BUYER'S GUIDE

SURFACE PLASMON RESONANCE SYSTEMS

CHOOSING AN SPR SYSTEM

Over the last decade, surface plasmon resonance (SPR) has become an invaluable technique for researchers in a variety of fields. One of the major benefits is that the technology doesn't require fluorescent labeling or radioactive tags, which can disturb the native biological state. With SPR, scientists can detect and monitor molecular binding kinetics, to study the full, natural ecosystem of biomolecules and biochemical mechanisms. SPR brings these benefits to a range of applications, involving interactions between and within all classes of biomolecules: proteins, peptides, DNA/RNA, lipids, carbohydrates as well as small molecules, cells and bacteria.

Now is a great time to get involved. The SPR field has significantly expanded in recent years. More companies are now in the market and customers are discovering a greater range of technology designs and price points. While this choice and accessibility is an overwhelmingly positive thing, it does present one new challenge: *How do you select the right surface plasmon resonance system for your academic, biopharmaceutical or core lab?*

Whether you're new to the field or looking to upgrade an existing system, **this document will help you find the best possible instrument and package for your SPR needs.** Your choice will depend on a number of factors including throughput and sample demands, which we evaluate in the various sections. For all buyers, however, there are three overarching principles to keep in mind to eliminate purchase regrets:

1. **FLEXIBILITY –** As the field and your research advances, you don't want to get caught short with a system that has limited applications and sample scope. Several years in, will you be able to run an experiment that uses crude samples; is there a range of sensor chips available? Can you combine your system with Mass Spectrometry or another technique?

2. **COST —**Scientists know that capital for equipment is hard to come by and that purchasing decisions must be well thought out. When evaluating cost, operating costs including sensor chips and maintenance, are equally as important as the initial purchase price.

3. **EASE-OF-USE —** Keep efficiency in mind as you evaluate system features. Some, such as intuitive software, benefit nearly every buyer. But you may not need other features that will instead slow your SPR studies down and limit the number of people that can use the instrument.

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Major Technology Decisions

Before evaluating individual systems, you'll need to determine how many channels are required for your workflow. More channels equate to a higher throughput, but it also increases the complexity of the experiment and data analysis. The majority of labs choose two or four channel instruments. Two channel instruments are typically sufficient for academic labs with a single principle investigator and relatively low throughput needs. Four channel instruments provide additional flexibility in experimental design, as well as increased throughput. These instruments are found in most pharmaceutical and biotech labs, as well as academic core facilities. They are the most common throughput option, providing a balance of flexibility and manageability.

If you require truly high throughput and anticipate running thousands of samples per day (often in a screening environment), then a 16+ channel system is the right choice. Ask around to find out what similarly sized labs use, to get a clear picture for your own.

With a basic idea of the number of channels and throughput you'll require, your attention should turn to the fundamental design differences to evaluate in an SPR system. Chief among them is whether the system design is **open or closed.** First generation equipment was typically closed, aka a *black box*, which prevents researchers from fixing or adjusting components themselves.

Newer systems can also be closed or have a modular, open design. This clearly has implications for **maintenance** (more on that below), but they also have different components and capabilities. Closed systems typically require a **microfluidics cartridge,** which can clog if crude samples or serums are run.

Top quality open and closed systems can both deliver good data, but as you develop a short-list of models, strive to understand how they get results, at what cost, and how often things go wrong.

FEATURES OVERVIEW

A rundown of some common SPR specifications, which may factor into your purchasing decisions:

- **AUTOSAMPLER:** Choosing a four-channel model with a larger sample capacity, such as 768 samples, can increase efficiency.

- **BASELINE NOISE:** Choose an instrument with a root mean square baseline noise level of +/- 0.05 μRIU to ensure the best signal-to-noise ratio.

- **BASELINE DRIFT:** Instruments with drift of 0.1 μRIU will improve data fitting without the complications of baseline drift.

- **SAMPLE VOLUME:** A larger range of sample volumes will give more flexibility. Smaller volumes can be used for sample-limited tests, and larger volumes are advantageous for longer runs.

- **TEMPERATURE RANGE:** A larger temperature range gives more options for experiments, and is especially helpful for thermodynamic measurements.

- **FLOW RATE RANGE:** Faster flow rates speed up buffer exchange and can provide more accurate kinetics.

COMBINING TECHNOLOGIES

Interactions can be studied using SPR alone, or in combination with other techniques such as mass spectrometry, electrochemistry, photochemistry and fluorescence. If this is a priority for your team – or a possible need for future studies, discuss with a customer support representative how their system features enable or limit combination research. For instance, look for instruments with custom flow cells and fluidic flexibility options, which enable the combination of SPR and other techniques.

