
Guidance for Industry

Drug Interaction Studies — Study Design, Data Analysis, and Implications for Dosing and Labeling

DRAFT GUIDANCE

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**U.S. Department of Health and Human Services
Food and Drug Administration
Center for Drug Evaluation and Research (CDER)
Center for Biologics Evaluation and Research (CBER)**

**September 2006
Clinical Pharmacology**

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**U.S. Department of Health and Human Services
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Center for Biologics Evaluation and Research (CBER)**

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TABLE OF CONTENTS

| | |
|---|-----------|
| I. INTRODUCTION..... | 1 |
| II. BACKGROUND | 2 |
| A. METABOLISM | 2 |
| B. DRUG-DRUG INTERACTIONS | 2 |
| III. GENERAL STRATEGIES | 4 |
| A. IN VITRO STUDIES..... | 4 |
| B. SPECIFIC IN VIVO CLINICAL INVESTIGATIONS..... | 5 |
| C. POPULATION PHARMACOKINETIC SCREENS | 6 |
| IV. DESIGN OF IN VIVO DRUG-DRUG INTERACTION STUDIES | 6 |
| A. STUDY DESIGN..... | 6 |
| B. STUDY POPULATION..... | 8 |
| C. CHOICE OF SUBSTRATE AND INTERACTING DRUGS | 8 |
| D. ROUTE OF ADMINISTRATION | 12 |
| E. DOSE SELECTION | 12 |
| F. ENDPOINTS..... | 13 |
| G. SAMPLE SIZE AND STATISTICAL CONSIDERATIONS | 14 |
| V. LABELING IMPLICATIONS | 15 |
| APPENDIX A TABLES..... | 17 |
| APPENDIX B FIGURES..... | 24 |
| APPENDIX C-1 IN VITRO DRUG METABOLIZING ENZYME IDENTIFICATION | 25 |
| APPENDIX C-2 IN VITRO EVALUATION OF CYP INHIBITORS..... | 31 |
| APPENDIX C-3 IN VITRO EVALUATION OF CYP INDUCTION..... | 35 |
| APPENDIX D IN VITRO EVALUATION OF P-GLYCOPROTEIN (P-GP, MDR1) SUBSTRATES AND INHIBITORS..... | 38 |
| REFERENCES | 51 |

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Contains Nonbinding Recommendations

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Guidance for Industry¹

**Drug Interaction Studies — Study Design, Data Analysis, and
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This draft guidance, when finalized, will represent the Food and Drug Administration's (FDA's) current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. You can use an alternative approach if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative approach, contact the FDA staff responsible for implementing this guidance. If you cannot identify the appropriate FDA staff, call the appropriate number listed on the title page of this guidance.

I. INTRODUCTION

This guidance provides recommendations for sponsors of new drug applications (NDAs) and biologics license applications (BLAs) for therapeutic biologics² who are performing in vitro and in vivo drug metabolism, drug transport, and drug-drug interaction studies. The guidance reflects the Agency's current view that the metabolism of an investigational new drug should be defined during drug development and that its interactions with other drugs should be explored as part of an adequate assessment of its safety and effectiveness. For drug-drug interactions, the approaches considered in the guidance are offered with the understanding that the relevance of a particular study depends on the characteristics and proposed indication of the drug under development. Furthermore, not every drug-drug interaction is metabolism-based, but may arise from changes in pharmacokinetics caused by absorption, distribution, and excretion interactions. Drug-drug interactions related to transporters are being documented with increasing frequency and are important to consider in drug development. Although less well studied, drug-drug interactions may alter pharmacokinetic/pharmacodynamic (PK/PD) relationships. These important areas are not considered in detail in this guidance.

Discussion of metabolic and other types of drug-drug interactions is also provided in other guidances, including the International Conference on Harmonization (ICH) *E7 Studies in Support of Special Populations: Geriatrics*, and *E3 Structure and Content of Clinical Study Reports*, and FDA guidances for industry on *Studying Drugs Likely to be Used in the Elderly* and *Study and Evaluation of Gender Differences in the Clinical Evaluation of Drugs*.

¹ This guidance has been prepared by the Drug-Drug Interaction Working Group in the Clinical Pharmacology Section of the Medical Policy Coordinating Committee in the Center for Drug Evaluation and Research, with input from the Center for Biologics Evaluation and Research, at the Food and Drug Administration.

² For more information on what constitutes a therapeutic biologic product, please see Internet site <http://www.fda.gov/cder/biologics/qa.htm>.

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41 FDA's guidance documents, including this guidance, do not establish legally enforceable
42 responsibilities. Instead, guidances describe the Agency's current thinking on a topic and
43 should be viewed only as recommendations, unless specific regulatory or statutory
44 requirements are cited. The use of the word *should* in Agency guidances means that
45 something is suggested or recommended, but not required.

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48 **II. BACKGROUND**

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50 **A. Metabolism**

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52 The desirable and undesirable effects of a drug arising from its concentrations at the sites of
53 action are usually related either to the amount administered (dose) or to the resulting blood
54 concentrations, which are affected by its absorption, distribution, metabolism, and/or
55 excretion. Elimination of a drug or its metabolites occurs either by metabolism, usually by
56 the liver or gut mucosa, or by excretion, usually by the kidneys and liver. In addition,
57 protein therapeutics may be eliminated through a specific interaction with cell surface
58 receptors, followed by internalization and lysosomal degradation within the target cell.
59 Hepatic elimination occurs primarily by the cytochrome P450 family (CYP) of enzymes
60 located in the hepatic endoplasmic reticulum, but may also occur by non-P450 enzyme
61 systems, such as N-acetyl and glucuronosyl transferases. Many factors can alter hepatic and
62 intestinal drug metabolism, including the presence or absence of disease and/or concomitant
63 medications, or even some foods, such as grapefruit juice. While most of these factors are
64 usually relatively stable over time, concomitant medications can alter metabolism abruptly
65 and are of particular concern. The influence of concomitant medications on hepatic and
66 intestinal metabolism becomes more complicated when a drug, including a prodrug, is
67 metabolized to one or more active metabolites. In this case, the safety and efficacy of the
68 drug/prodrug are determined not only by exposure to the parent drug but by exposure to the
69 active metabolites, which in turn is related to their formation, distribution, and elimination.
70 Therefore, adequate assessment of the safety and effectiveness of a drug includes a
71 description of its metabolism and the contribution of metabolism to overall elimination. For
72 this reason, the development of sensitive and specific assays for a drug and its important
73 metabolites is critical to the study of metabolism and drug-drug interactions.

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75 **B. Drug-Drug Interactions**

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77 *1. Metabolism-Based Drug-Drug Interactions*

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79 Many metabolic routes of elimination, including most of those occurring through the
80 P450 family of enzymes, can be inhibited or induced by concomitant drug treatment.
81 Observed changes arising from metabolic drug-drug interactions can be substantial —
82 an order of magnitude or more decrease or increase in the blood and tissue
83 concentrations of a drug or metabolite — and can include formation of toxic and/or

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