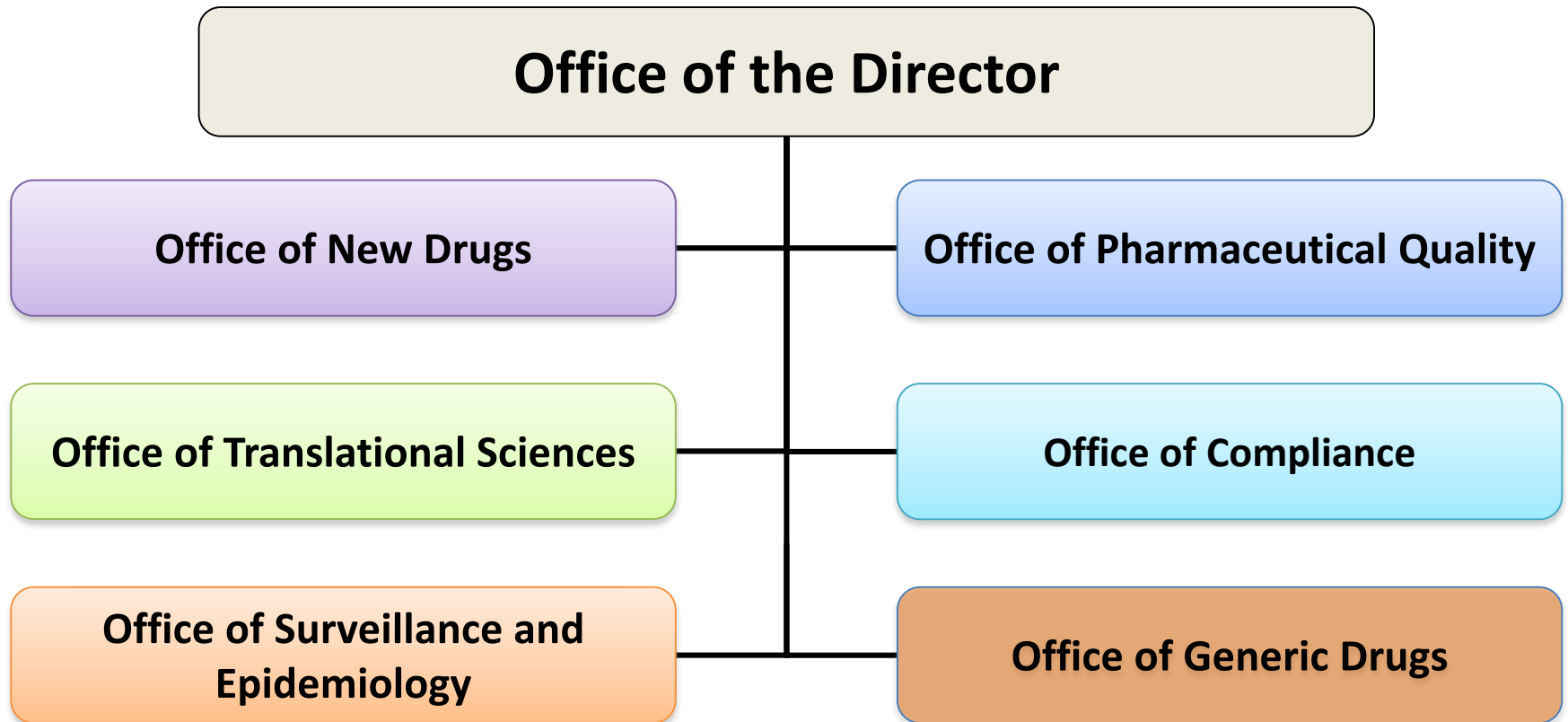
Office of Operations

**Office of Policy, Planning,
Legislation and Analysis**

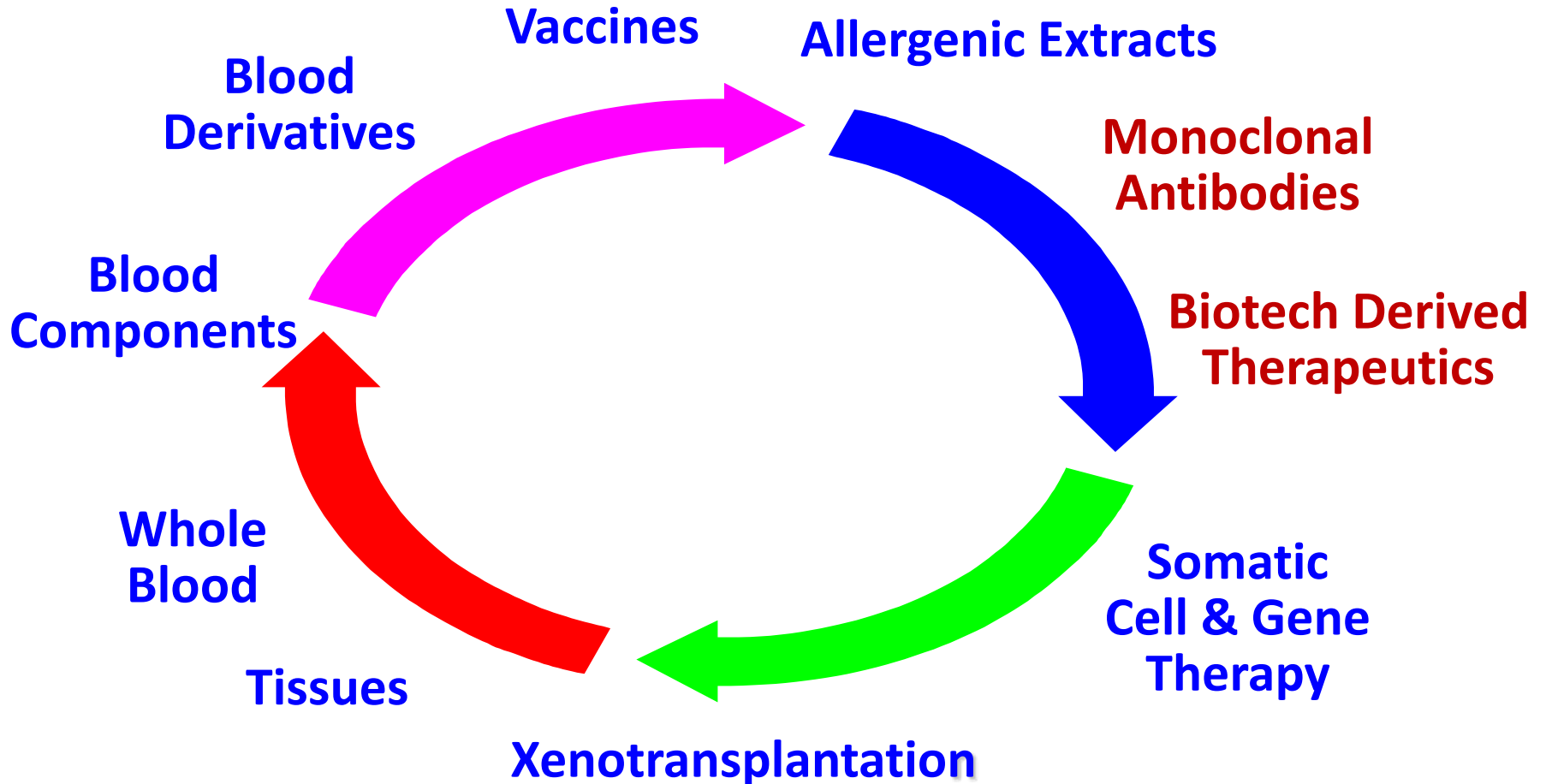
CBER Organization



CDER Organization



BIOLOGICAL PRODUCTS REGULATED BY CBER or CDER



Acts & Regulations Pertinent to Biological Product Development

- PHS Act (42 USC 262-63) Section 351
- FD & C Act (21 USC 301-392)
- FDAMA, 1997
 - Risk-based review of medical devices
 - Exemption for pharmacy compounding
 - Reauthorization of user fee for drugs
- FDAAA, 2007
 - Reauthorization of user fee for drugs and medical devices
 - Reauthorization of Best Pharmaceuticals for Children Act and Pediatric Research Equity Act
- FDASIA, 2012
 - User fee for generic drugs, biosimilar drugs
 - Reauthorization of user fee for drugs and medical devices

Acts & Regulations Pertinent to Biological Product Development

➤ 21 CFR

- 21 CFR 600-680 Biological Product Standards
- 21 CFR 314.126 Adequate and well-controlled trials
- 21 CFR 312 Investigational New Drug Application
- 21 CFR 210-211 Good Manufacturing Practices
- 21 CFR 58 Good Laboratory Practices
- 21 CFR 56 Institutional Review Boards
- 21 CFR 50 Protection of Human Subjects

Current Regulatory Pathways

➤ Biologic Products:

- IND – Investigational New Drug Application (21 CFR 312)
- BLA – Biologics License Application (21 CFR 600-680)

➤ Drugs:

- IND - Investigational New Drug Application (21 CFR 312)
- NDA – New Drug Application (21 CFR 314)

➤ Medical Devices:

- 510(k) – (21 CFR 807)
- IDE – Investigational Device Exemption (21 CFR 812)
- PMA – Pre-Market Application (21 CFR 814)

Drug or Biologic - What difference does it make?

