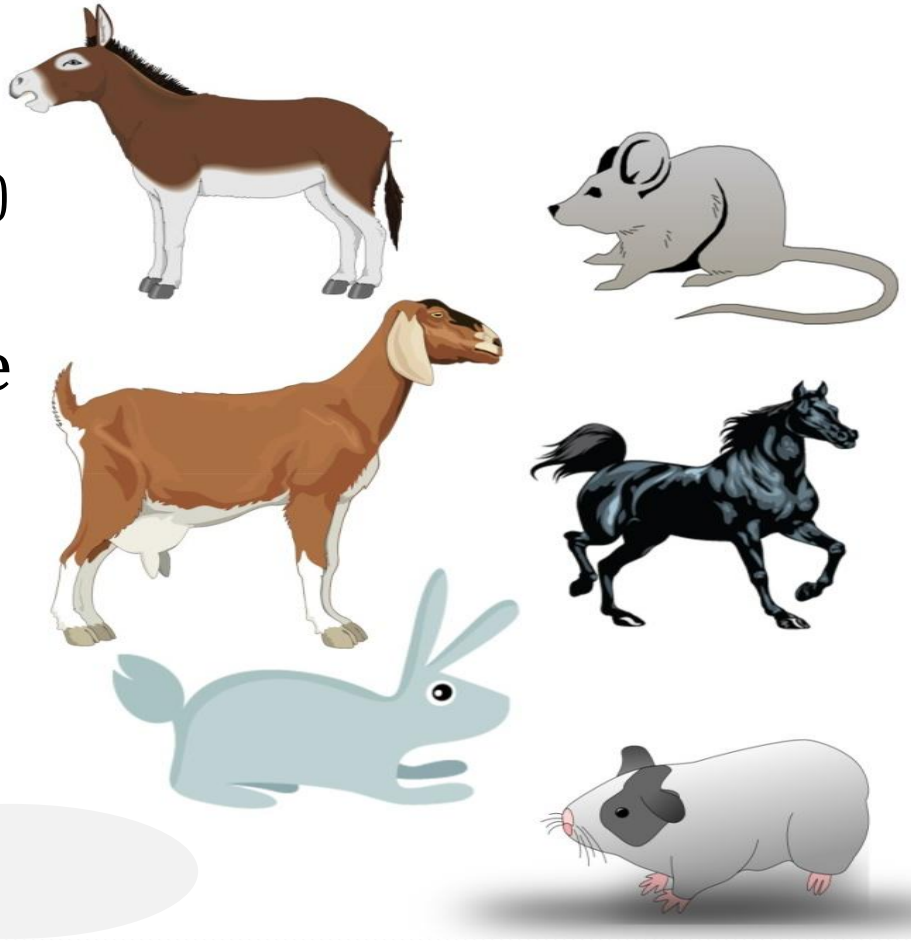
Human anti-animal antibodies (HAAA)

- Response to parenteral administration of animal MoAb
- Following radioimaging, cancer therapy, transplant immunotherapy
- High concentration, high avidity, epitope specific

Anti-animal antibodies

Mouse, goat, horse, cow, sheep, pig, rabbit, rat

- Can be of different classes (IgG,IgM, IgA, rarely IgE)
- They can have anti-isotype and anti-idiotype specificity
- Their magnitude and duration show great variability



Anti-animal antibodies

TABLE 2 Pharmaceutical and Experimental Drug Agents Derived from Animal Sources

Animal Source	Agent
Chicken	Hyaluronic acid
Cow	Insulin
Horse	Anti-thymocyte globulin, Premarin
Malayan pit viper	Ancrod
Mouse	Monoclonal antibody therapeutic and imaging agents
Pig	Factor VIII, insulin, heparin
Rat	Monoclonal antibody therapeutic agents
Salmon	Calcitonin
Sheep	Digibind™

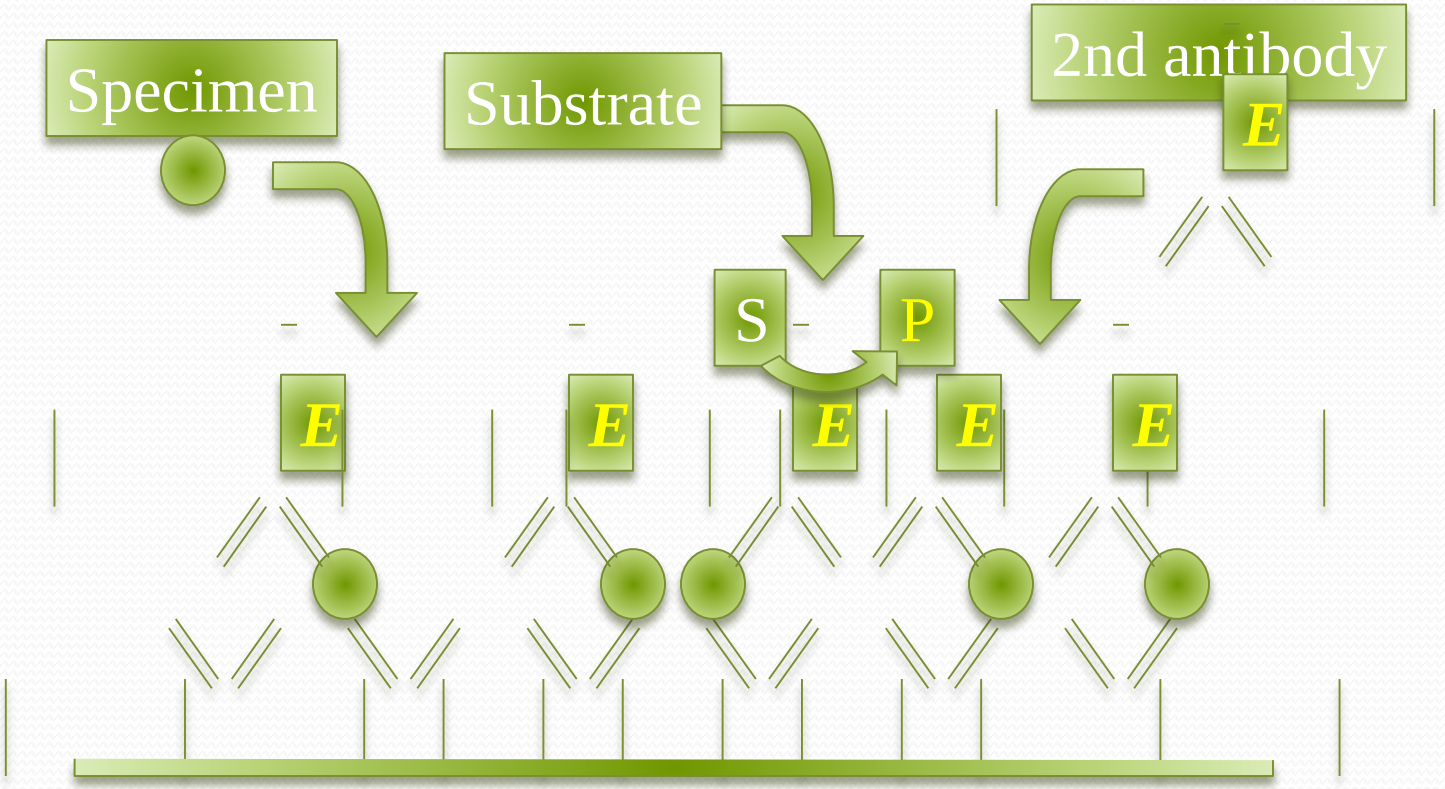
Sources of HAAAs:

- Diagnostic and pharmaceutical agents derived from animal sources
- Affinity purified (with mouse monoclonals) recombinant proteins
- Vaccination (some vaccines have residuals from chick

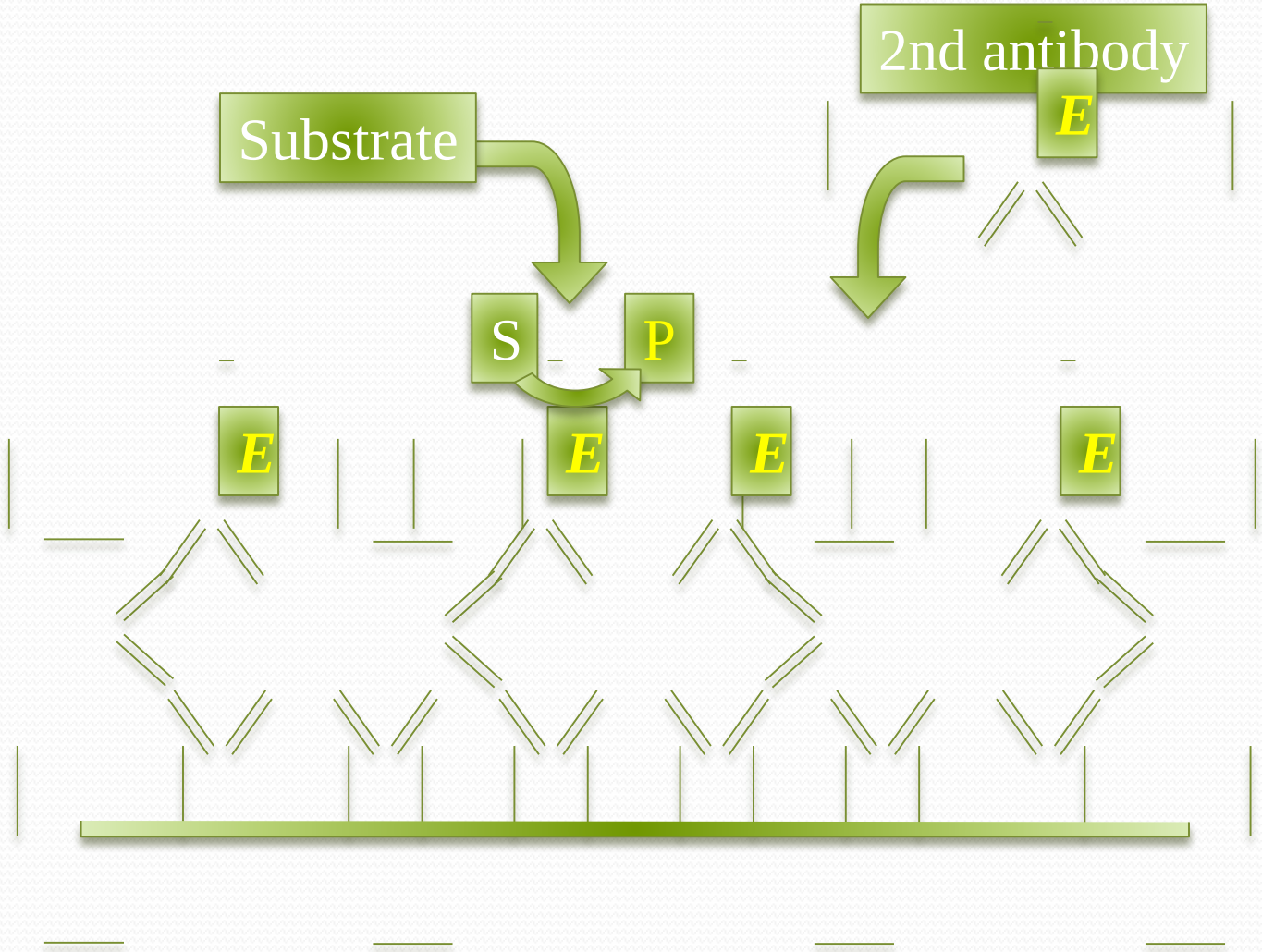
TABLE 3 Therapeutic Monoclonal Antibodies

