

Welcome to our Education Series



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Fetal Bovine Serum

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What is Fetal Bovine Serum?



Fetal bovine serum (FBS) is the liquid fraction remaining from the blood of a bovine fetus after it coagulates. Through centrifugation, cells, coagulation fibrinogens, and proteins are removed to produce serum.

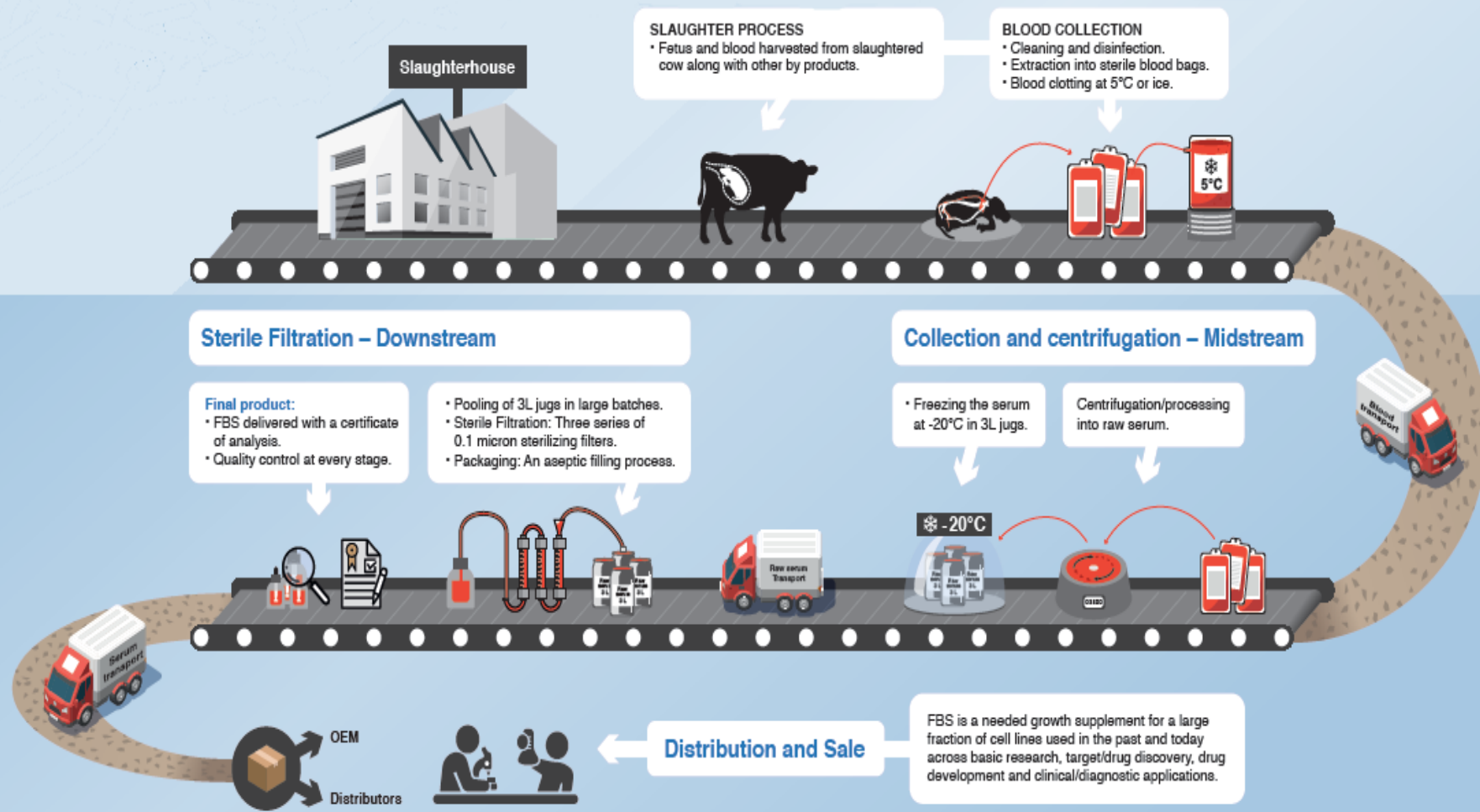
Although fetal bovine serum has the cells and clotting factors removed, over a 1000+ components conducive to cell growth remain, including:

- Attachment factors
- Electrolytes
- Growth factors
- Hormones
- Lipids
- Spreading factors
- Sugars
- Transport proteins
- Vitamins

Plus other undefined constituents, which are necessary in many culture conditions to support cell growth.