➤ IND PHASE

- Identical Regulations for Drugs and Biologics - 21 CFR 312
- Differences in emphasis and expectations of review divisions

➤ APPLICATION PHASE

- DRUGS: New Drug Application (NDA) Regulations - 21 CFR 314
- BIOLOGICS: Biologics Licensing Regulations - 21 CFR 601
- Harmonized Application Form - Form 356h; Drugs - NDA; Biologics-BLA

➤ POST APPROVAL PHASE

- DRUGS: Inspections, Annual Reports, Manufacturing changes (§ 314.70)
- BIOLOGICS: Inspections, Lot release, Manufacturing changes (§ 601.12)

Laws, Regulations, Guidance

➤ LAWS:

- Public Health Services Act ([Biologics](#))
- Food, Drug and Cosmetic Act (Drugs)

➤ REGULATIONS:

- Code of Federal Regulations (CFR)
- Proposed rule – Comments – Final rule
- Title 21 – Food and Drug Administration Regulations
- 21 CFR 600 – Biological Products : General

➤ GUIDANCE:

- Represents FDA current thinking on a specific topic.
Does not confer any rights and does not bind the FDA or the company

Therapeutic Biological Products: CDER

- Monoclonal antibodies for in vivo use
- Proteins intended for therapeutic use, including cytokines (e.g. interferons), enzymes (e.g. thrombolytics), and other novel proteins, except for those assigned to CBER (e.g., vaccines and blood products). This category includes therapeutic proteins derived from plants, animals, microorganisms, and recombinant versions of these products
- Immunomodulators (non-vaccine and non-allergenic products intended to treat disease by inhibiting or modifying a pre-existing immune response)
- Growth factors, cytokines, and monoclonal antibodies intended to mobilize, stimulate, decrease or otherwise alter the production of hematopoietic cells in vivo

Therapeutic Biological Products: CBER

- Cellular Products, including products composed of human, bacterial or animal cells or from physical parts of those cells
- Gene Therapy Products
- Vaccines
- Allergenic Extracts
- Antitoxins, antivenins, and venoms
- Blood, blood components, plasma derived products including recombinant and transgenic versions of plasma derivatives, blood substitutes, plasma volume expanders, human or animal polyclonal antibody preparations, and certain fibrinolytics such as plasma-derived plasmin, and red cell reagents.

