

PHARM 309
Introduction to Drug Information
Dr. O'Sullivan

PHARM 309 General Course Information

It is the hope of the instructors that by the end of this course, you will have grasped some of the building blocks necessary to ensure that your patients receive the right dose of any given drug.

To ensure the right dose, you will need to:

- locate treatments of choice (Drug Information Component: 40% of course)
- determine usual drug efficacy and toxicity (read primary literature and understand the methods by which the data were obtained) (Research Methods Component: 30% of course)
- calculate patient-specific doses (Pharmacy Calculations Component: 30% of course)

We expect you to:

- Attend all required drug information and research methods lectures and complete all assignments on time in order to maximize your learning in this class.
- Locate and read all required readings.
- Read all required material prior to the class session in which that material will be discussed.
- Demonstrate technical writing skills consistent with the ability of students obtaining a doctoral degree.
- Do all of your own writing. Plagiarism is a form of academic dishonesty and grounds for dismissal. You will cite resources you use in your writing, but you are expected to not plagiarize the work of others.
- Be comfortable with use of computer technology.

Assignments will include

- Calculations: 4 quizzes (on-line), 2 exams (in class)
- Drug information resources: 2 assignments, 1 drug information paper (2 partial-drafts)
- Research methods: several readings; 1 multiple-choice exam during finals week

These assignments will introduce you to the practice of evidence-based medicine.

A quick history of drug information services (read this on your own)

- 1864 – 1876: John Shaw Billings, a Civil War surgeon, is put in charge of expanding the Surgeon General's library. In 1876 he declares that it can now be called the National Library of Medicine (NLM).
- 1876-1879: Billings begins to catalog the contents of the library by overall medical subject addressed. The term Medical Subject Headings (MeSH) is used to describe the catalog headings. In 1879 the first *Index Medicus*, the NLM catalog of holdings, is published. It continues to be updated monthly and a new edition circulated annually. Information is catalogued by the overall subject addressed.
- 1890s: Billings develops an idea for organizing US Census data by using a series of punched cards. Herman Hollerith, a young engineer, helps him develop the punch card system and a machine for sorting them. They apply this technology to the NLM catalog to facilitate retrieval of medical information. In 1896 Hollerith creates a company called the Tabulating Machine Company, so that businesses can purchase and use the punch card technology. This company is eventually absorbed into a corporation called International Business Machines.

- 1900-1960: The number of available drugs and journal articles expands. It becomes more difficult for physicians to keep abreast of the medical literature. After World War II, a need is seen for information retrieval and not just cataloging. Development of such a system begins in the 1950s and uses Boolean search terms AND, OR, and NOT.
- 1962: The first drug information center opens at the University of Kentucky Medical Center.
- 1960s: Pharmacist-staffed drug information centers open around the country. Pharmacists are prohibited from giving patients any information about dispensed medications in early part of decade. Around 1963, the practice act in Washington state is changed to permit pharmacists to provide information about legend drugs. The Medical Literature Analysis and Retrieval System (MEDLARS) is developed by the NLM; this system uses computerized searches but information requests are submitted by telephone and results mailed to the requester.
- 1971: the ability to transmit information over telephone lines is applied to MEDLARS; the resulting database searching technology is called MEDLARS ON-LINE and soon shortened to MEDLINE. Searches of journal articles published in 1966 and after began to be done via computer/modem by a medical librarian trained to perform the searches.
- 1973: a formal survey counts 54 pharmacist-operated drug information centers in the United States.
- 1975: A report issued by an external review board strongly recommends that all pharmacy students be trained to use drug information resources.
- 1980s and early '90s: The number of drug information centers peaks. In 1988, the National Center for Biotechnology Information (NCBI) database of biotechnology is created to facilitate information access for scientists working on the Human Genome Project.
- mid-'90s: Formal drug information centers begin to close due to budget cuts. Individual pharmacists take over the role of providing drug information. MEDLINE available after 1992 on the Web through portals such as Grateful Med. but for a fee.
- 1997: By congressional decree, Web access to MEDLINE information is made free to the public. The NLM partners with NCBI to develop PubMed, a Web portal to access biomedical information from many databases, not just MEDLINE. Web sites with drug and disease information of varying quality are burgeoning.
- 2001: Publishers begin increasingly making available the electronic full-text version of medical study reports.
- 2004: You are beginning your training as a pharmacist. You will be expected to know how to access quality drug information resources and summarize and interpret for patients and health care colleagues the information you find in those resources. This class is the first in a series designed to help you learn these skills, which will allow you to practice evidence-based medicine.