Antibody (Brand Name)	Treatment Indication (Target)
Murine antibodies (suffix—*omab*)	
Ibritumomab tiuxetan (Zevalin)	Non-Hodgkin lymphoma (CD20)
Muromonab-CD3 (Orthoclone OKT3)	Transplant rejection (T cell CD3 Receptor)
Tositumomab (Bexxar)	Non-Hodgkin lymphoma (CD20)
Chimeric Mouse/human (suffixes—*ximab*)	
Abciximab (ReoPro)	Cardiovascular disease (glycoprotein IIb/IIIa)
Cetuximab (Erbitux)	Colorectal cancer, head and neck cancer (epidermal growth factor receptor)
Infliximab (Remicade)	Autoimmune disorders (TNF-α signaling)
Rituximab (Rituxan, Mabthera)	Non-Hodgkin lymphoma (CD20)
Basiliximab (Simulect)	Transplant rejection (CD25)
Humanized antibodies from mouse (suffix—*zumab*)	
Bevacizumab (Avastin)	Colorectal cancer, age-related macular degeneration (vascular endothelial growth factor)
Certolizumab pegol (Cimzia)	Crohn's disease (TNF-α signaling)
Daclizumab (Zenapax)	Transplant rejection
Eculizumab (Soliris)	Paroxysmal nocturnal hemoglobinuria (C5)
Efalizumab (Raptiva)	Psoriasis (CD11a)
Gemtuzumab (Mylotarg)	Acute myelogenous leukemia (CD33)
Natalizumab (Tysabri)	Multiple sclerosis and Crohn's disease (alpha-4 integrin)
Omalizumab (Xolair)	Mainly allergy-related asthma (IgE)
Palivizumab (Synagis)	Respiratory syncytial virus (RSV F protein)
Trastuzumab (Herceptin)	Breast cancer
Ranibizumab (Lucentis)	Macular degeneration (vascular endothelial growth factor A)
Humanized antibodies from rat	
Alemtuzumab (Campath)	Chronic lymphocytic leukemia (CD52)
Rat–murine hybrid	
Ertumaxomab (Rexomun)	Breast cancers (CD3E)

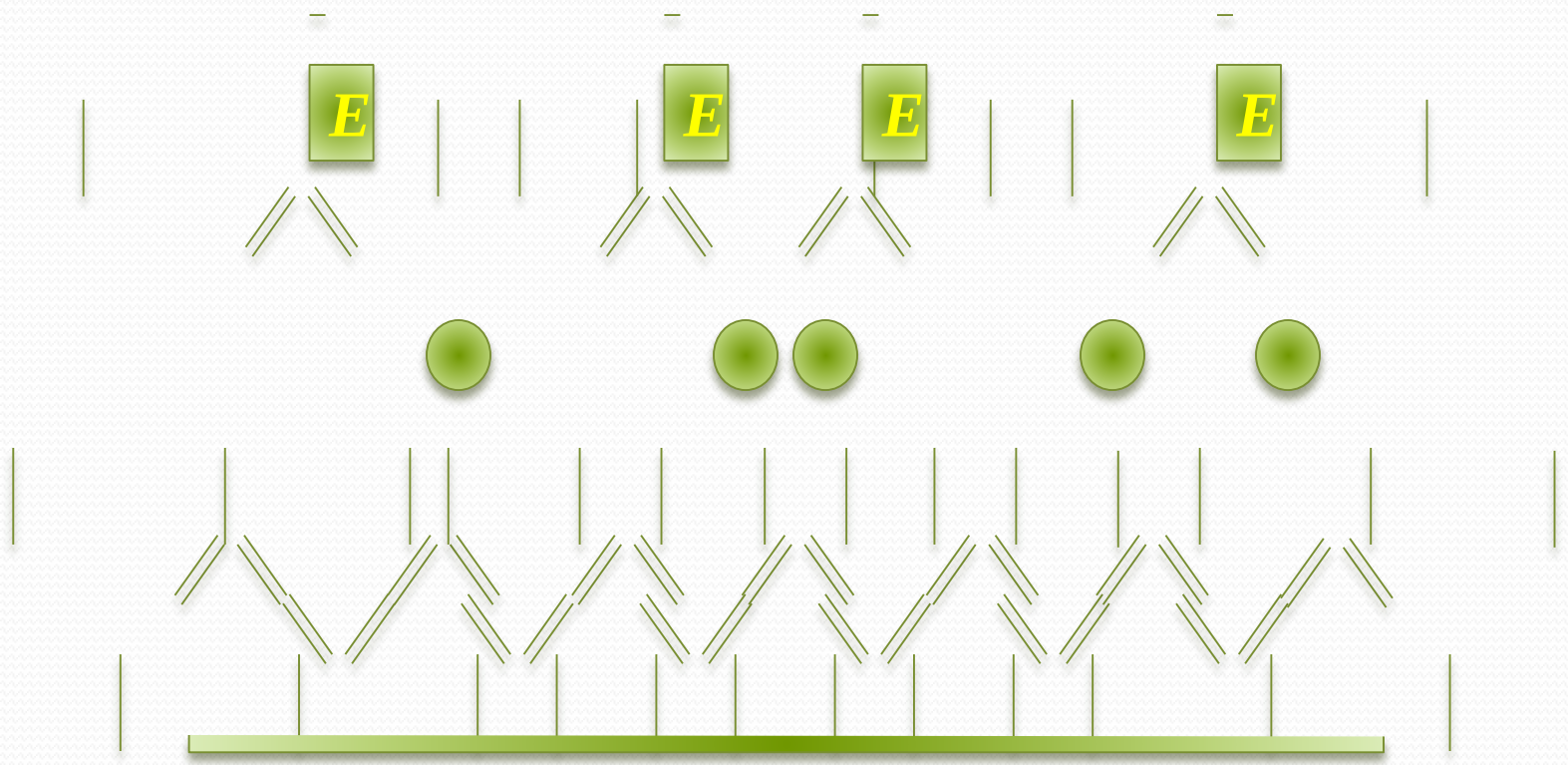
Two-site “sandwich” enzyme immunoassay



HAMA “bridging” interference



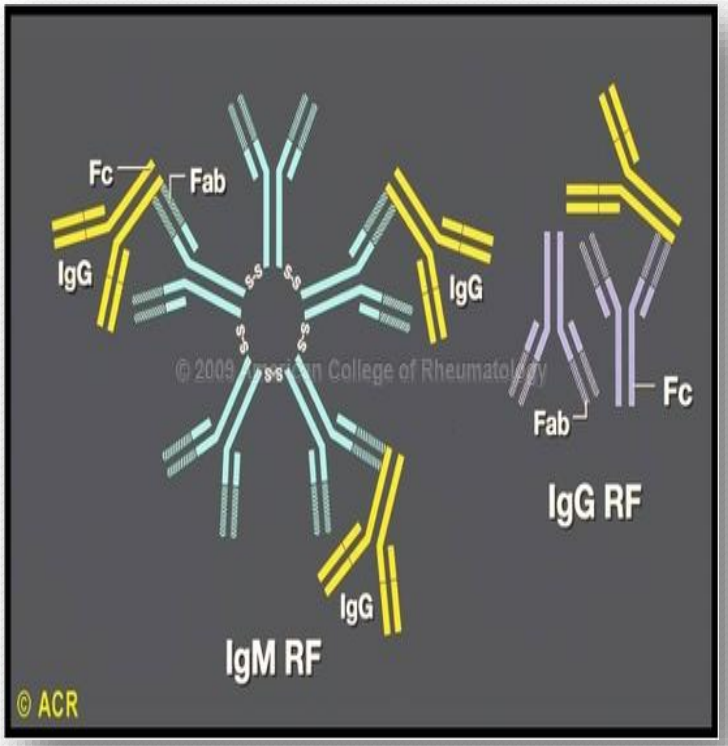
HAMA blocking interference

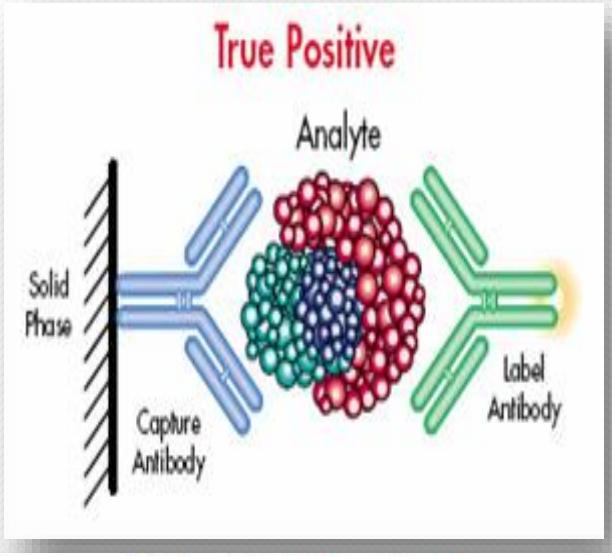


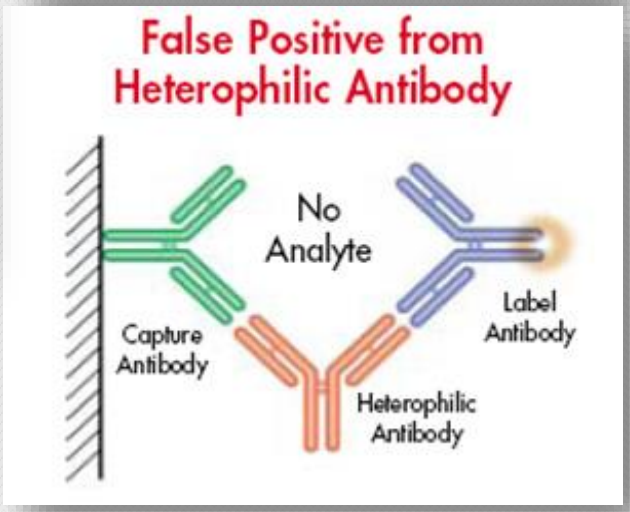
Heterophil antibodies

- Endogenous antibodies produced against poorly defined antigens
- Can react with several animal species (mouse is most common)
- Usually react with Fc
- IgG or IgM but can be IgA, IgE
- Frequency : up to 40% (0.05% may present clinical significance)
- Produced by enviromental contact, transplacental passage or viral infection