TRANSLATIONAL DEVELOPMENT

Discovery
Research



Regulated Product
Development

Empirical, trial
& error, unregulated
environment

Structured, highly
regulated
environment

Translational Development – Regulatory Challenges



- GLP
- Choice of animal model/species
- GMP
- GCP
- INDs, BLAs, NDAs

Comprehensive Product Development Planning and Management

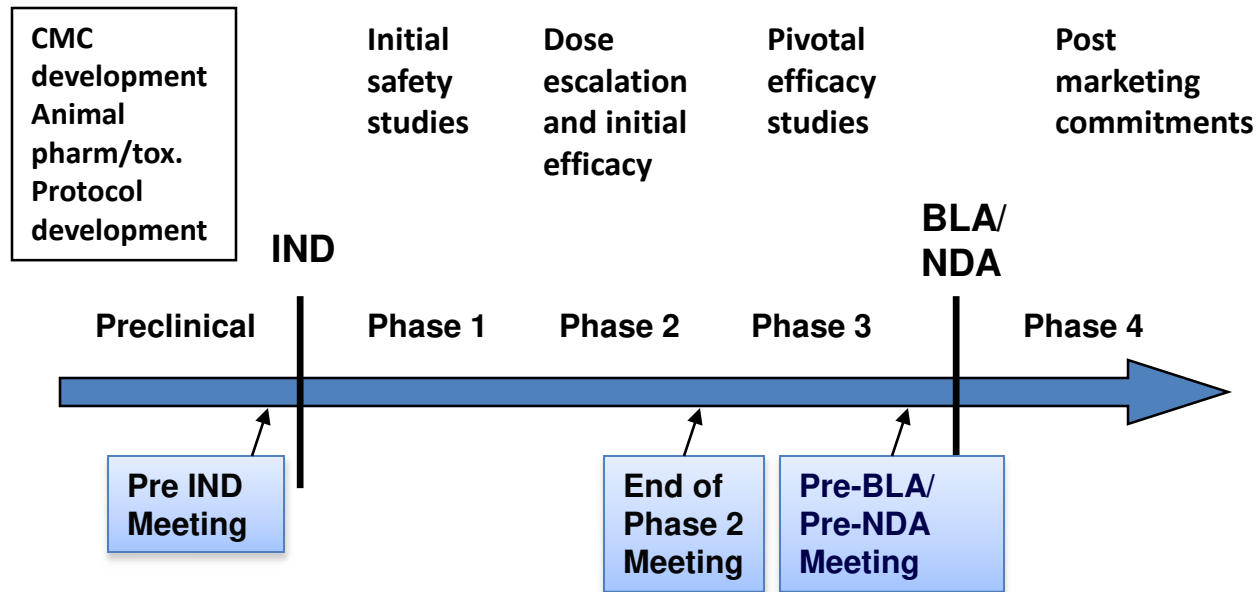
- Gap Analysis of all development areas
- Team approach to development management
 - Preclinical, CMC, clinical, project management

What is required to make the transition?

- Comprehensive Product Development Planning based on understanding of FDA regulations and expectations
- Effective communication with the FDA to assure concurrence with development plans
- Project management expertise to oversee execution of Product Development Plan
- Upper management support – Product development is a team effort and success is highly dependent on availability of appropriate resources and by upper management support

Product Development Phases

SPONSOR:



FDA:

30 Day
Safety
Review

Review amendments, annual
reports, safety reports

6-10
Month
Review

Review Phase 4
study reports

Product Development Phases

- Discovery/Basic Research – (pre-IND)
 - No FDA Oversight – HOWEVER , failure to appreciate the regulatory requirements for future product development can result in significant delays when attempting to transition a product from the research lab to the clinic
- Process and Analytical Development (pre & post IND)
 - Process – Development & Optimization
 - Manufacturing consistency
 - Assays – Development & Specifications
 - Identity, Purity, Potency
 - Stability indicating
 - Drug Substance (Bulk Substance) and Drug Product Characterization

Product Development Phases

- Preclinical Animal Studies (pre-IND)
 - Proof-of-Concept
 - Toxicology
 - Safety Pharmacology
- IND Submission
- Clinical Trials
 - Phase 0, 1, 2 & 3
- Product Approval/Licensure
- Post-Marketing Studies (Phase 4)

Product Development Regulatory Goals

- Develop a reproducible process that can yield a consistent product and that can be run under GMPs
- Develop analytical procedures that can reliably measure product parameters, that are stability indicating, and can demonstrate product comparability following manufacturing/facility/equipment changes
- Develop animal models that can demonstrate proof-of concept and safety
- Demonstrate safety and efficacy in clinical trials

A Poor Regulatory Strategy Has a Significant, Negative Financial Impact

CAUSE

- ▼ Inadequate Animal Studies
- ▼ Inadequate Bench Testing
- ▼ Poor characterization
- ▼ Poor validation

- ▼ Clinical Study Delays
- ▼ Poor Enrollment
- ▼ Clinical Hold
- ▼ Clinical Supply Shortages



EFFECT

Private company:

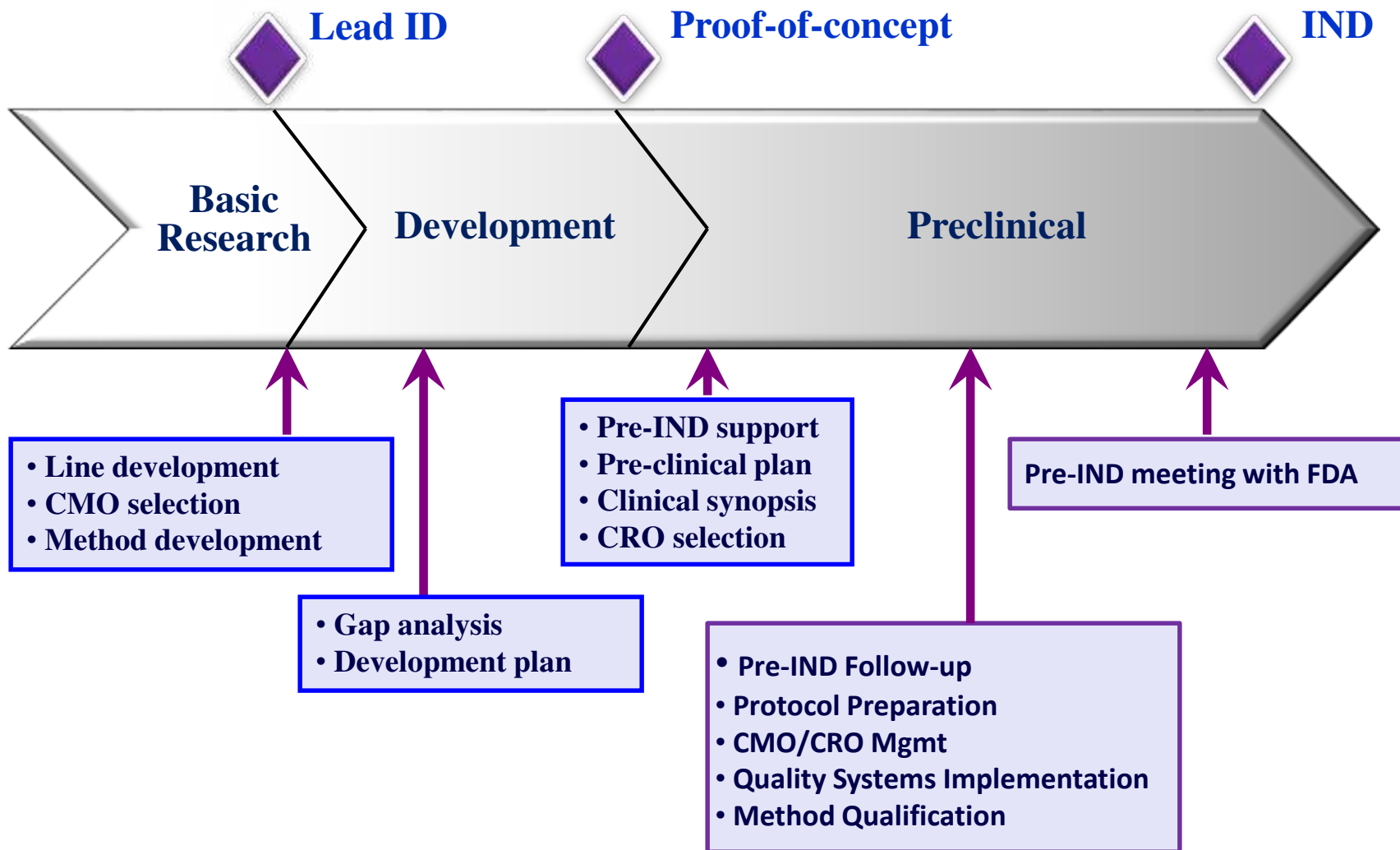
- Shut the doors
- Bridge financing may be needed
- IPO/M&A less likely

Public company:

- Decreased market cap
- Secondary offerings less likely
- Loss of confidence by public markets

