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Digital object identifier

Introduction

The Digital Object Identifier (DOI) is an Internet based global naming and resolution system that provides precise identification, retrieval, and trading of digital items in the form of articles, books, images, bibliographies, supporting data, videos, charts, tables, audio, and other electronic files.

The Digital Object Identifier (DOI) is an important emerging international standard for identification of published material online. It forms the foundation layer of a set of technologies that will enable commerce in published material on the Internet so that copyright is protected, content creators can be compensated for their work, and consumers can benefit from technology that is sophisticated, yet seamless and easy to use.

The DOI is equivalent of the familiar Universal Product Code (UPC) bar code printed on all physical products. The DOI, however, goes far beyond the capabilities of the UPC code. When publishers created the DOI in 1996, they had two goals in mind:

1. Facilitating the creation of an e-commerce market for digital content.
2. Enabling copyright protection and anti-piracy in the digital environment.

What is a digital object identifier, or DOI?

A digital object identifier (DOI) is a unique alphanumeric string assigned by a registration agency (the International DOI Foundation) to identify content and provide a persistent link to its location on the Internet. The publisher assigns a DOI when your article is published and made available electronically.

All DOI numbers begin with a *10* and contain a prefix and a suffix separated by a slash. The prefix is a unique number of four or more digits assigned to organizations; the suffix is assigned by the publisher and was designed to be flexible with publisher identification standards.

We recommend that when DOIs are available, you include them for both print and electronic sources. The DOI is typically located on the first page of the electronic journal article, near the copyright notice. The DOI can also be found on the database landing page for the article.

The Digital Object Identifier (DOI®) System is for identifying content objects in the digital environment.

DOI® names are assigned to any entity for use on digital networks. They are used to provide current information, including where they (or information about them) can be found on the Internet.

Information about a digital object may change over time, including where to find it, but its DOI name will not change. The metadata may include a location, such as a URL, where the object can be found.

The DOI for a document is permanent, whereas its location and other metadata may change. Referring to an online document by its DOI provides more stable linking than simply referring to it by its URL, because if its URL changes, the publisher need only update the metadata for the DOI to link to the new URL.

Organizations that meet the contractual obligations of the DOI system and are willing to pay to become a member of the system can assign DOIs.

The DOI System provides a framework for persistent identification, managing intellectual content, managing metadata, linking customers with content suppliers, facilitating electronic commerce, and enabling automated management of media.

DOI names can be used for any form of management of any data, whether commercial or non-commercial.

The system is managed by the International DOI Foundation, an open membership consortium including both commercial and non-commercial members, and has recently been accepted for standardization within ISO.

Over 40 million DOI names have been assigned by DOI System Registration Agencies in the US, Australasia, and Europe.

DOI names are widely used in scientific publishing to cite journal articles. More than 98% of all DOI registration is for scholarly articles. The use of DOI names for the citing of data sets makes their provenance tractable and citable and therefore allows interoperability with existing reference services.

The DOI system has been developed and implemented in a range of publishing applications since 2000; by late April 2011 more than 50 million DOI names had been assigned by some 4,000 organizations. The DOI system is part of the larger Handle System.

DOI names

A DOI name takes the form of a character string divided into two parts, a prefix and a suffix, separated by a forward slash. The prefix identifies the registrant of the name, and the suffix is chosen by the registrant and identifies the specific object associated with that DOI. Most legal Unicode characters are allowed in these strings, which are interpreted in a case-insensitive manner.

For example, in the DOI name 10.1000/182, the prefix is 10.1000 and the suffix is 182. The "10." part of the prefix identifies the DOI registry, and the characters 1000 in the prefix identify the registrant; in this case the registrant is the International DOI Foundation itself. 182 is the suffix, or item ID, identifying a single object (in this case, the latest version of the *DOI Handbook*). Citations using DOI names should be printed as doi: 10.1000/182. When the citation is a hypertext link, it is recommended to embed the link as a URL by concatenating "http://dx.doi.org/" to the DOI name, omitting it's "doi:" prefix; e.g., the DOI name doi:10.1000/182 is linked as http://dx.doi.org/10.1000/182. This URI provides the location of an HTTP proxy server which will redirect web accesses to the correct online location of the linked item.

DOI names can identify creative works (such as texts, images, audio or video items, and software) in both electronic and physical forms, performances, and abstract works such as licenses, parties to a transaction, etc. The names can refer to objects at varying levels of detail, thus DOI names can identify a journal, an individual issue of a journal, an individual article in the journal, or a single table in that article. The choice of level of detail is left to the assigner, but in the DOI system it must be declared as part of the metadata that is associated to a DOI name, using a data dictionary based on the indices Content Model.

Features and benefits

The DOI system was designed to provide a form of persistent identification, in which each DOI name unequivocally and permanently

identifies the object to which it is associated. And, it associates metadata with objects, allowing it to provide users with relevant pieces of information about the objects and their relationships. Included as part of this metadata are network actions that allow DOI names to be resolved to web locations where the objects they describe can be found. To achieve its goals, the DOI system combines the Handle System and the indices Content Model with a social infrastructure.

The Handle System ensures that the DOI name for an object is not based on any changeable attributes of the object such as its physical location or ownership, that the attributes of the object are encoded in its metadata rather than in its DOI name, and that no two objects are assigned the same DOI name. Because DOI names are short character strings, they are human-readable, may be copied and pasted as text, and fit into the URL specification. The DOI name resolution mechanism acts behind the scenes, so that users communicate with it in the same way as with any other web service; it is built on open architectures, incorporates trust mechanisms, and is engineered to operate reliably and flexibly so that it can be adapted to changing demands and new applications of the DOI system. DOI name resolution may be used with Open URL to select the most appropriate among multiple locations for a given object, according to the location of the user making the request. However, despite this ability, the DOI system has drawn criticism from librarians for directing users to non-free copies of documents that would have been available for no additional fee from alternative locations.

The indices Content Model is used within the DOI system to associate metadata with objects. A small kernel of common metadata is shared by all DOI names and can be optionally extended with other relevant data, which may be public or restricted. Registrants may update the metadata for their DOI names at any time, such as when publication information changes or when an object moves to a different URL.

The International DOI Foundation (IDF) oversees the integration of these technologies and operation of the system through a technical and social infrastructure. The social infrastructure of a federation of independent registration agencies offering DOI services was modeled on existing successful federated deployments of identifiers such as GS1 and ISBN.

Applications

Major applications of the DOI system currently include:

- persistent citations in scholarly materials (journal articles, books, etc.) through CrossRef, a consortium of around 3,000 publishers;
- research datasets through DataCite, a consortium of leading research libraries, technical information providers, and scientific data centers;
- European Union official publications through the EU publications office.

In the Organization for Economic Co-operation and Development's publication service Source OECD, each table or graph in an OECD publication is shown with a DOI name that leads to an Excel file of data underlying the tables and graphs. Further development of such services is planned.

A multilingual European DOI registration agency activity, *m*EDRA, and a Chinese registration agency, Wanfang Data, are active in non-English language markets. Expansion to other sectors is planned by the International DOI Foundation.

Comparison with other identifier schemes

A DOI name differs from commonly used Internet pointers to material, such as the Uniform Resource Locator (URL), in that it identifies an object as a first-class entity, not simply the place where the object is located. It implements the Uniform Resource Identifier (Uniform Resource Name) concept and adds to it a data model and social infrastructure.

A DOI name also differs from standard identifier registries such as the ISBN, ISRC, etc. The purpose of an identifier registry is to manage a given collection of identifiers, whereas the primary purpose of the DOI system is to make a collection of identifiers actionable and interoperable, where that collection can include identifiers from many other controlled collections.

The DOI system offers persistent, semantically interoperable resolution to related current data, and is best suited to material that will be used in services outside the direct control of the issuing assigner (e.g., public citation, or managing content of value). It uses a managed registry (providing social and technical infrastructure). It does not assume any specific business model for the provision of identifiers or services, and enables other existing services to link to it in defined ways. Several approaches for making identifiers persistent have been proposed. The comparison of persistent identifier approaches is difficult because they are not all doing the same thing. Imprecisely referring to a set of schemes as "identifiers" doesn't mean that they can be compared easily. Other "identifier systems" may be enabling technologies with low barriers to entry, providing an easy to use labeling mechanism that allows anyone to set up a new instance (examples include Persistent Uniform Resource Locator (PURL), URLs, Globally Unique Identifiers (GUIDs), etc.), but may lack some of the functionality of a registry-controlled scheme and will usually lack accompanying metadata in a controlled scheme. The DOI system does not have this approach and should not be compared directly to such identifier schemes. Various applications using such enabling technologies with added features have been devised that meet some of the features offered by the DOI system for specific sectors (e.g., ARK).

