

1 The Fluorescent Microsphere Resource Center (FMRC)

Purpose of the FMRC and this Manual

The Fluorescent Microsphere Resource Center (FMRC) developed from the need to identify and develop nonradioactive methods for measuring regional organ blood flow. This manual is intended to serve as a practical reference for scientists who are beginning to use fluorescent microspheres to measure regional organ perfusion.

The Fluorescent Microsphere Resource Center

The purpose of the FMRC is to provide a forum to exchange information among scientists regarding new methods for measuring regional organ blood flow as well as to continue the development of new methods.

Since its introduction by Rudolf and Heyman (1967), measurement of regional organ blood flow using radio-labeled microspheres has become the gold standard. However, there are increasing concerns regarding health and environmental hazards and expense associated with special handling, disposal and limited shelf-life.

Techniques using fluorescent microspheres to measure regional organ blood flow have only recently been developed and validated against traditional radioactive methods (Glenny, et al. 1993; Prinzen, et al. 1994; Van-Oosterhout, et al. 1995). Fluorescent methodologies are evolving rapidly and are currently being used world-wide. The FMRC serves as a focal point for compilation and dissemination of information regarding fluorescent technology.

The FMRC is a nonprofit organization located at the University of Washington. It is supported as a core facility by multiple investigators in the Division with grants from the NIH. Funds from private industry also support the FMRC with the understanding that these funds will be used to promote the advancement of the scientific process rather than exploitation of commercial interests.

The FMRC Manual

This manual serves as a primer and practical reference for scientists planning to use fluorescent microspheres to measure regional organ perfusion. The manual includes information on all aspects of fluorescent microsphere techniques related to the measurement of regional organ perfusion. Information about the physical properties of fluorescent microspheres, their preparation and injection, and techniques for their recovery are provided. The manual also includes a short tutorial on the principles and measurement of fluorescence. The specifics of using a spectrophotometer are addressed. The manual is

continually revised and updated based on comments, requests, and contributions from users. For this manual to serve its intended purpose, feedback from users is essential. We need to know what works and what does not. Please let us know about sections of the manual that are not clear.

A secondary purpose of this manual is to answer frequently-asked questions (FAQ's). If an answer cannot be found in the manual, personnel at the FMRC or users of the FMRC list server will respond to specific questions.

Obtaining Information from the FMRC

Distribution of information on fluorescent microsphere methods is accomplished through the following modalities:

- **Electronic mail.** Personnel at the FMRC answer this mail and return requested information and manuals. Electronic mail should be sent to:

glenny@u.washington.edu

- The FMRC has a home page on the WWW. This web site is updated regularly and provides a convenient interface to browse through FMRC information or download pertinent files. The web site includes recent announcements, the latest manuals and current WINFAC analysis software. Documents are available in Adobe Acrobat™ PDF format for easy viewing and printing. High-quality images of fluorescent microspheres are also available through the WWW site. The Uniform Resource Locator (URL) for the FMRC home page is:

<http://fmrc.pulmcc.washington.edu/>

- An FTP server is available for scientists to upload and download files. The files include the manual and information described above. The FTP server address is:

fmrc.pulmcc.washington.edu.

- An **automated mailing list** (LISTSERV) exists to promote discussion between investigators and/or providers using fluorescent microspheres. You must be able to send and receive electronic mail over the internet in order to participate in the group. After joining the group, all other members of the list are easily contacted through e-mail. The mailing list is not moderated, which means that all messages posted to the mailing list are forwarded to every member. We welcome and encourage anyone to join the discussion on fluorescent microspheres. Instructions for joining the list server are outlined in *Subscribing to the Automated Mailing List* (below).
- A **FAX** machine receives requests and transmits information to those scientists who do not have access to the Internet. The fax number is: (206) 685-8673.

- Requests for information or questions can also be answered through **postal mail**. The FMRC may be contacted at the following address:

Fluorescent Microsphere Resource Center
University of Washington
Box 356522
Seattle, WA 98195-6522
USA

- Scientists are encouraged to visit the FMRC Laboratory. Visitors are welcome to participate in experiments or simply observe. Scientists may conduct their own experiments if previously cleared by the University of Washington Animal Care Committee.

[Subscribing to the Automated Mailing List](#)

Unless noted, all commands sent to the list should be in the body of the text, rather than the subject line. The subject line should be left blank.

Send e-mail to "listproc@u.washington.edu" with the following request:

```
subscribe fmrc-l <Your name>
```

where <Your name> is your full name, not your e-mail address. A password will be assigned at the time of subscription and will be included in the reply message to your subscription request. The password is not necessary to send mail to the list.

[Mailing to the List](#)

Messages may be sent to current list subscribers by sending e-mail to fmrc-l@u.washington.edu. This is called "sending mail to the list", because you send mail to a single address and LISTPROC makes copies for all that have subscribed. This address is also called the "list address". Never try to send commands (such as subscribe or unsubscribe) to that address, as it would be distributed to all people who have subscribed. **All list commands such as subscribe and unsubscribe must be sent to the "LISTPROC address", listproc@u.washington.edu.**

[Unsubscribing From the List.](#)

Send to "listproc@u.washington.edu" with the following request:

```
unsubscribe fmrc-l
```

Archives

Messages sent to the list are automatically archived. This is useful for new subscribers who wish to catch up with the discussion. To access the archive, send an "index" request to "listproc@u.washington.edu". This will tell you the archives are available, and which files may be obtained from these archives.

```
index fmrc-l
```

You may then request one or more of these files via a "get" command sent to "listproc@u.washington.edu."

```
get fmrc-l filename
```

where filename is the name of the file you wish to retrieve.

References

Glenny, R. W., S. Bernard and M. Brinkley. Validation of fluorescent-labeled microspheres for measurement of regional organ perfusion. *J Appl Physiol.* 74:2585-97, 1993.

Prinzen, F. W. and R. W. Glenny. Developments in non-radioactive microsphere techniques for blood flow measurement. *Cardiovasc Res.* 28:1467-75, 1994.

Rudolph, A. M. and M. A. Heymann. The circulation of the fetus in utero. Methods for studying distribution of blood flow, cardiac output and organ blood flow. *Circ Res.* 21:163-84, 1967.

van Oosterhout, M. F., H. M. Willigers, R. S. Reneman and F. W. Prinzen. Fluorescent microspheres to measure organ perfusion: validation of a simplified sample processing technique. *Am J Physiol.* 269:H725-33, 1995.