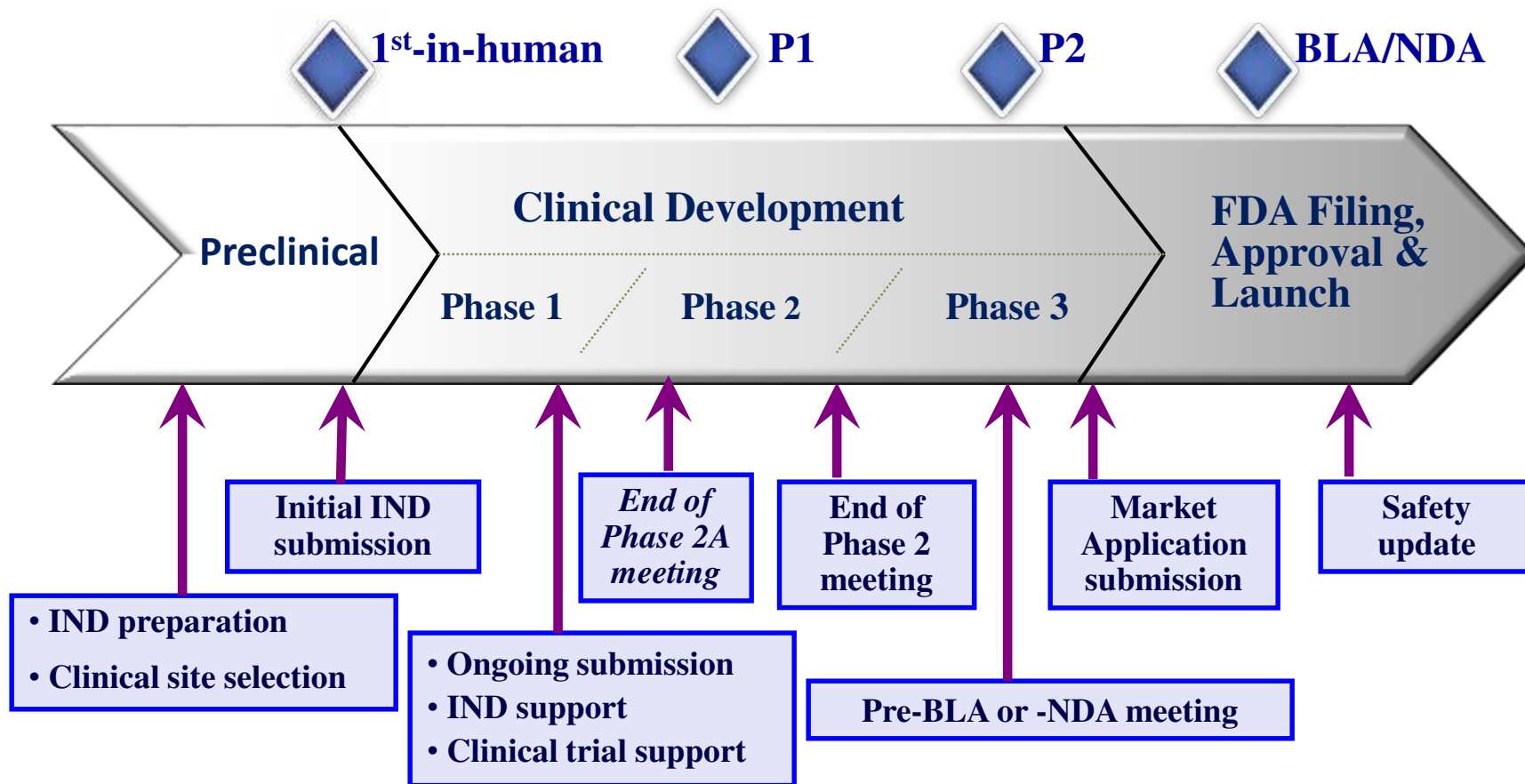
Regulatory Affairs Impact

Key Early Development Milestones



Regulatory Affairs Impact

Key Clinical Development Milestones



FDA Expedited Review Pathways

Accelerated Approval

- Approval of drugs/biologics for serious conditions that fill an unmet medical need based on a surrogate endpoint.

Fast Track

- Review process designed to facilitate the development, and expedite the review of drugs to treat serious conditions and fill an unmet medical need.

Breakthrough Therapy

- A designation designed to expedite the development and review of drugs which may demonstrate substantial improvement over available therapy.

Priority Review

- A review designation whereby FDA's goal is to take action on an application within 6 months.

Product Development Planning

- Product Planning is critical to any organization, and a well-conceived and comprehensive *Product Development Plan (PDP)* can provide a detailed assessment of your product and the most effective pathway to licensure/approval.

What is a Product Development Plan?

- A “roadmap” for your product’s development
- A concise, product-focused strategic document laying out the path to licensure/approval
- A detailed analysis of your product status and developmental requirements, including the four primary aspects of product development: Manufacturing, Preclinical, Regulatory and Clinical Development
- An integrated stand-alone document tying the four main areas of product development with budgets, tasks and timelines through Phase 1 or beyond