A DOI name does not depend on the object's location and, in this way, is similar to a Uniform Resource Name (URN) or PURL but differs from an ordinary URL. URLs are often used as substitute identifiers for documents on the Internet (better characterized as Uniform Resource Identifiers) although the same document at two different locations has two URLs. By contrast, persistent identifiers such as DOI names identify objects as first class entities: two instances of the same object would have the same DOI name.

Resolution

DOI name resolution is provided through the Handle System, developed by Corporation for National Research Initiatives, and is freely available to any user encountering a DOI name. Resolution redirects the user from a DOI name to one or more pieces of typed data: URLs representing instances of the object, services such as e-mail, or one or more items of metadata. To the Handle System, a DOI name is a handle, and so has a set of values assigned to it and may be thought of as a record that consists of a group of fields. Each handle value must have a data type specified in its "<type>" field that defines the syntax and semantics of its data.

To resolve a DOI name, it may be input to a DOI resolver (e.g., at www.doi.org) or may be represented as an HTTP string by preceding the DOI name by the string http://dx.doi.org/

For example, the DOI name 10.1000/182 can be resolved at the address "http://dx.doi.org/10.1000/182". Web pages or other hypertext documents can include hypertext links in this form. Some browsers allow the direct resolution of a DOI (or other

handles) with an add-on, e.g., CNRI Handle Extension for Firefox. The CNRI Handle Extension for Firefox enables the browser to access handle or DOI URIs like hdl:4263537/4000 or doi:10.1000/1 using the native Handle System protocol. It will even replace references to web-to-handle proxy servers with native resolution.

Organizational structure

The International DOI Foundation (IDF), a non-profit organization created in 1998, is the governance body of the DOI system. It safeguards all intellectual property rights relating to the DOI system, manages common operational features, and supports the development and promotion of the DOI system. The IDF ensures that any improvements made to the DOI system (including creation, maintenance, registration, resolution and policymaking of DOI names) are available to any DOI registrant. It also prevents third parties from imposing additional licensing requirements beyond those of the IDF on users of the DOI system.

The IDF is controlled by a Board elected by the members of the Foundation, with an appointed Managing Agent who is responsible for co-ordination and planning its activities. Membership is open to all organizations with an interest in electronic publishing and related enabling technologies. The IDF holds annual open meetings on the topics of DOI and related issues: the 2010 meeting is provisionally scheduled to be held in Hannover, Germany in mid year.

Registration agencies, appointed by the IDF, provide services to DOI registrants: they allocate DOI prefixes, register DOI names, and provide the necessary infrastructure to allow registrants to declare and maintain metadata and state data. Registration agencies are also expected to actively promote the widespread adoption of the DOI system, to cooperate with the IDF in the development of the DOI system as a whole, and to provide services on behalf of their specific user community. A list of current RAs is maintained by the International DOI Foundation.

Registration agencies generally charge a fee to assign a new DOI name; parts of these fees are used to support the IDF. The DOI system overall, through the IDF, operates on a not-for-profit cost recovery basis.

Standardization

The DOI system is currently being standardized through the International Organization for Standardization, in its technical committee on identification and description TC46/SC9. The Draft International Standard ISO/DIS 26324, Information and documentation - Digital Object Identifier System met the ISO requirements for approval. The relevant ISO Working Group had later submitted an edited version to ISO for distribution as an FDIS (Final Draft International Standard) ballot, which was approved by 100% of those voting in a ballot closing on November 15, 2010.

DOI is a registered URI under the info URI specification (IETF RFC4452), "The "info" URI Scheme for Information Assets with Identifiers in Public Namespaces". info:doi/ is the info URI Namespace of Digital Object Identifiers.

The DOI syntax is a NISO standard, first standardized in 2000, ANSI/NISO Z39.84-2005 Syntax for the Digital Object Identifier.

The DOI as article identifier

A DOI is a unique alphanumeric string assigned by a registration agency (the International DOI Foundation) to identify content and provide a persistent link to its location on the Internet. The publisher assigns a DOI when your article is published and made available electronically. All DOI numbers begin with a *10* and contain a prefix

and a suffix separated by a slash. The prefix is a unique number of four or more digits assigned to organizations; the suffix is assigned by the publisher and was designed to be flexible with publisher identification standards. We recommend that when DOIs are available, you include them for both print and electronic sources. The DOI is typically located on the first page of the electronic journal article, near the copyright notice (see Figure 6.2). The DOI can also be found on the database landing page for the article.

DOI System and Linked Data

Digital Object Identifiers assigned by CrossRef (www.crossref.org) are now enabled for use in linked data applications. The term "linked data" describes a set of best practices for exposing data in machine-readable form using the standard HTTP web protocol. These best practices support the development of tools to link and make use of data from multiple web sources without the need to deal with many different proprietary and incompatible application programming interfaces (APIs).

A significant advantage of applying Linked Data principles and technologies to DOI-registered material is that it is 'data worth linking to': it is curated, value-added, data, which is managed, corrected, updated and consistently maintained by Registration Agencies. It is also persistent, so avoiding 'bit-rot'. The DOI web proxy (http://dx.doi.org) is now enabled to support content negotiation for DOI names. In the early days of the web, human beings were following most URLs, and it made sense that the DOI web proxy only resolved CrossRef DOI names to human-readable web pages.

This announcement by CrossRef is part of improvements the International DOI Foundation is continuing to make to facilitate more sophisticated uses of a DOI name beyond single redirection to a human-readable landing page, including Linked Data (machine-readable metadata in the form of RDF); delivery of information in other formats (XML, etc.); and multiple typing (multiple URLs, other non-URL types to express semantic relationships, etc. using mapping technologies of the Vocabulary Mapping Framework (VMF). We will be making further announcements on some of these later this year.
For further information see:

- CrossRef Linked Data Announcement and Examples
- Vocabulary Mapping Framework (VMF)

Revised DOI cost-sharing model

The International DOI Foundation has announced a change in the way in which DOI Registration Agencies fund the common infrastructure of the DOI System.

The DOI System is a cost-recovery system. The cost of common DOI infrastructure (run by the International DOI Foundation on behalf of all DOI Registration Agencies) is met by a charge made to each Registration Agency, whilst allowing each Registration Agency to adopt individual commercial models incorporating DOI registration for their services. As of June 2011, the DOI System will adopt a revised model for this charge, transitioning from the current financial model (a charge per DOI name registered) to a revised model (based on a fixed fee per Registration Agency).

The introduction of this new system will result in lower long term charges, and has been made possible through the successful growth of the DOI System; it is designed to encourage further growth. Registration Agencies remain free to adopt their own charging model for their individual value-added services.
For further information, contact contact@doi.org.

DOI Syntax

The resulting scheme was called the Digital Object Identifier. DOIs actually are in line with the Internet Engineering Task Force's preliminary specifications for Uniform Resource Names (URNs). URNs are more general than standard Web URLs; they also have the properties of persistence over time (i.e., they do not become invalid) and high availability (e.g., they do not depend on a single Web server being up and running).

DOIs have a simple syntax, which is shown in Figure 1.

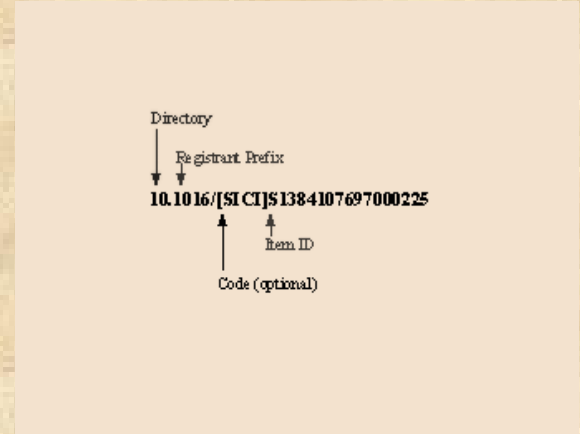


Figure 1: Syntax of the Digital Object Identifier.

The DOI has two parts: the prefix and the suffix.

The registrant prefix (1016 in this example, corresponding to Elsevier Science) is a number that corresponds to the publisher (or other intellectual property owner) that assigns the DOI. The prefix is prepended with a number (10 in this example) that can denote the directory that assigned the prefix to that publisher, followed by a period (.).

A slash (/) separates the prefix and the suffix.

The suffix begins with an optional code designator in square brackets, which can be helpful as a signal to software (or human users) that the following item ID uses a known identification scheme. Item IDs can be any character string, although the current implementation has a limitation of 128 characters. Almost any printable character is valid in item IDs. (There are a few minor limitations when DOIs are embedded within URLs.) URLs can even be embedded within item IDs. In the example in Figure 1, the suffix is [SICI]S1384107697000225. The [SICI] signals that the following item ID is a Serial Item and Contribution Identifier, while the item ID itself is S1384107697000225.

