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۰۲۱-۴۹۳۷۵۰۰۰ (خط ویژه)

Products	Thyroid Panel	T3 (96,192)	Tumor Markers	*CA19- 9	Vitamin D	25-Hydroxy Vitamin D (96,192)
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		*TSH (96,192)		*CA-125	Fertility Panel	*LH
		Free T3		*CEA		*FSH
		Free T4		*AFP		*PRL
		T-Uptake		*PSA		AMH
		PTH		*Free PSA		*βHCG Titr
		*Anti-Tg	Steroids Panel	*Progesterone		βHCG Rapid
		*Anti-TPO		*(E2) Estradiol	Thrombosis	Cardiolipin-IgG & IgM
		*Tg		*Testosterone		β2-Glyco-IgG & IgM
Infectious Diseases	HIV	HIV		*Free Testosterone		β2-Glyco-Check
		HCV		*17OH-Progesterone		Phospholipid-Screen-GM
		HBsAG		*Cortisol		Pro C
		*Anti-H.pylori-IgG		*DHEA-S		Pro S
		*Anti-H.pylori-IgA	Rheumatology	ANA-8S	Gastroenterology	GLIA-IgA
		*Anti-H.pylori-IgM		SS-A		GLIA-IgG
Anemia	*Ferritin	*Ferritin		SS-B		tTg-A
		*Folate		ANA-HeP2	Miscellaneous	tTg-g
		*Vitamin B12		ANA Quantitative		*GH
Vasculitis	PR3 sensitive-c-ANCA	PR3 sensitive-c-ANCA		dsDNA-Check		*Insulin
		MPO-p-ANCA		dsDNA-IgG		Interleukin-6
Coagulation	PT (4ml,10ml)	PT (4ml,10ml)		RA/CCP Detect		*Troponin I
		PTT (4ml,10ml)		CCp (3rd Generation)		

* تکمیل دیتا استریتوریو دیتا - بیوتین



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تلفن: ۸۸۷۰۳۰۵۰ (خط ۱۰)



ژال تجهیز



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(دانش بنیان)

(طراحی - مشاوره - اجرا و ساخت تجهیزات آزمایشگاهی و تحقیقاتی)

با مجوز از وزارت بهداشت درمان و آموزش پزشکی و وزارت صنایع و معادن استان تهران

ردیف	تاریخ	نحوه برگزاری	مبحث	نام استاد	امتیاز بازآموزی
۱	۱۴۰۱/۱۰/۰۲	آنلاین - حضوری	سل کانترهای پیشرفته	دکتر نادر وظیفه شیران	✓
۲	۱۴۰۱/۱۰/۰۶	آنلاین - حضوری	مدیریت ریسک و مدیریت هزینه	دکتر مهرداد ونکی	✓
۳	۱۴۰۱/۱۰/۱۵	آنلاین - حضوری	تیروئید شناسی	دکتر محمدرضا بختیاری	✓
۴	۱۴۰۱/۱۰/۱۶	آنلاین - حضوری	تیروئید شناسی	دکتر محمدرضا بختیاری	✓
۵	۱۴۰۱/۱۰/۲۲	آنلاین - حضوری	تیروئید شناسی	دکتر محمدرضا بختیاری	✓
۶	۱۴۰۱/۱۰/۲۳	آنلاین - حضوری	تیروئید شناسی	دکتر محمدرضا بختیاری	✓
۷	۱۴۰۱/۱۰/۲۹	آنلاین	کنترل کیفیت در آزمایش تعیین حساسیت ضد میکروبی (آنتی بیوگرام)	دکتر سید مهدی بوتراپی	✓
۸	۱۴۰۱/۱۰/۳۰	آنلاین	تفسیر و نتایج EQAP در بخش بیوشیمی	دکتر رضا محمدی	✓
۹	۱۴۰۱/۱۱/۰۵	آنلاین	تفسیر و نتایج EQAP در بخش هماتولوژی	دکتر نادر وظیفه شیران	✓
۱۰	۱۴۰۱/۱۱/۰۶	آنلاین	ایمونوپاتولوژی انواع هپاتیت های ویروسی و اتوایمون	دکتر بابک بلبلی	✓
۱۱	۱۴۰۱/۱۱/۰۷	آنلاین	اصول تفسیر و چالشهای آزمایشگاهی انواع هپاتیت ویروسی	دکتر بابک بلبلی	✓
۱۲	۱۴۰۱/۱۱/۰۸	آنلاین	کنترلی کیفیت ابزار پایه در بخش میکروب شناسی	سرکار خانم صبوریان	✓
۱۳	۱۴۰۱/۱۱/۰۹	آنلاین	کنترل کیفیت در بخش میکروب شناسی	سرکار خانم صبوریان	✓
۱۴	۱۴۰۱/۱۱/۱۱	آنلاین - حضوری	اصول مشتری مداری	مهندس بابکی	✗
۱۵	۱۴۰۱/۱۱/۱۲	آنلاین - حضوری	اصول مشتری مداری	مهندس بابکی	✗
۱۶	۱۴۰۱/۱۲/۰۴	آنلاین	جنبه های آزمایشگاهی هورمون رشد و پرولاکتین	دکتر رضا محمدی	✓
۱۷	۱۴۰۱/۱۲/۰۵	آنلاین	جنبه های آزمایشگاهی غدد فوق کلیوی	دکتر رضا محمدی	✓
۱۸	۱۴۰۱/۱۲/۱۱	آنلاین	جنبه های آزمایشگاهی غدد تیروئید	دکتر رضا محمدی	✓
۱۹	۱۴۰۱/۱۲/۱۲	آنلاین	جنبه های آزمایشگاهی غدد جنسی	دکتر رضا محمدی	✓

دیپارتمار آموزش و پژوهش

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Department of DCLS
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تلفن: ۰۳۰۵۰۰۸۸۷ (خط ۱۰)

- ANA
- ds DNA
- CCP
- AMH
- CA 19-9
- Folate
- CA 125
- PTH
- CA 15-3

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NEW KITS

تولید کننده

• کیت های تشخیص رطبی الایزا

JAL TAJHIZ MEHRAN
LAB EQUIPMENT DESIGN & PRODUCTION

Thyroid Function Tests

(Interpretation Challenges)

M Reza Bakhtiari, DCLS, PhD



dr.bakhtiari.academy

Challenging TFTs

Definition:

1. Discordant Results vs. Clinical Picture



2. Inharmonious Results



• ANA • ds DNA • CCP • AMH • Folate • PTH

• CA 125 • CA 19-9 • CA 15-3

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کیت های تشخیص طبی الیزا

Challenging TFTs Results

(A Systematic Approach)

Revisit Clinical Context & Medications



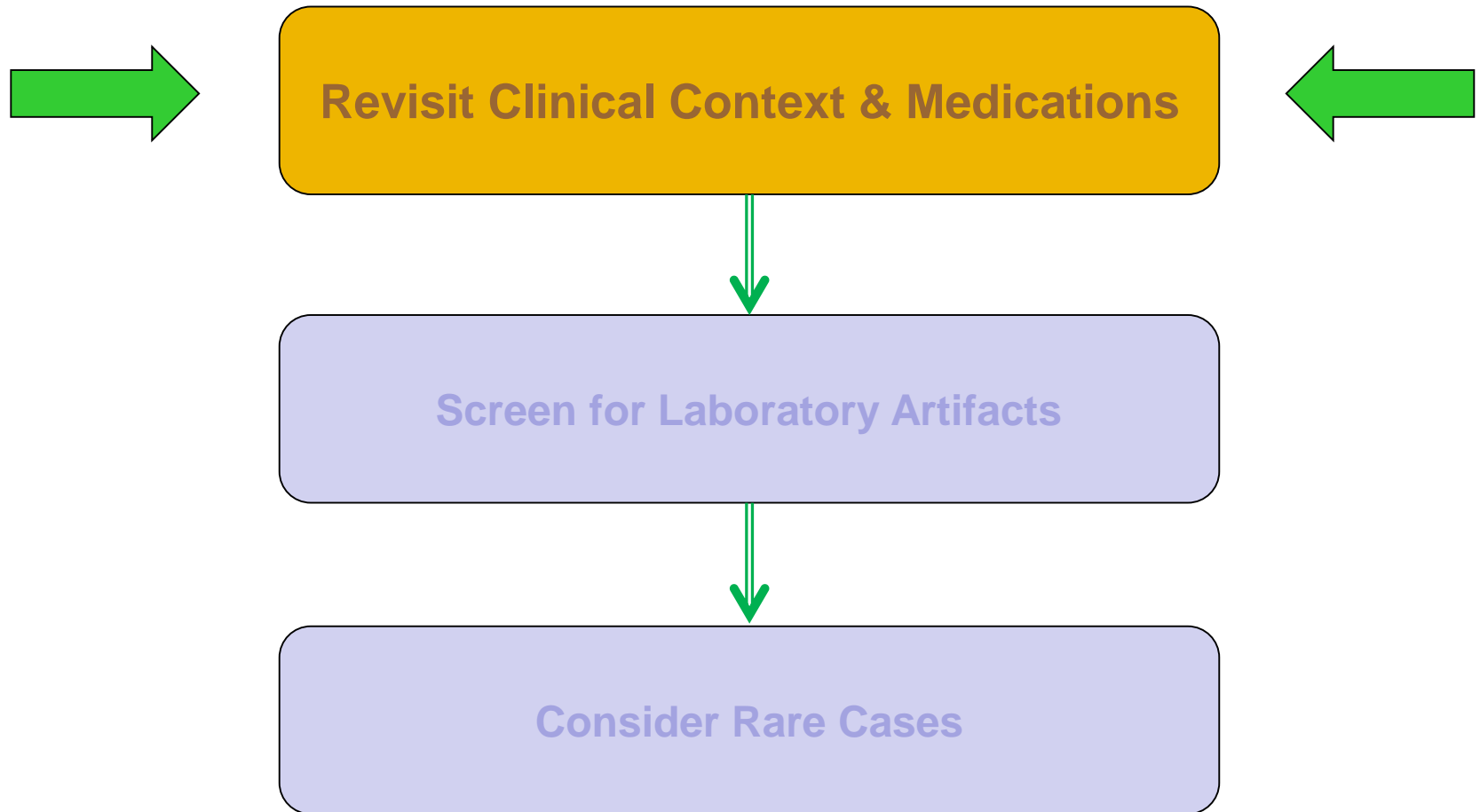
Screen for Laboratory Artifacts



Consider Rare Cases

Challenging TFTs Results

(A Systematic Approach)



Clinical Considerations



Hipre®

Automated
Immunoassay System



Lifotronic

Electro-chemiluminescence
Immunoassay (ECLIA) System



Magnus

Clinical & Research
Microscopes



• ANA • ds DNA • CCP • AMH • Folate • PTH

NEW KITS • CA 125 • CA 19-9 • CA 15-3

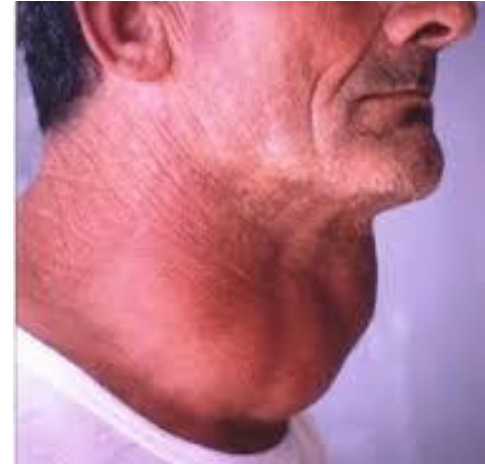
تولید کننده
کیت‌های تشخیص طبی الایزا

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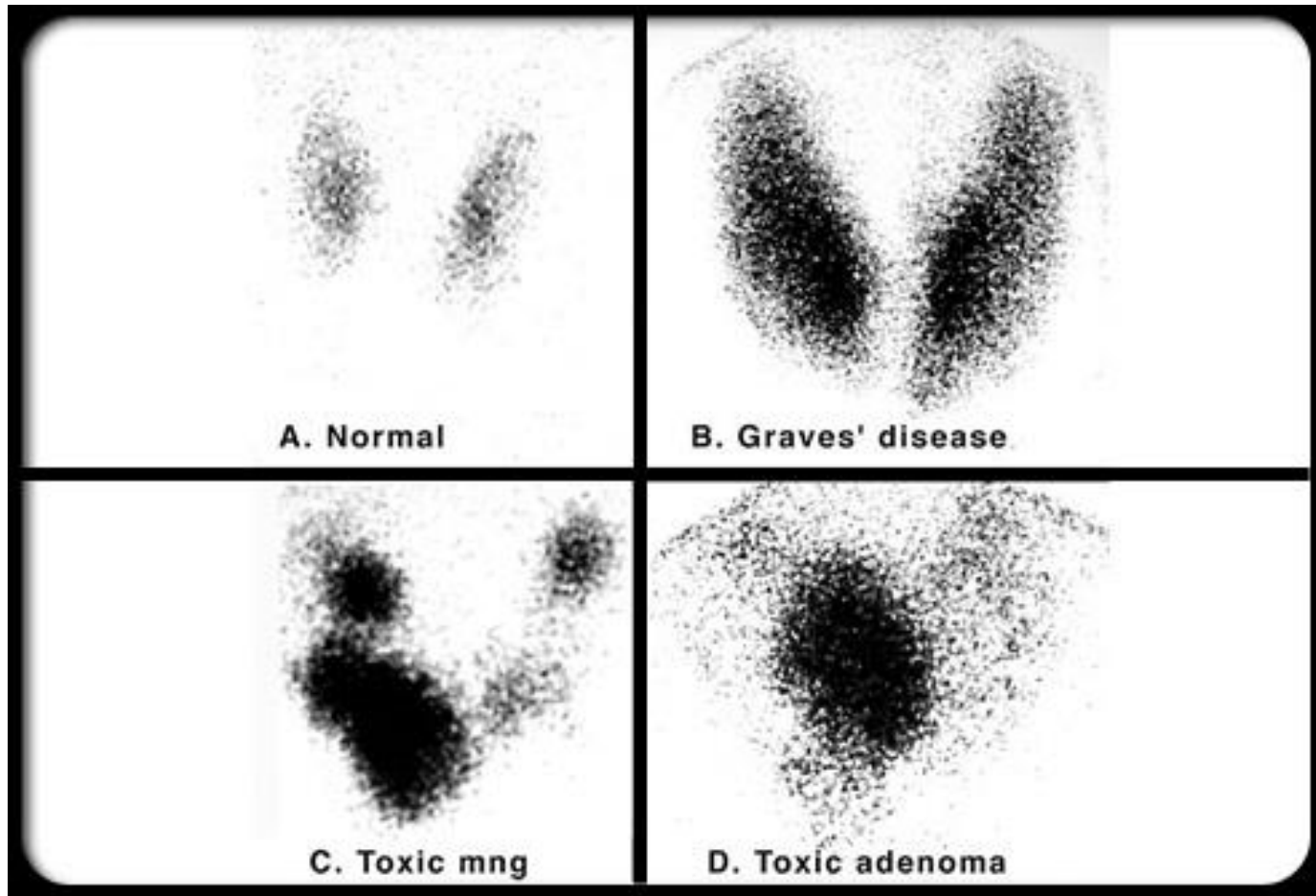
شرکت بنیان درمان
تلفن: ۰۵۰-۸۸۷۰۳۰ (خط ۱۰)

Goiters

1. Eu-thyroid Goiter
2. Hypo-thyroid Goiter
3. Hyper-thyroid (Toxic) Goiter



Thyroid Scan



Symptoms & Signs of Thyroid Disease

Hyperthyroidism (Overactive) % Cases		Hypothyroidism (Underactive) % Cases	
Rapid heart rate	100	Weakness	99
Goiter	100	Dry or coarse skin	97
Nervousness	99	Fatigue	91
Tremor	97	Slow speech	91
Increased swelling	91	Swelling of eyelids	90
Heat intolerance	89	Cold intolerance	89
Palpitation	89	Thick tongue	82
Fatigue	88	Slow movements	80
Weight loss	85	Swelling of face	79
Trouble breathing or shortage of breath	66	Memory impairment	75
Weakness	70	Constipation	61
Increased appetite	65	Weight gain	59
Eye complaints	40	Hair loss	57
Leg swelling	55	Trouble breathing or shortage of breath	35
Increased bowel habit	33	Ankle swelling	55
Poor appetite	9	Menstrual problems	32
Constipation	4	Goiter	30
Weight gain	2	Slowed heart rate	10

Symptoms & Signs of Hyperthyroidism

Symptoms	%	Signs	%
Nervousness	99	Tachycardia	100
Excessive sweating	91	Goiter	97
Intolerance to heat	89	Tremor	97
Palpitations	89	Warm and wet skin	90
Fatigue	88	Thyroid murmur	77
Weight loss	85	Eye disorders	71
Dyspnea	75	Atrial fibrillation	10
Weakness	70	Gynecomastia	10
Increased appetite	65	Palmar erythema	8
Ocular complaints	54		
Limb edema	35		
Increased frequency of bowel movements	33		
Diarrhea	23		
Menstrual disorders	20		
Anorexia	9		
Weight gain	2		

Iranian Patients ?