Chips and Microfluidics

MICROFLUIDICS CARTRIDGES

Microfluidics cartridges are commonly required for closed-system, but not open design SPR instruments. For many models this can be an Achilles' heel, as they are prone to clogging and expensive to replace. This limits the researcher to exclusively using purified samples. Crude samples, such as cell lysates or serums, are more efficiently run in an open system. Likewise, testing new or unknown samples for composition is better performed on systems that lack a microfluidics cartridge.

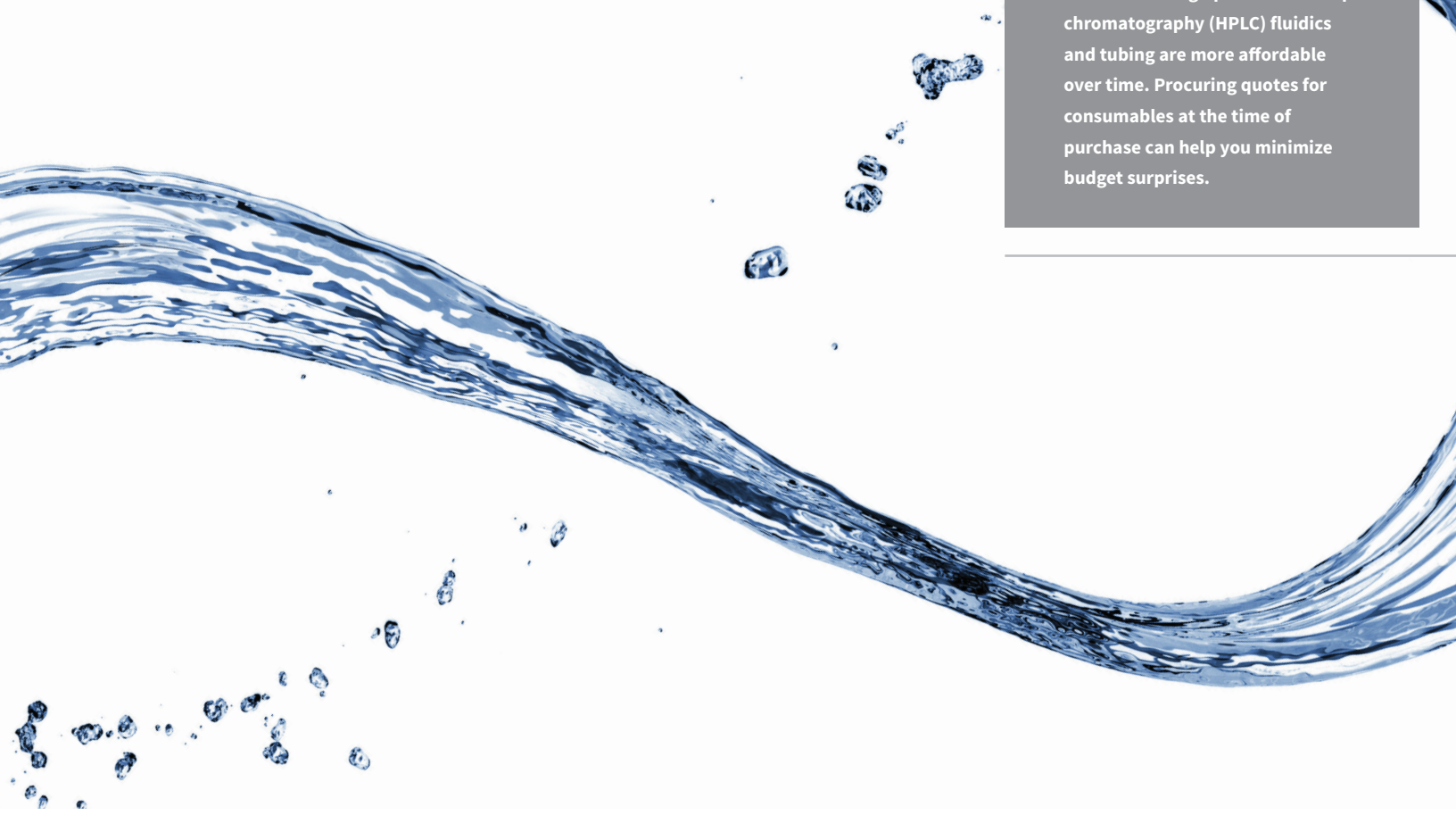
The decreased risk of clogging with an open design also expands the number of people that can use the instrument. Many people, even novices, can successfully use a robust machine. On the other hand, instruments with temperamental designs are typically reserved for a handful of experts. They are more likely to clog and the maintenance costs and downtime are high when they do.