The Directory: Making DOIs Work

DOIs work by means of a directory that resolves them to Internet addresses, which are Internet URLs. URLs are typically Web addresses (HTTP), but they can also be addresses for such things as FTP and gopher servers. The DOI System will ultimately have a global, distributed, highly available network of directories, but currently, there are three directory servers: one in Reston, Virginia, the others in California, all run by the Corporation for National Research Initiatives, with directory ID 10. In the future, third parties — such as publishers, "infomediary" Web sites, and other value-added service providers — may be able to run their own directories in the network. If that capability is built into the underlying technology, then each will get its own directory number.

Each directory has a manager who assigns DOI registrant prefixes and establishes password-protected interfaces to publishers and other intellectual-property owners. A publisher can get a single prefix or many, e.g., one for each division or imprint. After a publisher receives its prefix, it can deposit full DOIs with the directory. To deposit a DOI, the publisher must supply both the DOI and a URL. Publishers can register one DOI at a time or, more commonly, in batches. (Some publishers have already registered tens of thousands of DOIs in one step.)

The URL does not necessarily point to the content item itself. At a minimum, it should point to a response page that tells the user — or a piece of software — what to do next. Here are some examples of what a response page can do:

- Show some information about the content item, such as author, title, publication date, an abstract, perhaps a GIF image of the cover, and an offer to sell the item to the user — like book description pages on Amazon.com[5].
- Provide an order form for subscribing to a journal.
- Offer to transmit the content itself in a secure container.
- Download a Java applet that runs on the user's machine.
- Give information that the DOI refers to an out-of-date publication, perhaps with an offer to link to the most recent version.

A DOI never changes once it is registered. However, a publisher can change the URL corresponding to a DOI in the directory. That is one of the most important advantages of DOIs — they are persistent identifiers that provide a buffer between a reference to an object and its physical location. If a publisher restructures its Web server, installs a new content-management system, or changes its internal organization of content in some other way, it need simply change the URLs corresponding to DOIs it has registered.

DOIs don't change even if a publisher sells or otherwise transfers ownership of content items to another organization. Even the prefixes stay the same. The prefix of a DOI is primarily meant to ensure that the directory issues no duplicate DOIs, and that publishers have maximum freedom to assign whatever item IDs they wish. Therefore, DOIs can find content even if — as happens all too frequently — product lines are bought and sold among publishers.

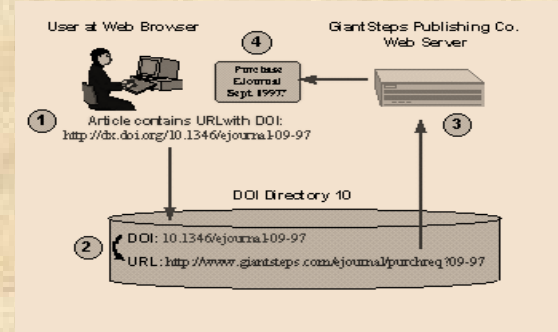
Using DOIs

DOIs can be used in various ways. At the most minimal level, users can enter DOIs by hand (or cut and paste them) into a lookup screen [formerly http://www.doi.org/lookup.html] at the DOI directory's Web site and get them resolved to URLs. But a more typical way of using DOIs is to embed them in URLs for simple, click-to-resolve functionality. Currently, a URL of the form http://dx.doi.org/DOI initiates the resolution process when invoked.

As a very simple example, http://dx.doi.org/10.1000/9 contains the DOI 10.1000/9, which belongs to the DOI Foundation (prefix 1000) and refers to the DOI Frequently Asked Questions document (item ID 9). In this case, the DOI resolves directly to the document itself at URL http://www.doi.org/faq.html. But if The International DOI Foundation wanted to charge for access to that document, offer to put you on its mailing list, inform you that the document is obsolete, or even just ensure the longevity of the reference; it could use a DOI and embed it in a dx.doi.org URL.

If the DOI Foundation were to transfer ownership of that document to another organization, the DOI for the document would stay the same, even though the URL to which it resolves might change. For example, let's say that the International Federation of Reproduction Rights Organizations (IFRRO) took over responsibility for the DOI. Then the document might move to IFRRO's Web site, and the URL in the DOI directory would need to be changed to something like http://www.copyright.com/ifrro/doi/faq.html. But the DOI would still be 10.1000/9.

Figure 2 shows how the DOI directory resolves



URLs. Figure 2: Resolving a DOI through the directory.

In step 1, a user is looking at an article on her Web browser that refers to the September 1997 issue of EJournal, published by GiantSteps Publishing Co. The article has a URL containing a DOI, http://dx.doi.org/10.1346/ejournal-09-97. The DOI prefix 1346 is owned by GiantSteps. When the user clicks on that URL, the Web browser goes to dx.doi.org to access the DOI directory.

In step 2, DOI Directory 10 looks up DOI 10.1346/ejournal-09-97 and finds the URL http://www.giantsteps.com/ejournal/purchreq?09-97. That happens to be a CGI script on GiantSteps' Web site that constructs a response page asking the user if he or she would like to purchase the journal issue (supplied as argument after the ? in the URL).

In step 3, The DOI Directory fires off that URL, which reaches GiantSteps' Web server.

Finally, in step 4, GiantSteps' Web server sends a response page asking the user if she would like to purchase the September 1997 issue of EJournal.

DOIs can be used in ways other than embedding in URLs. For example, a "secure container" may contain a DOI, which it can use to access content once the user has satisfied the security or payment requirements. We have already been discussing with some of the secure container software vendors the possibility of incorporating the DOI into their technologies. As another example, a library lookup service that uses Dublin Core bibliographic data could populate the Resource Identifier elements of its database with DOIs and use them to retrieve items found in bibliographic searches.

DOI Status and Outlook

The DOI model happened to be a perfect fit to technology developed by the Corporation for National Research Initiatives (CNRI) called the Handle System. CNRI is a not-for-profit organization in Reston, Virginia, that was founded by Robert Kahn and Vinton Cerf, two of the fathers of the Internet. It engages in research and development intended to advance the technology of the National Information Infrastructure.

CNRI adapted the Handle System for use with DOIs, and the result was the current DOI Directory. Nine publishers voluntarily participated in a prototype phase from July through mid-October 1997, committing their own resources to create DOIs for their material. At the end of that phase, those publishers had deposited over a quarter million DOIs. Then, three years after the AAP Enabling Technologies Committee first convened, the system went "live" to the world and was presented at the Frankfurt Book Fair in October 1997, to overwhelmingly positive reaction. At this point, the directory is ready to accept online applications for DOI prefixes and to register DOIs; the DOI Web site has a "Getting Started" page for those who are interested. CNRI is continuing development on the DOI System.

The DOI initiative has expanded beyond the purview of the AAP. The International DOI Foundation (IDF), a not-for-profit organization, was incorporated on October 10th, 1997, with offices in the United States and Switzerland. An international Board of Directors was appointed to oversee the Foundation. Under the chairmanship of U.S. Representative Charles Ellis (John Wiley & Sons), the Board currently comprises Jean-

Manuel Bourgois (Editions Vuibert, France), Dietrich Goetze (Springer-Verlag, Germany), Robert Kiernan (Routledge, U.K.), and Herman Spruijt (Elsevier Science BV, Netherlands). Carol Risher of AAP is the IDF's acting General Manager. The DOI has been endorsed by such international organizations as the International Publishers Association (IPA) and the International Association of Scientific, Technical & Medical Publishers (STM).

The cat is out of the proverbial bag now. Although the members of the various committees and subcommittees worked assiduously to ensure publishers' cooperation, the coming months will be crucial in determining its success. Will its relatively modest level of standardization prove valuable for publishers? Will other media industries want to embrace the technology? (Already some, like the music and motion picture industries, have begun to look at it.) Will it attract a critical mass of commercial technology vendors? Those are among the yardsticks by which the publishing community will measure the DOI's success.

Perhaps the real value of the DOI is that it has brought publishers and technologists to the same table. Mutually beneficial discussions have already taken place about the nature of the problem, the business risks and opportunities, the magnitude of work publishers must do to be successful online, and the opportunity for technology vendors. The DOI is not a silver bullet that will eliminate the urgent need for publishers to get their houses in order with respect to intellectual-property management — although, with the establishment of a mini-industry of technology vendors building DOI-compatible electronic publishing solutions, they should find their burdens eased and their time to market shortened.

At a minimum, the DOI helps ensure that publishers will dance to the same rhythm. By adopting the DOI, publishers are making a statement akin to the one the great publisher Benjamin Franklin made at the signing of the Declaration of Independence, "We must all hang together, or assuredly we shall all hang separately." Adopting electronic-publishing solutions based on common open standards increases the likelihood that publishers' capital investments will pay off. It helps ensure that publishers will be able to extend their franchises into cyberspace, where much of the world of information is surely going.