Proper Test Utilization

1. T3, T4
 2. T3, T4, TSH
 3. T3, T4, T3UP, FTI
 4. TSH, Free T4
 5. TSH, Free T4, Free T3
 6. Anti TPO, Tg, Anti tg
- ➔
- T4, T3U
 - TSH, Free T4
 - Anti TPO
 - T3



T3 (FT3) Indications

Indications for Measurement

Required

Potential thyrotoxicosis with suppressed TSH and normal serum free T4.

During antithyroid drug therapy to identify persistent isolated T3 excess.

Diagnosis of amiodarone-induced thyrotoxicosis.

Useful

Early recurrence of thyrotoxicosis.

Extent of T3 excess during suppressive T4 therapy or after T4 overdose

Not required or misleading

Diagnosis of hypothyroidism

During critical illness

During routine T4 replacement

Screening of asymptomatic subjects

Monitoring of T3 treatment

Relationship Between T4 and T3

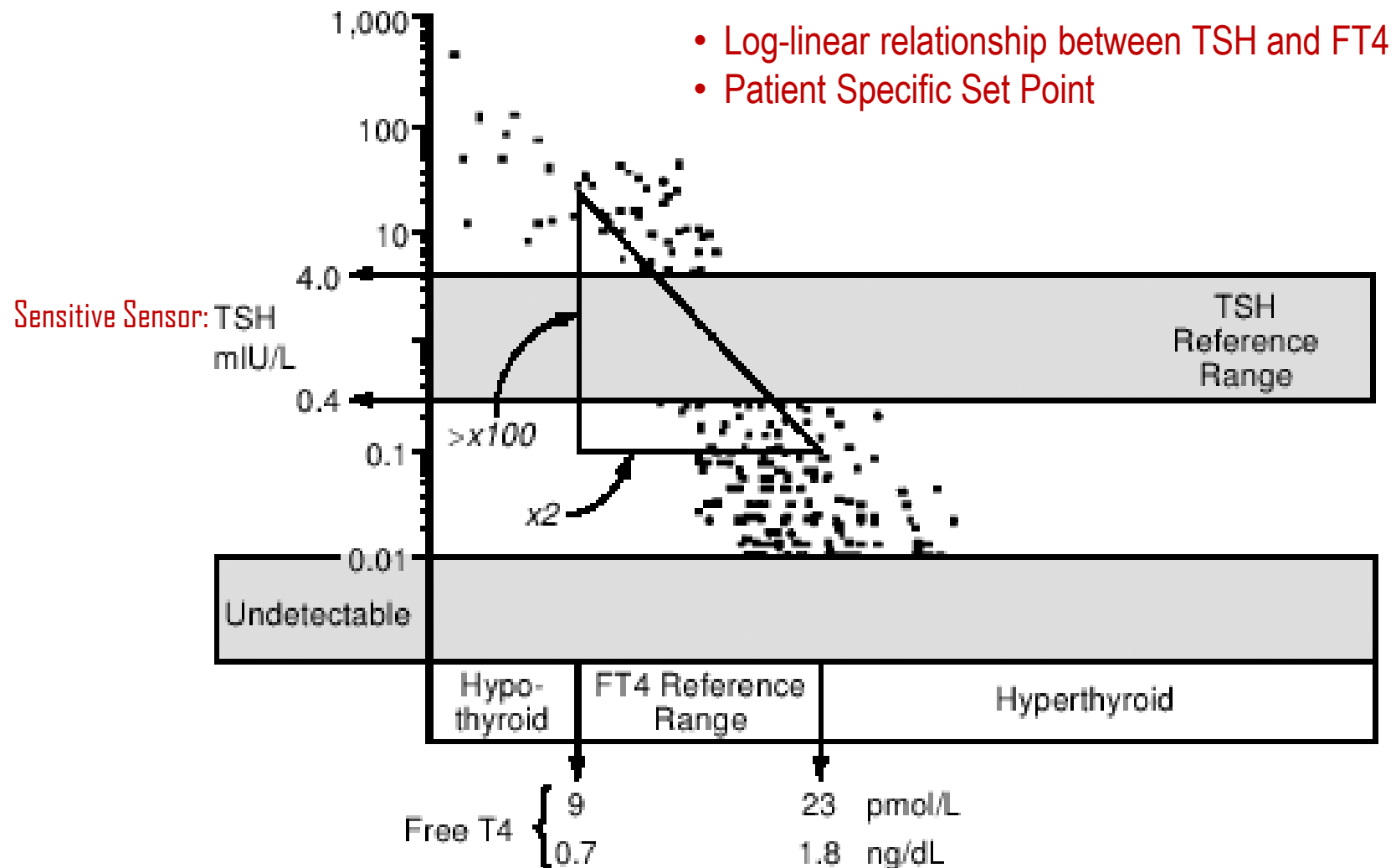
(Various Disorders)*

		T4		
		Low	Normal	High
T3	Low	<ul style="list-style-type: none"> •Severe hypothyroidism. •TBG deficiency. # •Severe nonthyroidal illness. •Euthyroid hypothyroxinemia 	<ul style="list-style-type: none"> •NTI •Medications. •Fetus. •Restricted nutrition. 	<ul style="list-style-type: none"> •Hyperthyroidism with severe NTI •Amiodarone.
	Normal	<ul style="list-style-type: none"> •Iodine deficiency. •T3 treatment. •Hypothyroidism. 		<ul style="list-style-type: none"> •T4 treatment. •Euthyroid hyper- thyroxinemia. •Hyperthyroidism with nonthyroidal illness. •T4 binding autoantibodies.
	High	<ul style="list-style-type: none"> •Iodine deficiency •T3 treatment •Antithyroid drugs 	<ul style="list-style-type: none"> •T3 toxicosis •T3 binding Auto Abs 	<ul style="list-style-type: none"> •Hyperthyroidism. •Excess T4 ingestion •Hormone resistance. •TBG excess #

* Excludes short term changes related to initiation or cessation of therapy

Effect on total hormone concentration; free hormone concentration remains normal.

HPT axis physiology



ASSESSMENT of CLINICAL SIGNIFICANCE of RESULTS

TABLE 7-2

Clinically Significant Difference between Two Consecutive Patient Results

Analyte	Change
Total T ₄	2.2 µg/dL
Free T ₄	0.5 ng/dL
Total T ₃	35 ng/dL
Free T ₃	0.1 ng/dL
TSH	0.75 mIU/L
Thyroglobulin	1.5 ng/mL

Data from Baloch Z, Carayon P, Conte-Devolx B, et al: Laboratory medicine practice guidelines: laboratory support for the diagnosis and monitoring of thyroid disease, *Thyroid* 13(1):3–126, 2003.

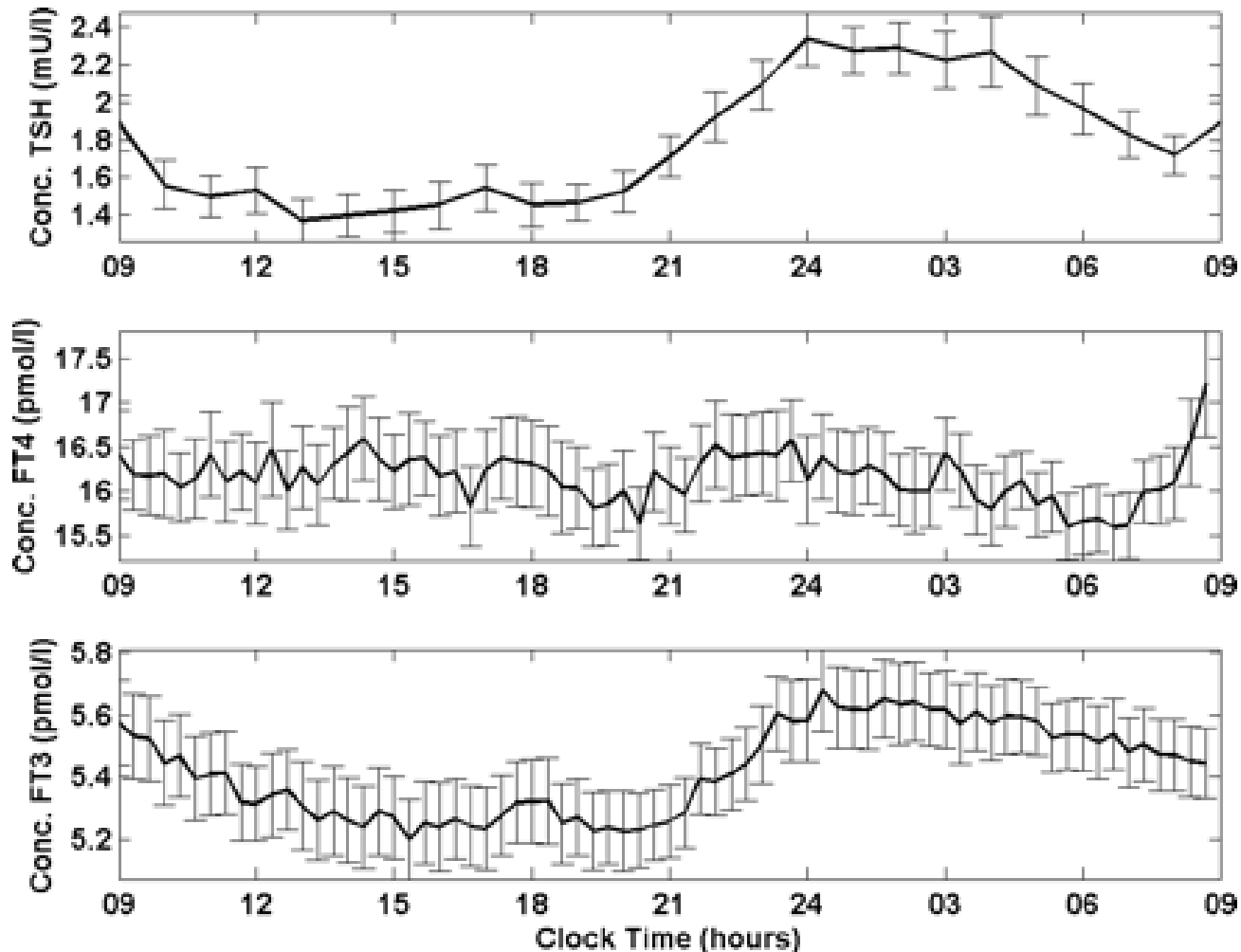
T₃, Triiodothyronine; T₄, thyroxine; TSH, thyroid-stimulating hormone.

TSH Biological Variations

- Inter individual Variation: High 32%
- Intra individual Variation: Moderate 20%
 - Serial determination in a person: $\Delta 0.75 \text{ mIU/L}$
- A wide population-based RI