Heterophile antibody and RF



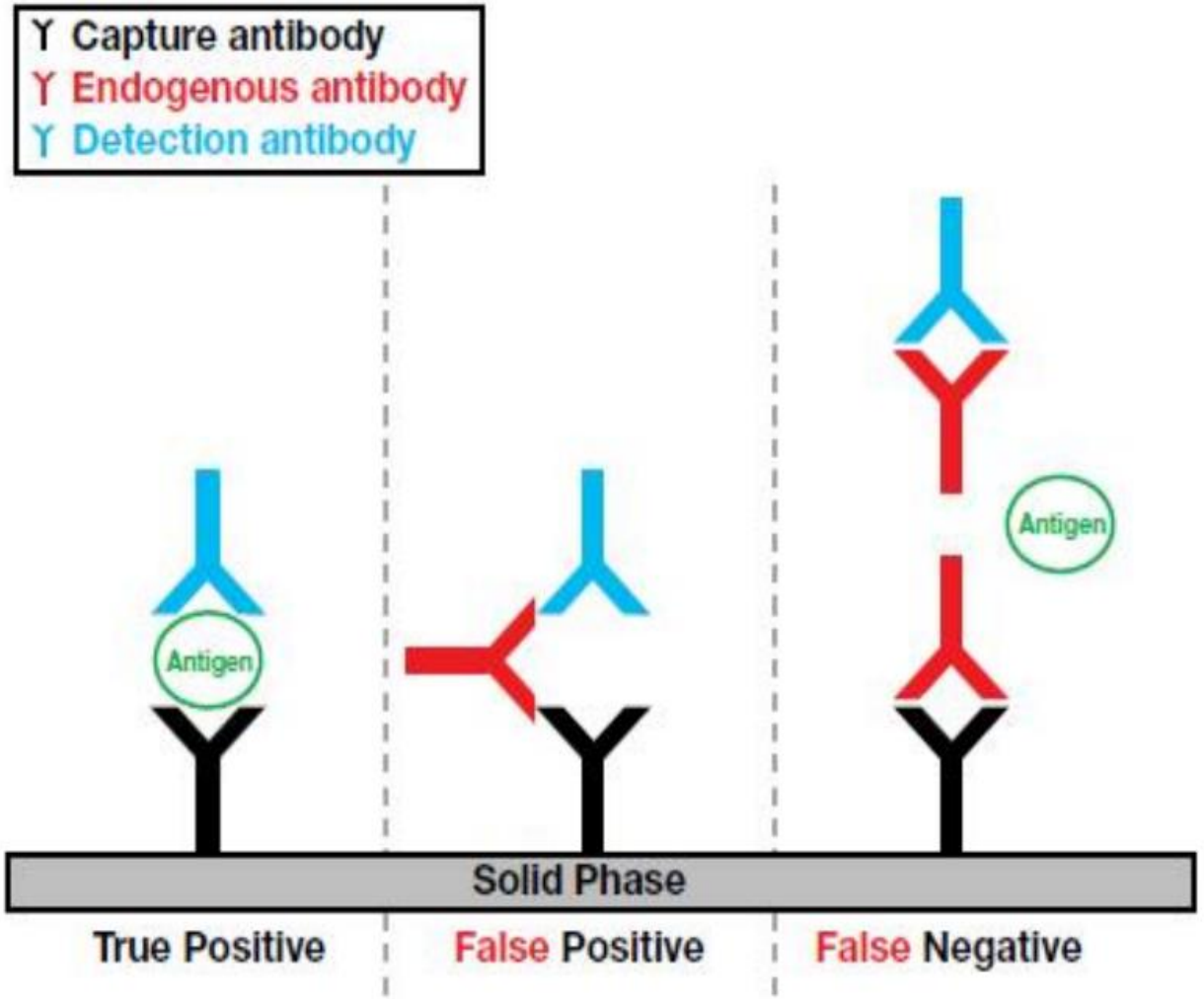




NATURE OF INTERFERENCES.

- **1. Interferences that alter the measurable analyte concentration in the sample**
- • Hormone binding proteins
- • Pre-analytical factors, e.g., anticoagulants, sample storage
- • Autoanalyte antibodies
- **2. Interferences that alter antibody binding**
- • Heterophile antibodies
- • Human anti-animal antibodies
- • High-dose hook effect

Mechanisms of interference by heterophilicantibodies



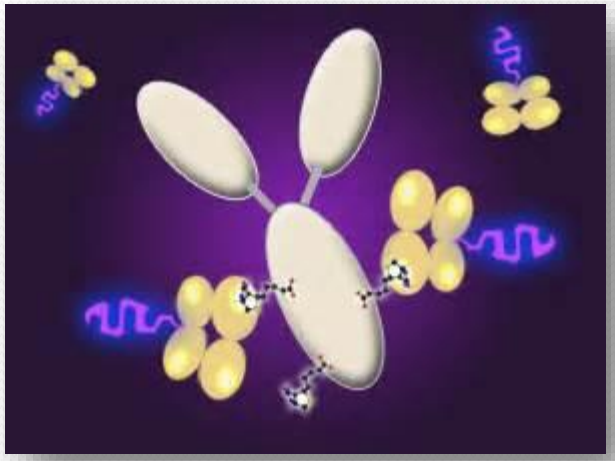
Rheumatoid Factor, RF

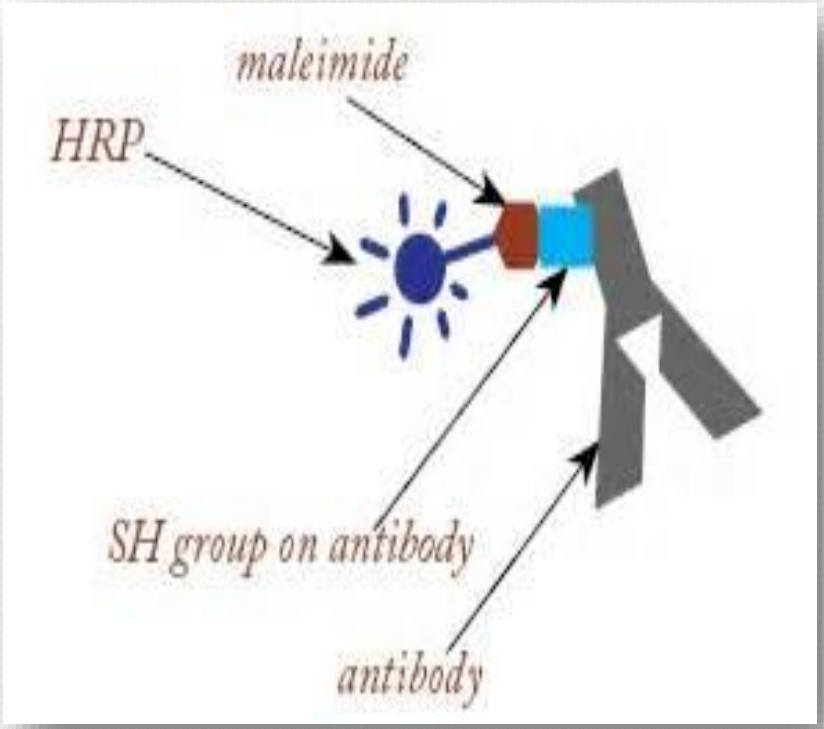
- An IgM that act to IgG Fc
- 70% RA patients
- May bind to rabbit, sheep, goat and mouse Ig
- Special technical problem for IgM quantitation
- False positivity is common, but competitive inhibitor may cause false negative

Antibody to label marker

The label in an enzyme conjugate can also be a target for circulating antibodies

- Anti-HRP
- Anti-ruthenium label
- Anti-streptavidin





Normal blood components in excess

Elevated levels of lipides, hemoglubin, and bilirubin have been shown to cause interference in certain immunoassays.

Bilirubin: negative interference in cTnI concentration.
Hemoglobin and RBC proteases: negative interference in ACTH, Gastrin, insulin, PTH, and cTnT.
Lipemia: negative interference in ECL testosterone measurement.

Blood collection tubes

A blood collection tube is a complex device that is fabricated from multiple components made of different materials that can interact with the components of a specimen or shed interfering material into the specimen.

- Siliconization
- Separator gel
- Other surfactants

Cross-reacting substances

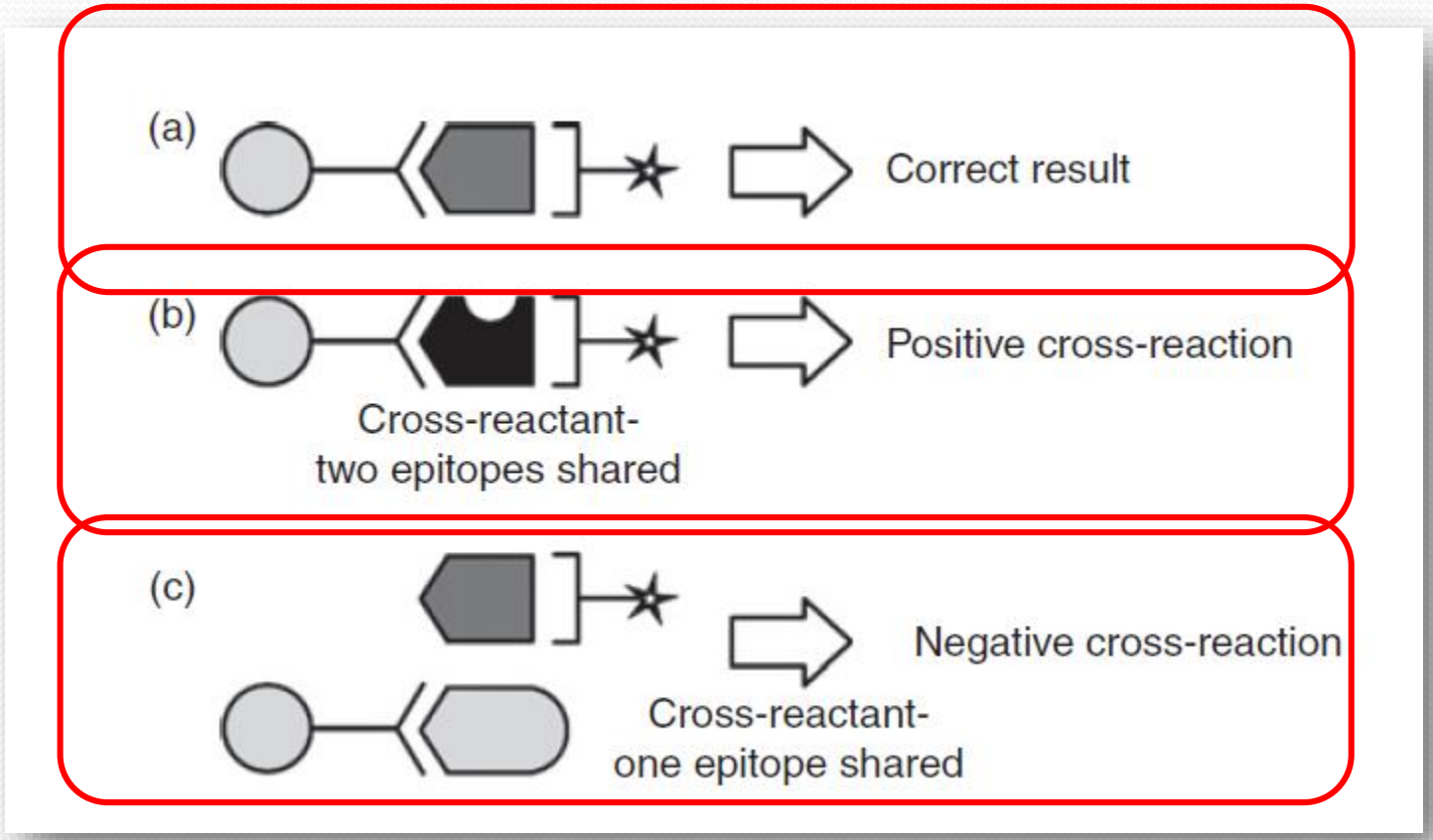


Table 2.