Evidence-based Medicine (EBM)

Evidence-based medicine is an approach to solving clinical questions that uses **information from medical research** in addition to the **clinician's/team's experience** and the **patient's preferences**. The best decisions will consider each component in this triad of factors leading to decisions about a patient's drug therapy.

Information from medical research means results from studies of drugs that identify **treatment effects**. Treatment effects mean therapeutic outcomes, good and bad, and side effects and drug interactions, good and bad. Information about treatment effects can also come from an

individual's (clinician and patient) personal experience with the use of that drug. Patient preferences will play an important role in the decision-making process.

You will use EBM both in your own therapeutic decision-making, but also in your support of therapeutic decision-making by other individuals and policy-making groups. In these situations, you yourself will act as a drug information resource when they pose to you drug information questions.

Answering Drug Information Questions

There is a good tutorial section on this information at healthlinks.washington.edu/howto/drugs/

These are the steps you should go through when you are asked a question:

Step 1: Identify the requester. This will help you get an idea of the depth and detail of information the requester is probably expecting.

Step 2: Determine and categorize the “real” question. It is remarkably common for the question you are asked to not be the requester's “real” question. Determining the true question involves *answering the question with some questions*.

- Ask for background information. Examples:
 - “I want to make sure I answer (or understand) your question adequately, so tell me a little more about what led you to ask me this question.”
 - “There are several different answers to that question. To make sure I give you the right answer, I'd like you to describe in more detail what it is you wish to better understand.”
 - “Tell me how you want to use this information.”
- In some cases, it is appropriate to use an algorithm similar to the one you will learn for patient interviewing, considering each area but including only questions about those variables that might affect your answer.
 - history of current question (is this a general question or specific to a person or situation?)
 - other disease states that might affect the answer to the question, including potential disease states, i.e., signs or symptoms that have not been diagnosed (pharmacokinetic, pharmacodynamic, adverse reaction masquerade)
 - other medications (Rx, OTC, herbal, illicit) that might affect the answer to the question (drug interactions)
 - pertinent social or family history (financial, medical, or belief issues)
 - desired detail of response
- Questions you receive will usually be in one of the following categories:
 - proper use of drugs: efficacy for specified disease state, dosing, compatibility, use in pregnancy or lactation, monitoring parameters, drug identification, pharmacokinetics, pharmacodynamics, storage conditions, stability
 - adverse reactions: side effects, drug interactions, allergic reactions, toxicity, poisoning, contraindications, warnings
 - product queries: formulary status, cost, availability

Once you think you know the real question, repeat it to the requester to confirm you have identified the appropriate question.

Step 3: Choose an appropriate resource (or resources) to consult.

Classification of drug information resources:

type of literature	main benefit	main problem
Tertiary literature provides an interpretation and summary of the primary literature by someone other than the original authors of the primary literature publication. Examples: <ul style="list-style-type: none">• review in health sciences journal• textbooks and other reference material• computer databases (e.g., Micromedex)• web sites• advertisements	can get a lot of information in a short amount of time relative to reading all the studies of a subject yourself	subject to interpretation bias: “spin”
Secondary literature provides a summary, index, or abstract of a piece of primary literature, usually written by the authors of a primary literature paper. Examples: <ul style="list-style-type: none">• Medline (PubMed is the web portal)• IPA• EMBASE• current contents	location of primary literature	not enough information to determine quality of research work
Primary literature contains new/original material. Examples: <ul style="list-style-type: none">• study published in health sciences journal (including symposium and conference proceedings and abstracts)• package insert and other manufacturer technical pamphlets• patents and trademarks• government bulletins• case studies	you can determine the quality of the research and usability of information	not enough time to read it all

In general, it is most efficient to start with tertiary literature (especially for questions from non-health care professionals). Sometimes you will use secondary literature to locate primary literature and then will need primary literature to answer the question (not uncommon with questions from health care professionals: they will expect you to be able to interpret and explain a study).