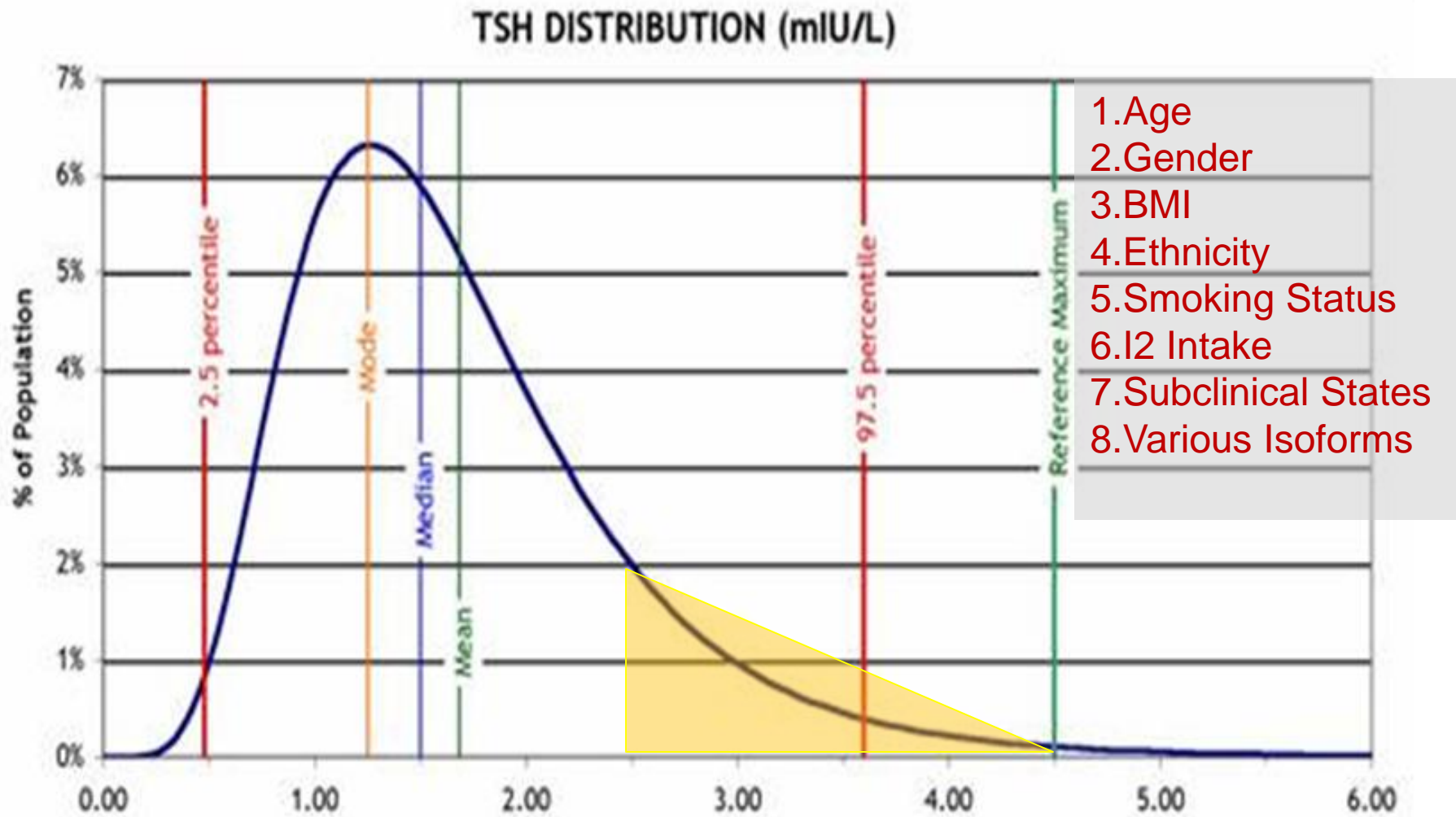


TSH Diurnal Rhythm

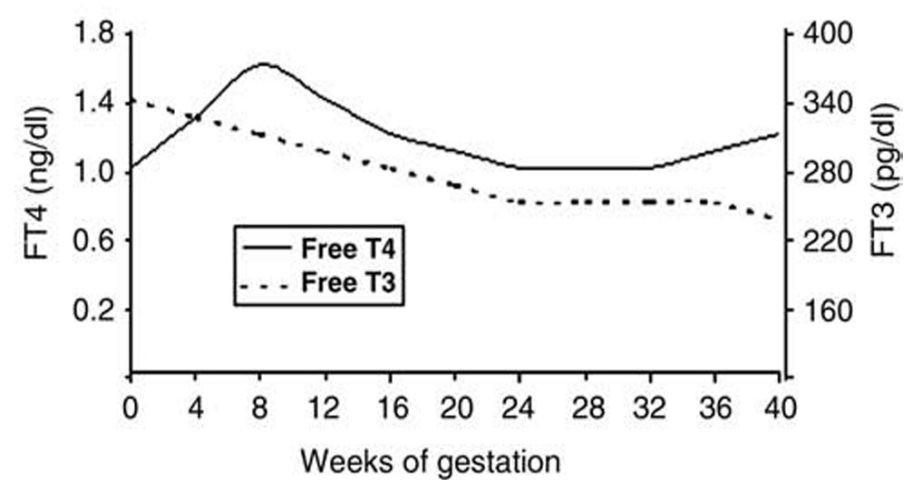
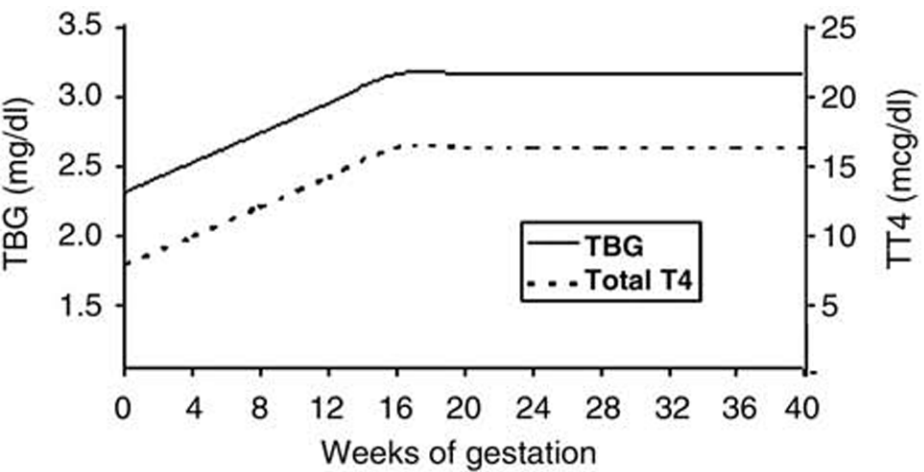
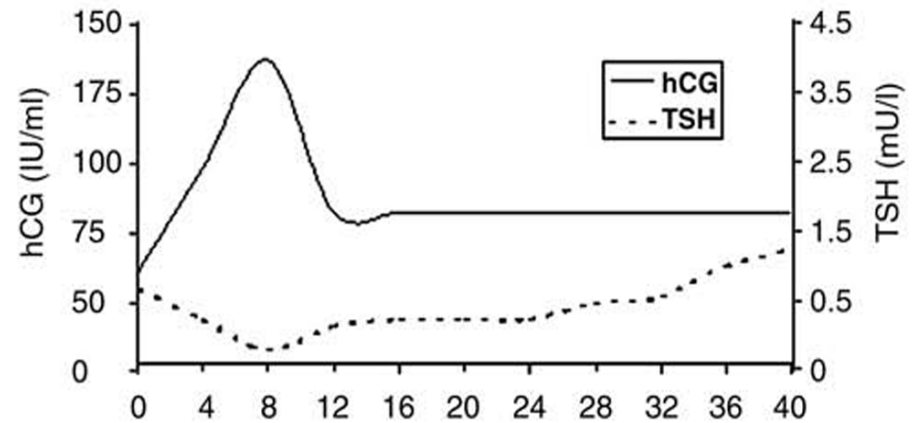
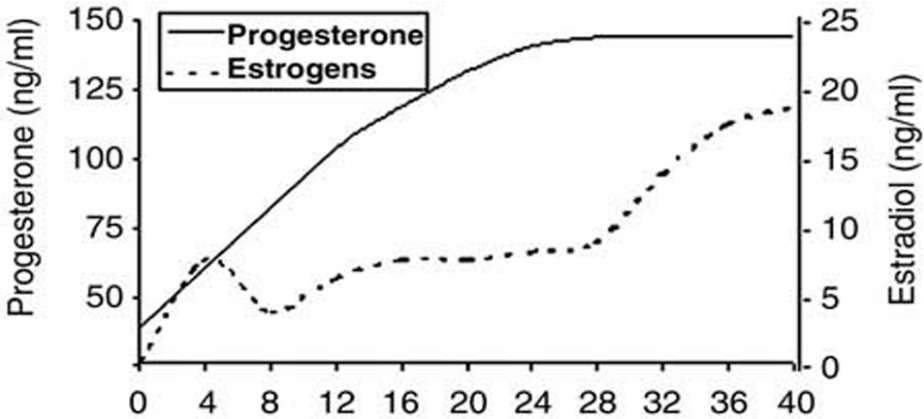


Be Careful in Serial Evaluations

TSH Reference Interval



Pregnancy Induced TFTs Changes



TFTs Reference Intervals in Pregnancy

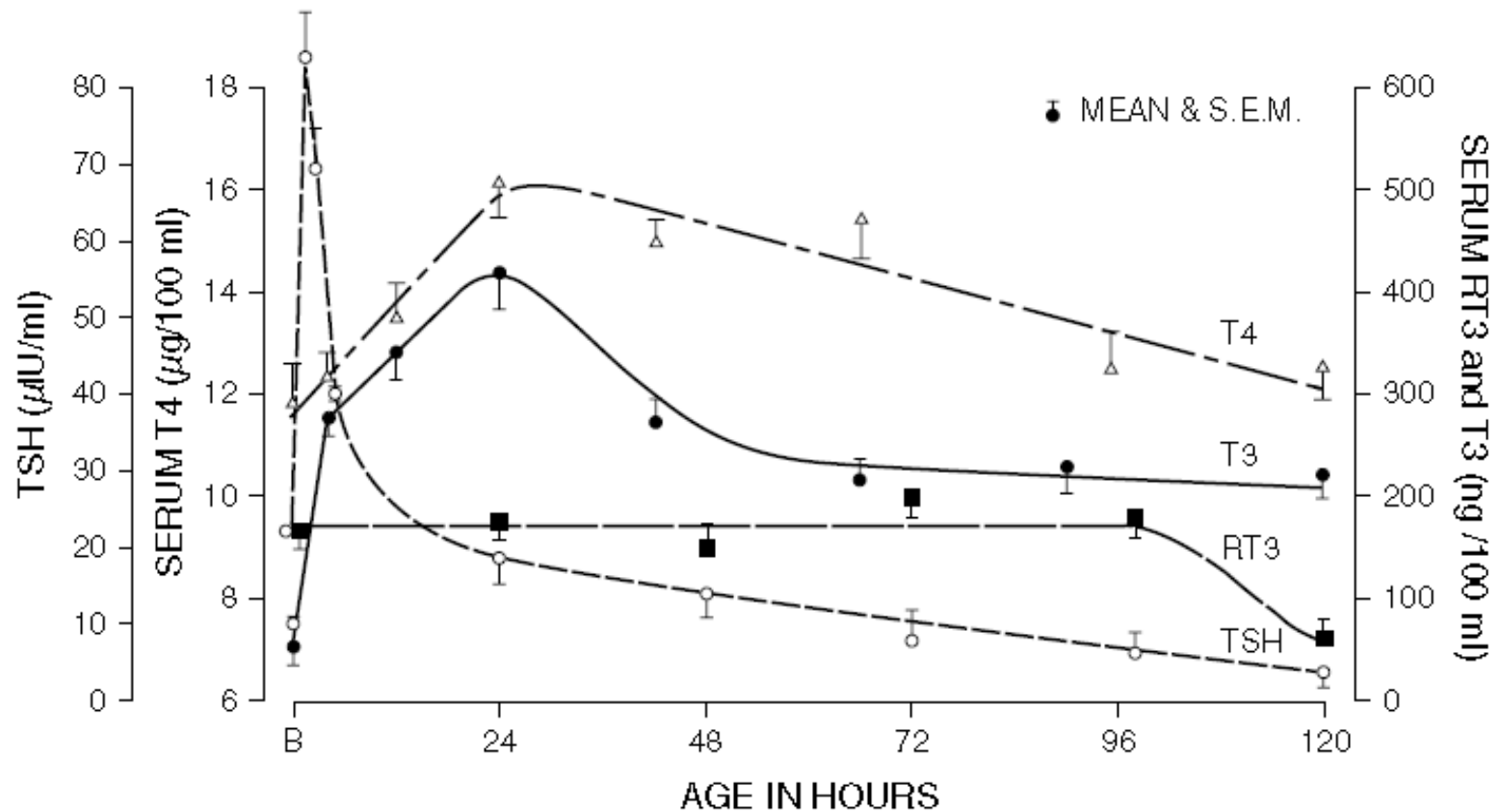
	<u>American Thyroid A.</u>	<u>Iran Endocrine Society</u>
TSH (mIU/L):		
1 st Trimester:	0.1 – 2.5	0.2 - 3.9
2 nd Trimester:	0.2 – 3.0	0.5 - 4.1
3 rd Trimester:	0.3 – 3.0	0.6 - 4.1

TT4 & TT3:

Adult RI * 1.5

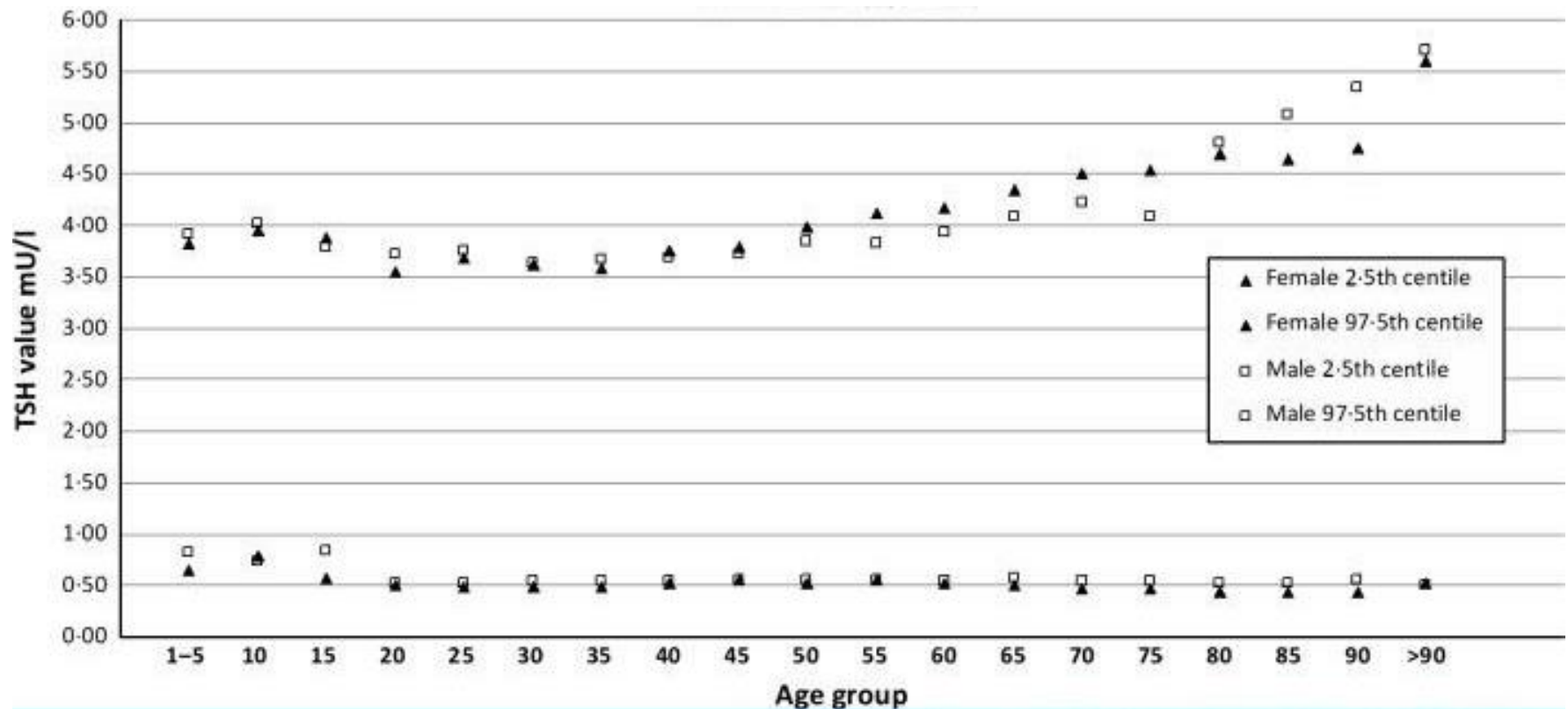


Changes of TFTs after Birth



Aging and TSH Reference Interval

Age Specific RI: for >70 years up to 6.0



Source: Clin Endocrinol © 2012 Blackwell Publishing

TFTs Reference Intervals

(infants, children and adults)

Age	Free T ₄ (ng/dL)	T ₄ (ug/dL)	Free T ₃ (pg/dL)	T ₃ (ng/dL)	TSH (mIU/L)	TBG (mg/dL)
Cord blood	0.9–2.2	7.4–13.0		15–75	1.0–17.4	2.5–5.1
1–4 days	2.2–5.3	14.0–28.4	180–760	100–740	1.0–39.0	
2–20 weeks	0.9–2.3	7.2–15.7	185–770	105–245	1.7–9.1	2.1–6.0
5–24 months	0.8–1.8	7.2–15.7	215–770	105–269	0.8–8.2	
2–7 years	1.0–2.1	6.0–14.2	215–700	94–241	0.7–5.7	2.0–5.3
8–20 years	0.8–1.9	4.7–12.4	230–650	80–210	0.7–5.7	1.8–4.2
21–45 years	0.9–2.5	5.3–10.5	210–440	70–204	0.4–4.2	1.8–4.2

THYROID FUNCTION TESTING, Springer, 2010

Clinically Significant Difference between Two Consecutive Patient Results

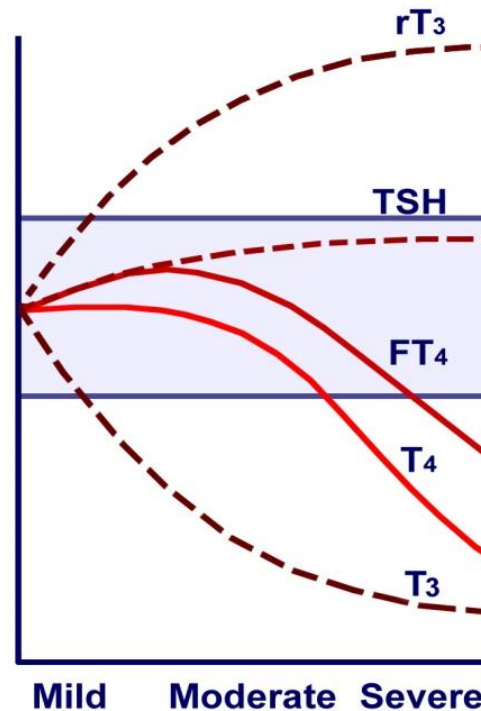
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Free T ₃	0.1 ng/dL
TSH	0.75 mIU/L
Thyroglobulin	1.5 ng/mL

Non Thyroidal Illness (NTI)

(Euthyroid Sick Syndrome)