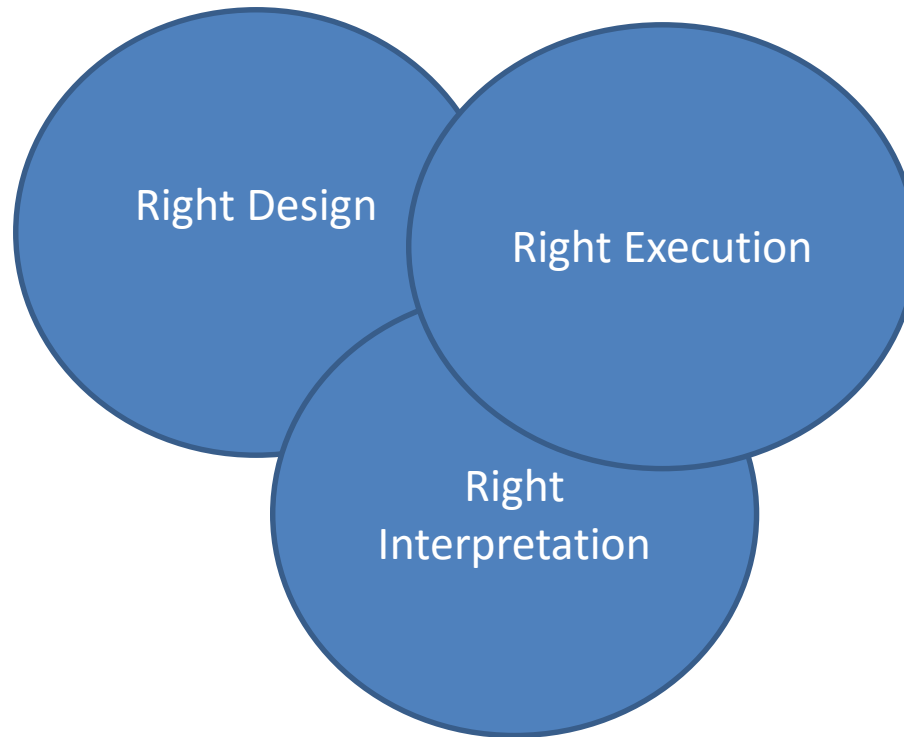
Why Develop a Product Development Plan?

- Planning is crucial at every stage of development, particularly at the outset
- Provides a concise detailed analysis of your product and the roadmap to market
- Clearly states developmental objectives and crucial milestones
- Presents a single (or multiple, if desired) focused regulatory strategy for presenting your product to the FDA
- Presents strategies for dealing with potential roadblocks and hurdles in the product development process
- Lays out accurate and realistic budgets and timelines through clinical development

Typical PDP Content

- Background and Product Assessment
- Manufacturing Development Plan
- Preclinical Development Plan
- Clinical Development Plan
- Regulatory Development
- Project Management
- Budget
- Timelines

What you need for a successful PDP



Biosimilar Products in the US

BPCI

- The Biologics Price Competition and Innovation Act of 2009 (BPCI Act) was passed as part of health reform (Affordable Care Act) that was signed into law on March 23, 2010
- BPCI Act creates an *abbreviated licensure pathway for biological products shown to be biosimilar to or interchangeable with* an FDA-licensed reference product

Take Home Message

- The goal is to **demonstrate biosimilarity** between the proposed product and a reference product
- The goal is **not** to independently establish safety and effectiveness of the proposed product

Definition

Biosimilar or Biosimilarity means:

- that the biological product is **highly similar** to the reference product notwithstanding minor differences in clinically inactive components; and
- there are **no clinically meaningful differences** between the biological product and the reference product in terms of the safety, purity, and potency of the product

Definition

Reference Product means:

- the **single biological product, licensed under section 351(a) of the PHS Act,** against which a biological product is evaluated in an application submitted under section 351(k) of the PHS Act

[A biological product, in a 351(k) application, may not be evaluated against more than 1 reference product]

Comparator Products

- The PHS Act defines the “reference product” for a 351(k) application as the “single biological product licensed under section 351(a) against which a biological product is evaluated.”
- Data from animal studies and certain clinical studies comparing a proposed biosimilar product with a non-US licensed product may be used to support a demonstration of biosimilarity to a US-licensed reference product
- Adequate data or information should be provided to **scientifically** justify the relevance of these comparative data to an assessment of biosimilarity and to **establish** an **acceptable bridge** to the U.S.-licensed reference product

General Requirements

A 351(k) application must include information demonstrating that the biological product:

- Is **biosimilar** to a reference product;
- Utilizes the **same mechanism(s) of action** for the proposed condition(s) of use -- but only to the extent the mechanism(s) are known for the reference product;
- **Condition(s) of use** proposed in labeling have been **previously approved** for the reference product;
- Has the **same route of administration, dosage form, and strength** as the reference product; and
- Is manufactured, processed, packed, or held in a facility that **meets standards** designed to assure that the biological product continues to be safe, pure, and potent