MOST COMMON INTERFERENCES AND OTHER SOURCE OF VARIATION IN IMMUNOASSAYS

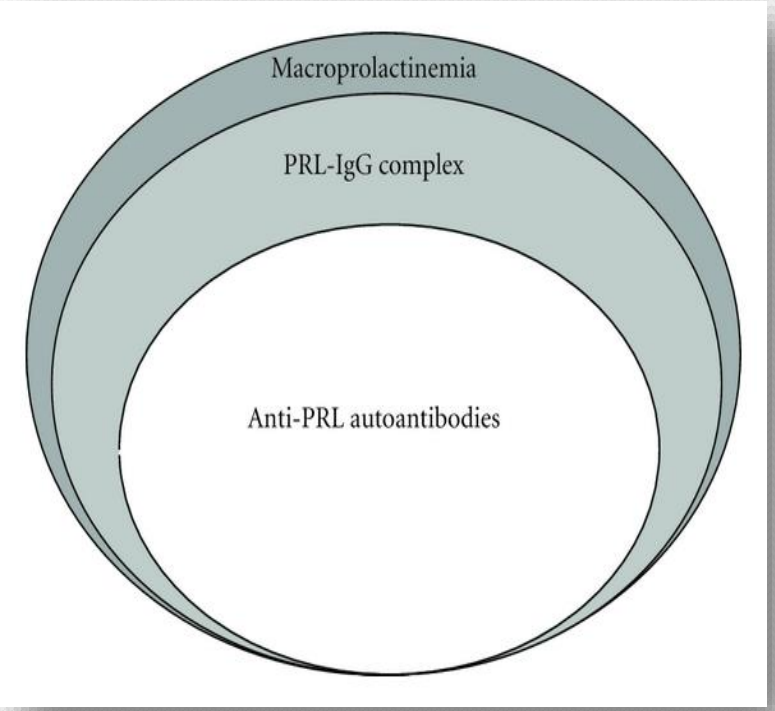
Analyte	Possible interference and other sources of variation		
	Increased result value	Decreased result value	Increased or decreased value
α-1-fetoprotein AFP	Benign disease (alcohol hepatitis, cholestasis), pregnancy).	Long-term sample preservation.	HAMA and heterophile antibodies.
Carcinoembryonic antigen CEA	Benign disease (chronic hepatitis, renal disease, gastrointestinal diseases), smoking, Li and Na-heparin plasma.	Long-term sample preservation.	HAMA and heterophile antibodies.
Carbohydrate Antigen 15-3 CA 15-3	Benign disease (chronic hepatitis, autoimmune disease, gynecologic diseases), other cancer diseases.	High-dose hook effect.	HAMA and heterophile antibodies.
Carbohydrate Antigen 125 CA 125	Benign disease (endometriosis, ovarium cysts, liver diseases, pregnancy, hart failure), other cancer diseases, menstruation period.	Long-term sample preservation.	HAMA and heterophile antibodies.
Carbohydrate Antigen19-9 CA 19-9	Menstruation period, pregnancy, contamination of sample with secretion (saliva, etc.), benign disease (chronic hepatitis, cholestasis, gynecologic diseases).	Patients with blood group Levis(a) and Levis(b).	HAMA and heterophile antibodies.
Human epididymis protein 4 HE4	Menopause, renal disease	Pregnancy, High BMI	
Total specific prostate antigen tPSA	Hormonal therapy, prostate manipulation and ultrasound examination, ejaculation, other cancer disease (breast cancer, salivary gland neoplasms).	Prolonged time to sample spin, thermal sample manipulation.	HAMA and heterophile antibodies.
Human chorionic gonadotropin total hCG	Heterophile antibodies, non-specific protein binders, Renal disease, menopause, cannabis consummation.	Hook effect, thermal sample manipulation.	
Thyroid Stimulating Hormone TSH	AntiTPO, HAMA and auto antibodies Pregnancy, Cardio vascular risk		
Thyroxine T4 and free form fT4	T4 autoantibodies, HAMA Hashimoto's thyroiditis, Graves' disease		Non-esterified fatty acids, thyroid binding globulin (TBG)
Triiodothyronine T3 and free form fT3	T3 autoantibodies. HAMA Hashimoto's thyroiditis, Graves' disease		Non-esterified fatty acids, thyroid binding globulin (TBG)

Table 2 Examples of analytes for which the analytical specificity of the immunoassay method used is likely to affect clinical interpretation

Analyte	Potential cross-reactants	Effect of presence of cross-reactant on analytical result obtained	Clinical implications	References
Chorionic gonadotrophin (hCG)	hCG beta-subunit (hCGβ)	Potentially higher hCG results obtained in immunoassays recognizing hCGβ	Use of an immunoassay recognizing hCG + hCGβ essential for oncology applications as some testicular cancers may produce only hCGβ and not intact hCG	9
Digoxin	Aldosterone antagonists – e.g. spironolactone, canrenoate	Falsely elevated or lowered digoxin concentrations	Not possible to assume interchangeability of immunoassays. Analytical interferences in digoxin immunoassays (both from digoxin-like immunoreactive substances and drug metabolites) are a real problem, likely to become even more important as lower therapeutic ranges are recommended. Confirmation in a physicochemical method such as HPLC is highly desirable	70,71
Growth hormone (GH)	GH receptor antagonist – e.g. Pegvisomant (Somavert®)	Falsely elevated or lowered GH concentrations	Only certain immunoassays can be used to measure GH in the presence of Pegvisomant	72
Insulin	Novel insulin analogues – e.g. Insulin Lispro (Humalog®), Insulin Detemir (Levemir®)	Differences in cross-reactivity of novel insulin analogues are reflected in discordant insulin concentrations as measured in different methods	Knowledge of such differences may be critical for adequate assessment, e.g. of factitious hypoglycaemia	73
Luteinising hormone	hCG	Apparently measurable LH in early pregnancy, when LH and FSH are both suppressed	Failure to appreciate this when using an LH assay which cross-reacts with hCG may delay pregnancy diagnosis in an amenorrhoeic patient	74
Parathyroid hormone (PTH)	N-truncated fragments – e.g. 7–84 PTH	Different results for patients with chronic renal failure depending on the assay used	Not possible to assume interchangeability of immunoassays. Establishment of appropriate method-specific reference intervals or cut-off values essential for clinically effective application of clinical guidelines	75
Prostate specific antigen (PSA)	PSA complexed to α_1-antichymotrypsin inhibitor	Measurement of 'total' PSA influenced by relative recognition of free and complexed forms of PSA	Not possible to assume interchangeability of immunoassays. For non-equimolar assays, establishment of appropriate method-specific decision points essential for screening applications	26,76
Testosterone	Other steroids – e.g. dehydroepiandrosterone sulphate	Potentially higher testosterone results in immunoassays cross-reacting with other steroids. Most likely to be a problem in direct non-extraction methods	Inappropriate clinical referral and unnecessary further investigations	77,78

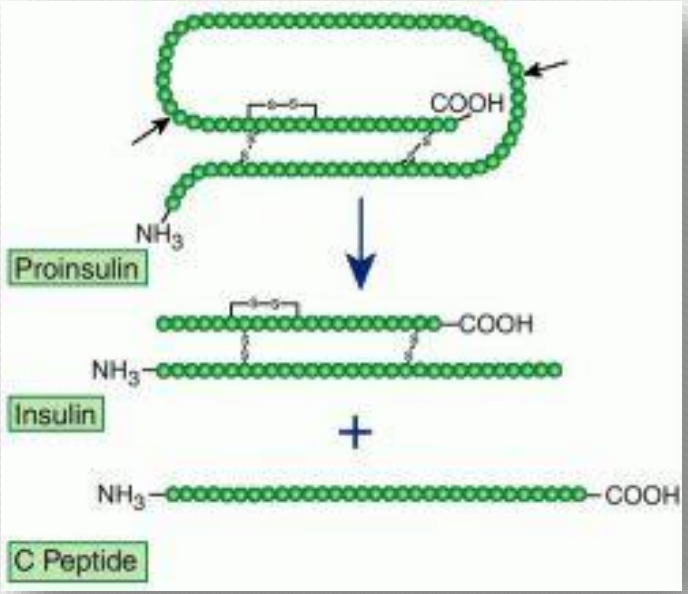
Anti-analyte antibodies & macrocomplexes

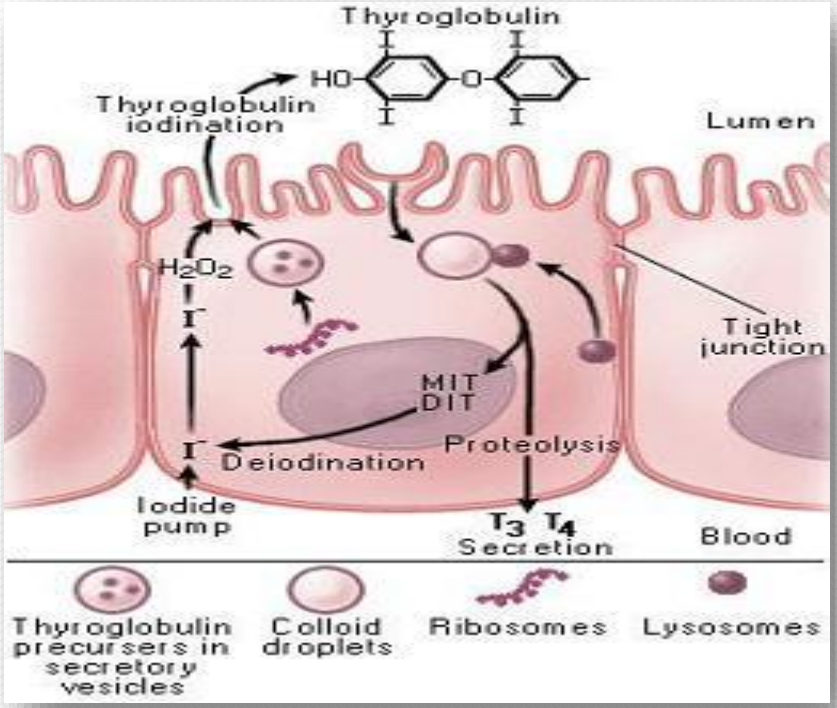
Macroprolactinemia is a heterogeneous condition with different etiologies; 87% of macroprolactin was PRL-IgG complex and 67% of macroprolactin was autoantibody-bound PRL