Some Examples

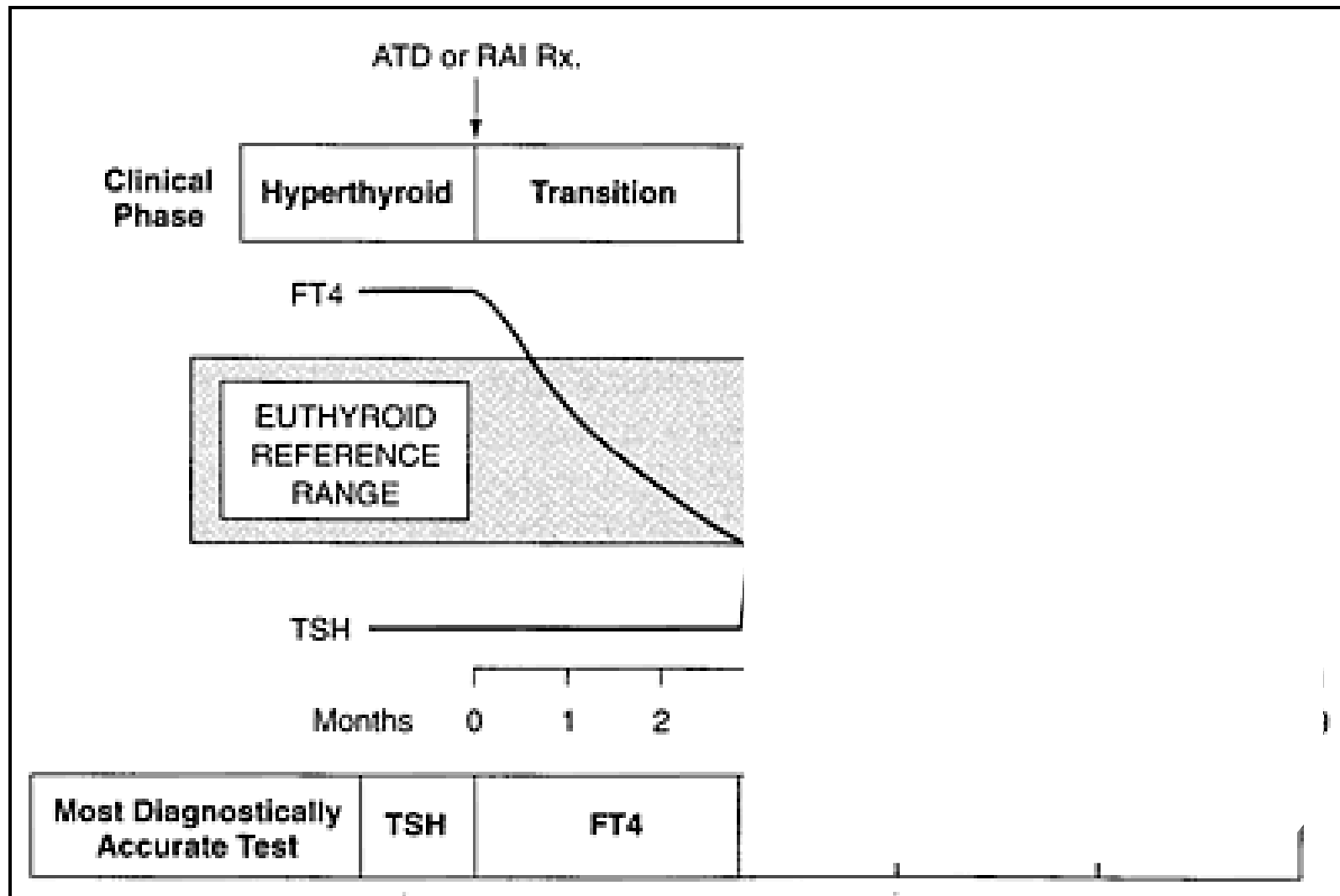
- Gastrointestinal diseases
- Pulmonary diseases
- Cardiovascular diseases
- Renal diseases
- Infiltrative and metabolic disorders
- Inflammatory conditions
- Myocardial infarction
- Starvation
- Sepsis
- Burns
- Trauma
- Surgery
- Malignancy
- Bone marrow transplantation



Mechanisms of TFTs changes in NTI

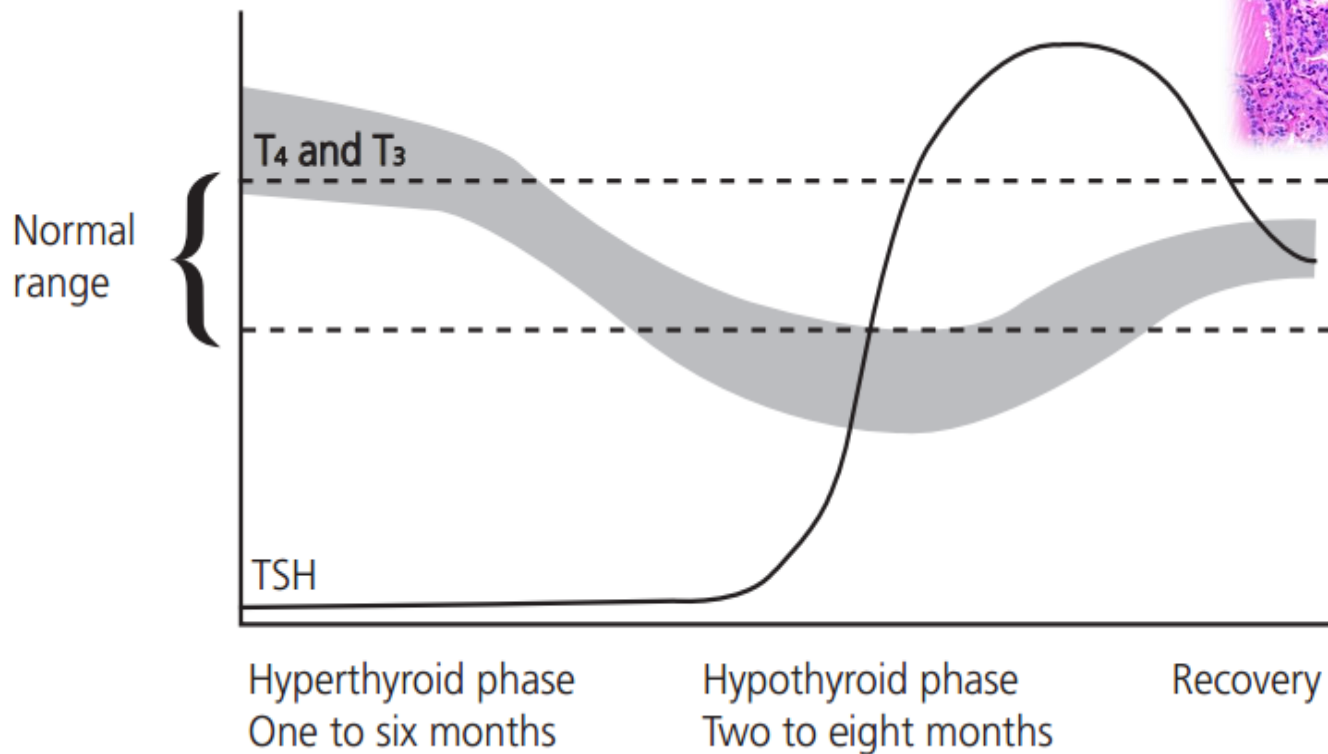
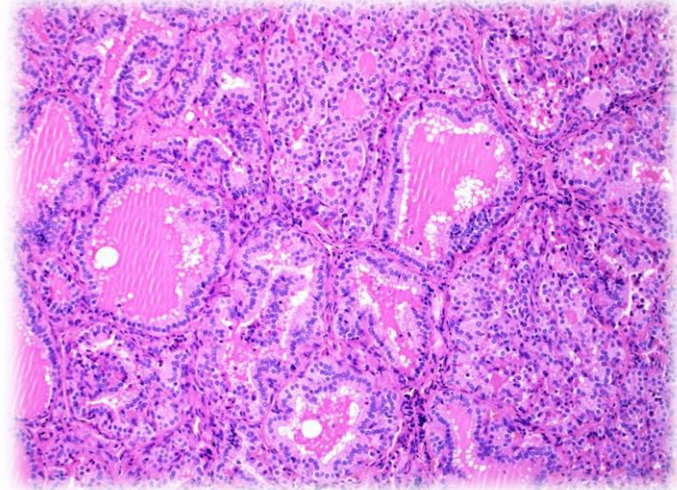
Hypothalamus	<ul style="list-style-type: none"> * Malnutrition \rightarrow \downarrow Leptin \rightarrow \downarrow TRH * Sepsis/Inflammation \rightarrow \uparrow D2 (tanycyte) \rightarrow \uparrow T₃ \rightarrow \downarrow TRH
Pituitary	<ul style="list-style-type: none"> * Cytokines \rightarrow \downarrow TSH
Plasma	<ul style="list-style-type: none"> * Acute phase response \rightarrow \downarrow TBG \rightarrow \downarrow TT₄ \downarrow TT₃ * \uparrow Competitors for TH binding proteins \rightarrow \downarrow TT₄ \downarrow TT₃ * Free T₃ and free T₄ may also fall due to a central hypothyroidism
Tissue uptake	<ul style="list-style-type: none"> * \downarrow T₄/T₃ uptake * \uparrow or unchanged thyroid hormone transporter expression
Intracellular deiodination	<ul style="list-style-type: none"> * \downarrow D1 Liver/kidney * \uparrow D2 Muscle, prolonged illness, LPS, turpentine \downarrow D2 Muscle/pneumonia * \uparrow D3 Muscle/liver
Nuclear TH receptors and coactivators	<ul style="list-style-type: none"> * \uparrow Chronic illness * \downarrow Acute illness

Concept of Steady State Conditions & Treatment




Thyroiditis

(TFTs Time Course)



Medications






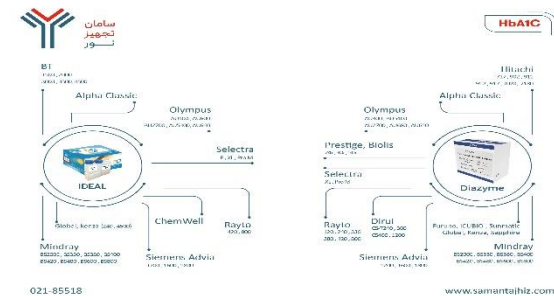
NEW Kits

- ANA
- ds DNA
- CCP
- AMH
- PTH
- CA 125
- CA 19-9
- CA 15-3
- Folate

www.ideal-diag.com 021-85519519

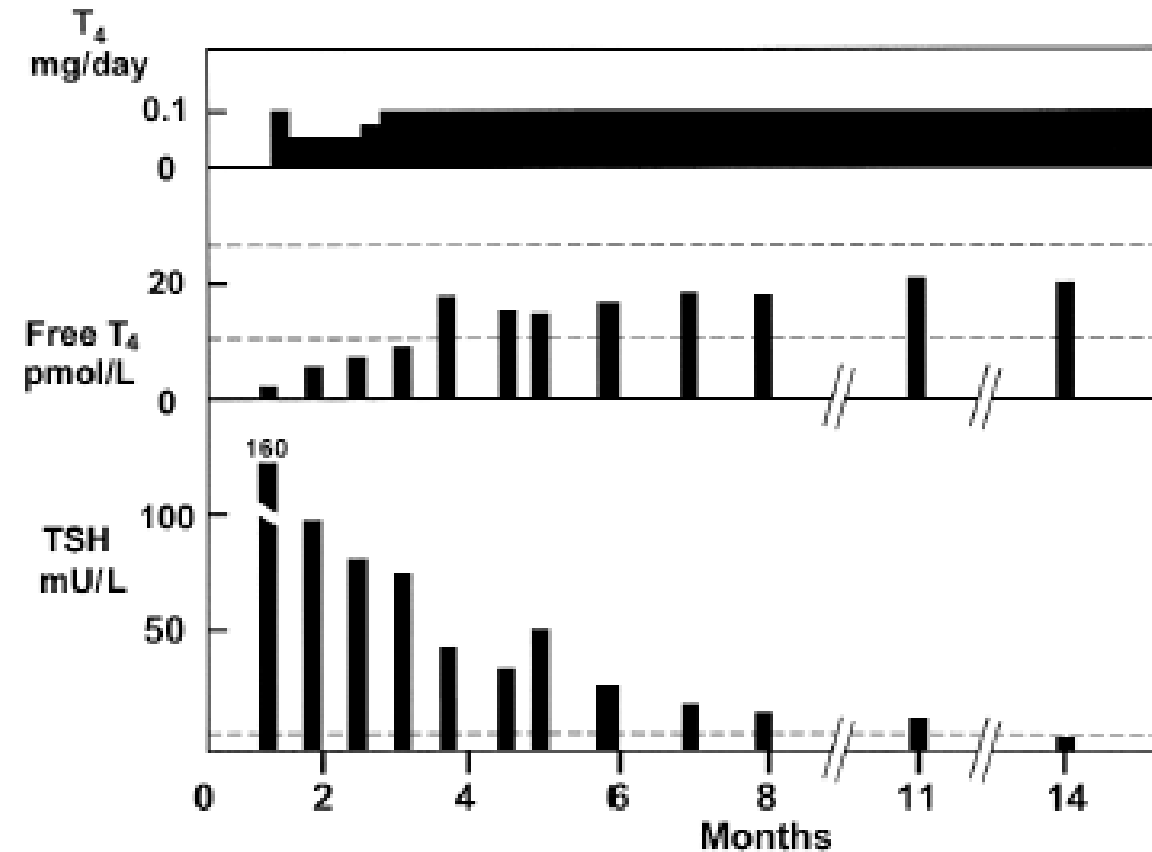


سماهن
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Thyroxine Replacement Therapy

(Poor compliance to LT4)



Intermittent hormone ingestion may result in normal or even elevated Thyroid Hormone levels, but fails to normalize TSH.

Drug Effects on TFTs

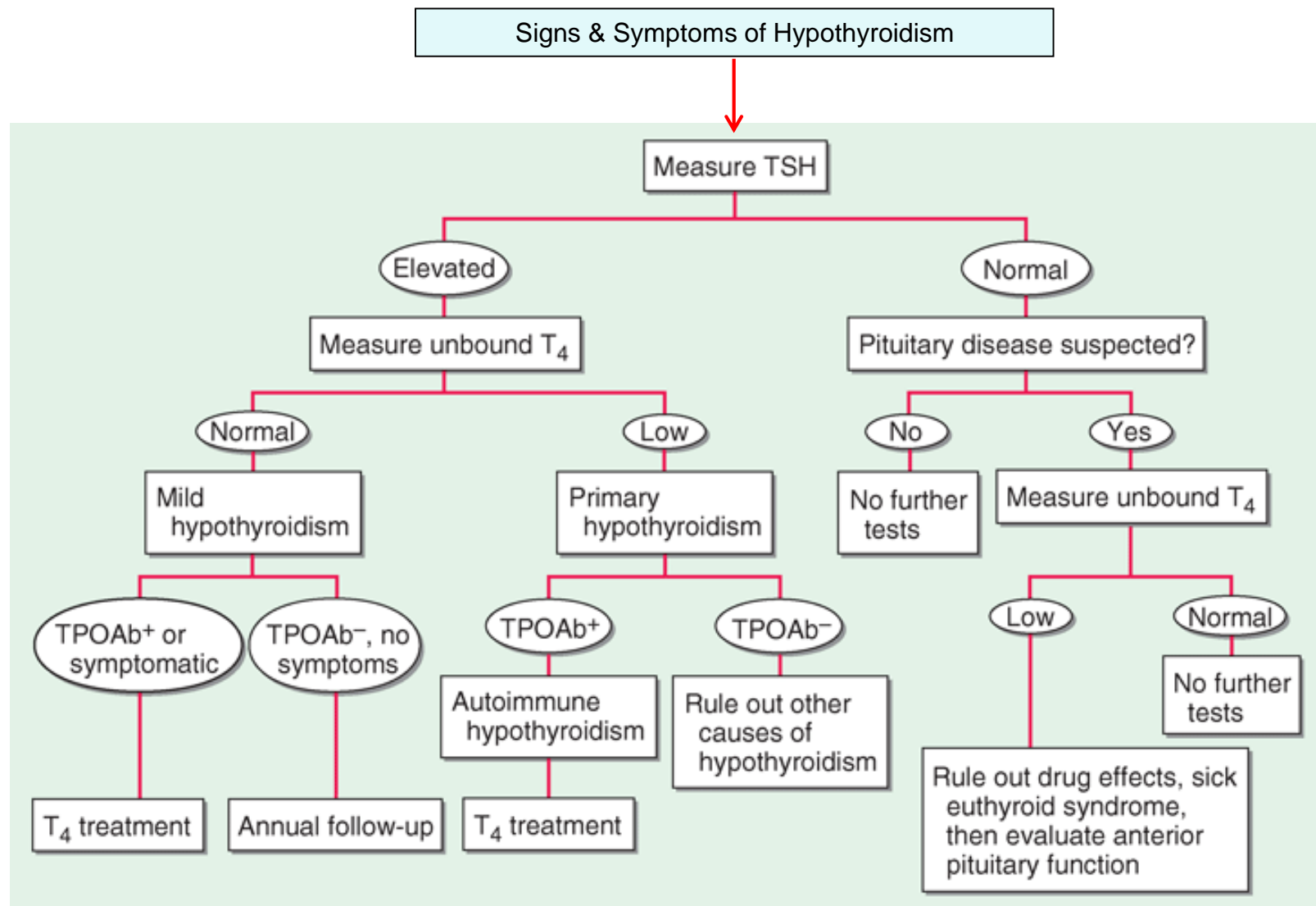
Table II. **Effects of some drugs on thyroid function tests**