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Six Sigma is a relatively new concept as compared to Total Quality Management (TQM). However, when it was conceptualized, it was not intended to be a replacement for TQM. Both Six Sigma and TQM have many similarities and are compatible in varied business environments, including manufacturing and service industries. While TQM has helped many companies in improving the quality of manufactured goods or services rendered, Six Sigma has the potential of delivering even sharper results.

What is Six Sigma and Total Quality Management?

Six Sigma was developed by CEOs to create an infrastructure of change agents throughout the organization. These change agents focus on strategic goals to provide tangible benefits to major stake holder groups (customers, shareholders, and employees). Six Sigma emphasizes breakthrough rates of improvement, and focuses on world class performance to achieve organizational success.

Total Quality Management is often associated with the development, deployment, and maintenance of organizational systems that are required for various business processes. It is based on a strategic approach that focuses on maintaining existing quality standards as well as making incremental quality improvements. It can also be described as a cultural initiative as the focus is on establishing a culture of collaboration among various functional departments within an organization for improving overall quality.

The Evolution of Six Sigma and TQM

Before, January 15, 1987, Six Sigma was solely a statistical term. Since then, the Six Sigma crusade, which began at Motorola, has spread to other companies who are continually striving for excellence. While it is progressing, it has extended and evolved from a problem-solving technique to a quality strategy and ultimately into a sophisticated quality philosophy. However, this unique philosophy only became well known after GE's Jack Welch made it a central focus of his business strategy in 1995. Today, Six Sigma is the fastest growing business management system in industry.

The TQM concept was developed by a number of American management consultants, including W. Edwards Deming, Joeseph Juran, and A.V. Feigenbaum. Originally, these consultants won few converts in the United States. However, managers in Japan embraced their ideas

enthusiastically and even named their premier annual prize for manufacturing excellence after Deming.

Six Sigma Success Factors

Research into what makes a Six Sigma implementation a success has revealed 10 Critical Success Factors. They are, in order of importance:

1. Top management leadership & commitment
2. A well implemented customer management system
3. A continuous education & training system
4. A well-organized information & analysis system
5. A well-implemented process management system
6. A well-developed strategic planning system
7. A well-developed supplier management system
8. Equipping everyone in the organization, from top management to employees, with a working knowledge of the quality tools
9. A well-developed human resource management system
10. A well-developed competitive benchmarking system

How Does Six Sigma Work

Six Sigma is a disciplined and quantitative approach involving setting up a system and process for the improvement of defined metrics in manufacturing, service, or financial processes. The approach drives the overall process of selecting the right projects based on an organization's business goals and selecting and training the right people to obtain the results. Improvement projects follow a disciplined process defined by a system of four macro phases: measure, analyze, improve, control (MAIC).

Sometimes a preliminary step, define, is added at the beginning, which relates to the appropriate selection of projects and problem definition. The problem must be chronic and impactful.

Statistical Meaning of Six Sigma

The term sigma is a Greek alphabet letter (σ) used to describe variability. In Six Sigma, the common measurement index is DPMO (Defects per Million Operations) and can include anything from a component, piece of material, or line of code, to an administrative form, time frame or distance. A sigma quality level offers an indicator of how often defects are likely to occur, where a higher sigma quality level indicates a process that is less likely to create defects. Consequently, as sigma level of quality increases, product reliability improves, the need for testing and inspection diminishes, work in progress declines, cycle time goes down, costs go down, and customer satisfaction goes up.
To have a more comprehensive understanding about sigma quality level, it will be explained from two perspectives of process capability: short-term and long-term process capabilities.

Applications Where Six Sigma is Better

Six Sigma initiatives are based on a preplanned project charter that outlines the scale of a project, financial targets, anticipated benefits and milestones. In comparison, organizations that have implemented TQM, work without fully knowing what the financial gains might be. Six Sigma is based on DMAIC (Define-Measure-Analyze-Improve-Control) that helps in making precise measurements, identifying exact problems, and providing solutions that can be measured.

Table 1: TQM vs. Six Sigma

TQM	Six Sigma
A functional specialty within the organization.	An infrastructure of dedicated change agents. Focuses on cross-functional value delivery streams rather than functional division of labour.
Focuses on quality.	Focuses on strategic goals and applies them to cost, schedule and other key business metrics.
Motivated by quality idealism.	Driven by tangible benefit for a major stockholder group (customers, shareholders, and employees).
Loosely monitors progress toward goals.	Ensures that the investment produces the expected return.
People are engaged in routine duties (Planning, improvement, and control).	"Slack" resources are created to change key business processes and the organization itself.
Emphasizes problem solving.	Emphasizes breakthrough rates of improvement.
Focuses on standard performance, e.g. ISO 9000.	Focuses on world class performance, e.g., 3.4 PPM error rate.
Quality is a permanent, full-time job. Career path is in the quality profession.	Six Sigma job is temporary. Six Sigma is a stepping-stone; career path leads elsewhere.
Provides a vast set of tools and techniques with no clear framework for using them effectively.	Provides a selected subset of tools and techniques and a clearly defined framework for using them to achieve results (DMAIC).
Goals are developed by quality department based on quality criteria and the assumption that what is good for quality is good for the organization.	Goals flow down from customers and senior leadership's strategic objectives. Goals and metrics are reviewed at the enterprise level to assure that local sub-optimization does not occur.
Developed by technical personnel.	Developed by CEOs.

Conclusion

Six sigma is also different from TQM in that it is fact based and data driven, result oriented, providing quantifiable and measurable bottom-line results, linked to strategy and related to customer requirements. It is applicable to all common business processes such as administration, sales, marketing and R & D. Although many tools and techniques used in Six Sigma may appear similar to TQM, they are often distinct as in Six Sigma, the focus is on the strategic and systematic application of the tools on targeted projects at the appropriate time. It is predicted that Six Sigma will outlast TQM as it has the potential of achieving more than TQM.

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Grey Literature

What is Grey Literature?

The Fourth International Conference on Grey Literature (GL '99) in Washington, DC, in October 1999 defined grey literature as follows: "That which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers."

In general, grey literature publications are non-conventional, fugitive, and sometimes ephemeral publications. They may include, but are not limited to the following types of materials: reports (pre-prints, preliminary progress and advanced reports, technical reports, statistical reports, memoranda, state-of-the art reports, market research reports, etc.), theses, conference proceedings, technical specifications and standards, non-commercial translations, bibliographies, technical and commercial documentation, and official documents not published commercially (primarily government reports and documents) (Alberani, 1990).

Due to the nature of grey literature, librarians have had difficulty acquiring and making accessible grey literature. At The New York Academy of Medicine, there has been a push by public health and health policy researchers for the Academy Library to obtain this type of material and to add it to the catalog (Gray, 1998). As a result, the Library acquires materials from various organizations publishing in these areas and gives them special cataloging treatment. The Grey Literature Report is the first step in this initiative to not only collects these items for the Academy's collection, but to assist other librarians with collections in these fields in developing theirs.

Definition(s)

- "Grey literature is defined as ... **"information produced on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing" ie. where publishing is not the primary activity of the producing body."**
  (ICGL Luxembourg definition, 1997 - Expanded in New York, 2004)

- **"...grey literature publications are non-conventional, fugitive and often ephemeral. They may include but are not necessarily limited to the following types of materials: reports (pre-prints, preliminary progress and advanced reports, technical reports, statistical reports, memoranda, state-of-the art reports, market research reports, etc.), theses, conference proceedings, technical specifications and standards, non-commercial translations, bibliographies, technical and commercial documentation, and official documents not published commercially (primarily government reports and documents)". (Alberani, 1990).**

Introduction

- Grey - or gray - literature is historically difficult to identify because: much of it is unindexed or unpublished (often both), and it is often locked deep within the "hidden or invisible" web.
- Due to changes in scholarly publishing - ie. digitization projects, Google Book Search, open access and self-archiving, grey literature is now more visible and retrievable.
- The explosive growth of the web has had a significant impact on production, access and distribution of grey literature such that "the difficulty of retrieval, which used to be a distinctive feature of grey literature . . . is now being minimized."
- Increasingly, institutional repositories - such as the University of Toronto TSpace - archive faculty publications and make them available and searchable on the web. For example, materials may be crawled by Google scholar and/or Scirus. For systematic reviews, several search engines that crawl different portions of the Web should be searched as "one-stop searching" does not (yet) exist.
- Start your search for grey literature by scanning/browsing relevant government or institutional websites.
- If you are an information professional or searcher, try: ***Grey Text*** - An Inhouse Archive of Documents on Grey Literature

What differentiates traditional GL from other published literature?

- Historically, the publication of GL has not been considered part of traditional publishing channels and models.
- Producers of GL include research groups, non-profits, universities and government departments, to name a few.
- *Not widely disseminated or promoted.*
- Wide dissemination of published materials is the goal in traditional publishing. Often, an infrastructure exists to disseminate this material to make it visible.
- The web is changing dissemination and publishing processes. However, their retrieval on the web remains a difficult issue.

