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**INTRODUCTION**

By now, millions of people exchange data over the Internet. Having 4 computing centers connected to the Internet in 1969, the number of connected computers grew to a 100 in 1977, to a 1000 in 1984, to 10,000 in 1987, to 1 million in 1991 and to 10 million in 1996 [1]. Including all controlled-access Internets, so-called "Intranets", this number was expected to grow well over 100 million in just a few years of the new millennium [2].

It all started 1969 in the United States. What we know today as "Internet", "Web", "Net", "Information Superhighway", or "Cyberspace" has its origin in an U.S. Department of Defense project to connect several computers in the country. The ARPANET (Advanced Research Projects Agency Network) was designed to stay functional after partial destruction from bombs or other disasters. In the early 1990's, search tools such as "Gopher" and "Archie" lead to an exponential growth rate of the Internet. In 1991, the World Wide Web (WWW) was born at CERN in Switzerland (European Laboratory for Particle Physics). A simple way to exchange information on the Internet was created. The release of the first graphical web browser in 1993 was another milestone in the development of today's Internet. And who would not remember the storm in the stock market when Netscape (the first multifunctional web browser company) climbed to new financial heights during its 1995 Initial Public Offering (IPO), starting the era of the "Dot.com's". And despite the crash of the Internet companies in the late nineties (era of the Dot.bomb's) the Internet is here to stay and will play a very important role in our daily life.

Today, most people think about how to retrieve information when talking about the Internet. However, it is equally important for the medical community to know how to disseminate information. During this workshop we will look at a variety of aspects such as the basic technologies behind the Web, discuss how to retrieve information, look at selected anesthesia web resources, explain how to disseminate information, and have a look into the future.

**INTERNET BASICS**

The Internet, also called the Net, the Web or World Wide Web (WWW) is a network of networks. People sitting in front of computers called "clients" connect with a software program called "browser" through a connection (modem, Asynchronous Digital Subscriber Line ADSL, satellite, or cable) to the network. Traffic distributors called "routers" will direct data within the network. Requests for information will go to special storage computers called "servers" and the requested information will be sent back to the people asking for it.

The information is transformed into numbers, blocks of numbers are formed, and a computer address is applied to each packet of numbers. The packets are sent as electronic signal and received by the client (requesting computer). The numbers are reassembled and the information (numbers, text, sound, image, video) appears on the computer screen. The packets sent over the network do not necessarily take the same route. They can be redirected to other paths whenever an existing path is blocked or destroyed. Since all packets have the same address they will ultimately find their way to the requesting computer (at least in the perfect world). In order for all this to function several conditions have to apply: Computers have to be connected to the network (Internet) and have to have a unique address to receive the packets. At the same time, web pages stored on the servers must have a unique address called "URL or Uniform Resource Locator". Behind web site addresses such as [www.euroanesthesia.org](http://www.euroanesthesia.org) is a unique number identifying the server on which ESA's web site is stored. "www" indicates that the server is connected to the World Wide Web and "euroanesthesia.org" is called the domain name. Each page within this domain has its own URL.

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## RETRIEVING DATA FROM THE NET

What has originally been built to transfer military data and then scientific information has become a public information super highway. According to the American Medical Association (AMA), only 37 % of US physicians were connected in 2000 to the Internet. Most of them used the web for E-mail, information gathering, for fun or for online trading. Interactive tools make it possible to search thousands of web sites for specific information. However, after a few seconds, the user is left with an overwhelming amount of web addresses pretending to offer the most up-to-date information on the requested topic. Nevertheless, never before was it possible to get such instant information around the clock. It is estimated that the web usage among physicians around the world will substantially grow over the coming years and that doctors already using the net will expand their professional online activities. When asked how electronic data transfer via the Net would affect the daily life of physicians 52% expected an improvement in practice management, 30% improved claims processing, 22% improved patient communication, 12% improved customer service, 12% improved medical literature management, and 8% thought it would provide them with a good marketing platform for themselves.