Cause	Drugs	Effects
Inhibit thyroid hormone synthesis or release from the thyroid gland	Lithium, sulfonylureas	↓ FT4, ↓ FT3, ↑ TSH
Decreases triiodothyronine hormone production by inhibiting peripheral conversion of FT4 to FT3	Glucocorticoids, propranolol, amiodarone, propylthiouracil	↓ FT3 leads to ↑ FT4
Stimulate TSH secretion	Iodine, lithium, dopamine antagonists, cimetidine	↑ TSH
Inhibit TSH secretion	Glucocorticoids, dopamine agonists, somatostatin	↓ TSH
Inhibit T4 and T3 binding to transport proteins	Phenytoin, sulfonylureas, diazepam, furosemide, salicylates	↑ FT4, ↑ FT3
Inhibit gastrointestinal absorption of ingested thyroid hormones for those on thyroid treatment	Cholestyramine, ferrous sulfate, aluminum hydroxide, and sucralfate	↓ FT4, ↑ TSH

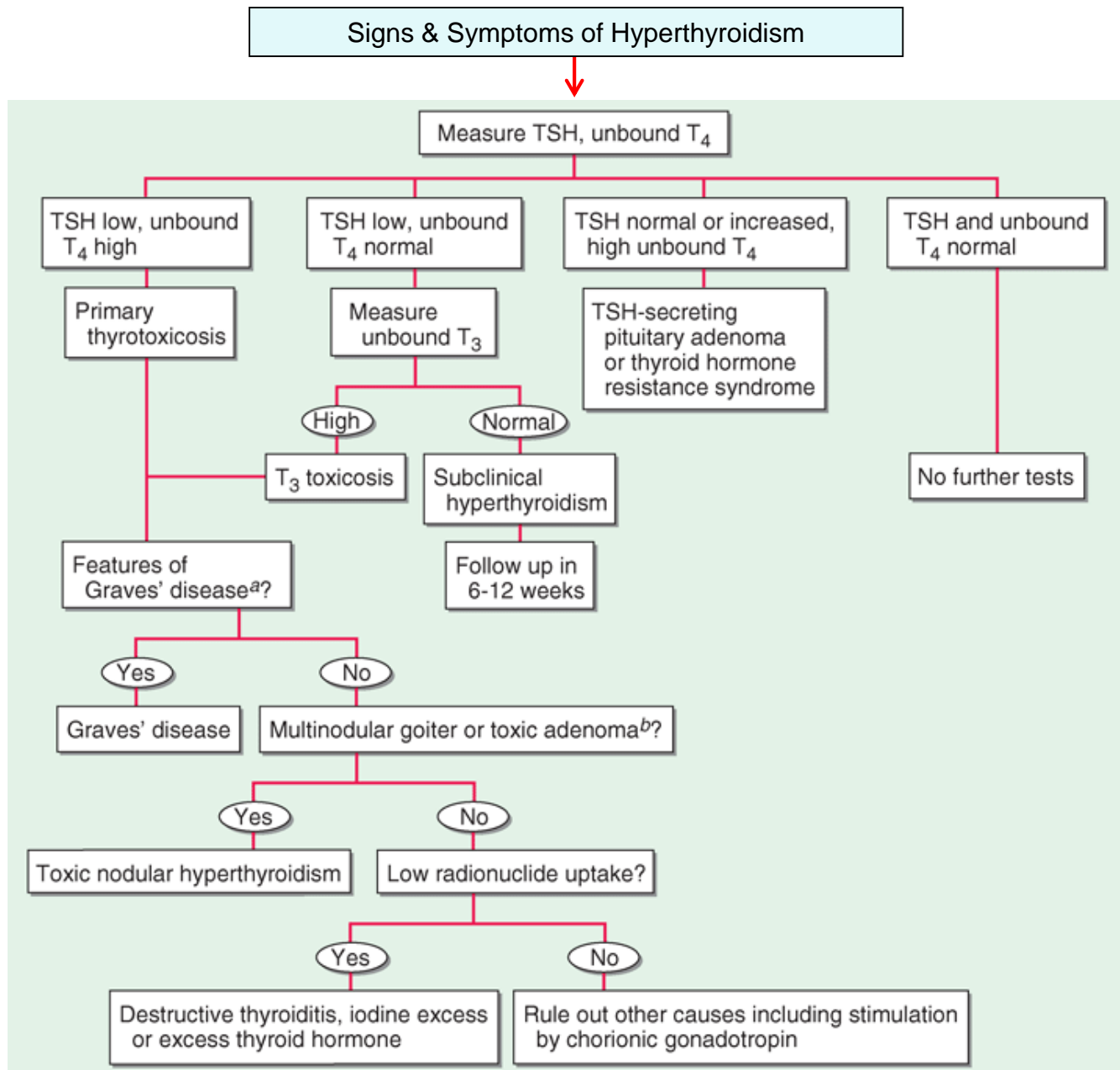
Guideline Based Approach



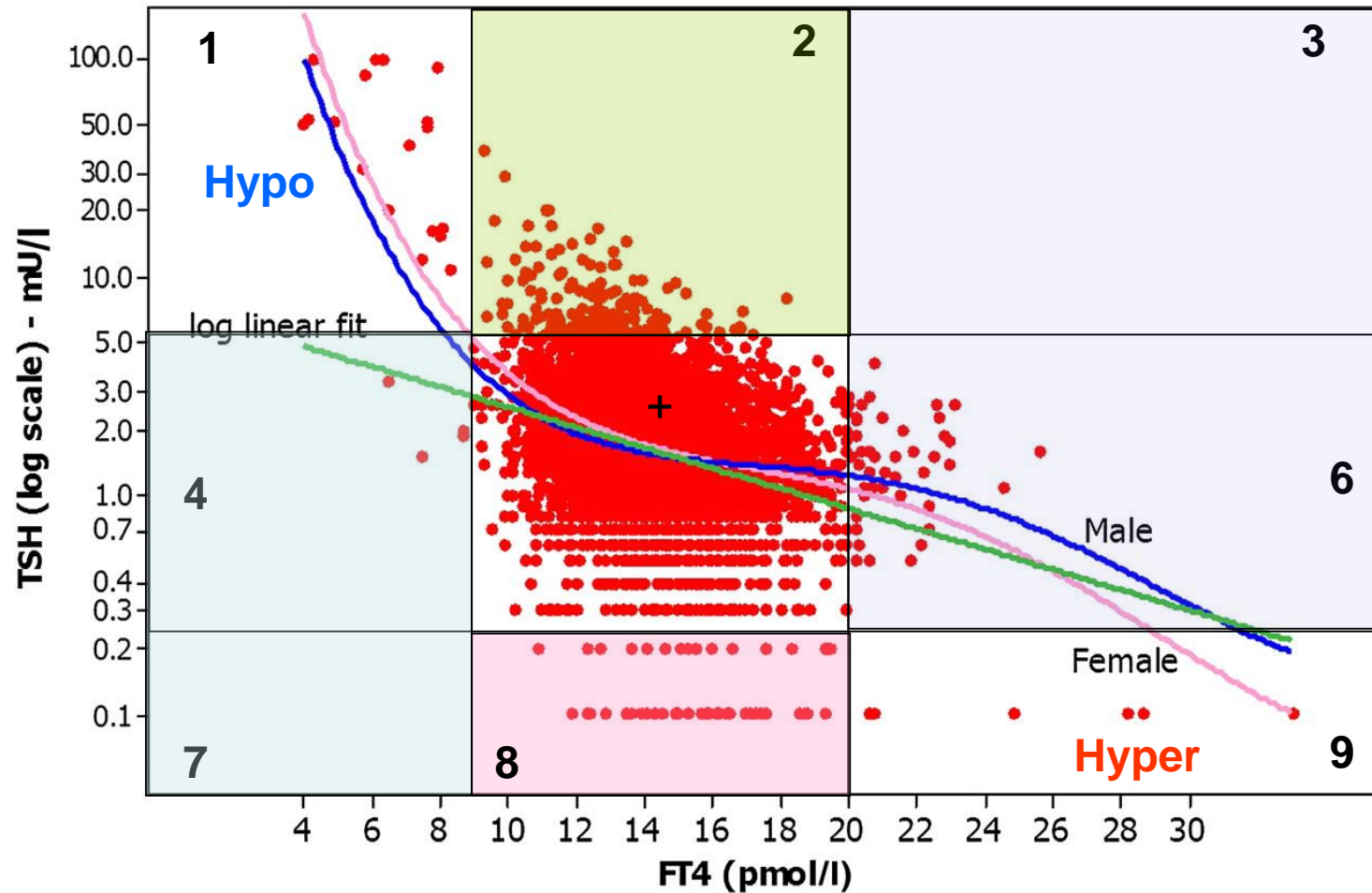
Guidelines based Evaluation for Suspected Hypothyroidism



Guidelines based Evaluation for Suspected Hyperthyroidism



FT4 & TSH Possible Results



FT4 (↓) & TSH (↑)

Common

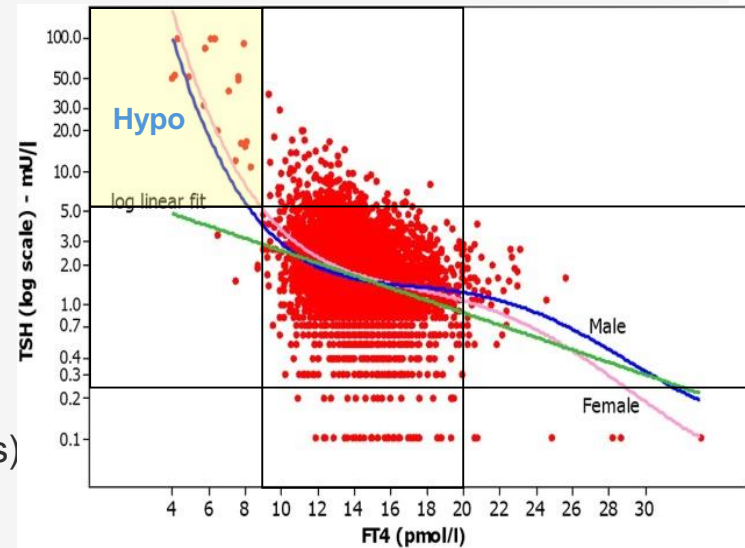
- Chronic autoimmune thyroiditis
- Post radioiodine Therapy
- Post thyroidectomy
- Hypothyroid phase of transient thyroiditis

Less Common (anti-TPO negative, no radioiodine or surgery)

- Post external-beam irradiation to the neck
- Drugs: amiodarone, lithium, interferons, interleukin-2

Iodine deficiency

- Iodine excess-iodide goitre in Japan (water purification units)
- Goitrogens
- Amyloid goitre (large, firm goitre with systemic amyloidosis)
- Riedel's thyroiditis†



Rare:

Congenital—thyroid tissue absent

Thyroid dysgenesis possibly associated with TSH-receptor, *PAX-8*, and *TTF2* mutations

Congenital—thyroid tissue present

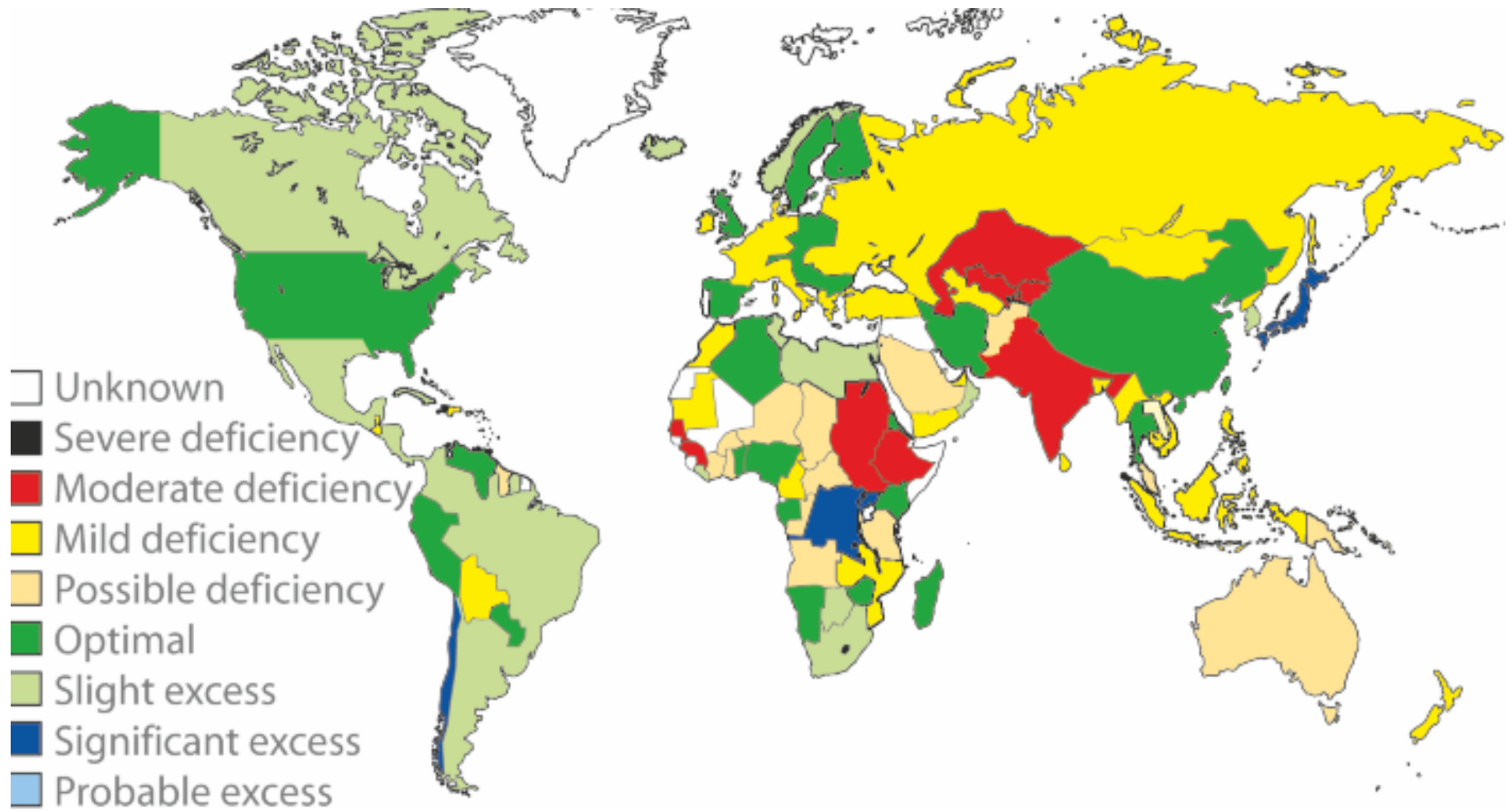
- Iodine transport defects—low radioiodine uptake or saliva iodine
- Iodine organification defect

