

serum components and their functions is given in Table 12.2. The major functions of serum are as follows:

1. To stimulate cell growth and other cell activities by hormones and growth factors
2. To enhance cell attachment by certain proteins such as collagen and fibronectin
3. To provide transport proteins carrying hormones, minerals, and lipids

Serum is an expensive medium component (\$100 to \$500/l) and may cause further complications in the cultivation and downstream separation processes. The demand for serum is increasing rapidly and periodically exceeds supply. The presence of serum proteins and peptides greatly complicates downstream processing. Serum must be filtered sterilized, and contamination with viruses and possibly mycoplasma (a wallless bacterium) are potential problems. Contamination by prions (agents that cause diseases such as “mad cow” disease) is a real concern, and source animals cannot come from regions known to have contaminated animals. Serum-containing medium foams easily. Perhaps most disturbing from a production perspective is the intrinsic variability in serum. No one batch of serum

TABLE 12.2 Important Components of Serum and Their Probable Role in Cell Culture

Component	Probable function
Proteins	
Albumin	Osmoticum and buffer
Fetuin	Lipid, hormone, mineral carrier
Fibronectin	Cell attachment
α_2 -Macroglobulin	Cell attachment
Transferrin	Trypsin inhibitor Binds iron
Polypeptides	
Endothelial growth factor (ECGF)	Mitogen ^a
Epidermal growth factor (EGF)	Mitogen
Fibroblast growth factor (FGF)	Mitogen
Insulin-like growth factors (IGF-I and IGF-II)	Mitogen
Platelet-derived growth factor (PDGF)	Mitogen and major growth factor
Hormones	
Hydrocortisone	Promotes attachment and proliferation
Insulin	Promotes uptake of glucose and amino acids
Growth hormones	Mitogen—present in fetal sera
Metabolites and nutrients	
Amino acids	Cell proliferation
Glucose	Cell proliferation
Keto-acids (e.g., pyruvate)	Cell proliferation
Lipids (e.g., cholesterol)	Membrane synthesis
Minerals	
Iron, copper, zinc, and selenium	Enzymes and other constituents
Inhibitors	
γ -globulin	
Bacterial toxins from prior contaminants	
Chalones (tissue-specific inhibitors)	

^aA mitogen is a substance that signals mitosis to begin.