Healthcare professionals can benefit from a wide variety of resources on the Net (besides the so popular web sites offering porn, news, stock market information, travel, and entertainment news). The problem is therefore no longer finding information but assessing the credibility of the publisher as well as the relevance and accuracy of a document retrieved from the Net. The challenge is to filter the good from the bad. In many cases, a given Web site provides no appropriate documentation regarding the scientific design of a medical study, nor are studies made available that support given claims. Several methods can be used to assess the credibility of online resources. Good web sites usually list their supporter (academic institutions, sponsors, organizations) and contributors. Peer reviewed sites are certainly valued higher than non-peer reviewed ones.

Some organizations such as The Health on the Net Foundation offer Code of Conducts (HONcode) for medical and health Web sites with the goal to promote the reliability and credibility of information. However, a review of the review organizations revealed that services differ greatly in term of coverage, formality, and intended audience. In addition, the number of evaluated sites affects the quality of review and smaller review sites (such as libraries, information professionals) offer detailed evaluation and look for quality in contrast to larger sites (such as Lycos) using different criteria such as layout and presentation of content [3]. Non-profit organizations such as the Health Information Technology Institute (HITI), the Agency for Health Care Policy and Research (AHCPR), the Joint Commission on Accreditation of Health Organizations (JCAHO), and the American Medical Association (AMA), have created a White Paper to provide some guidelines regarding credibility of web sites. They recommend to look for the following criteria when assessing quality of Health Information on the Internet: credibility (source, currency, peer-review), content (accuracy, authorship, intent), design (ease of navigation, overall design), interactivity (feedback, chat rooms, search), links (internal and external), and disclaimer/disclosure information.

## SOME SELECTED ANESTHESIA-RELATED WEB SITES

There are many good web sites for anesthesiologists on the Internet. It is almost impossible to continuously track them and keep an updated list of such sites. The following sites are by no means part of a complete listing. They represent a personal selection made by the presenter of this workshop. Please use links on your society's web sites or online search engines to find more anesthesia-related URL's.

### EUROPEAN SOCIETY OF ANAESTHESIOLOGISTS

The ESA web site is divided into 4 sections: About ESA, Education, Links, and Congresses. The site offers a wide variety of information and education and provides a good service to members and non-members alike. If you have not visited our society web site yet...now is the time! [www.euroanesthesia.org](http://www.euroanesthesia.org)

### AMERICAN SOCIETY OF ANESTHESIOLOGISTS

Similar to the ESA web site, the ASA is offering lots of useful information and education via its online portal. In addition to professional information, the site offers a nice selection of patient education. Check what your American colleagues do! <http://www.asahq.org/>

### THE INTERNET JOURNAL OF ANESTHESIOLOGY (IJA)

This online journal was created by Olivier Wenker in 1995. It is published by Internet Scientific Publications, an online publishing house with 54 online medical journals. Access to the content is free. All

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articles are peer reviewed. This site was awarded by the ASA for its educational value. <http://www.ispub.com/journals/ija.htm> (Disclosure statement: this site and all other 53 online journals are owned and managed by the speaker in this workshop)

#### **GLOBAL ANESTHESIOLOGY SERVER NETWORK (GASNET)**

GASNet is probably the most complete online resource for the anesthesia community. The site offers a variety of "Divisions" such as Services, Point-of-care, Education, Library, Tools, Journals, Internet, and Societies divisions. The site is managed by Keith Ruskin, Charlotte Bell, Tom Engel, and Rene Hagenouw. <http://www.gasnet.org/>

#### **THE ANAESTHESIA CRITICAL INCIDENT REPORTING SYSTEM (CIRS) ON THE INTERNET:**

CIRS is an experience-based database collecting information about critical incidents from all over the world. Critical incidents are defined as events under anaesthetic care which had the potential to lead to an undesirable outcome if left to progress. Reporting is anonymous and reports are linked to a discussion forum. A statistics page provides updates statistics on the reports. The site is managed by its co-founder Sven Staender in Switzerland. <http://www.anaesthesie.ch/cirs/>