Congenital-high radioiodine uptake, positive perchlorate discharge

- Thyroglobulin synthetic defect—low thyroglobulin concentration
- TSH-receptor defects
- Resistance to TSH with other (unspecified) defects

Global Iodine Availability

(Natural availability and I_2 consumed as food additives)



FT4 (↑) & TSH (↓)

Common

Primary hyperthyroidism:

Graves' disease

Multinodular goiter

Toxic nodule

Relatively common—with low radioiodine uptake

Transient thyroiditis:

Postpartum

Silent (lymphocytic)

Postviral (granulomatous, subacute, De Quervain's)

Rare—with a low radioiodine uptake

Thyroxine ingestion

Ectopic thyroid tissue or struma ovarii

Iodine induced

Amiodarone therapy

Rare—with a positive pregnancy test

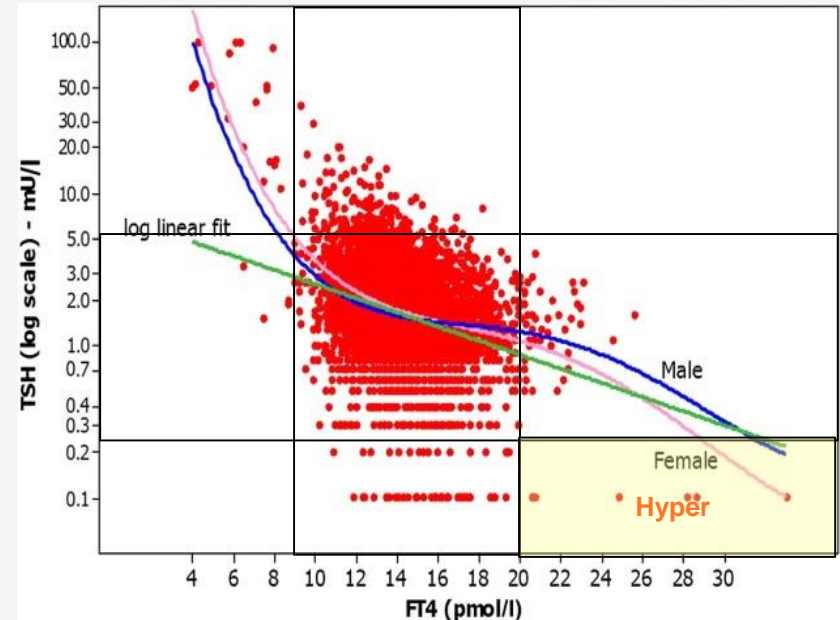
Gestational thyrotoxicosis with hyperemesis gravidarum

Hydatidiform mole

Familial gestational hyperthyroidism

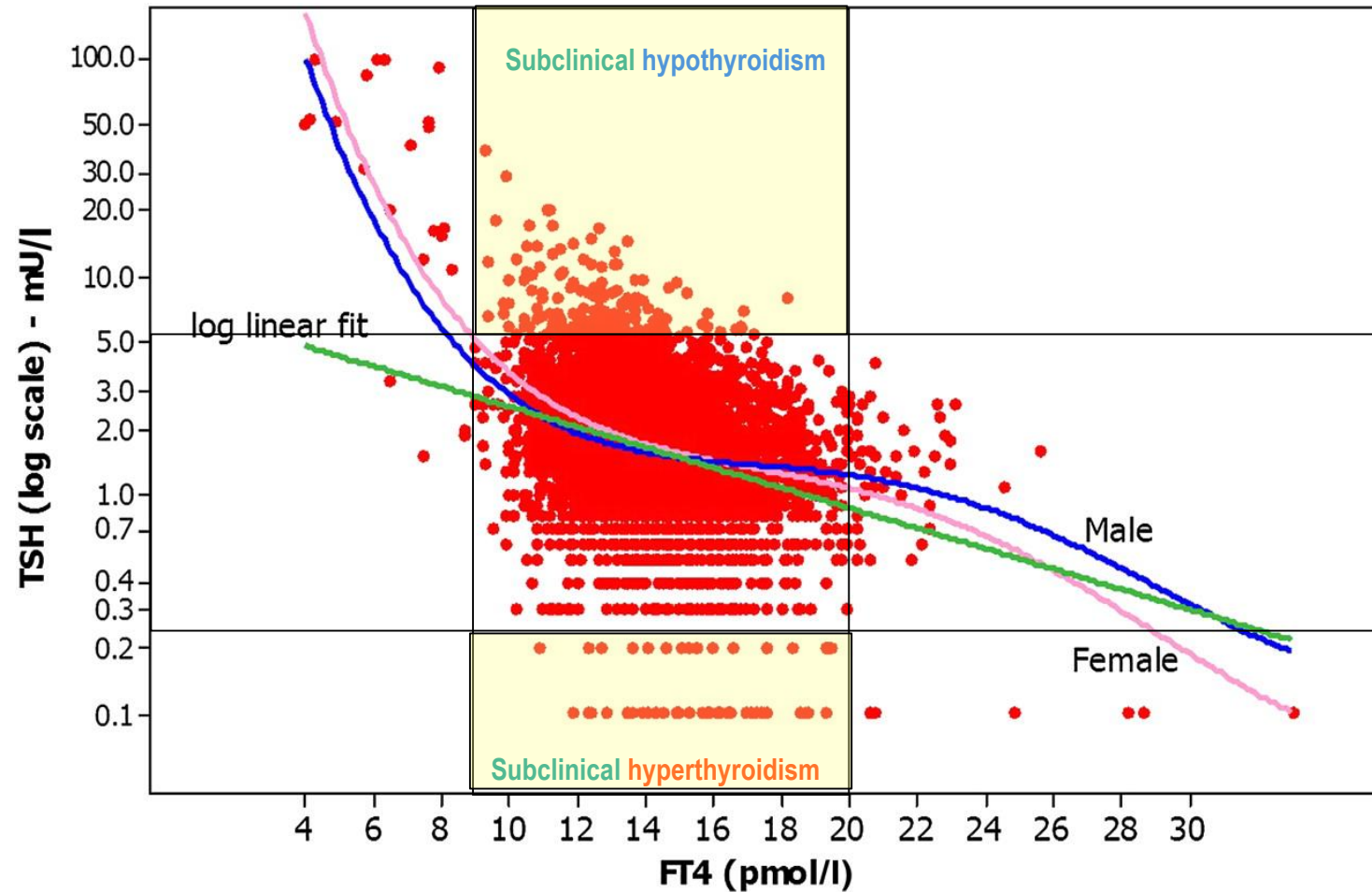
Rare-familial or resistant to treatment

Activating germline TSH-receptor mutation



Subclinical Thyroid States

(Zones 2 & 8)



FT4 (\leftrightarrow) and TSH (\uparrow) (Zone 2)

Common

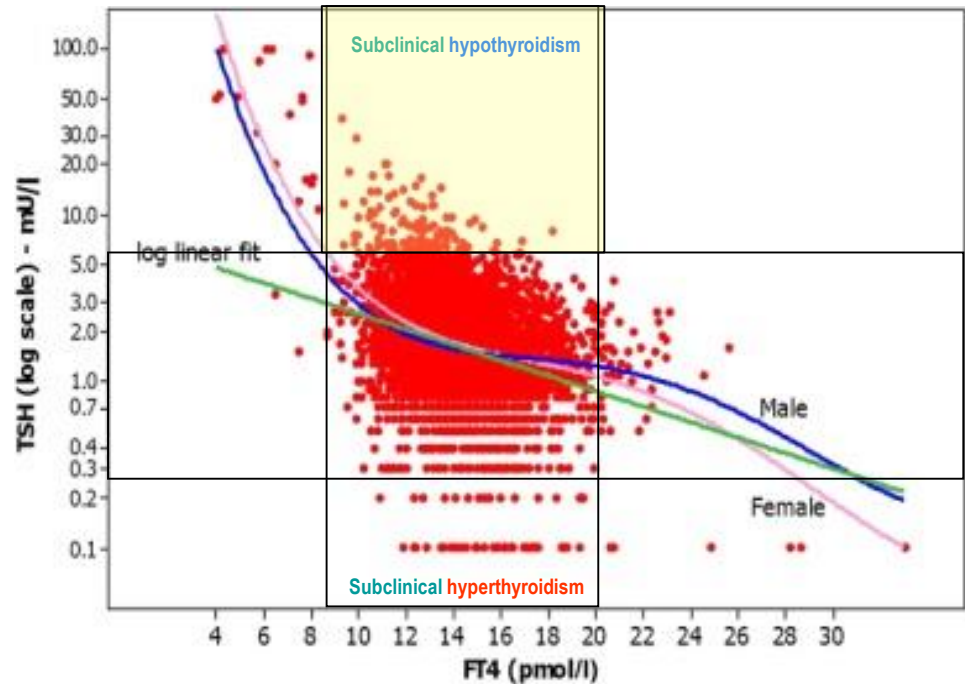
- Subclinical Hypothyroidism

Rare

- Heterophile (interfering) antibody
- Macro-TSH
- Poor compliance with thyroxine
- Malabsorption of thyroxine
- Drugs (e.g. amiodarone, Li, sertraline, cholestyramine)
- NTI recovery phase

Congenital

- TSH-receptor defects
- Resistance to TSH associated with other (unspecified) defects
- Biologically inactive TSH
- Pendred's syndrome—some cases (associated with sensorineural deafness and goitre)



Hypothyroidism Stages

1. Subclinical Hypothyroidism	TSH↑	T4↔	T3 ↔
2. Mild Hypothyroidism	TSH↑↑	T4↓	T3 ↔
3. Overt Hypothyroidism	TSH↑↑↑	T4↓↓	T3↓

Table 1.
Classification of hypothyroidism according to its clinical manifestations and endocrine biochemical parameters (adapted from ref. 7).

	TRH-TSH stimulus	TSH	T4 (total or free)	T3
Subclinical hypothyroidism				
Stage 1	Hyper-response	Normal	Normal	Normal
Stage 2	Not possible	Increased	Normal	Normal
Clinical hypothyroidism				
Stage 3	Not possible	Increased	Decreased	Normal
Stage 4	Not possible	Increased	Decreased	Decreased

Epidemiology of dysfunction in the Whickham survey

(#2779 adults for 20 years)

		Women %	Men %	Ratio
Prevalence	Tg antibodies	3	0.9	3.3
	TPO antibodies	10.3	2.7	3.8
	Subclinical hypothyroidism	7.5	2.8	2.7
	Hypothyroidism	1.8	0.1	18
Incidence	Hypothyroidism	0.41/y	0.06/y	6.8

• Tunbridge WMG, Evered DC, Hall R, et al.: The spectrum of thyroid disease in the community: the Whickham Survey. *Clin Endocrinol* 1977; 7: 481-493.

• Vanderpump MPJ, Tunbridge WMG, French JM, et al.: The incidence of thyroid disorders in the community: a twenty-year follow-up of the Whickham Survey. *Clin Endocrinol* 1995; 43: 55-68.

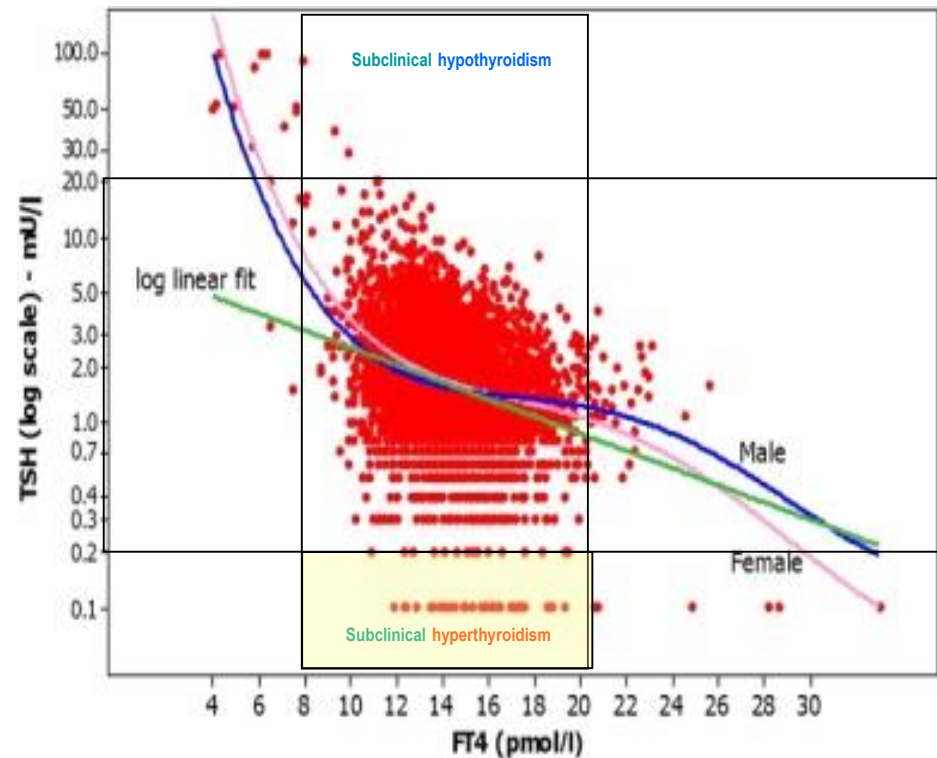
FT4 (\rightarrow) and TSH (\downarrow) (Zone 8)

Common

- Subclinical hyperthyroidism
- T3 Thyrotoxicosis

Rare

- Recent treatment for hyperthyroidism
- Drugs (e.g. steroids, dopamine)
- NTI





Lifotronic

Advantages of Electro-chemiluminescence Immunoassay

- Continuous Optical Signal
- High Sensitivity and Precision
- Magnitude of Luminescent Intensity Reached Six Orders
- Compatible with Small Sample Volumes
- High Stability for Reagent
- One of The ECLIA Systems in the World



eCL8000
Electro-chemiluminescence Immunoassay (ECLIA) System

شرکت رفیان درمان
تهران - خیابان ولیعصر (کاخ)

Importance of Subclinical Thyroid Dysfunction

Subclinical Thyrotoxicosis (\downarrow TSH, \leftrightarrow FT4, FT3)

Progression to overt thyrotoxicosis

Exposure to iodine may precipitate severe thyrotoxicosis

Threefold increased risk of atrial fibrillation after 10 years

Osteoporosis risk is increased

Subclinical Hypothyroidism (Mild thyroid failure) (\uparrow TSH, \leftrightarrow FT4)

Non specific symptoms may improve with treatment

Progression to overt hypothyroidism (~ 5% per year)

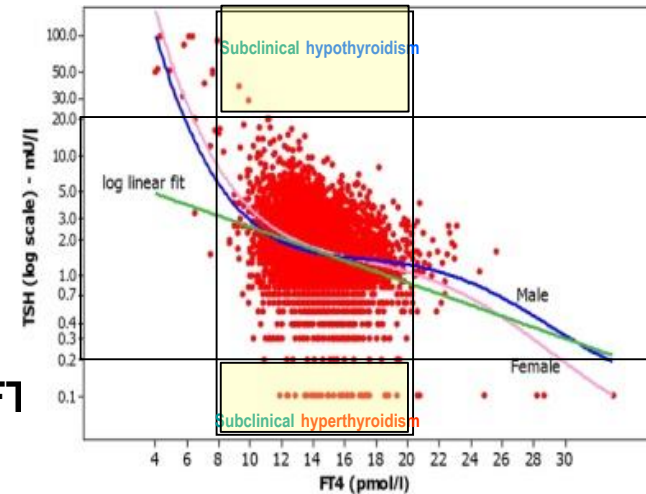
Adverse effect on foetal brain development in pregnancy

Adverse effects on vascular compliance

Independent risk factor for atherosclerotic disease?


Beneficial effect of treatment on lipids?

Increased prevalence of depressive illness?