Step 4: Analyze quality and appropriateness of material in resource(s). Summarize the best evidence in your own words.

Step 5: Synthesize (formulate) a response.

Step 6: document and follow up on recommendations, so that others will know what you advised and why, and so that you can see if your advice was sound.

Over the quarter we will be journeying through tertiary, secondary, and primary literature so you can experience some of the material available to you. All assignments were created thoughtfully as a way of getting you to use and become comfortable with navigating your way through the various resources, so that you can ensure that all your patients receive “the right dose.”

This week, you should begin to formulate a potential question to answer for your drug information paper and begin reading the first lesson in your pharmacy calculations textbook.

Choosing a good drug information question to answer

- The drug information question should be about the use of a specific drug for a specific medical condition.
- You must be able to locate at least three clinical trials on the subject, which you will review in the body of your paper. One of the first things that you will thus do once you have a few candidates for your drug info paper topic, is to confirm that you can find clinical trials on that paper.
- Clinical trials generally examine whether or not a drug is effective for a given condition.
- A drug is considered effective if it has one of the four following effects:
 - eliminate a condition e.g., cure a bacterial infection
 - decrease symptoms of a condition e.g., relieve pain
 - slow disease progression e.g., slow the rate at which complications of diabetes appear or worsen
 - prevent a condition e.g., women take oral contraceptives to prevent pregnancy

Using Tertiary Resources

At the end of this lecture (and possibly after some studying!), you should be able to:

- define the term “tertiary drug information resources.”
 - describe situations where tertiary resources may be useful for locating information.
 - identify important tertiary literature frequently used by pharmacists.
 - use tertiary resources to locate an answer to a drug information question.
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Introduction

Tertiary resources are summaries of available information in an understandable format. Examples include textbooks, reference texts, databases, review articles, lecture notes, and web sites. **Tertiary resources are the *best starting point* for finding the answer to drug information queries.**

Strengths of tertiary resources:

- Most answers to questions you are asked will be found in a tertiary resource.
- Because the information is organized, they are time-efficient to use compared to examining primary literature yourself.

- Because they summarize information from many sources, they may contain information important to the question which you might miss if you consulted only one piece of the primary literature.
- Tertiary resources often provide background information. For example, you may be asked about the treatment of choice for a sinus infection. Many reviews of sinus infections will also include a short summary of the epidemiology and microbiology of sinus infections, which can help you better understand and remember the treatment alternatives.
- Tertiary resources are generally more accessible to the average pharmacist than secondary or primary resources.

Limitations of Tertiary resources:

- A literature summary is only as good as its author(s).
 - All authors will have interpretation bias.
 - Author(s) may not have the expertise to correctly interpret the literature or may not have consulted the literature (opinion versus fact).
 - Author may not write well.
 - You may have no information about the author.
- Information may not be complete.
 - Literature search may not be extensive.
 - Space limitations of publisher may limit amount of information that can be included.
- Information may be out of date.
- Tertiary resources which draw on information from other tertiary resources can perpetuate incorrect information.
- Some sources can be difficult to use.

Tertiary resources you will use (print and online)

General medication information. You will use these resources for questions involving indications, pharmacology, pharmacokinetics, precautions and adverse effects, administration and dosing, drug interactions, and available commercial products. Example questions for which you should use these resources: “What is propranolol used for?” “Is there a liquid form of morphine available?” “Could citalopram cause an increase in sweating?”

- Drugdex (Micromedex) *on-line, via Healthlinks*
- Facts and Comparisons (eFacts) *on-line, via Healthlinks*
- Drug Information Handbook (Lexi-Comp) *book, PDA version*
- AHFS (Stat!Ref) *on-line, via Healthlinks*
- USPDI-I (Stat!Ref) *on-line, via Healthlinks*
- [Physician’s Desk Reference (PDR)] *available on-line, but not via Healthlinks; medical, but not pharmacy students can get this for free; old copies of the book are in the PCLC*

Natural Product Resources

- Natural Medicines Comprehensive Database *on-line, via Healthlinks*
- Review of Natural Products (eFacts) *on-line, via Healthlinks*
- AltMedDex (Micromedex) *on-line, via Healthlinks*
- HerbMed and American Herbal Products Association *on-line at www.ahpa.org*. These are quasi-tertiary resources, because links to other tertiary resources are available. They are also

secondary resources (indexing) as they connect you to PubMed for info about specific studies. HerbMed is assembled by the Alternative Medicine Foundation and AHPA by a consortium of herbal product manufacturers. You will find the information on each to be similar.