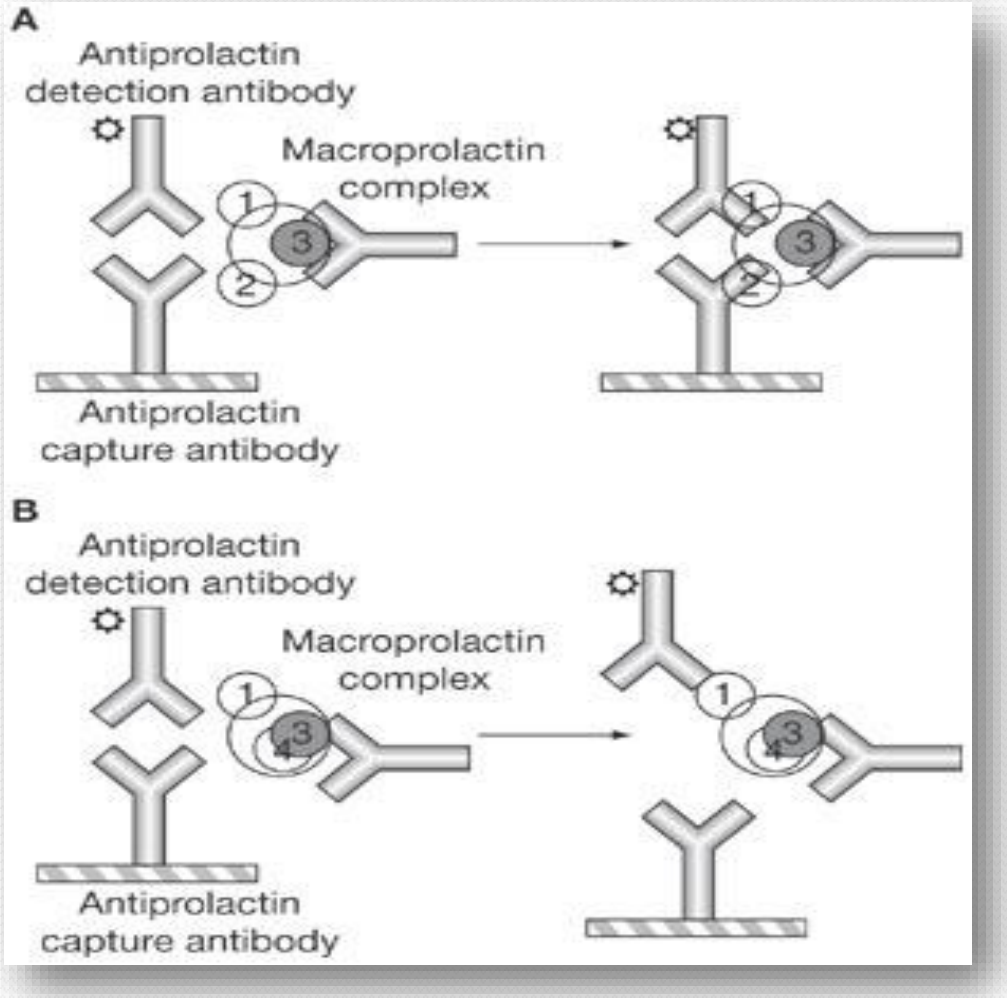
Anti-analyte antibodies

- Anti-insulin
- Anti-thyroglobulin





Anti-analyte antibodies



Protocol 2. Procedure for screening for macroprolactin using PEG precipitation.[45]

Reagents

(1) Prepare 200 mL of phosphate-buffered saline (PBS; 137 mmol/L sodium chloride, 10 mmol/L sodium phosphate, pH 7.4);
(2) Prepare 100 mL of 25% w/v PEG by dissolving 25 g of PEG 6000 in 80 mL of PBS. When dissolved, make the volume up to 100 mL with PBS and store at 4°C (N.B. solid PEG should be less than 5 years old and PEG solutions should be used within 2 weeks of preparation);
(3) Equilibrate the PEG solution at room temperature prior to use.

Procedure

(1) Add 250 μL of PEG solution (25% w/v) to 250 μL of each specimen in appropriately labelled tubes, vortex thoroughly and incubate at room temperature for 10 min;
(2) Centrifuge the tubes (14,000*g*; 5 min);
(3) Decant each supernatant into a second appropriately labelled tube and measure the prolactin concentrations within 24 h. (For some immunoassays [e.g. the Beckman Access and Siemens Immulite methods], dilution of the supernatant 1 in 5 with PBS is also recommended.) If the prolactin result is over range or if there is insufficient sample to analyse without dilution, the specimen can be diluted with PBS;
(4) Multiply the prolactin concentrations by 2 to correct for the dilution with PEG. Additional multiplication will be required for diluted specimens.

The PEG-precipitable PRL (%), which represents the amount of **macroprolactin**, is **calculated** as follows:

(total PRL-free PRL)/total PRL × 100. PEG-precipitation ratio greater than 60% (recovery less than 40%) is used as the cut-off value for the diagnosis of macroprolactinaemia.

نحوه محاسبه ماکرو پرولاکتین در ازمایشگاه

- پرولاکتینی که بعدازمجاورت باPEGرسوب می کند نمایانگرماکروپرلاکتین است. برای گزارش ماکروپرولاکتین معمولا به دوصورت می توان عمل کرد:
۱- تعیین نسبت پرولاکتین رسوب یافته
- PEG-Precipitation ratio
- Total PRL-Free PRL/Total PRLx۱۰۰
- که اگراین نسبت بیش از٪۶۰ باشد نشانه ماکروپرولاکتینمی است.
۲- تعیین درصدریکاوری که عددفرمول قبلی رااز۱۰۰ کم می کنیم. بنابراین ریکاوری کمتراز٪۴۰ نشانه ماکروپرولاکتینمی است.

اندازه گیری ماکرو پرولاکتین با peg

ضریب رقت سرم بیمار که با محلول ۲۵ درصد pegبه نسبت مساوی مخلوط نموده و با سانتریفیوژ رسوب گیری نموده و سپس از سوپرناتانت آن مجددا پرولاکتین اندازه گیری میشود توجه داشته باشند و آن را در نتیجه بدست آمده ضرب نمایند.

معمولا به نسبت مساوی مخلوط میشود لذا باید عدد بدست آمده از سوپرناتانت را که موید پرولاکتین مونومر یا فرم آزاد پرولاکتین هست را ضربدر ۲ نماییم ..مطلب بعدی اینکه بنا به توصیه اکثر مراجع معتبر لازم است برای تفسیر نتیجه آزمایش و افتراق موارد پرولاکتینمیای حقیقی از ماکروپرولاکتینمیا ، علاوه بر اینکه مقدار پرولاکتین توتال و پرولاکتین بعد از رسوب با pegرا بصورت جداگانه گزارش مینماییم

حتما درصد ریکاوری recovery rate % را با استفاده از فرمول

(total prl - free prl)/total prl ×100)

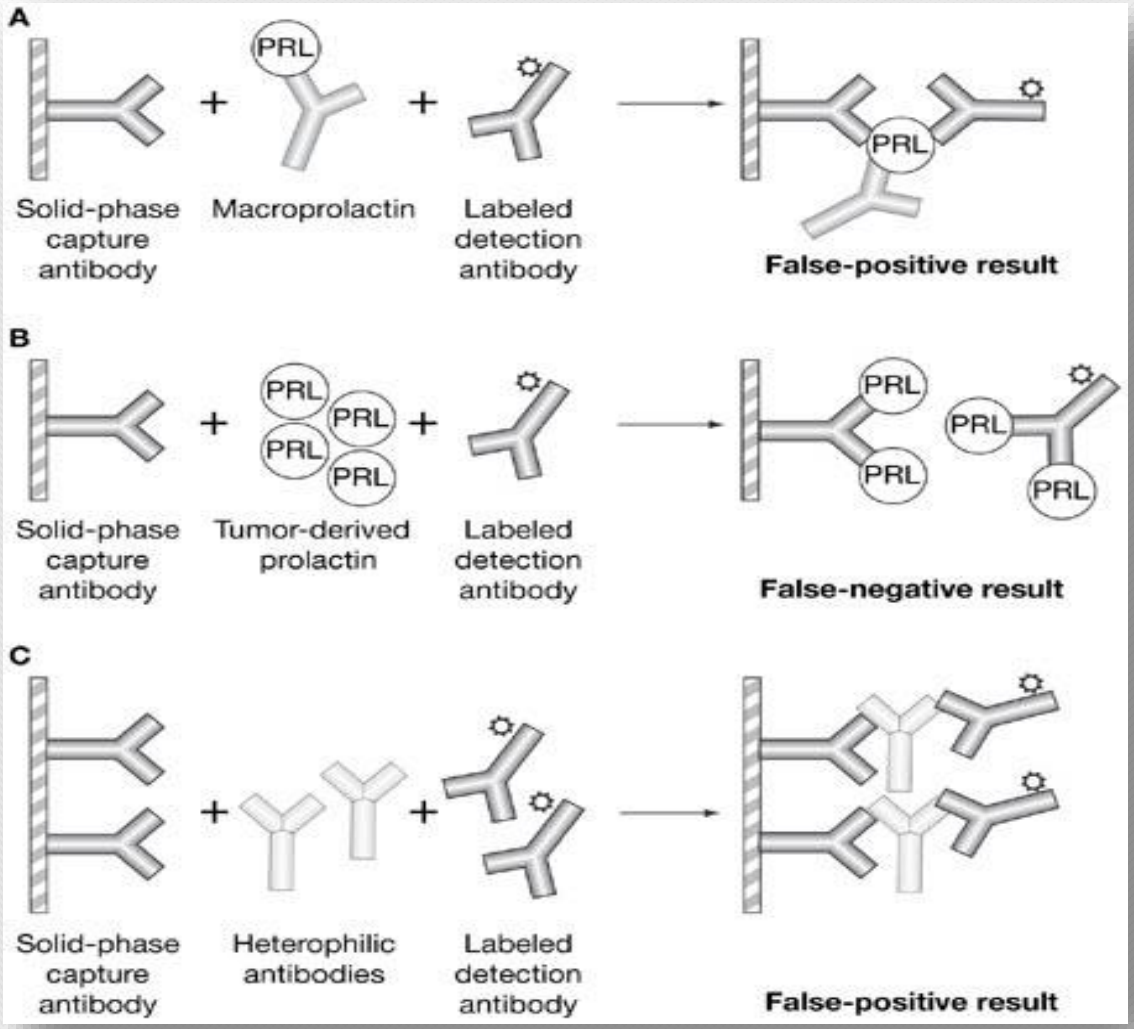
به دست می آوریم .

لازم به ذکر است عدد حاصل از فرمول در واقع اشاره مستقیم به درصد پرولاکتین راسب شده دارد و چنانچه عدد بدست آمده را از صد کم کنیم درصد ریکاوری را به ما میدهد..

در پست بعدی مثالی آورده میشود..

در صورتیکه درصد ریکاوری پرولاکتین انداره گیری شده بر روی سوپرناتانت بعد از رسوب با pegکمتر یا مساوی ۴۰ درصد پرولاکتین توتال باشد یا بعبارت دیگر میزان رسوب پرولاکتین بعد از مجاورت با peg بیشتر از ۶۰ درصد باشد وجود ماکروپرولاکتین به اثبات میرسد.. در غیر اینصورت بعنوان پرولاکتینمیای واقعی در نظر گرفته میشود (لازم به ذکر است تعداد کمی از رفرنسها کلا عدد ۵۰ درصد را در نظر میگیرند) نکته دیگر اینکه لازمست هر دو اندازه گیری لزوما با یک روش و ترجیحا در یک ران کاری انجام شود.. ضمنا معمولا توصیه چندانی به کسر نمودن پاسخ پرولاکتین بعد از pegاز پرولاکتین توتال و گزارش آن بعنوان پرولاکتین مونومر یا آزاد یا حقیقی یا بیواکتیو نمیشود.