Some examples of non-traditional publishing

- Some organizations create their own reports, studies, etc. This is increasingly true in web 2.0.
- Think of health organizations that publish their own studies, such as the Canadian Cancer Society and the Heart & Stroke Foundation
- Government publications
- Librarians try to adopt pro-active approaches to finding locally-published materials, though Web-based searching, self-archiving and open access are helping to facilitate access.

- Specialized strategies are needed to facilitate identification and retrieval of GL.

The field of GL has evolved into a world of its own with specific research methodologies, vocabularies, systems and solutions. Before exploring these methods, let's highlight some of the work that health librarians are doing in this area.

Library & information research into Grey Literature (GL)

- Librarians and information specialists are the acknowledged experts in searching.
- Several LIS experts write regularly about searching for the grey literature. *See* **Who is who in GL?**
    - Julia Gelfand is an applied sciences librarian at the University of California who has studied grey literature for many years and presented at international GL conferences. Her research includes searching, preservation issues and scholarly communication.
    - Canadian librarian Diane Helmer has written articles about GL and presented at CHLA/ABSC.
    - CADTH (Canadian Agency for Drugs and Technologies in Health) employs a number of health librarians and expert searchers and has developed extensive lists of sources.
    - U.S. health librarian Marcus Banks has published several papers about the positive impact of open access on GL.
    - Librarians at the New York Academy of Medicine produce reports on grey literature, which are useful for collection development and current awareness <http://www.nyam.org/library/pages/grey_literature_report>.

- Search engines help to uncover a lot of grey literature. Marcus Bank's research suggests that the barriers to finding grey literature may be coming down as a result of open access and search engines. Gary Price, a search expert and librarian, has said that 'public information on the deep Web is currently 400 to 550 times larger than the surface Web'. In light of institutional repositories and open archives the deep web is more accessible than ever but much continues to be locked away behind commercial (or password-protected) databases.

- Health literature fares better than some areas. But conference proceedings, abstracts and government reports in the pre-digital era are difficult to locate. The Web provides access to billions of web pages, but not all relevant health information is digitized yet. Health librarians should work toward improving access to older materials, which, arguably, now form part of the grey literature.

Examples of where Grey Literature is used

- Most work done at PhD-level requires exhaustive searching for hard-to-finds
- Systematic reviews, clinical trials and in-house research covering health and wellness issues
- Most advanced research done at universities, medical schools and health organizations
- Environmental organizations distribute publications and newsletters designed to gain support for conservation of wildlife and natural resources and to promote greater environmental awareness
- Geological and geophysical surveys, maps, fossil records, and locations of minerals and ores are among the items of grey literature used by geologists to support their research.
- Grey literature in technological fields like aeronautics and engineering may include contractor reports, technical reports, product codes and standards, special publications, handbooks and patents.

Major trends in Grey Literature

Open Access (OA) to materials and the creation of institutional repositories has revolutionized publishing and the work of providing access to published works. Despite pivotal information trends like these, some digital and print materials are still hard to find and obtain. All librarians and information specialists have personal stories about finding elusive conference proceedings, abstracts and reports. The digital age has not completely changed that - not yet in any case.

The emergence of search engines has helped to index (and make findable) a lot of GL. But searching carelessly with Google creates other problems for information specialists as important documents can easily be missed. Even though the Web is estimated to be 500 billion - perhaps as high as one trillion pages, its functionality as a search space is limited due to its methods of organization.

Computer algorithms help to improve search engines. Page rank uses popularity as a means of ranking results with important items rising to the top. But by placing popular materials at the top of results, searchers will rarely beyond the first six or seven results.

As librarians know, relying on popular documents that rise in search results is not a recommended strategy. Important documents may be easily retrieved via search engines, but some GL may ultimately be hidden within results, down several pages or not visible at all due to a relative lack of popularity. (Other trends to watch: collaborative writing/publishing via Wikis and blikis.)

Indexes & Databases with Grey Literature

See **189 relevant health databases**

- Academic Search Complete
- Biosis® - international life sciences journals and meetings
- CINAHL - nursing and allied health literature
- ERIC - http://www.eric.ed.gov/

- Free Public Health Databases - http://library.umassmed.edu/ebpph/freephdbs.cfm
- GIDEON (Global Infectious Disease Epidemiology Online Network) - http://web.gideononline.com/web/epidemiology/
- Google scholar - http://scholar.google.com
- LISA (Library and Information Science Abstracts)
- Library Literature and Information Science
- Medline® - http://hlwiki.slais.ubc.ca/index.php/Medline
- PAIS International - Social and public policy
- Scirus - http://scirus.com
- Web of Science® - science and social science journals and cited references

Problems Surrounding the Identification and Acquisition of Grey Literature

As Charles P. Augur points out in his book, the core reasons for difficulties in identifying and acquiring this type of literature are due to its "poor bibliographic information and control, non-professional layout and format, and low print runs" (Augur 1989,3). The implementation of bibliographic control through ISBNs, ISSNs, and report numbers has been somewhat helpful, but also disorganized. For instance, reports, which make up the lion's share of grey literature, do not as a rule use ISBNs, which require a depository (Augur 1989,39). Instead, report numbering was initiated as a means to introduce standardization. The problem is that these numbers were designed to include subject matter, date, form, agency, security classification, location, additional data, and consequently, are quite long and confusing. In addition, given the nature of the literature, some categories contain security restrictions (Augur 1989, 18). Furthermore, non-availability may be due to "incomplete or incorrect identification," since accession or report numbers must be correct to obtain access (Augur 1989, 19). M.C. Debachere points out those problems arise in libraries when a patron requests a particular document, and the librarian does not know where to begin the search (Debachere 1995, 95).

Many attempts have been made to provide sourcing for grey literature, including the *Griseli Project* in France; the UK's *British Library Document Supply Centre;* the *Russian Union Catalogue of Grey Literature; and the previously mentioned SIGLE,* which is maintained and operated under the auspices of the European Association for Grey Literature Exploitation (EAGLE). AGRINDEX database is available for life sciences and agriculture, but to date, very few grey literature documents are found in it. Energy and aerospace sciences documents are predominately found in STAR (Scientific and Technical Aerospace Reports) through NASA.

Many other countries have appointed organizations to keep track of the grey literature being produced. In Canada, the *Canada Institute for Scientific and Technical Information (CISTI)* has a network set up to provide information to scientists and researchers. It operates a document delivery service that has three million titles in its database and two million technical reports on microfiche. The United States issues a general index of government publications and technical reports in the *Monthly Catalog of US Government Publications*. Other publications report the

work commissioned by the United States government, but use the minimalist approach of few details, no abstracts, and no indexes. Additionally, the *International Federation of Library Associations (IFLA)* developed the *Universal Availability of Publications (UAP)* program, which is supported by *United Nations Educational, Scientific and Cultural Organization (UNESCO)*, and offers a wide range of educational, scientific, social, economic, and technical materials to anyone anywhere (Augur 1989,34).

Grey literature is sometimes available through exchange agreements with other organizations or by subscription. Annual subscriptions are expensive, but convenient, if complete subject coverage is needed (Augur 1989, 30). Other facilities used were UNESCO book coupons, monthly standing orders, and a company such as Communicating Science, to find the information, or Crimdoc, which maintains a criminology library database for grey literature from the criminology field. Currently, many items can also be purchased through booksellers and subscription agents as the scope of the literature is growing.

Overall, there are some important things to remember when a request for grey literature is made: 1.) if there is a known ISBN, use it, 2.) reports are often issued what are called accession or report numbers that can be crucial for identification, and 3.) date, author, title, and originating body are required (Augur 1989,31). Translations can be found in UNESCO's *Index Translationum* through the *International Translations Centre, the British Library Document Supply Centre, the Consolidated Index of Translations in English, the Naval Ocean Systems Center*, and the *Canadian Index of Scientific Translations*, among other sources. Meeting papers are more difficult to get, but Simonton's *Directory* is sometimes helpful.

Cataloguing

Cataloguing and maintenance of grey literature should be considered on a library to library basis. It would appear that special libraries are primarily concerned with this literature, but academic libraries will have their share, depending upon the academic scope. Small libraries may not catalogue them at all, and choose to file grey literature in a pamphlet or vertical file collection (Augur 1989,40). AACR2 rules are available, which specify to catalogue under the corporate body, if possible. Another option is to use the guidelines set down by *Committee on Scientific and Technical Information (COSATI)* for technical and scientific reports. The following elements are included in the descriptive cataloguing process for COSATI and appear verbatim from Charles P. Augur's book (p. 40):

1. Accession or report number
2. Corporate author
3. Title
4.Descriptive role - subtitle or progress report, etc.
5. Personal author
6. Date
7. Pagination
8. Contract number
9. Report number
10. Availability
11. Supplementary note
12. Security classification

Conclusion

Many possibilities exist, but it would be more practical for some kind of universal standard protocol to be used to ensure that bibliographic access is available for all who need it. The Internet definitely helps to

provide access to some kinds of grey literature, but it is difficult to sift through all the information to find what you need. Solutions for its identification, acquisition, and cataloguing are far from solved, and will need international cooperation and consensus.