How FBS is produced



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Safety, Authenticity & Quality

To ensure the safety of the product for our customers, extensive analytical and biological testing is performed on every lot produced. Any negative safety test or authenticity results in the rejection of the lot.

Because the price of FBS is high, there are nefarious vendors that sell synthetic or blended FBS with calf serum as real FBS. To ensure the authenticity FBS, the GGT value should be ≤ 10 , osmolality between 260-350, total protein of < 3.5 , and IgG $< 300 \mu\text{g/mL}$.

FBS quality is typically classified by endotoxin and hemoglobin levels and exact level varies from vendor to vendor.

Safety	Authenticity	Quality
9 CFR Viral Testing	GGT	Endotoxin Testing
Sterility	Osmolality	Hemoglobin
Mycoplasma	Total Protein	Biochemical Profile
	IgG	pH
		IgG



FBS Applications

In the 1950s, Theodore Puck first introduced the use of FBS with the purpose of encouraging cellular proliferation. For several decades, the use of fetal bovine serum has been ubiquitous in laboratories worldwide. Its popularity has continued grow as a supplement in cell and tissue culture applications.

Research, pharmaceutical, and biotech manufacturing have relied on FBS's valuable properties. Its uses include but are not limited to:

Animal diagnostics	Biopharmaceuticals
Biotechnology research and production	Cryopreservation
In vitro fertilization	Gene therapy
Immunotherapy	Stem-cell research
Synthetic proteins	Vaccine production

Although fetal bovine serum has many applications, it is most frequently sought after for *in vitro* cell culture. Supplementing culture media with animal serum primarily aids in:

- Stimulating cell differentiation
- Supplying hormone factors for cell proliferation and growth
- Providing nutrients, trace elements, transport proteins, adherence, and extension factors
- Cultivating a suitable environment for growth with stabilizing and detoxifying factors



Important factors in FBS selection

FBS protects cells from:

- Large pH shifts
- Proteases
- Toxic agents
- Shear forces
- Agents that would typically break up monolayers of adherent cells (FBS acts to inactivate these agents)

Cell growth in the presence of quality FBS is typically:

- Rapid
- Consistent and reproducible
- Lacking in undesirable changes in differentiation
- Not hampered by the introduction of detrimental contaminants

Researcher's primary concerns regarding FBS:

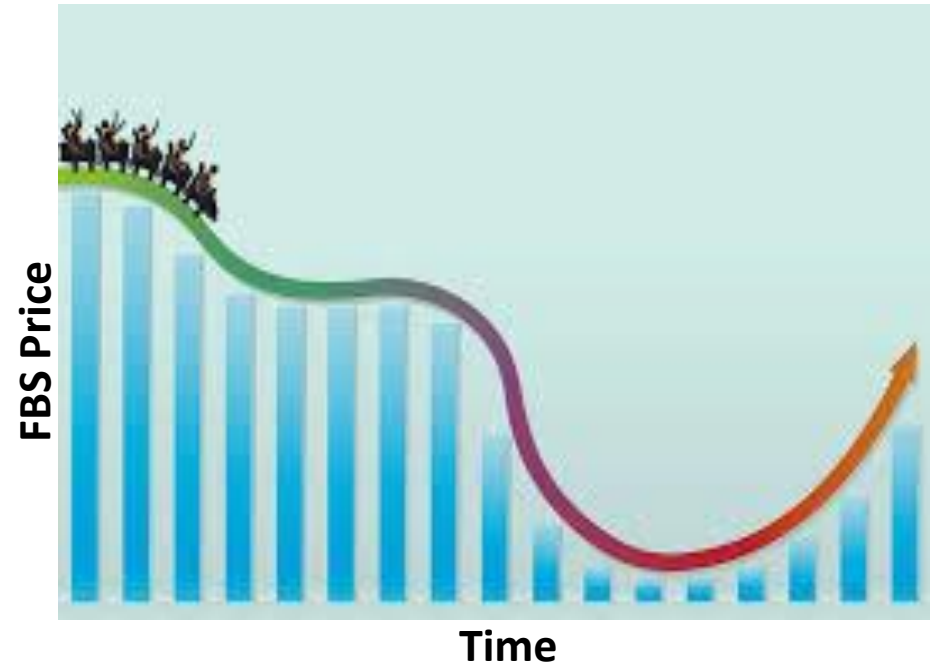
- Supply continuity
- Lot-to-lot consistency
- Reproducible results
- Price fluctuation
- Product integrity



Market forces driving FBS availability and price

Fetal bovine serum has dramatically increased the pace of biomedical science. As a supplement to growth culture media, it's unparalleled.