Prolactin: multiple interferences



High-dose Hook effect

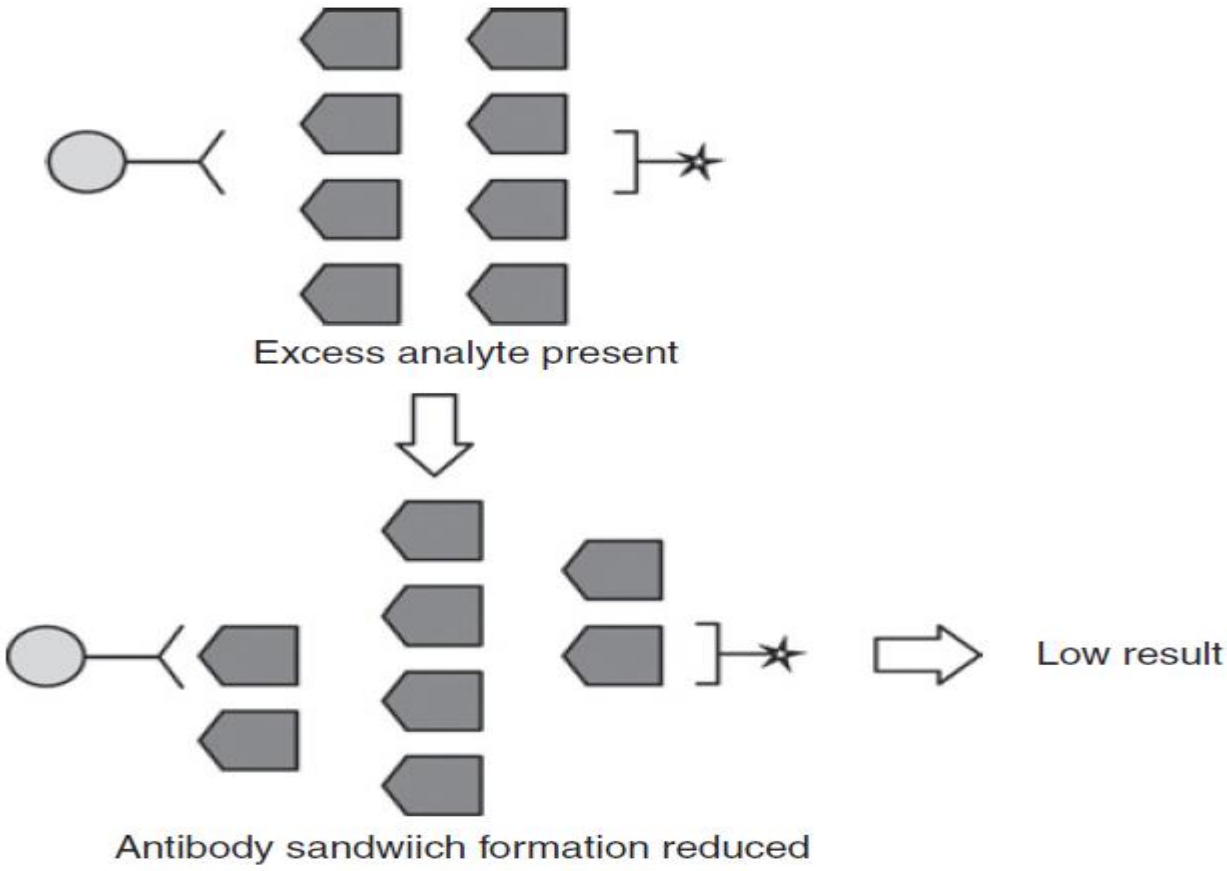


Figure 4 Mechanism of high-dose hook effect in two-site immunometric assay. As analyte concentrations increase to very high concentrations, both

Hook effect

- Unexpected fall in the amount of analyte resulting in the gross under-estimation of the analyte
- Particularly in sandwich immunoassays when sample contain extremely high level
- Upon further dilution, the result will be out of range
- Most commonly occurred in measurement of IgE, hCG, Ferittin, tumor marker, infectious Ag-Ab

How to deal with Hook effect

1. Run all samples in duplicate dilution
2. Ensure for adequate washings
3. Know the level of Hook phenomenon according to manufacturer suggestion
4. Good communication with clinicians

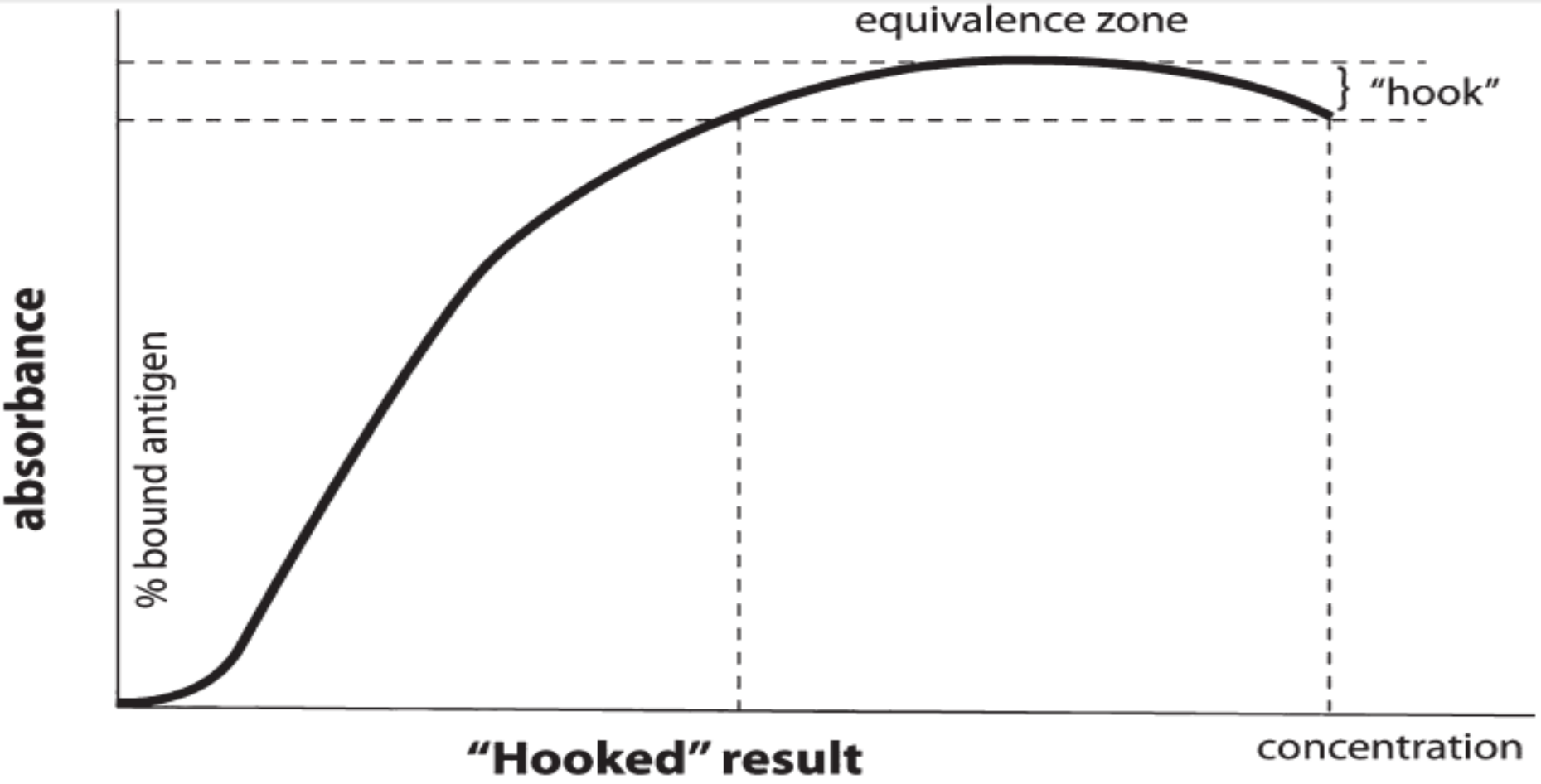


Figure 2.The hook effect - An excessive amount of analyte overwhelms the binding capacity of the capture antibody. This results in an inappropriately low signal that causes erroneous low or normal result ("hooked" result) for a patient with an excessively elevated serum analyte concentration (5).

The steps to minimize interferences

1. The use of chimeric Abs (animal Fab + human Fc)

2. Using other methods based upon different MoAb

3. Removal of unusual Ab by PEG

4. Making dilutions usually produce non linear results

5. Commercial mixture of animal proteins for pre-analysis incubation

Investigating suspected antibody interference

- Confirmation of results by other immunoassay methods
- Dilution and recovery studies
- Treatment with heterophilic blocking reagents
- Addition of non-immune animal serum
- Polyethylene glycol precipitation
- Confirmation of serum results by testing in the urine (HCG)
- Sample extraction
- Confirmation by mass spectrometry
- Gel filtration chromatography
- Immunoadsorption chromatography on immobilized IgG binding proteins (protein A, Protein G)
- Assessment in a “non-sence” assay