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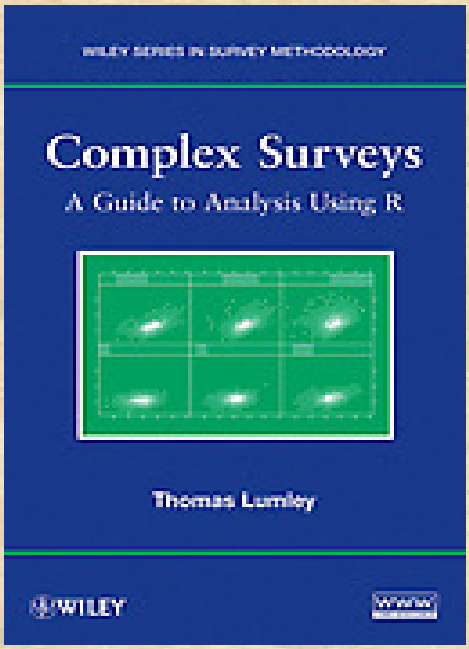
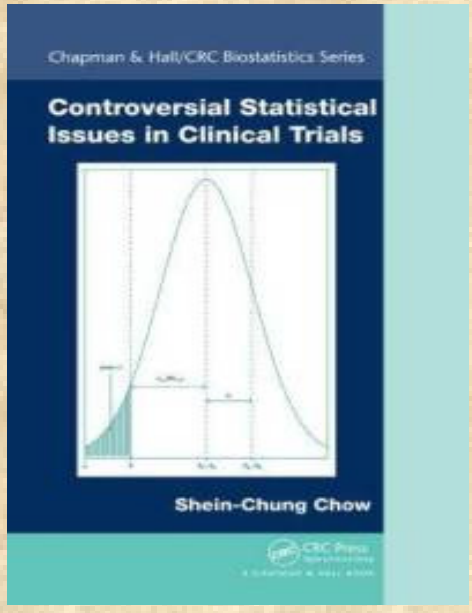
NEW ARRIVALS

A complete guide to carrying out complex survey analysis using R



As survey analysis continues to serve as a core component of sociological research, researchers are increasingly relying upon data gathered from complex surveys to carry out traditional analyses. "Complex Surveys" is a practical guide to the analysis of this kind of data using R, the freely available and downloadable statistical programming language. As creator of the specific survey package for R, the author provides the ultimate presentation of how to successfully use the software for analyzing data from complex surveys while also utilizing the most current data from health and social sciences studies to demonstrate the application of survey research methods in these fields

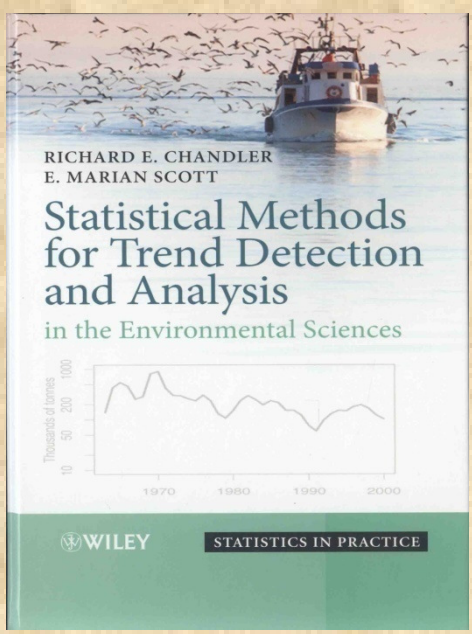
Controversial Statistical Issues in Clinical Trials



In clinical trial practice, controversial statistical issues inevitably occur regardless of the compliance with good statistical practice and good clinical practice. But by identifying the causes of the issues and correcting them, the study objectives of clinical trials can be better achieved. **Controversial Statistical Issues in Clinical Trials** covers commonly encountered controversial statistical issues in clinical trials and, whenever possible, makes recommendations to resolve these problems.

The book focuses on issues occurring at various stages of clinical research and development, including early-phase clinical development (such as bioavailability/ bioequivalence), bench-to-bedside translational research, and late-phase clinical development. Numerous examples illustrate the impact of these issues on the evaluation of the safety and efficacy of the test treatment under investigation. The author also offers recommendations regarding possible resolutions of the problems.

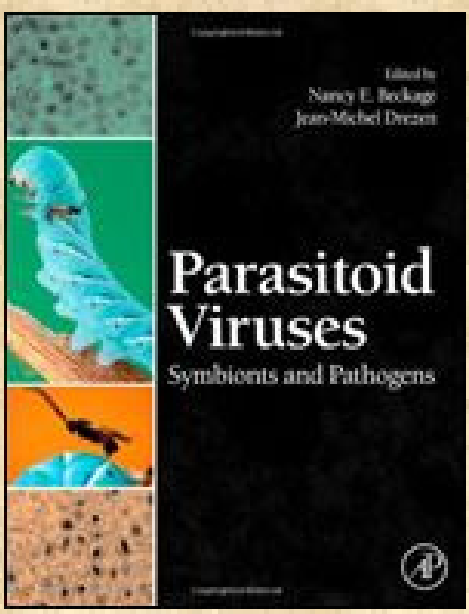
Statistical Methods for Trend Detection and Analysis in the Environmental Sciences



The need to understand and quantify change is fundamental throughout the environmental sciences. This might involve describing past variation, understanding the mechanisms underlying observed changes, making projections of possible future change, or monitoring the effect of intervening in some environmental system. This book provides an overview of modern statistical techniques that may be relevant in problems of this nature.

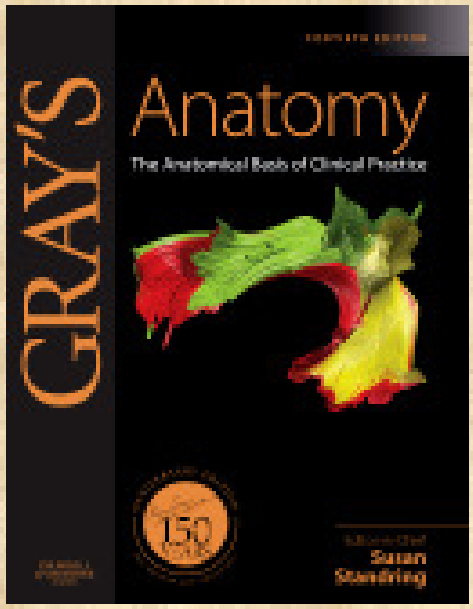
Practitioners studying environmental change will be familiar with many classical statistical procedures for the detection and estimation of trends. However, the ever increasing capacity to collect and process vast amounts of environmental information has led to growing awareness that such procedures are limited in the insights that they can deliver. At the same time, significant developments in statistical methodology have often been widely dispersed in the statistical literature and have therefore received limited exposure in the environmental science community. This book aims to provide a thorough but accessible review of these developments. It is split into two parts: the first provides an introduction to this area and the second part presents a collection of case studies illustrating the practical application of modern statistical approaches to the analysis of trends in real studies.

Parasitoid Viruses*:* Symbionts and Pathogens



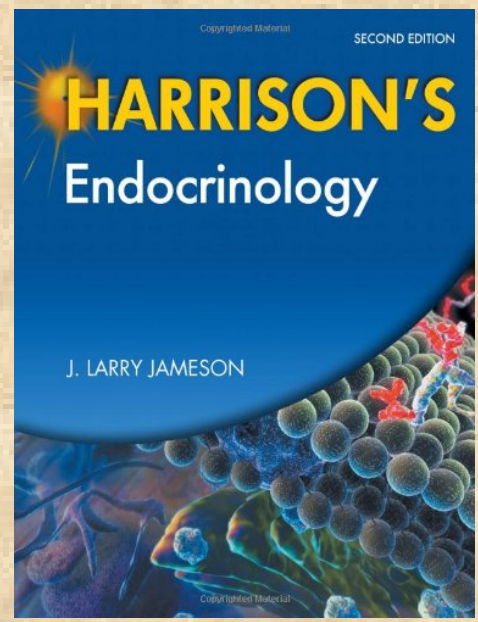
Parasitoids are parasitic insects that kill their insect hosts in immature pre-reproductive stages. Parasitoids are employed in biological control programs worldwide to kill insect pests and are environmentally safe and benign alternatives to chemical pesticides. As resistance to chemical pesticides continues to escalate in many pest populations, attention is now refocusing on biologically-based strategies to control pest species in agriculture and forestry as well as insect vector populations that transmit human and animal diseases. Parasitoids are an economically critical element in this equation and ‘integrated pest management. This book is an authentic reference on parasitoid.