#### **ANESTHESIA AND CRITICAL CARE RESOURCES ON THE INTERNET (ACCRI)**

This web site was created in 1994 and keeps an updated list of anesthesia and critical care related web sites on the web. Frank O'Connor in The Nederland manages the hypertext version of the site. <http://www.eur.nl/fgg/anest/wright/index.html>

#### **THE ANSWER PAGE**

Harvard Medical School Clinical Faculty prepares an anesthesia section of the site with daily questions and peer reviewed answers. Registered users can earn Category I CME credit for using the site. Check it out at <http://www.theanswerpage.com>

#### **ANESTHESIA WEB**

AnesthesiaWeb's content includes ambulatory care, bioengineering, critical care, managed care, medical informatics, pediatrics, and pharmacology. The Anesthesia Department of Duke University Medical Center and an independent board of practicing and teaching anesthesiologists from leading institutions across the nation determine the content. <http://www.Anesthesiaweb.com>

#### **THE VIRTUAL ANESTHESIA MACHINE**

This online educational tool was created by Sam Lampotang from the Department of Anesthesiology at the University of Florida. The interactive web site offers tutorials and the actual virtual anesthesia machine as download. This tool was awarded by the ASA for its educational value. <http://www.anest.ufl.edu/~eduweb/vam/index.html>

#### **NDA ONLINE ANAESTHESIA MUSEUM**

This site is published by the Nuffield Department of Anaesthetics, University of Oxford, UK. The content of the departmental museum was collected by Richard "Dicky" Salt over many years, from a wide variety of sources in the UK and abroad. The site contains a large collection of images related to anaesthesia. <http://www.nda.ox.ac.uk/museum/index.htm>

#### **THE VIRTUAL ANAESTHESIA TEXTBOOK**

The Virtual Anaesthesia Textbook is a collaborative project involving many individuals around the globe. Its goal is to create and maintain, using a familiar 'textbook' style, a comprehensive set of links to all known anaesthesia related Internet information. Chris Thompson conceived the project during the April 1996 World Congress of Anaesthesia meeting in Sydney, Australia. <http://www.virtual-anaesthesia-textbook.com/>

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## **MEDLINE/PUBMED**

PubMed, a service of the U.S. National Library of Medicine, provides access to over 12 million MEDLINE citations back to the mid-1960's and additional life science journals. PubMed includes links to many sites providing full text articles and other related resources. <http://www.ncbi.nih.gov/PubMed/>

## **DISSEMINATION INFORMATION VIA THE NET**

Dissemination of Information via the Net (electronic publishing) is undergoing a revolution. The Internet gave everyone the opportunity to post articles and other content to be viewed at any time and from everywhere in the world. This workshop addresses a variety of issues involved with electronic publishing and introduces the reader to some of the technology that will soon impact the way we distribute educational content.

## **ELECTRONIC PUBLISHING VS. TRADITIONAL PRINT PUBLISHING**

There are many advantages of e-publishing: digital platforms have little restrictions in regard to color images, sound files, or movies. Turnover times for articles submitted to online journals are much shorter and its content can be retrieved 24/7 from all around the world. The visibility for authors is enormous and the content is searchable. Interactive online search and printing of selected full text articles replaces the time consuming walk to the library. It really seems that electronic publishing is the way to go.

## **QUALITY AND CREDIBILITY**

Credibility of a web site and high quality of the content has to be established by strategic alliances with known institutions/names and by serious peer review. Names of partners/peer reviewers should be clearly visible to the readers. Quality control, high visibility, indexing by major medical databases, and ultimately recognition by academic institutions will convince authors to submit their high quality content to online publishers. No credibility and quality = no authors = no content = no readers = no online publishing.

## **HOW SHOULD THE IMPACT OF E-PUBLICATIONS BE MEASURED?**

Traditionally, the importance of a publication or a journal is measured by the impact factor (IF). 60 % of all articles in anesthesia are submitted to the 2 top-rated journals (according to their impact factor) Anesthesiology (IF 4.62) and Anesthesia & Analgesia (IF 2.83). The remaining 40 % of submissions go to the other about 100 anesthesia-related journals. The result of this trend is the slow death of smaller or national journals. For the first time in publishing history, another potentially better factor evolves. The web allows measuring how often an article is selected for download. Resulting is a new way of measuring the global impact of an article: the reading factor (RF).