351(k) Application Requirements

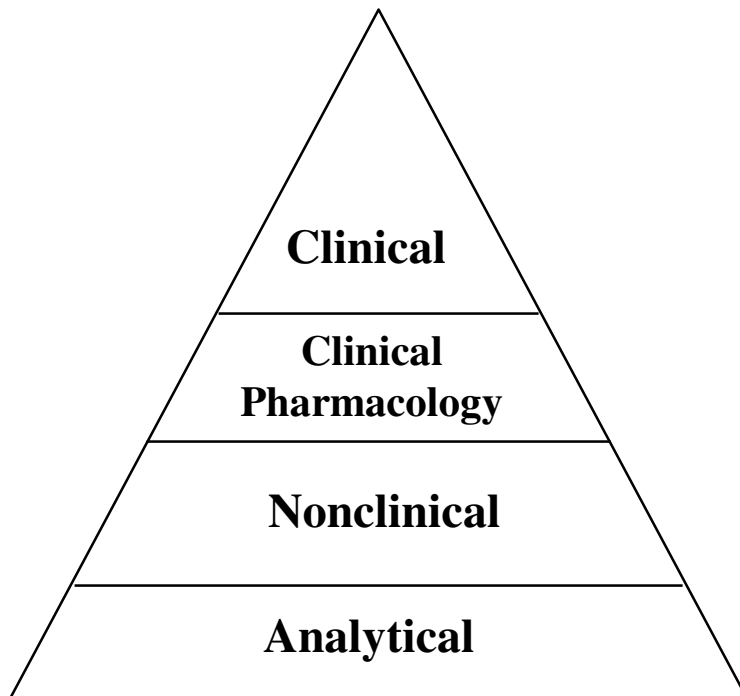
The PHS Act requires that a 351(k) application include, among other things, **information demonstrating biosimilarity based upon data derived from:**

- **Analytical studies** demonstrating that the biological product is “highly similar” to the reference product notwithstanding minor differences in clinically inactive components;
- **Animal studies** (including the assessment of toxicity); and
- A **clinical study or studies** (including the assessment of immunogenicity and pharmacokinetics (PK) or pharmacodynamics (PD) that are sufficient to demonstrate safety, purity, and potency in 1 or more appropriate conditions of use for which the reference product is licensed and for which licensure is sought for the biosimilar product

General FDA Review Approach

- Therapeutic Biologics and Biosimilars Staff in the Office of New Drugs
 - Ensure consistency in regulatory approach and in advice provided to sponsors regarding biosimilar development programs
 - Manage CDER's Biosimilar Review Committee
- Collaborative review team
 - 5 specific meeting types under BSUFA
 - Multiple internal meetings if there are novel/complex issues

Totality of Evidence



FDA will consider the totality of the data and information submitted in the application

There Has Been Positive Outcomes

- FDA has approved five (5) 351(k) BLAs for biosimilar products
 - Zarxio (filgrastim-sndz) [3/6/15] - Sandoz
 - Inflectra (infliximab-dyyb) [4/05/16] - Celltrion
 - Erelzi (etanercept-szzs) [8/30/16] - Sandoz
 - Amjevita (adalimumab-atto) [9/23/16] - Amgen
 - Renflexis (infliximab-abda) [4/21/17] – Samsung Bioepis

“Biobetter” Biological Products

Definition

- A biological product that has been structurally and/or functionally altered to achieve an improved or different clinical performance (eg, altered structure, compared to an already approved biologic product)
- Not defined in BPCI

- Perceived to be a lower business risk vs originator biologic product
 - Build on already-validated targets, mechanism of action, etc.
- Require discovery, with a full complement of pre-clinical and clinical data for marketing approval
- Licensure (approval) through 351(a) under PHS Act – same as for originator biologic product
- 12 years exclusivity and patentable

Summary

- Regulatory Compliance is Critical to Success
 - If the FDA does not approve it you cannot test it in humans and you cannot sell it
- Achieving Regulatory Compliance is not simple
 - It requires a significant dedication of resources by product development specialists who have expertise with your product type
- A Rigorous PDP will provide a roadmap to efficient development and speedy approval
- Biosimilar development pathway has legally been in place since 2010
- Biobetter biologic products do not have a separate regulatory development path as compared to originator product

Thank You