However, the amount of FBS available is variable; as a byproduct of the beef industry, environmental factors influences the price and availability of FBS.



Drought, high feed prices and high beef demand leads to more available FBS and generally lower pricing. When farmers are rebuilding their herds, there is less FBS on the market, and pricing increases. However, the ever increasing FBS demand outstrips supply leading to prices increasing each year.

The result? The price and availability of FBS is difficult to predict but is ever-increasing.



Quality Redefined at Phoenix Scientific

Never choose origin over quality again

Our FBS products are organized differently than most other manufacturers. We simplified our offerings by product quality as shown in the table below. The exact pricing is dependent on the supply/demand for country of origin.

All three (3) grades Pinnacle, Choice and Cornerstone are available from the following origins:

- US
- USDA
- AU & NZ

Because of government regulations, not all FBS is available in every country. Here is a [general country eligibility](#), but we encourage you to [contact us](#) to discuss your unique situation.

Name	Grade	Hemoglobin (mg/dL)	Endotoxin (EU/mL)
Pinnacle	Premium	< 20	< 10
Choice	High	< 50	< 20
Cornerstone	Research	As reported	As reported

Depending on your application, choosing the best serum can be a difficult task. Just reach out to our great [sales reps](#). They will help you with samples and pricing. They are always happy to help.



OUR FBS OFFERINGS

[Pinnacle Fetal Bovine Serum \(US, USDA, AU & NZ\) PS-100](#)

Pinnacle fetal bovine serum meets the highest industry standards for endotoxin and hemoglobin levels and supports the growth of the widest variety of cell lines.

[Choice Fetal Bovine Serum \(US, USDA, AU & NZ\) PS-200](#)

Choice fetal bovine serum is intended for the customer who wants excellent cell growth while buying at more economical prices. This material goes through the same filtration schemes and final quality-control testing as our other grades. Our Choice FBS supports a wide variety of cell lines for all of your culture needs.

[Cornerstone Fetal Bovine Serum \(US & USDA\) PS-300](#)

Cornerstone fetal bovine serum is our research grade for those who want excellent cell growth but are price sensitive. This product typically has higher hemoglobin and/or endotoxin levels compared to Pinnacle or Choice FBS.



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OUR SPECIALITY FBS OFFERINGS

We offer a large selection of specialty serum products designed for specific applications and sensitive cell culture, including stem cell research, cancer research, reporter assays, immunoassays, and more.

[Naturally Low IgG Fetal Bovine Serum](#) **PS-400**

Naturally Low IgG fetal bovine serum is chosen from lots with naturally low occurring amounts of IgG. Typically levels are 50-100 ug/mL.

[Stripped Low IgG Fetal Bovine Serum](#) **PS-401**

Stripped Low IgG fetal bovine serum is chosen for those demanding applications where IgG interference must be reduced as much as possible. Typically levels are 0.5-5 ug/mL.

[Charcoal Dextran Stripped Fetal Bovine Serum](#) **PS-402**

Charcoal Dextran stripped is chosen for low levels of certain steroid hormones and growth factors such as cortisol, estradiol, corticosterone, B vitamins, T3, T4 and prostaglandins that interference for certain research experiments. This product may show reduced growth ability for cells due to the stripping process.

[Stem Cell Qualified Fetal Bovine Serum](#) **PS-403**

Stem cell qualified FBS has been specifically tested for its ability to sustain the undifferentiated cellular morphology of the stem cells with growth promotion.

[Dialyzed Fetal Bovine Serum](#) **PS-404**

Dialyzed fetal bovine serum is processed to remove small molecules such as glucose, salts, and some non-protein binding serum molecules. The process is done with a 10,000 molecular weight cut-off membrane at 4°C with careful monitoring of pH, osmolality and glucose concentration.

[TET Free Fetal Bovine Serum](#) **PS-405**

TET Free is used in cell culture applications using tet-inducible gene expression systems, and other applications in which the presence of tetracycline would prove disruptive. To be considered Tet-Free, the concentration should be < 1 ng/mL.



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Country Eligibility

The country eligibility table shows what FBS origins are available in your country. For example, your home country is USA, the only origins available USA, USDA approved, Australian and New Zealand origin FBS.

	FBS ORIGIN	USA	USDA APPROVED	URUGUAY	BRAZIL	AUSTRALIA	NEW ZEALAND	FRANCE
YOUR COUNTRY								
USA		✓	✓			✓	✓	
JAPAN		✓	✓					
KOREA		✓						
CHINA				✓		✓	✓	✓
SIGNAPORE		✓	✓		✓	✓	✓	
AUSTRALIA						✓		
EU						✓		