IDEAL
INTEGRATED
DIAGNOSTIC
ANALYSIS
LABORATORY
NETWORK

» Tumor Markers » Thyroid » Growth Hormone »

Fertility »  » Steroids

Anemia » » Allergy

» Rheumatology » Vitamin D » Infectious Diseases »

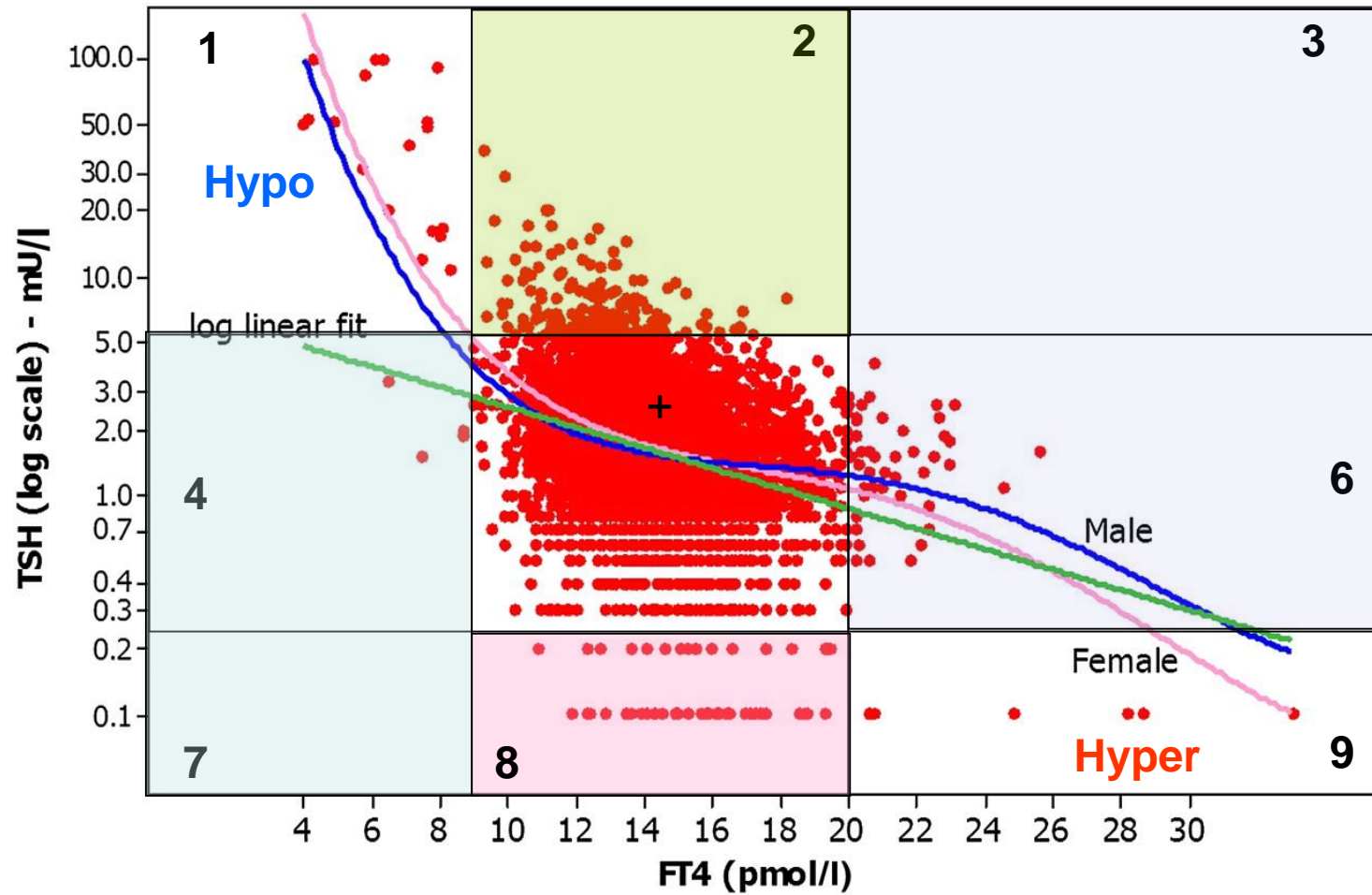
NEW KITS

ANA	dsDNA	CCP	CA 125	CA19-9
AMH	Folate	PTH	CA15-3	

ShadFrag.com

FT4 & TSH

(3-6 & 4-7 Zones)



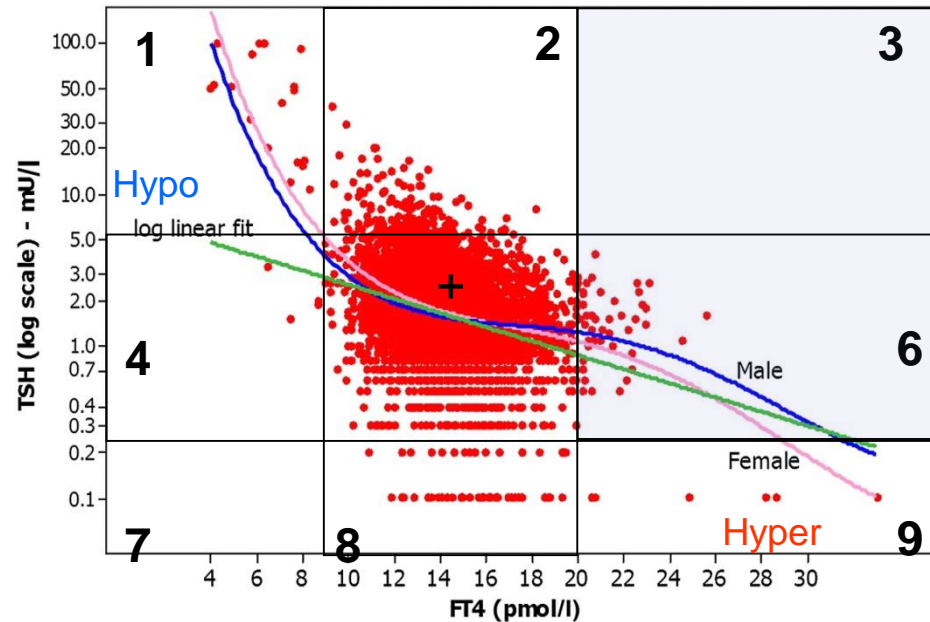
FT4 (\uparrow) and TSH ($\uparrow \leftrightarrow$) (Zones 3, 6)

Rare (with discordant FT4 versus FT3)

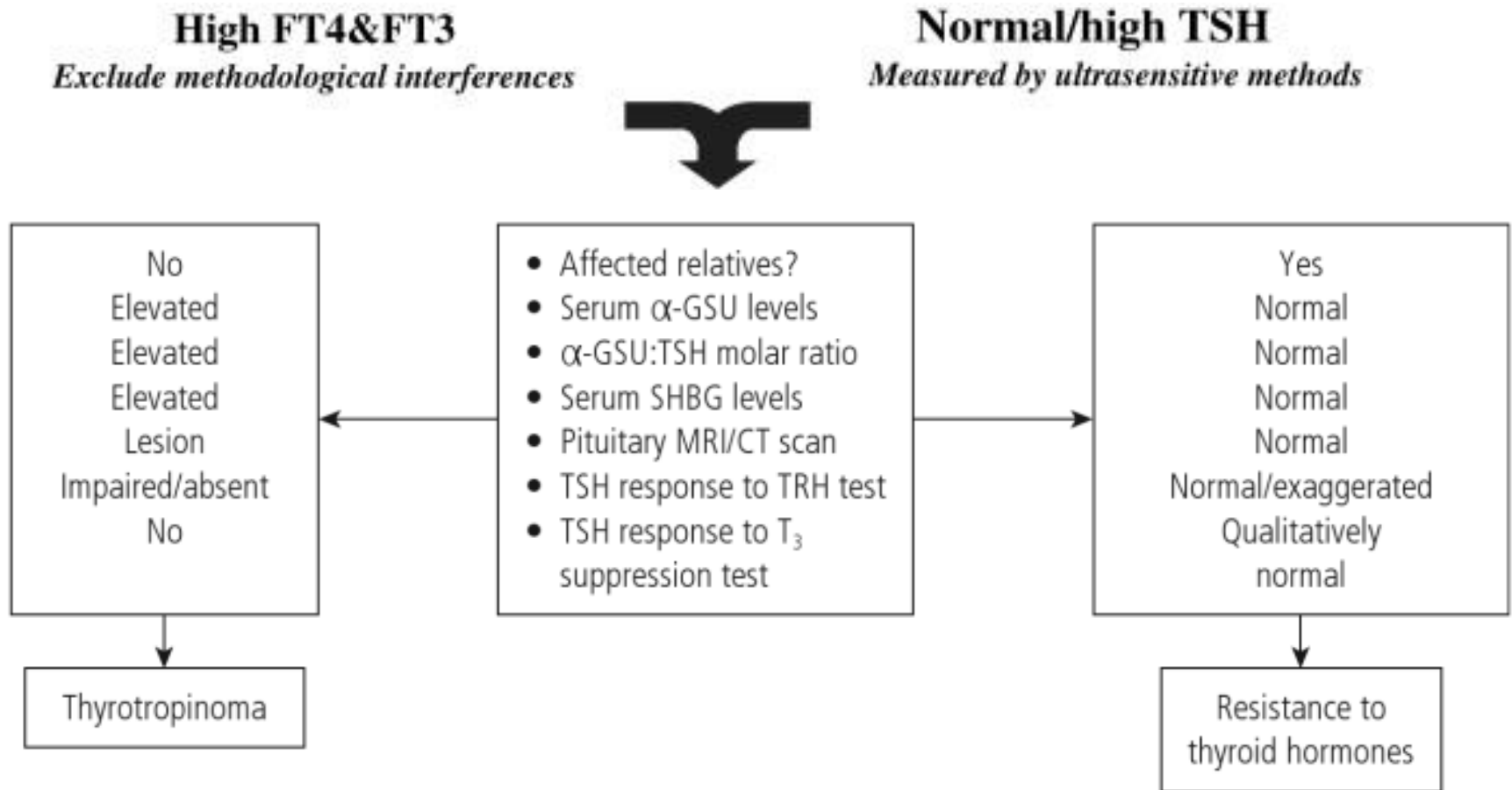
- Interfering Abs to thyroid hormones
- FDH=Familial dysalbuminaemic hyperthyroxinaemia
- Drugs (e.g. amiodarone, heparin)

Rare-other

- Intermittent T4 therapy / T4 overdose
- **NTI** (including acute psychiatric disorders)
- Neonatal period
- **TSH-secreting pituitary adenoma** (Hyper)
- Resistance to thyroid hormone
- Disorders of thyroid hormone transport or metabolism



Resistance to thyroid hormone (RTH) vs TSH-secreting pituitary tumor (TSHoma)



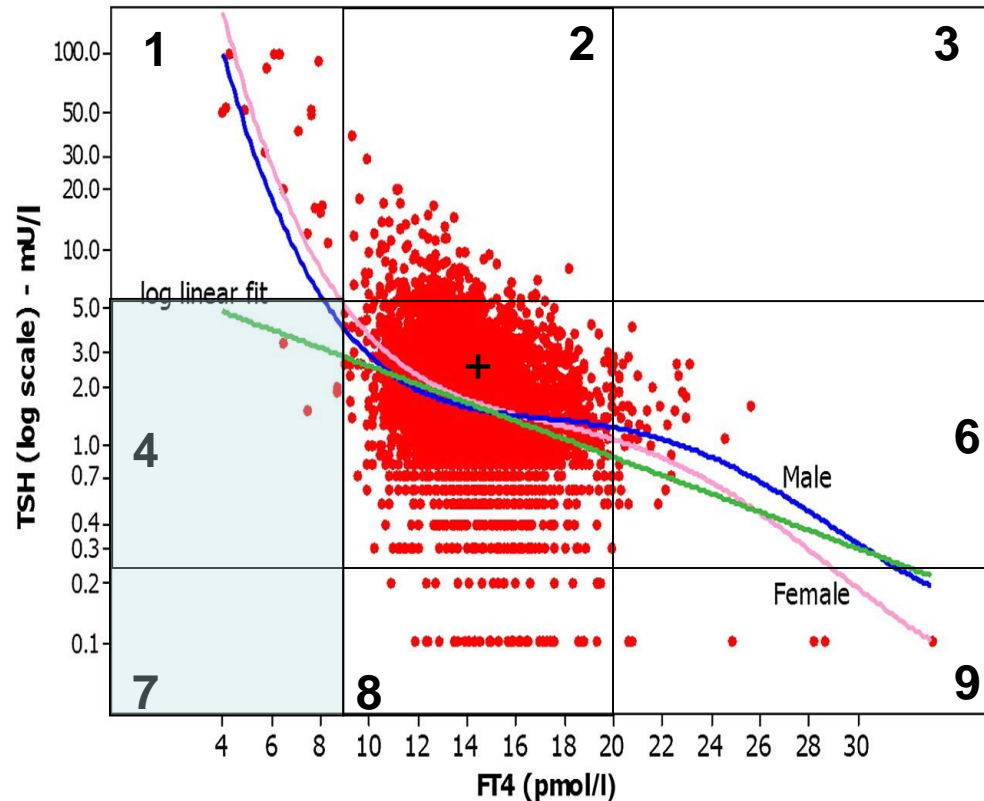
FT4(↓) and TSH ($\rightarrow \downarrow^*$) (Zones 4, 7)

Common

- NTI
- Recent treatment for hyperthyroidism (TSH remains suppressed)

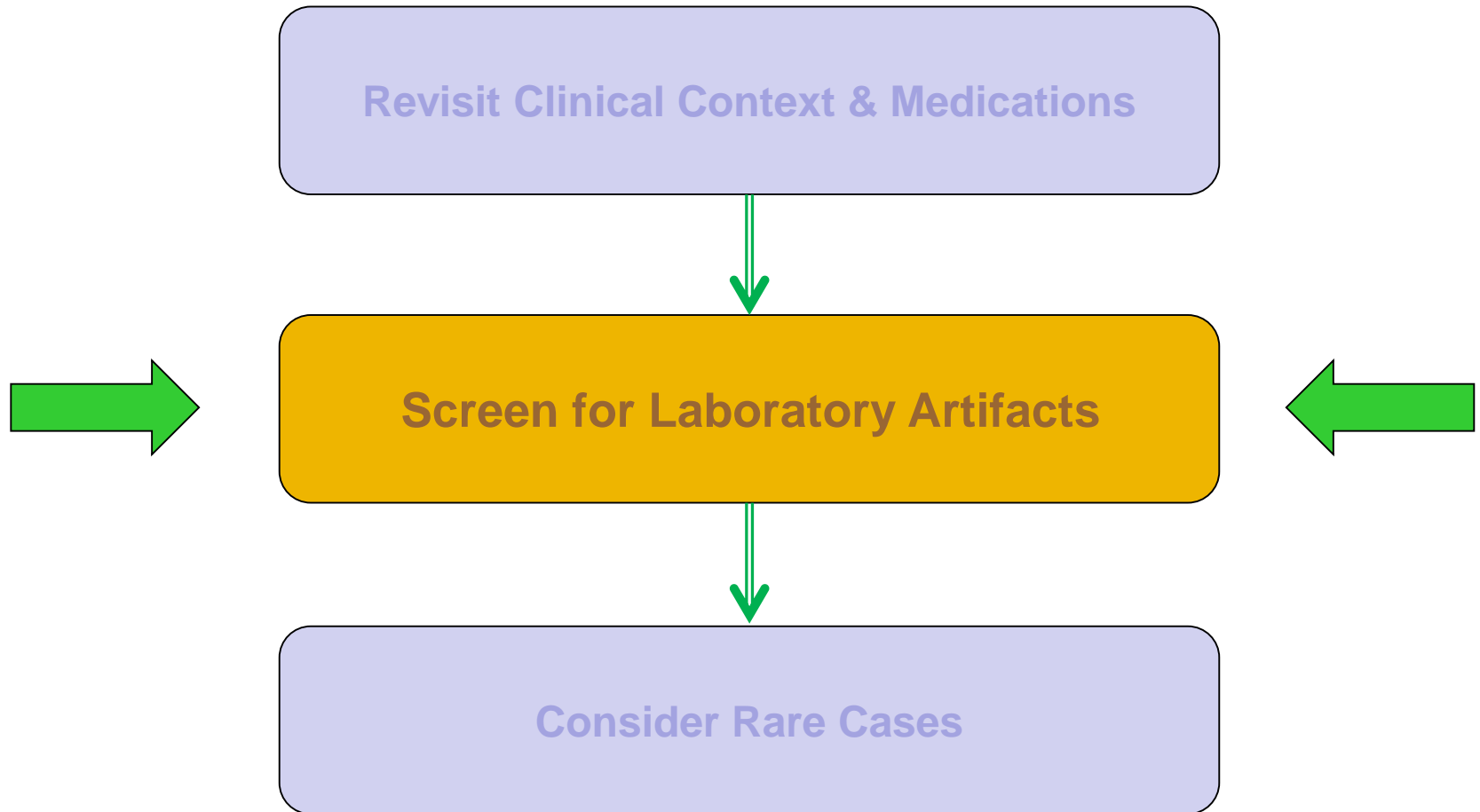
Rare

- Central hypothyroidism
- Isolated TSH / TRH deficiency



Challenging TFTs Results

(A Systematic Approach)