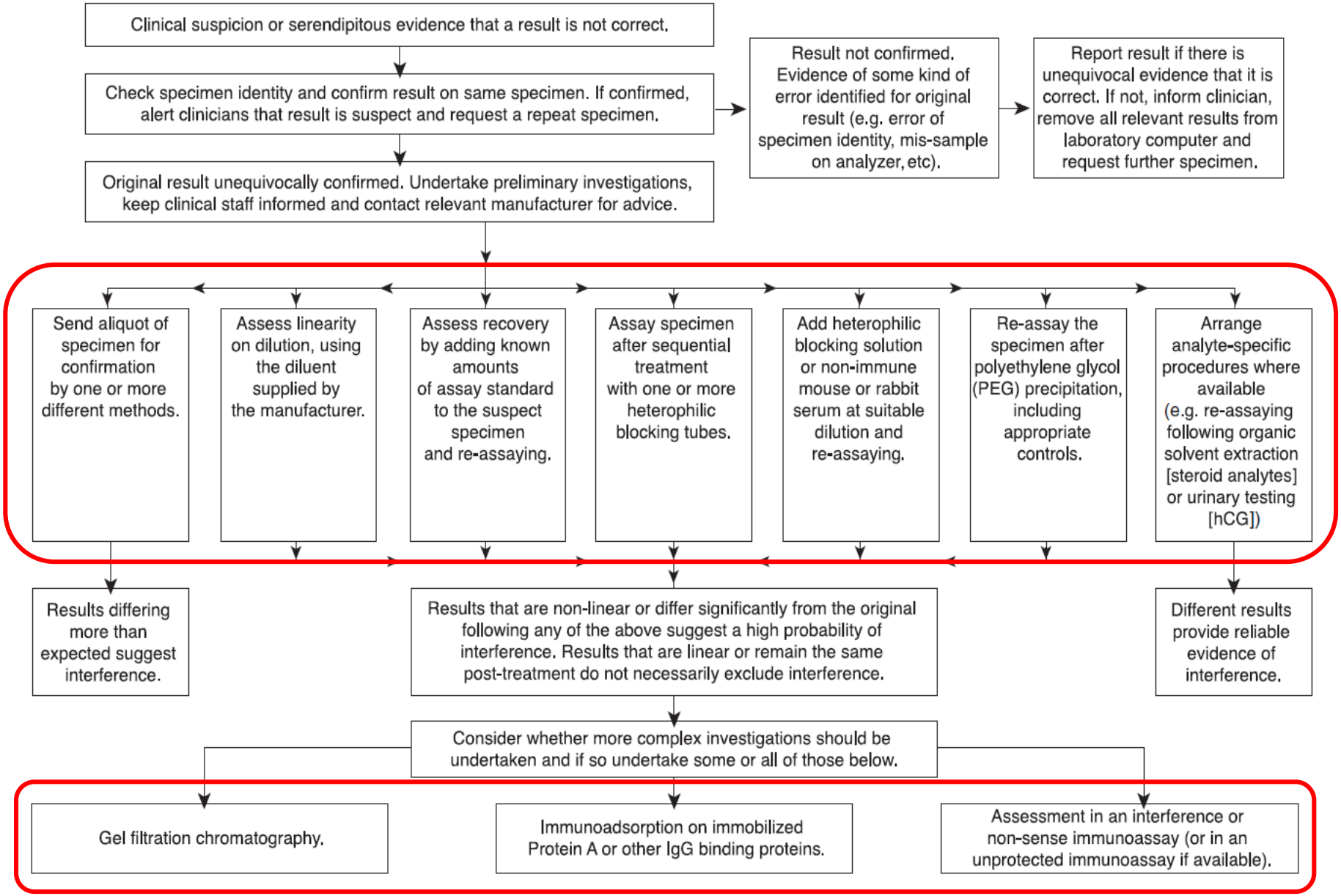
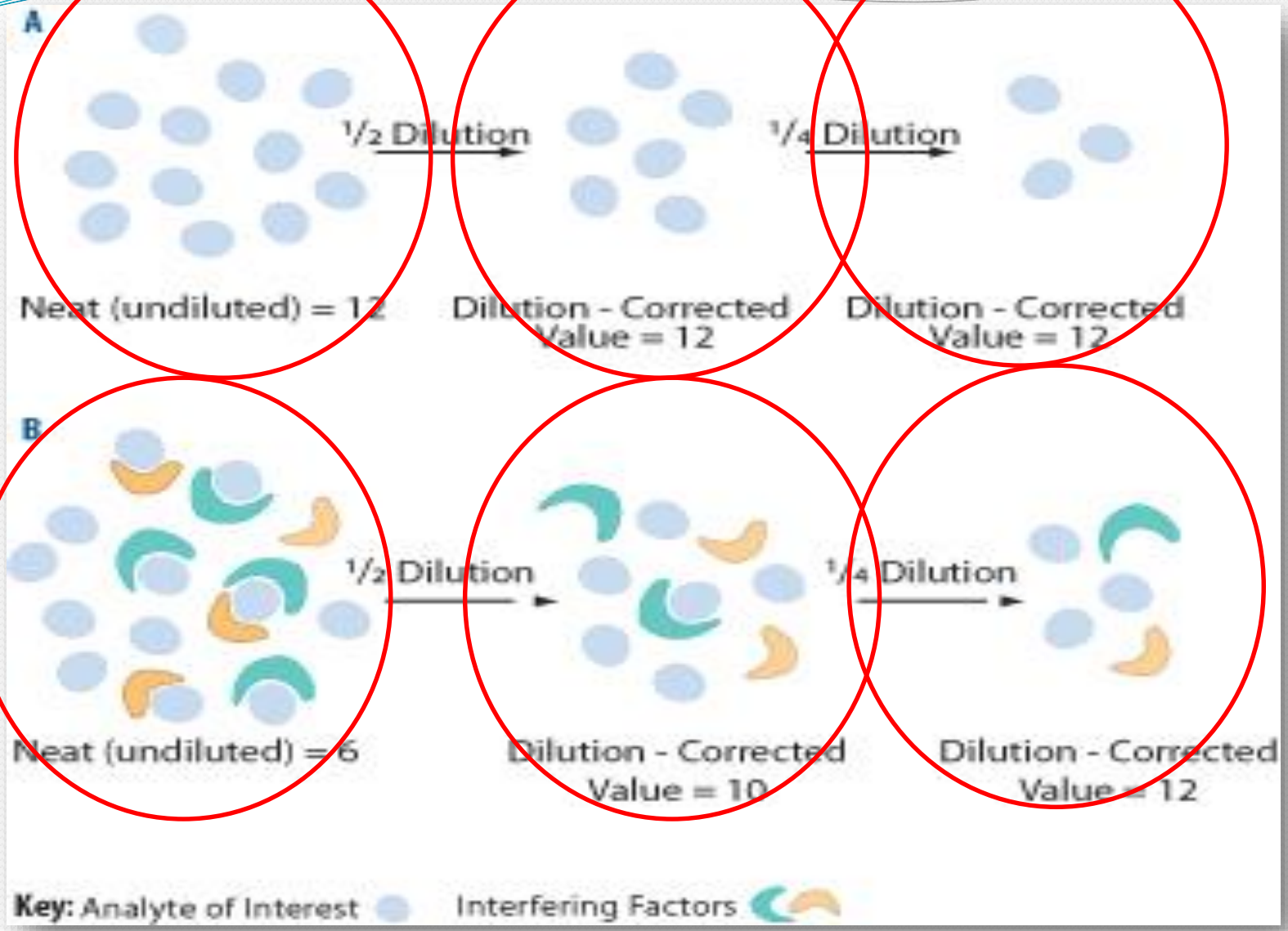
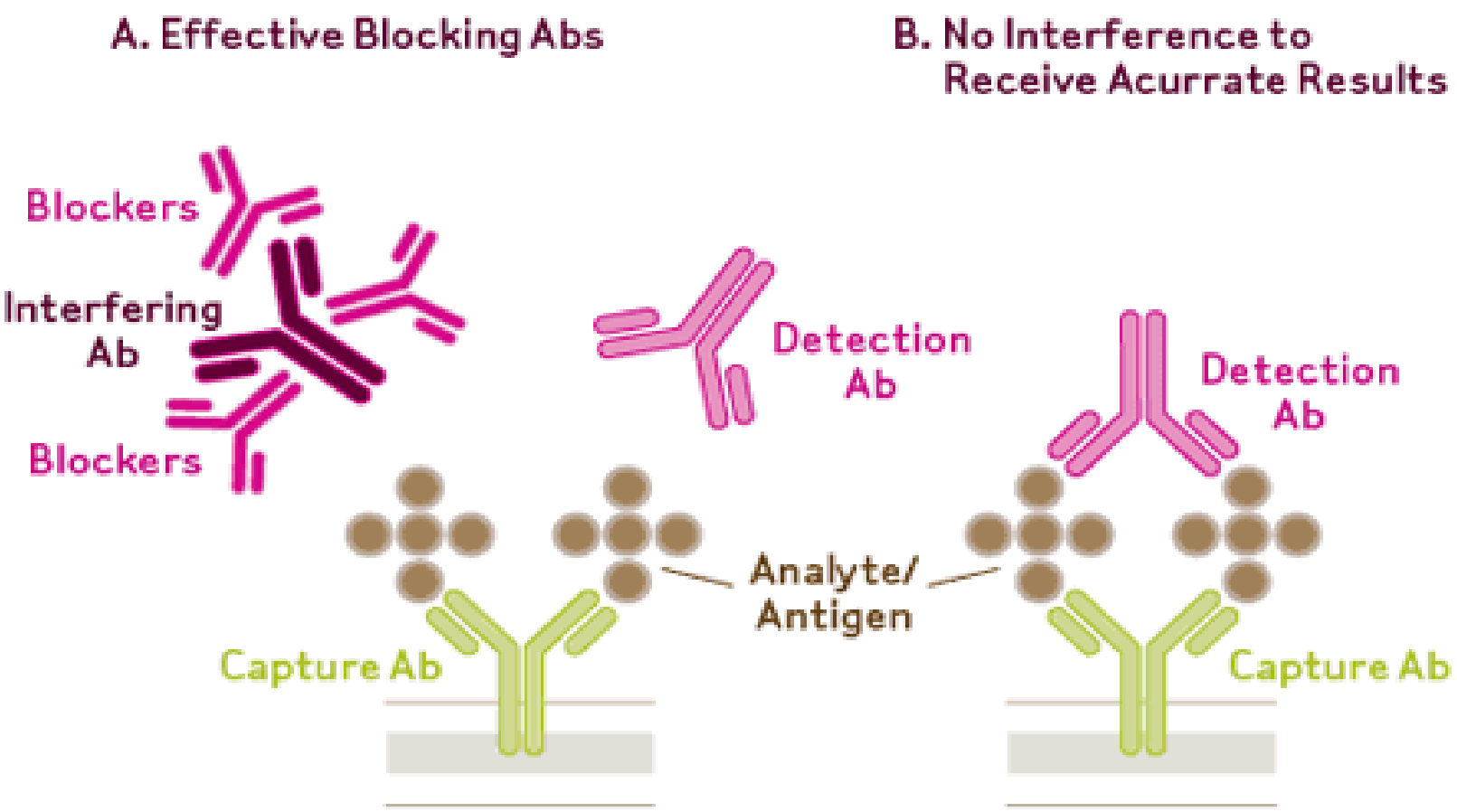


Figure 3 Flow chart showing sequence of investigations that might be undertaken to investigated suspected immunoassay interference


A
1/2 Dilution
1/4 Dilution
Neat (undiluted) = 12
Dilution - Corrected Value = 12
Dilution - Corrected Value = 12
B
1/2 Dilution
1/4 Dilution
Neat (undiluted) = 6
Dilution - Corrected Value = 10
Dilution - Corrected Value = 12
Key: Analyte of Interest
Interfering Factors

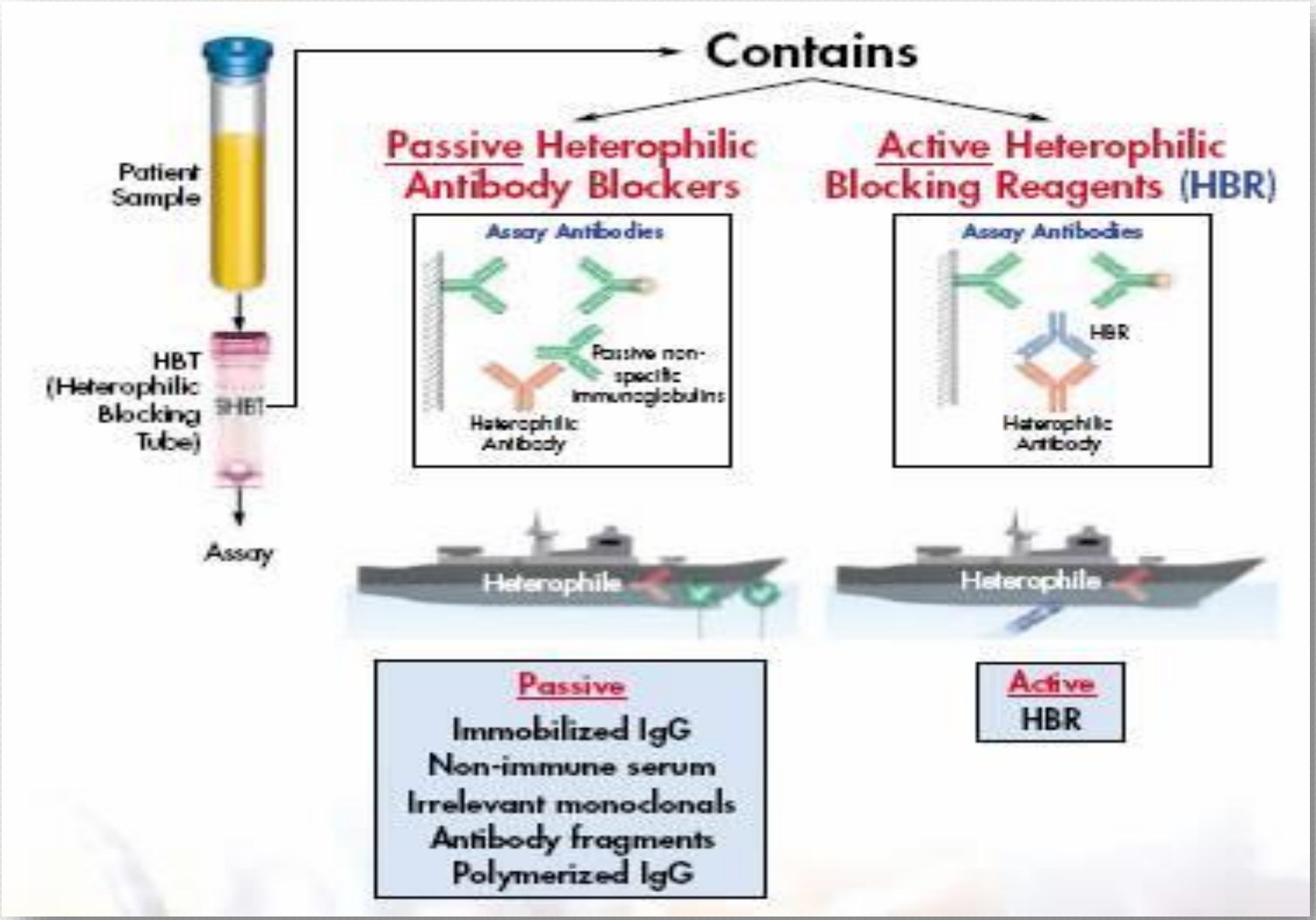
How Blocking Reagents Prevent False Results