## **WHO PAYS THE BILL?**

Only a dozen of the currently over 100 anesthesia-related print journals are available in full text via the Internet. All these journals are limited in their online access (subscription, passwords). Only 3 serious full-text electronic anesthesia journals are currently available: The Internet Journal of Anesthesiology (IJA) from ISPUB.com, The Educational Synopsis In Anesthesia (ESIA) from GASNet, and BCN Anesthesiology from BioMed Central. They are free of charge and easily accessible.

How can electronic publishers thrive in this difficult economic market space? Banner advertising on web pages is not as attractive as it was in the past. 85 % of the users do not read it and the click-through rates declined steadily to 0.2 %. Will in the near future the readers or even the authors have to pick up their share of the bill? The coming years will brutally select the survivors in e-publishing and will reveal what the best business model will look like. Recent trends have gone towards charging the authors: charges per article range from US \$ 500 (BioMed Central) to US \$ 1,500 (Public Library of Science).

## **IS ELECTRONIC PUBLISHING HERE TO STAY?**

The transition from traditional to electronic publishing has begun. The advantages of electronic distribution of content are too obvious and will continue to promote online publishing. A few web sites will emerge as being the recognized platform for high quality academic publishing. Both, authors and readers will increasingly enjoy the possibilities of distributing rich multimedia such as color images, sound, or movies and authors will benefit from the high popularity and visibility of online publishing. Academic institutions and universities will soon

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recognize these emerging sites and accept online publishing has an additional tool for academic promotion. Established medical databases will pick the leaders and include them into their index enhancing furthermore the visibility and attraction for authors.

## CONCLUSION

Electronic publishing is here to stay. A shakeout will select the few survivors that will provide high quality medical content. Traditional brick-and-mortar print publishing will continue to exist but will be threatened by the possibilities of online publishing. Most traditional publishers will offer both, print issues and some kind of electronic format. Medical societies will gain in importance because online publishing gives them the opportunity to offer value-added services to their members (CME content, e-commerce, electronic abstract submission, multimedia education, quick turn-around and publication of congress proceedings, discussion groups,....). Electronic publishing will thrive and survive! Anesthesiologists around the world will find over time more and better online educational content.

## THE FUTURE OF ELECTRONIC INFORMATION RETRIEVAL AND DISSEMINATION

Electronic publishing is moving towards mobile and/or wireless technologies. Many anesthesiologists use already handheld devices in their daily practice. They are mostly used for drug information, download of daily news, and set-up of small databases about anesthesia services or patient information. Newer devices such as web-boards are coming to market. These interactive board-like computers will connect to the Internet and allow mobile browsing and data transfer on the go.

Another emerging technology is called "electronic paper". Electronic paper is about 7x thicker than regular paper. It consists of thousands of small spheres lined up between two sheets. The spheres have a white and a black side. Depending on the electric currents in the sheet, the spheres will turn their white or black side up and form letters or images. One sheet of e-paper will store information up to 10 years and can be used up to 10,000 times.

The Net will gain importance in the sense that many anesthesia services will start to connect to their patients via the Internet. Preoperative evaluation and postoperative follow-up can be partially conducted by electronic means. Pilot programs at Stanford (Anesthesia Preop: A Pilot Project of the ASA Electronic Media Information Technology EMIT Committee) and University of Chicago Medical Center are evaluating the feasibility of such online support systems [4,5]. The future will show how meaningful such systems are and how willing patients will be to use them.

## DISCLOSURE

The author of this article is the editor-in-chief of The Internet Journal of Anesthesiology (<http://www.ispub.com/journals/ija.htm>). In addition, he is the founder and current CEO of Internet Scientific Publications (ISPUB.com), a leading online medical publishing house.

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