Disease state information. You will use these resources to better understand medical conditions. Examples of questions you would use these resources to answer: “What is the most common cause of diarrhea in children?” “What are the most common complications of uncontrolled diabetes?”

- UpToDate *on-line, via Healthlinks*
- The Merck Manual (www.merck.com) *on-line, via Healthlinks*
- Harrison’s Online *on-line, via Healthlinks*
- medical specialty textbooks (MD Consult) *on-line, via Healthlinks*

Pharmacotherapy references. Use these for general information about treatment alternatives for specific disease states. Examples of questions you would use these resources to answer: “What is the recommended agent and dose for a 45-year old male with newly diagnosed hypertension?” “What are reasonable monitoring parameters for patients taking medication for chronic obstructive lung disease?”

- Pharmacotherapy: a Pathophysiologic Approach *book only*
- Applied Therapeutics: The Clinical Use of Drugs *book only*

Over-the-counter Drugs Example of questions you would use this resource to answer: “What is available over-the-counter that I could use for my cough?” “What can I use for this rash?”

- Handbook of Non-Prescription Drugs *book only; in PCLC*

Drug Interaction references Example of question you would use these resources to answer: “Can I drink grapefruit juice if I’m taking atorvastatin?”

- Hansten and Horn’s Drug Interactions *book only; in PCLC*
- Drug Interaction Facts (eFacts) *on-line, via Healthlinks*
- Micromedex also has a decent drug interaction section *on-line, via Healthlinks*

Terminology Examples of questions you would use these resources to answer: “Where is the ‘lateral’ chest located?” “What does DNR mean?”

- medical dictionary; Stedman’s is *on-line, via Healthlinks*
- medical abbreviations (eFacts) *on-line, via Healthlinks*

Laboratory Tests Example of question you would use these resources to answer: “What is the normal serum concentration range for potassium?” Only the first reference will answer the following type of question, however: “What might be the cause and consequences of a serum potassium concentration above the normal range?”

- Basic Skills in Interpreting Laboratory Data *book only; in PCLC*
- Laboratory test information (online)
- Normal laboratory values (eFacts) *on-line, via Healthlinks*

Drug Identification Example of question you would use these resources to answer: “I found a white tablet with M 23 stamped on it. What drug is this?” Martindale would help you answer the following question: “When I was in England, a doctor gave me an inhaler called salbutamol. What does this drug do? Is it similar to any inhaler I normally use for my asthma?”

- Identidex (Micromedex) *on-line, via Healthlinks*
- Drug/Imprint Index (eFacts) *on-line, via Healthlinks*
- Martindale (Micromedex) for non-US drugs *on-line, via Healthlinks*

Bioequivalence Example of question you would use this resource to answer: “Is there a generic form of Levoxyl that is bioequivalent?”

- Orange book; *on-line: www.fda.gov*

Drug Prices Example of question you would use this resource to answer: What is the AWP for a 30-day supply of diltiazem 120mg XL capsules?” (Note that here you might first have to look up the AWP in the medical abbreviations book!)

- Redbook *book only; in PCLC*
- Mosby’s Drug Consult (MD Consult). This is also general medication information on this site. *on-line, via Healthlinks*

Drug IV Compatibility Example of question you would use this resource to answer: “Can Lasix be given in the same line in which dopamine is running?”

- Handbook on Injectable Drugs *book only; in PCLC*

Drug dosing in special populations Examples of questions you might use some of these resources to answer: “Is it safe to use ibuprofen while I’m pregnant? While I’m breastfeeding?” “How much acetaminophen should I give my 30-lb child who is running a temperature of 103°F?” “What is a good starting dose for lisinopril in an 80 year-old patient?” “Does aztreonam cover *Pseudomonas aeruginosa*?”