A. Blocking Abs neutralize the interfering Abs.

B. With neutralized interfering Abs, an accurate result is achieved through correct binding of the analyte/antigen between the capture and detection Abs.

Heterophilic blocking tube



»TABLE: Testing for Interfering Antibodies in Suspected Samples

Method	Rationale	Detail	Limitation
Serial dilution	Sample dilutions will change the relative ratios of reagent and interfering antibodies[18]	When the interfering antibody is present, values from an immunoassay do not usually exhibit a linear dilution pattern	Linearity can still occur despite the presence of interfering antibodies
Alternative methods	Interference may be method dependent	Use a different immunoassay format preferably with antibodies from a different species	~ 20-30% of samples with interfering antibodies may generate similar results using a different assay platform[2]
Blocking reagents	To saturate interfering antibody[5]	These agents generally consist of non-immune animal serum, irrelevant immunoglobulins, or antibody fragments preferably from the same species used in the assay reagents	No single blocking reagent can guarantee eliminating all types of interfering antibodies
Pre-treatment	To remove the interfering antibodies	Incubation with protein A/G-Sepharose to selectively absorb IgG; Precipitation with polyethylene glycol (PEG 600) to remove Immunoglobulins	Protein A/G-Sepharose has low affinity to IgM[5]; PEG600 cannot be used if the analyte itself is an immunoglobulin[2]

Box 1 Minimizing risk of interference – key points

1. Substances such as immunoglobulins, other proteins, lipids and bilirubin present in some blood serum samples can interfere in some immunoassays to give falsely high or low results.
2. Immunoassays can be designed by careful selection of reagents, addition of blocking agents and reaction kinetics to minimize, but probably not eliminate, the effects of such interferents.
3. Falsely high or falsely low results due to interferences endogenous to the specimen present a particular risk to patient care because they (a) are not detectable by normal laboratory quality control procedures, (b) are reproducible within the test system, (c) are often clinically plausible and (d) are relatively rare.
4. The diagnostics industry has done much to design assays that are robust to endogenous interferents and laboratories should include test robustness in their selection criteria for assay platforms.
5. As with all investigative procedures, both laboratory and clinical staff should maintain a high index of suspicion in inspecting test results, especially where major clinical interventions are based on test results alone. Good laboratory-clinical liaison will assist this.
6. Procedures (e.g. use of blocking reagents) are available for the laboratory to check whether a suspicious result might be due to endogenous interferents.

Case story 1

The laboratory director was consulted by a gynecologist about discrepant CA-125 results on a patient being monitored for recurrence of a surgically removed ovarian tumor. CA-125 results from a private laboratory had been consistently high and increasing, while results from the hospital laboratory were within normal limits.

CA-125

- A large glycoprotein expressed by tissues originating from the müllerian ducts
- Useful for detecting and monitoring ovarian tumors
  - Also elevated in endometrial, pancreatic, breast, colorectal, lung and GI carcinomas
- Lacks sensitivity and specificity as a screening test for ovarian cancer
  - Normal in 50% of stage I ovarian cancers
  - $PV_+ \approx 5\%$
- Very sensitive indicator of recurrence following surgical resection
  - Failure to return to normal after chemotherapy is indicative of drug-resistant disease

Conclusion

- HAMA can cause clinically significant elevations in CA-125 assays
- Different immunoassays may not respond equally to the presence of HAMA
- The population frequency of HAMA is not known, but is likely to increase
- Interference may occur at modest concentrations of HAMA

Follow-up studies

- HAMA quantitation (IRMA)*
  - Result = 196 ng/mL (0 – 188)
- CA-125 with heterophilic blocking reagent*
  - Without blocking reagent: 211.5 U/mL
  - With blocking reagent: 11.0 U/mL

- CONCLUSION interference of immunoassay

Interference in immunoassays is a serious problem which can have important clinical consequences and may lead to unnecessary clinical investigation as well as inappropriate treatment with potentially unfavorable outcome for the patient.

There is no single procedure that can rule out all interferences. It is important to recognize the potential for interference in immunoassay and to put procedures in place to identify them wherever possible. Process need to be in place in order

to make both laboratories and physicians aware of the potential for immunoassay interference, which can lead to clinical misinterpretation. In table 2. are shown some of the most common interferen

کنترل کیفی اب در آزمایشگاه بالینی

دکتر مهرداد ونکی

مرجع : مستندات سیستم مدیریت کیفیت در آزمایشگاه

دستورالعمل تهیه آب خالص و کنترل کیفی آن و تجهیزات مربوطه

کلیات

کیفیت نامرغوب آب اثر نامطلوبی بر نتایج آزمایش‌ها داشته و از این رو تضمین کیفیت آب مصرفی در آزمایشگاه لازم و ضروری است.

آب خالص به سه روش تهیه می‌شود:

۱- تقطیر: در روش تقطیر، آب را می‌جوشانند و بخار آن را سرد می‌کنند. در این روش، آهن، منیزیم و کلسیم و همچنین ارگانیسم‌ها برداشته می‌شوند اما ناخالصی‌های فرار مانند دی اکسید کربن، کلر و آمونیاک جدا نمی‌شوند. آب به‌دست آمده از این روش درجه II یا III است.

۲- دیونیزه‌کردن: در این روش آب از بین ستون‌های رزینی که حاوی ذرات باردار منفی و مثبت است عبور داده می‌شود. این ذرات با یون‌های موجود در آب ترکیب شده و آب نهایی دیونیزه خواهد بود. مواد آلی و سایر موادی که قادر به یونیزه شدن نیستند برداشته نمی‌شوند. برای تهیه آب درجه I باید از فیلتر غشایی و شارکول فعال استفاده کنیم.

۳- روش اسمز معکوس: آب تحت فشار از غشای نیمه تراوا (معمولا استات سلولز) عبور داده می‌شود. این غشا حدود ۹۰٪ مواد جامد محلول، ۹۸٪ ناخالص‌های آلی و مواد غیر قابل حل و ارگانیسم‌های میکروبی را جدا می‌سازد. قادر به جداسازی گازهای محلول نیست و فقط ۱۰٪ ذرات یونیزه را جدا می‌کند. معیارهای CLSI برای درجه‌بندی آب خالص در جدول ۵-۴ نشان داده شده است.

جدول ۵-۴: معیارهای CLSI برای درجه‌بندی آب خالص

ویژگی	درجه I	درجه II	درجه III
pH	درنظر گرفته نمی‌شود.	درنظرگرفته نمی‌شود.	۵-۸
آلودگی میکروبی براساس CFU/ml	۱۰	$۱۰^{۳}$	درنظرگرفته نمی‌شود.
مقاومت الکتریکی برحسب Mohm/cm	۱۰	۲	۰/۱
هدایت الکتریکی برحسب میکروزیمنس بر سانتی‌متر	۰/۱	۰/۵	۱۰
مواد آلی	آب از کربن فعال عبور داده شود.	درنظر گرفته نمی‌شود.	درنظرگرفته نمی‌شود.
تعداد ذرات ریز معلق که از فیلتر ۰/۲۲ میکرون عبور داده می‌شود.	< ۵۰۰/Lit	درنظر گرفته نمی‌شود.	درنظرگرفته نمی‌شود.

موارد مصرف انواع آب به شرح زیر است:

- موارد مصرف آب درجه I:

تهیه محلول‌های استاندارد، بافر، حل‌کردن سرم‌های کنترل و لیوفیلیزه، الکتروفورز، غربالگری سم شناسی و HPLC، عناصر کمیاب و کشت سلول

- موارد مصرف آب درجه II:

آزمایش‌های بیوشیمی، هماتولوژی، ایمنولوژی، میکروبیولوژی و سرولوژی

- موارد مصرف آب درجه III:

تجزیه ادرار و مدفوع، شست‌وشو و آب‌کشی وسایل شیشه‌ای، ساخت محیط کشت و بافت‌شناسی

روش نگهداری انواع آب:

- نگهداری آب درجه یک:

آب درجه یک را حداکثر دو تا سه ساعت پس از تهیه باید مصرف شود.

- نگهداری آب درجه دو و سه:

آب‌های درجه دو و سه را می‌توان در شیشه‌هایی ازجنس بروسیلیکات یا ظروف پلی اتیلن نگهداری کرد اما سریع باید مصرف شود تا از آلودگی میکروبی با میکروب‌های موجود در هوا جلوگیری شود. درب ظروف را باید محکم بست تا از جذب گازها جلوگیری شود. آب مقطر حداکثر یک هفته در ظروف پلاستیکی یا شیشه‌ای نگهداری می‌شود. آب دیونیزه برای تعیین مقدار الکترولیت‌ها مناسب‌تر است.

چگونگی کاربری تجهیزات

برحسب روش تخلیص و نوع دستگاه متفاوت بوده و در کتابچه راهنمای دستگاه نیز موجود است.

کنترل کیفیت

- کنترل کیفی آب آزمایشگاه
  - تعیین هدایت یا مقاومت الکتریکی:

با استفاده از دستگاه هدایت‌سنج* یا مقاومت‌سنج، میزان هدایت یا مقاومت الکتریکی آب انجام می‌گیرد. بعضی دستگاه‌های تخلیص آب، این وسایل را در مسیر خروجی خود دارند اما در بیشتر موارد میزان هدایت یا مقاومت الکتریکی آب باید در فواصل هفتگی (یا برحسب نیاز در هر بار مصرف) اندازه‌گیری می‌شوند. استفاده از این روش حساسیت بالایی داشته و توصیه می‌گردد در آزمایشگاه‌ها این روش مورد استفاده قرار گیرد.

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* فرهنگستان زبان و ادب فارسی واژه هدایت‌سنج را جایگزین واژه کنداکتومتر نموده است.