Gray's Anatomy



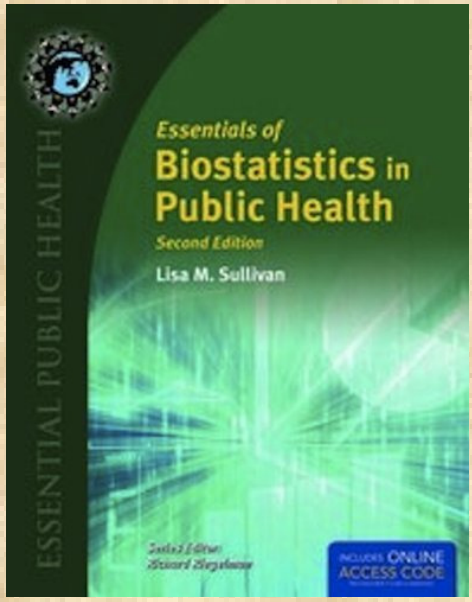
A universal landmark in medicine ever since Drs. Henry Gray and H.V. Carter published the first edition in 1858, Gray's Anatomy now celebrates its 150th anniversary! From state-of-the-art coverage of important new areas such as functional neuro-imaging, embryogenesis, and biomechanics . . . through a comprehensively revamped, lavish full-color art program . . . as well as convenient access to the complete contents online, with downloadable illustrations, the new 40th edition sets a new world standard for accuracy, clarity, and clinical relevance. It is the place to turn when you want to be sure about the anatomical considerations that pertain to safe and effective practice. You will find it an invaluable clinical resource, a pleasure to consult, and a reference.

HARRISON'S Endocrinology



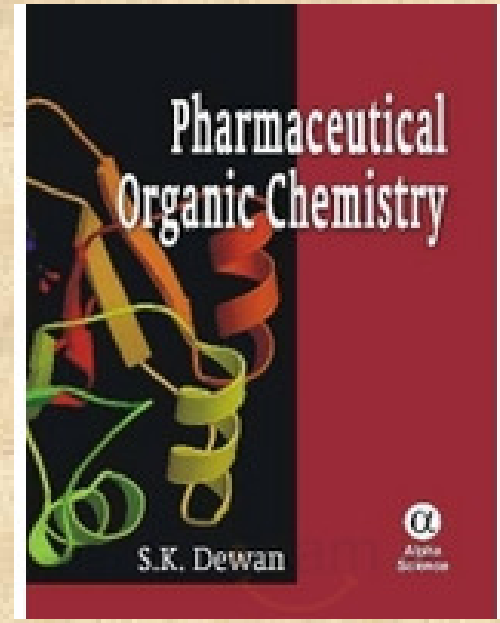
Endocrinology--with all the authority of HARRISON'S Featuring the chapters on endocrinology that appear in Harrison's principles of Internal Medicine, 17e, this compact clinical companion delivers the latest knowledge in the field, backed by the scientific rigor and reliability that have defined Harrison's. There is coverage that reflects the expertise inside of renowned editors and contributors--presented in a format that makes it an ideal resource book, it has features like Current, through coverage of need-to-know endocrinology topics, including pituitary, thyroid, and adrenal disorders; reproductive endocrinology; diabetes mellitus, obesity, and lipoprotein metabolism; disorders affecting multiple endocrine systems, and disorders of bone and calcium metabolism Integration of pathophysiology with clinical management topics in each of the disease-oriented topics Helpful appendix of laboratory values of clinical importance 88 high-yield questions and answers drawn from Harrison's Principles of Internal Medicine Self-Assessment and Board Review, 17e Content updates, new developments, and reference updates since the publication of Harrison's Principles of Internal Medicine, 17e 29 chapters written by physicians who have made seminal contributions to the body of knowledge in their areas of expertise.

Essentials of Biostatistics in Public Health



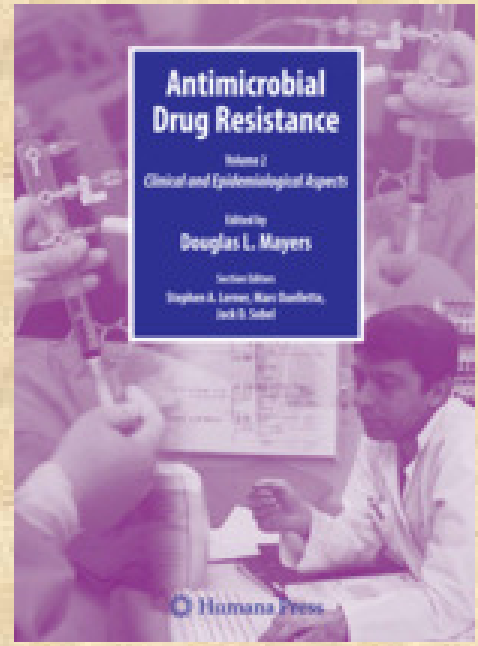
Essentials of biostatistics provide a fundamental and engaging background for students learning to apply and appropriately interpret biostatistician applications in the field of public health. As the sixth offering in the new Jones and Bartlett essential public health series, the text complements and is consistent with the approach used in the other series titles. Many examples are drawn directly from the authors' remarkable clinical experiences with applied biostatistics making this text relevant, practical, and interesting for students. The authors are integrally involved with the Framingham heart study and data will be used from that study throughout the textbook.

Pharmaceutical Organic Chemistry



Pharmaceutical Organic Chemistry introduces both fundamental and advanced topics in an easy-to-comprehend manner, covering stereochemistry, carbanions in organic synthesis, electrocyctic and sigmatropic reactions M.O. Theory, Nucleophitic substitutions, elimination reactions, neighbouring group participation, catalysis by transition metals and reagents in drug synthesis etc. The topics have been presented in a didactic approach. Students of pharmacy, biochemistry, biophysics, chemistry will find this book very useful.

Antimicrobial Drug Resistance

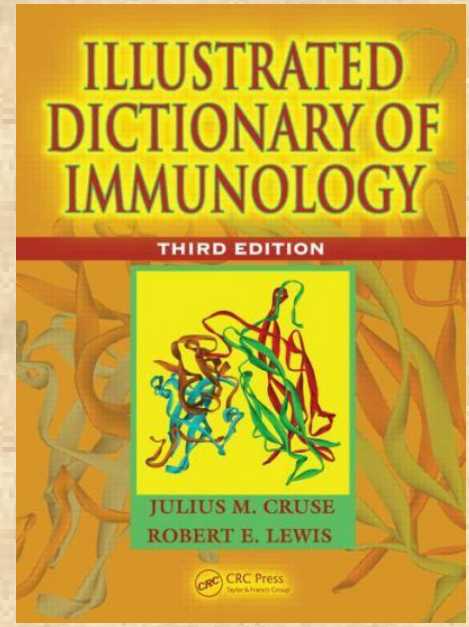


The volumes included in *Antimicrobial Drug Resistance* represent the first comprehensive, multidisciplinary reference covering the area of antimicrobial drug resistance in bacteria, fungi, viruses, and parasites from basic science, clinical, and epidemiological perspectives.

The first volume, *Antimicrobial Drug Resistance, Mechanisms of Drug Resistance*, is dedicated to the biological basis of drug resistance and effective avenues for drug development. With the emergence of more drug-resistant strains, the approach to dealing with the drug resistance problem must include the research of different aspects of the mechanisms of bacterial resistance and the dissemination of resistance genes as well as research utilizing new genomic information. These approaches will permit the design of novel strategies to develop new antibiotics and preserve the effectiveness of currently available ones.

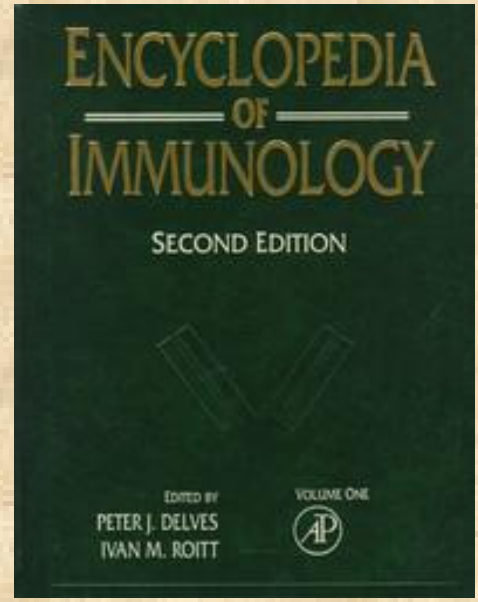
The second volume, *Antimicrobial Drug Resistance, Clinical and Epidemiological Aspects*, is devoted to the clinical aspects of drug resistance. Although there is evidence that restricted use of a specific antibiotic can be followed by a decrease in drug resistance to that agent, drug resistance control is not easily achieved. Thus, the infectious disease physician requires input from the clinical microbiologist and infection control specialist to make informed choices for the effective treatment of various strains of drug-resistant pathogens in individual patients.