- Drugs in Pregnancy and Lactation *book only; in PCLC*
- LactMed *on-line, via Healthlinks*
- Pediatric Dosage Handbook *book, PDA versions available*
- Drug Prescribing in Renal Failure *book only; in PCLC*
- pharmacokinetic equation reference *book only; several different books available*
- Geriatric Dosage Handbook *book, PDA versions available*
- The Sanford Guide to Antimicrobial Therapy *book in PCLC; PDA version available*

Extemporaneous compounding Example of question you would use these resources to answer: “What is the E-value of gentamicin sulfate?”

- Remington: the Science and Practice of Pharmacy *book only; in PCLC*
- A Practical Guide to Contemporary Pharmacy Practice *book only; in PCLC*

Patient Counseling You would use these to augment your verbal medication information. Some pharmacy systems automatically print these, but look them over carefully for information accuracy before handing them out.

- Medline Plus (medications, medical conditions, trials) *on-line at medlineplus.gov*

- Med Facts: Patient Counseling (eFacts): in English and Spanish *on-line, via Healthlinks*
- CareNotes (Micromedex) *on-line, via Healthlinks*

Toxicology Example of question you would use this resource to answer: “My child just swallowed some of my iron tablets. Could anything bad happen?”

- Poisindex (Micromedex) *on-line, via Healthlinks*

Clinical Guidelines Example of question you would use these resources to answer: “What initial medications for treatment of a heart attack do current American Heart Association guidelines recommend?”

- National Guideline Clearinghouse *on-line at www.guideline.gov*
- Cochrane Library *on-line, via Healthlinks* This resource is unique and designed to support practitioners of “evidence-based medicine” (EBM), which is when evidence from studies is combined with practitioner expertise and patient preference to provide the best care possible to that patient. There are 7 databases in the Cochrane Library:
 - *The Cochrane Database of Systematic Reviews*
 - *The Database of Abstracts of Reviews of Effects (DARE)*
 - *The Cochrane Central Register of Controlled Trials (CENTRAL)*
 - *The Cochrane Database of Methodology Reviews*
 - *The Cochrane Methodology Register*
 - *The Health Technology Assessment Database*
 - *The NHS Economic Evaluation Database*

Search Engines

In order to find drug information on the World Wide Web, you will need to understand how to use search engines. Using keywords that you provide, search engines are software programs that search web sites for the particular information you are looking for. There are 4 types of search engines that are available to use:

Simple-search engines (ex: Yahoo, WebCrawler, Galaxy)

These engines classify web sites into categories and usually have editors who decide how the information will be categorized. This type of search engine is also referred to as a web directory.

Keyword-search engines (ex: AltaVista, Go.com, Google, Hotbot, Lycos)

Using keywords that are provided by the user, a key-word search engine moves throughout the web capturing information about web sites and organizes the information on what it considers to be most relevant on the top of the list that it generates.

Meta-search engines (ex: Dogpile, Metacrawler)

These engines pull from a variety of search engines and allow you to use them simultaneously. Meta-search engines that are useful to access drug information are listed below. They help you access both tertiary and primary literature (so they are really a combination of 3^o and 2^o resources). They are categorized as EBM resources.

- TRIP+ database: TRIP = turning research into practice; started by an employee of the UK National Health Service; updated monthly; links to many national health care health quality and informatics web sites.

- PrimeAnswers: funded by a NLM grant, this tool was developed by our own health science library to facilitate access to multiple sources of health information; in addition to searching a wide variety of textbooks, health information web sites, and drug databases, it has other nifty tools, such as links to calculators, a dermatology atlas, and the UWMC antibiogram.
- SUMsearch: administered by University of Texas Health Science Center; its technology is dated.

Natural-language search engines (ex: Ask Jeeves)

This type of search engines allows you to search for information using a question.

Among the search engines that are available, there are some engines that can specifically search for information on a particular subject such as business, arts, health and medicine. These search engines are usually referred to as “topical”, “specialty” or “vertical” search engines. For medical information, there are many medical and health search engines but unfortunately there are none available specifically for pharmacy.

Strengths of Search Engines

- Search engines are convenient to use. You do not have to go to the library, you only need to have internet access.
- Search engines are fast and can locate information quickly.
- Information can be found that is not available from other resources.
 - ex: finding out information on various uses of natural medicines.
- If information is difficult to find, search engines might identify any available information.
 - ex: look at references used on websites.
- Phrases and other wording (such as slang) can be used to search.