SENSOR CHIPS

Sensor chips are an incredibly important part of any SPR experiment. As your chip options typically go hand-in-hand with the system and vendor, it's wise to evaluate sensor chip performance and application range before committing to either. The vendor should be able to recommend the appropriate chips for your application. Sensor chip prices vary significantly so it is an important factor to evaluate as part of ongoing operating costs.

FINDING GOOD VALUE

Note that the cost of an instrument is not fully apparent in the purchase price. The price of consumables, particularly if microfluidics cartridges are needed, can cut into research budgets over the life of the instrument. Likewise, sensor chips need to be priced out for value. These should ideally be less than $100 each, given their critical role in method development. You want to be able to afford many options to increase the number of interactions you can study and to deliver greater study design flexibility. Another point to note is that systems that use off-the-shelf high performance liquid chromatography (HPLC) fluidics and tubing are more affordable over time. Procuring quotes for consumables at the time of purchase can help you minimize budget surprises.



Maintenance

As with estimating the cost of consumables at the time of purchase, it is pertinent to evaluate maintenance costs. Ask the manufacturer to outline which components can be swapped out by researchers and which ones need the assistance of a field service engineer. Some instruments are designed for convenient access to the most commonly replaced parts, while others have a black box design. Parts, such as tubing, may often need replacing. Yet even these inexpensive components can require a service engineer to fix.

Note: Some suppliers offer maintenance kits - a toolbox of the most common replacement parts for an open design system. This can prevent any instrument downtime when fluidics components or tubing need to be changed.

FOR REPAIRS THAT DO REQUIRE A FIX FROM THE MANUFACTURER, CONSIDER THE FOLLOWING:

- **How fast is the response time for service and repairs?**
- **What is the lead time for repair?**
- **Will a replacement instrument be provided as a loan while the broken one is being repaired?**

Software and Analysis

It would be a mistake to overlook the importance of the system's software; it is the centerpiece of the user experience. It also functions as the connecting point between raw data and data analysis. To avoid introducing variables during this phase, look for a system with simplified, integrated data analysis tools. This feature can reduce errors and accelerate the pace of the workflow.

The usability of the software will also impact the number of people that can successfully run your SPR experiments. Look for an easy-to-use interface that is intuitive and practical. This allows scientists with varying levels of expertise to perform runs with minimal training.

Finally, try before you buy. Many companies provide on-site or virtual demonstrations that allow you to explore the software and interface, before you commit to a purchase.

Performance

The million-dollar question: Does the SPR system deliver quality results? A system that allows you to interpret results and draw conclusions effectively, with minimum difficulty is – practically speaking – the high performance machine you seek. Some other tips:

TARGET FOR BASELINE STABILITY.

Instruments with drift of 0.1 μRIU will improve data fitting without the complications of baseline drift.