Illustrated Dictionary of Immunology



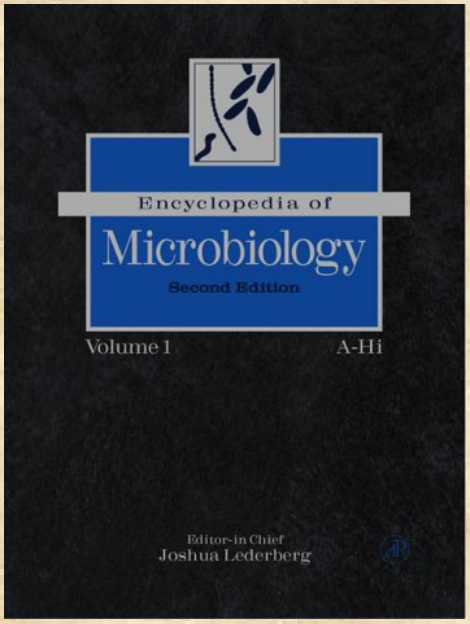
From the beginning, immunologists have maintained a unique nomenclature that has often mystified and even baffled their colleagues in other fields, causing them to liken immunology to a black box. With more than 1200 illustrations, the **Illustrated Dictionary of Immunology, Third Edition** provides immunologists and nonimmunologists a single-volume resource for the many terms encountered in contemporary immunological literature. Encyclopedic in scope, the content ranges from photographs of historical figures to molecular structures of recently characterized cytokines, the major histocompatibility complex molecules, immunoglobulin's, and molecules of related interest to immunologists. These descriptive illustrations provide a concise and thorough understanding of the subject.

Encyclopedia of Immunology



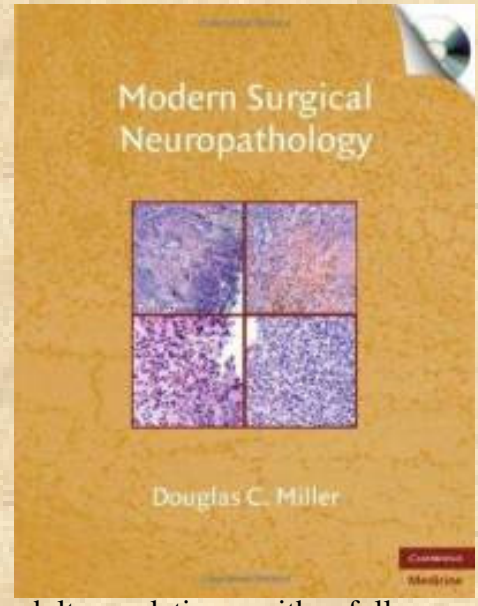
With more than 700 expert authors from 22 different countries, the **Encyclopedia of Immunology, Second Edition** is the largest comprehensive reference source of current immunological knowledge available. It provides a broad scope and high level of expertise to the many aspects of the field of immunology and related areas, including microbiology, virology, and parasitology. Arranged into 31 subject areas with extensive cross-referencing and subject indexes in each volume, the **Encyclopedia** is easy-to-use for virtually any researcher, regardless of his or her field. Concise definitions of the subject area also introduce each entry. The **Second Edition** includes more than 60 new entries, a glossary of immunological terms in each volume, a total of 500 figures and tables, and new color plates sections.

Encyclopedia of Microbiology



Encyclopedia of Microbiology is a huge reference work a must for all libraries. The topics covered are both accurately and widely discussed, and written in such a way as to be understood by non-specialists.
The 4000 pages that make up Encyclopedia of Microbiology Comprise 298 articles distributed alphabetically in four volumes. Volume 4 includes a complete subject index for the entire work, an alphabetical list of the contributors, and a glossary of key-terms used in the different articles.

Modern surgical Neuropathology



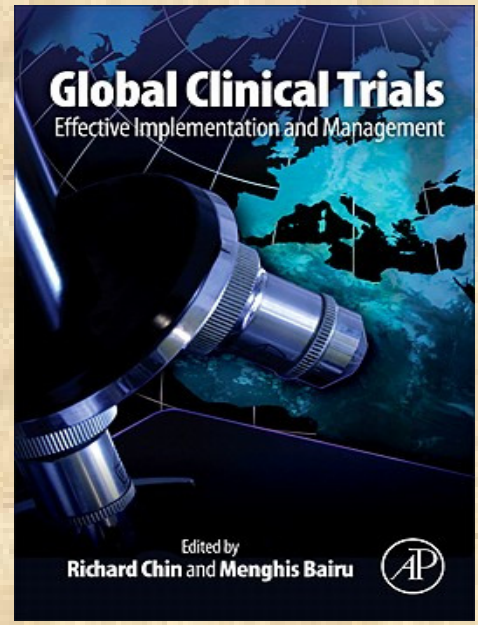
The nervous system constitutes arguably the most complex organ system in the human body, which contributes to the over-susceptibility of disease in this area. Although brain tumors were once an automatic death sentence, the outlook for recovery has brightened significantly in the past decade. The pathologist plays an indispensable role in surgical diagnosis; he or she must accurately diagnose a potentially wide array of disease entities, determine the spread of disease within millimeters, and assess patient prognosis. This new and modern reference in neuropathology comprehensively covers all the methods used by pathologists to accurately diagnose a wide array of neurologic illnesses. Brain and spinal cord tumors are the predominant focus, but a full spectrum of infectious, inflammatory, and congenital disorders are also covered in detail, in both pediatric and adult populations, with a full range of diagnostic modalities. The book is illustrated with more than 1,200 full-color photomicrographs and accompanied by a CD-ROM of all images in a downloadable format.

On the Turnpike

On the Turnpike traces the origin and history of the Indian Economic Service and in the process provides fascinating glimpses into how economic policy in India was shaped, the drama behind the various Budgets, and the thinking and compulsions that led to key decisions being made. It also captures the personalities of the key players who shaped these policies.

The book describes the circumstances under which the Cadre for advising and shaping economic policy under the Ministry of Finance was born, the contributions it has made, the challenges it has faced and the path ahead. Those looking for a quick and comprehensible insights into the wisdom and follies of Indian economic policy over the last 60 years will find this book instructive and amusing.

Global Clinical Trials



This book explores the great opportunities and challenges which exist in conducting clinical trials in developing countries. By exploring the various regulations specific to the major players and providing insight into the logical challenges including language barriers, this book provides a working tool for clinical researchers and administrators to navigate the intricacies of clinical trials in developing countries. Important topics such as ethical issues are handled very carefully to highlight the significant differences of conducting this work in various jurisdictions. Overall, it presents a clear and comprehensive guide to the ins-and-outs of clinical trials in various countries to assist in design, development, and effectiveness of these trials.

NEW CONCEPTS

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Seminars / Conferences / Workshops in Library/Information Science

1. **International Conference on Trends in Knowledge and Information Dynamics - ICTK 2012**

   Time: July 10, 2012 to July 13, 2012
   Venue: Bangalore
   Themes: Stream 1: Trends in Library Education and Research
   Stream 2: Trends in Public Library Services
   Stream 3: Trends in Domain Specific Information Systems and Services
   Stream 4: Trends in Open Access to Information and Data
   Stream 5: Trends in ICT applications to Library and Information Science
   Website or Map: http://drtc.isibang.ac.in/

2. **Innovative Practices in LIS Education and Services in the Present Era**

   Time: July 27, 2012 at 9pm to July 28, 2012 at 5pm
   Venue: Dayanand Arya Kanya Mahavidhyalaya Jaripatka, Nagpur
   Themes: ICT challenges to Library Professionals
   Present status of Information System, Network & consortia
   Web resources for Libraries
   Knowledge Mapping
   Digital Library Services

3. **ISKO International Conference (ISKO 2012) on Categories, Conceptual Structures, Contents and Relations in Knowledge Organization**

   Time: August 6, 2012 at 6pm to August 9, 2012 at 7pm
   Venue: University of Mysore, Mysore
   Themes: Categories, Relations and Contexts in Knowledge Organization

4. **Conservation of Library Materials**

   Time: August 20, 2012 to August 24, 2012
   Venue: National Research Laboratory for Conservation of Cultural Property (NRLC), E/3, Aliganj, Lucknow
   Themes: History and technology, types of constituents, deterioration studies, physic-chemical studies, documentation, conservation techniques of library materials and filed studies

   Website: www.nrlc.gov.in