Limitations of Search Engines

- Each search engine indexes Web sites and Web pages a different way. Results can greatly differ, especially when narrowing a search. Some search engines will “hit” first only on the most popular sites or those that change frequently, leaving out those sites that are unpopular or are not hit frequently.
- None of the available search engines cover the entire web. To get enough information, you may need to use several search engines.
- The amount of information a search engine can give can be large disorganized. The information can be almost meaningless and difficult to use.
- There are search engines that are not capable of using standard search methods such as Boolean, wild cards, or phrasing that are used in such programs such as PubMed.
- Capitalization and punctuation can cause different search engines to produce different amounts of information.
- Meta-search engines can be slow and produce too much information. A meta-search engine may be unable to search a particular search engine if the search engine’s format has changed and the meta-search engine has not been updated to accommodate that change.
- Search engines are not capable of generating the comprehensive information that databases and other library resources are capable of producing.

Effectively Using the Health Sciences Libraries & HealthLinks
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PHARM 309
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Learning Objectives:

By the end of this session (and with a little practice), students will be able to:

- Connect to library resources
- Navigate HealthLinks
- Identify how to find help with the library and library resources

Introduction

On behalf of the Health Sciences Libraries (HSL), welcome to the University of Washington and our resources. All of the information you need about HSL is available on our website <http://healthlinks.washington.edu/hsl> It is open 24 hours a day – please come to visit.

Physical Library

- Main HSL is located in T-334 – it is the only open door evenings, weekends and holidays
- “Branch libraries” at Harborview Hospital and Social Work building
- Basic hours are 7:30 am – 8:45 pm Mon-Thurs, 7:30 am – 6:45 pm Fri, 9 am – 4:45 pm Sat and 1 pm – 6:45 pm Sun
- Telephone number is 206.543.3390
- Visit the web page to contact us by email, instant messaging, etc.
- Take a look at our Code of Conduct - <http://www.lib.washington.edu/about/codeofconduct.html> and Policy on Use of Computers in the University Libraries <http://www.lib.washington.edu/about/computerusepolicy.html>

Your Library Liaison

- Terry Ann Jankowski - <http://healthlinks.washington.edu/hsl/liaisons/jankowski/>
- Available by appointment to guide you – terryj@u.washington.edu or uwterryj@gmail.com or 206.543.3397
- Purpose – give the library a face – you can ask me anything library related
- Don’t forget to work with our friendly, Information Desk staff for quick questions whenever the library is open
- Drop-in assistance from reference librarians is available Mon – Fri 10 am – 3 pm – I’m usually there Mondays 12-2 and Thursdays 2-3

Virtual Library

Getting Started with Library Resources - <http://healthlinks.washington.edu/howto/getstarted/>

- Key to using the library are:
- Linking your barcode and creating a PIN – stop by the Information Desk to do this
- Using your UWNetID and password

Connecting to UW Restricted Resources - <http://healthlinks.washington.edu/howto/connect/>

- Electronic resources are licensed for the **personal use** of current UW students, staff, and faculty. You are responsible for reading and abiding by guidelines in the Responsible use of Electronic Resources - <http://www.lib.washington.edu/cms/usageguidelines.html>
- When working from off-campus click on the off-campus access button on a Libraries page (even if you have already logged in to MyUW)
- Alternatively you can use the proxy bookmarklet

HealthLinks – <http://healthlinks.washington.edu>

- Gateway (portal) to reliable health information
- For professionals and public
- Work in progress – suggestions welcome
- Many resources (restricted and free) and many access points
- Bookmark or save as a favorite
- Key features
- News
- UW links (4 blue links at the top of the page)
- Toolkits
 - Resources specific to that need or role
 - Note CareProvider toolkit – and Pharmacist Toolkit there
- Key resources (red tabs in upper right hand corner of page)
 - PubMed – database to find journal articles in biosciences
 - eJournals – link to over 10,000 health-related electronic journals
 - Reference – starting points for basic reference tools such as dictionaries, directories, statistics, etc.
 - How-To – factsheets, help sheets and tutorials on resources available at HSL
 - Library Services – HSL hours, directions, services, fees, etc
- Search box – use it to find anything on HealthLinks

Getting help from HSL

- Ask us button – in-person, phone, email, IM
- How-to tab
- Contact me directly

Work smart. Save time. Ask us!