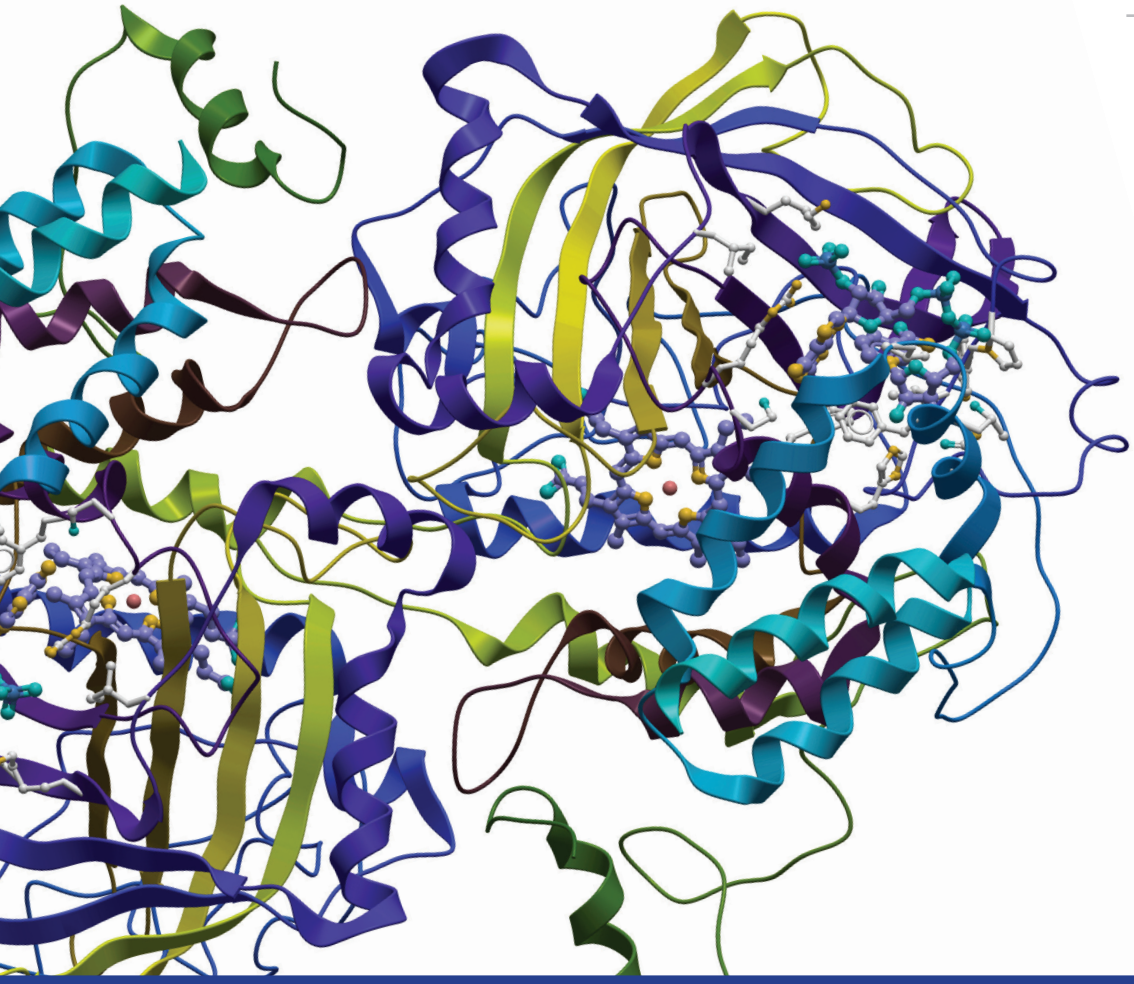
MINIMIZE NOISE TO MAXIMIZE DATA QUALITY.

Choose an instrument with a root mean square baseline noise level of ±0.05 μRIU or less, to ensure the best signal-to-noise ratio. This target is suitable for studies of small molecules and for low concentrations of larger biomolecules.

Note: *Small molecules studied with SPR can have molecular weights of 100 Da or less. You need a high sensitivity instrument to get high quality, low noise results for this type of interaction.*

PEOPLE AND PROCESSES

High quality SPR data relies on more than just equipment. Your team and your protocol also need to be fine-tuned. Standard best practices include running replicates, blanks, and at least four or five sample concentrations to show the responses are not degrading over time. You should also run the experiment on multiple days to further prove reproducibility. Ensure your team is adequately trained and understands best practices for experimental design and execution.



Customer Support/Service

Customer service covers four key domains: product demonstrations, method development, training and instrument repair. Look for a manufacturer that will support you and your lab throughout the life of the instrument—from inquiry, to installations, and maintenance.

PRODUCT DEMONSTRATIONS ENSURE THE RIGHT FIT.

A lot of companies offer on-site product demonstrations. Some tips on what to consider:

- Does the footprint of the instrument fit conveniently in your lab?
- Are your samples compatible with the instrument design?
- Does the data output in a convenient format?

ON-SITE TRAINING CAN SAVE TIME.

It is advantageous to complete a training program with the instrument manufacturer. Training can help researchers understand the vast capabilities of a new instrument and prevent instrument downtime caused by misuse.

Almost all companies offer instrument training in some capacity. However, the convenience of these training sessions can vary. Inquire if researchers are expected to travel to a set location for training or if a service representative is available to give training on-site. On-site training can be especially advantageous for an instrument that will be used by many people.

For installation, ask if a representative from the company can assist. Similar to training, having an SPR expert present when the instrument is first installed can prevent any system mishandling.

Surface Plasmon Resonance (SPR) is an invaluable technique for many laboratories, as they seek to understand the real-time behavior and interactions of a broad range of molecules. Only your team can determine which SPR system will best enable this research in your lab. However, with this buyer's guide, you now understand the key features, benefits and drawbacks to consider. **Choose wisely and enjoy your new capabilities for many years to come.**

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