Outlines

1. TSH Molecular Structure
2. TSH Assay Standardization / Harmonization
3. TSH Assay Sensitivity
4. Assay Interferences

• ANA • ds DNA • CCP • AMH • Folate • PTH

• CA 125 • CA 19-9 • CA 15-3

NEW KITS

تولید کننده
کیت‌های تشخیص طبی الایزا



Hipro®

Automated
Immunoassay System



Lifotronic

Electro-chemiluminescence
Immunoassay (ECLIA) System



Magnus

Clinical & Research
Microscopes



شرکت بنیان درمان
تلفن: ۰۲۰۳۰۸۸۷۰۳۰ (خط ۱۰)

TSH Molecular Structure

Lifotronic
GeneStar-96 Real-Time PCR System

- Compact & High throughput
- High efficiency
- Reliable
- High flexibility

شرکت پارس درمیان
تلفن: ۰۲۱-۸۸۷۷۴۰۰۰ (خط ۲)



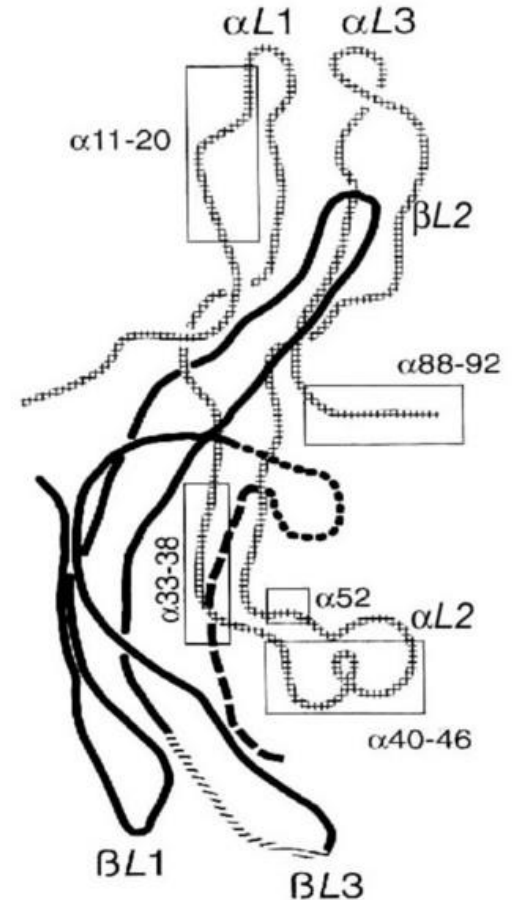
NEW Kits

- ANA
- CCP
- PTH
- ds DNA
- AMH
- Folate
- CA 125
- CA 19-9
- CA 15-3

Thyroid Stimulating Hormone

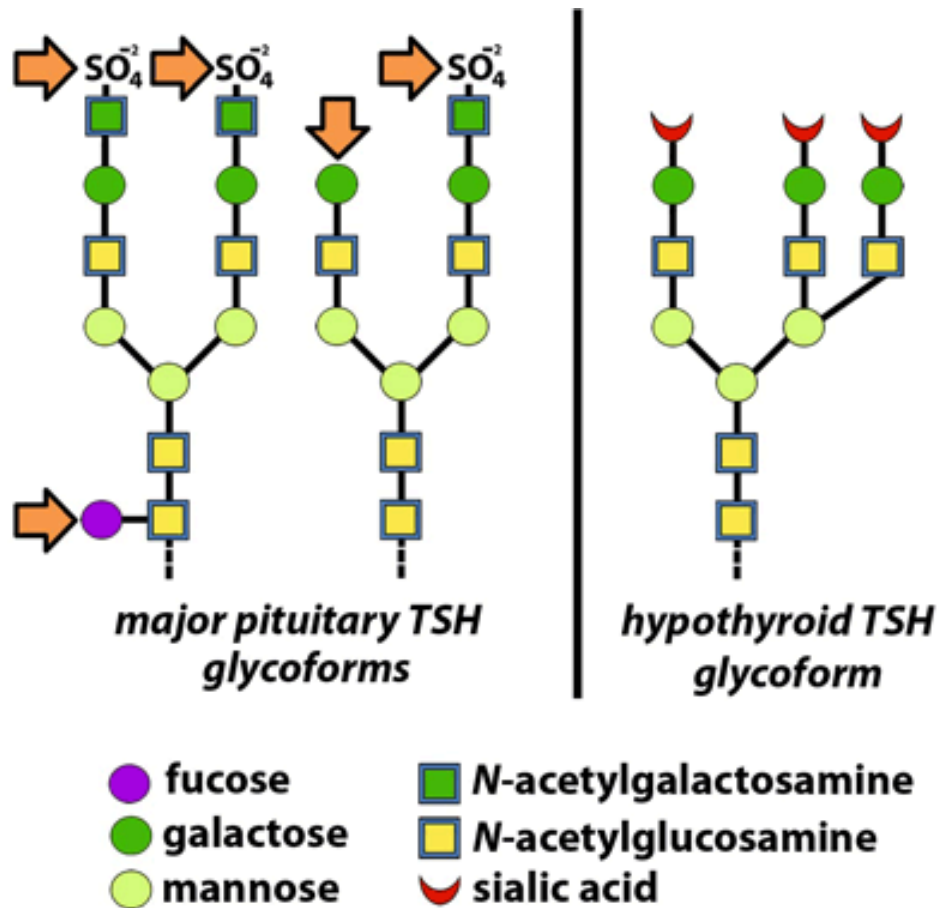
(Characteristics)

- ✓ A heterodimeric glycosylated peptide (92+118)
- ✓ 28- to 30- kDa
- ✓ Synthesized & secreted from thyrotrophs of the anterior pituitary
- ✓ Turnover: 40-150 mU/day
- ✓ Half Life: 1 hour (Variable)
- ✓ Major role: Regulates the growth and function of thyroid gland



Grossmann, M., Weintraub, B.D. & Szkudlinski, M.W.. Novel insights into the molecular mechanisms of human thyrotropin action: structural, physiological, and therapeutic implications for the glycoprotein hormone family. *Endocr Rev* , 18 , 476-501. (1997)

Thyroid Stimulating Hormone (Glycobiology)



<https://www.aacc.org/publications/cln/articles/2013/may/tsh-harmonization>. Last seen: 4/23/2016

TSH Assay Standardization / Harmonization

JAL TAJHIZ MEHRAN
LAB EQUIPMENT DESIGN & PRODUCTION

• ANA • ds DNA • CCP • AMH • Folate • PTH

NEW KITS

• CA 125

• CA 19-9

• CA 15-3

تولید کننده

• کیت‌های تشخیص طبی الایزا

 **IDEAL**
TASHKHIS ATIEH

 **Hipre**

Automated
Immunoassay System



 **Lifotronic**

Electro-chemiluminescence
Immunoassay (ECLIA) System



Magnus

Clinical & Research
Microscopes



شرکت بنیان درمان
تلفن: ۸۸۷۰۳۰۵۰ (خط ۱۰)

Assay Standardization

Goal: Measurement results be comparable between laboratories and methods, over time, with common reference ranges.

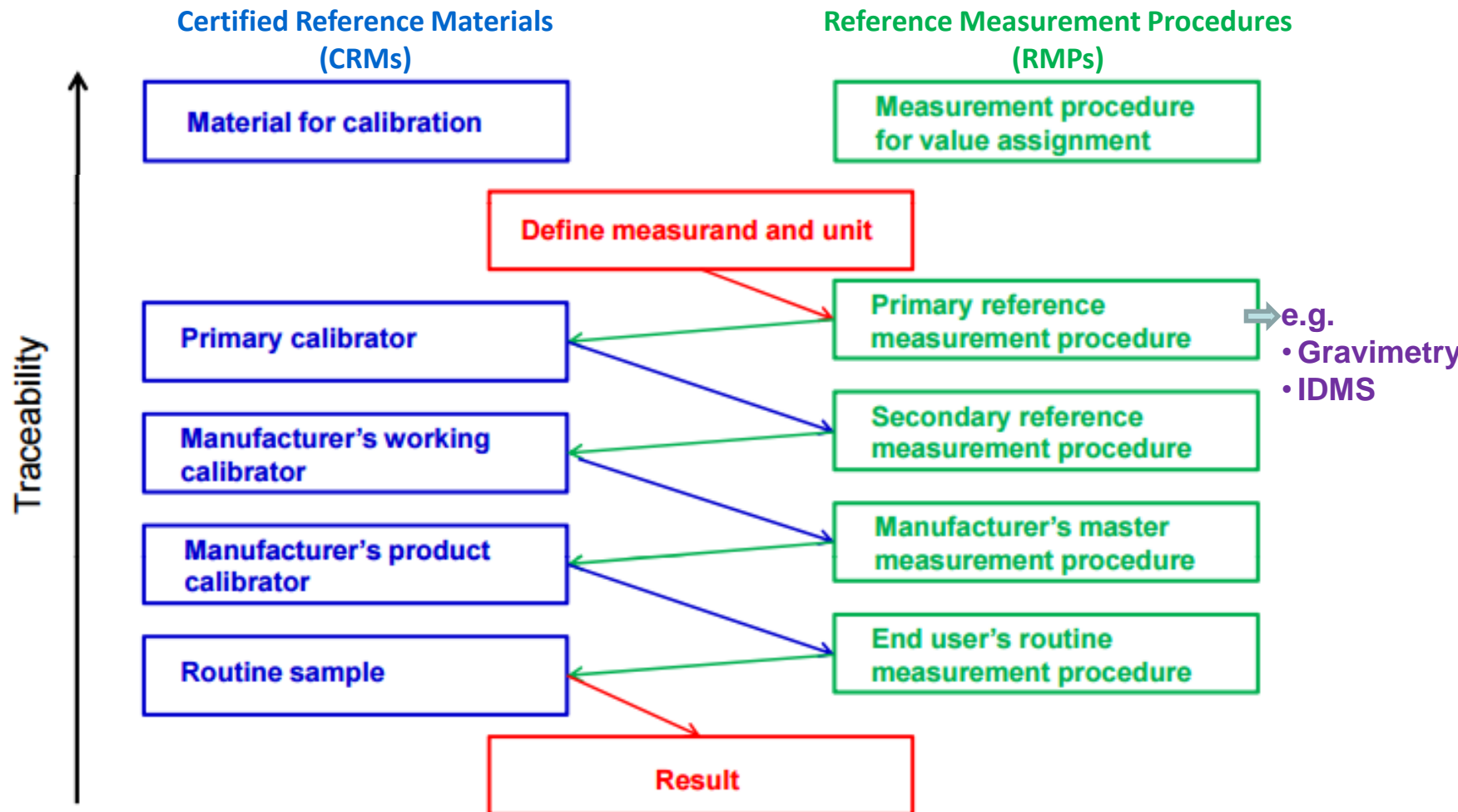
Definition: **Calibration traceable to International System of Units using an RMP**
(to cause to conform with a standard)

Requirements:

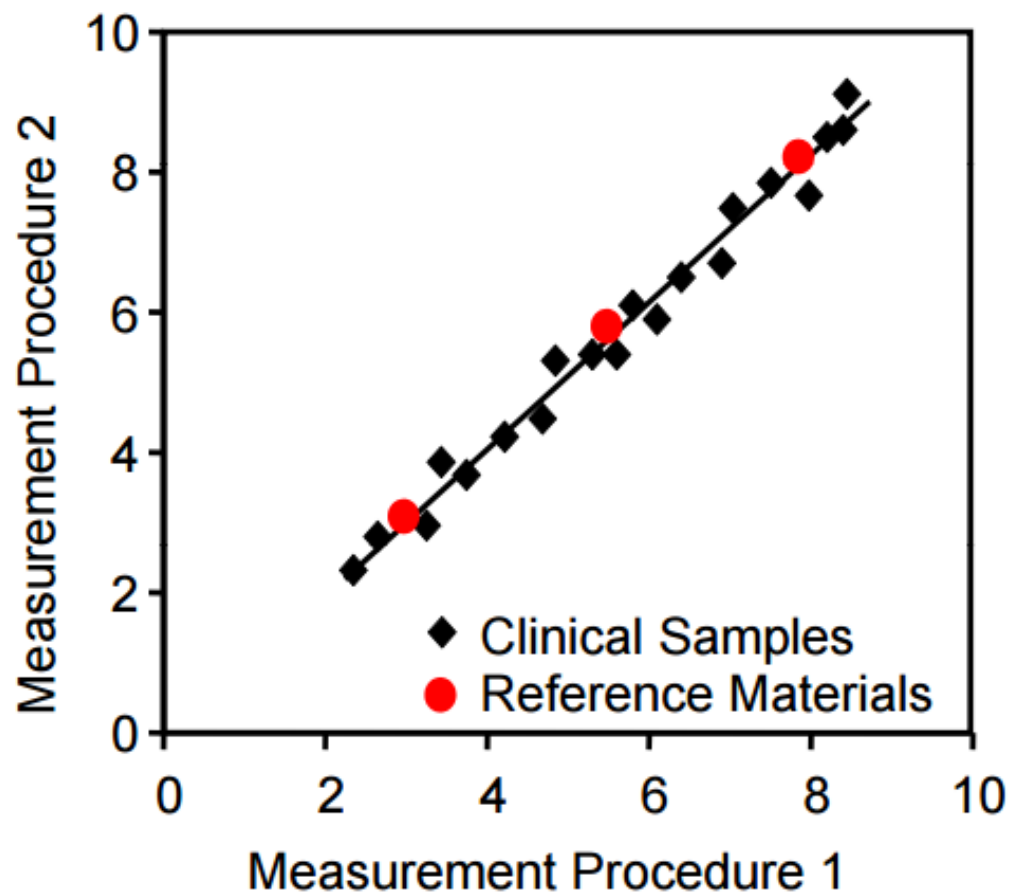
- Full Metrological Traceability
 - ✓ Reference Measurement Procedure (RMP)
 - ✓ Certified Standard Reference Material (CRM)
 - ✓ Traceability Concept
- Commutability
- Broad Range Coverage

Assay Standardization

(Full Metrological Traceability)



Assay Standardization (Commutability)



Miller 2012

Thyroid Stimulating Hormone

(Assay Standardization)

- Goal: Measurement results be comparable between laboratories and methods, over time, with common reference intervals. (Very challenging for TSH)
- Definition: Calibration traceable to International System of Units using an RMP
(to cause to conform with a standard)
- Requirements:
 - Full Metrological Traceability
 - ✓ Reference Measurement Procedure (RMP): Not available for TSH
 - ✓ Certified Standard Reference Material (CRM): Not available for TSH
 - ✓ Traceability: No
 - Commutability: No
 - Broad Range Coverage: ?

TSH Standardization

Not feasible yet.

So, what to do?

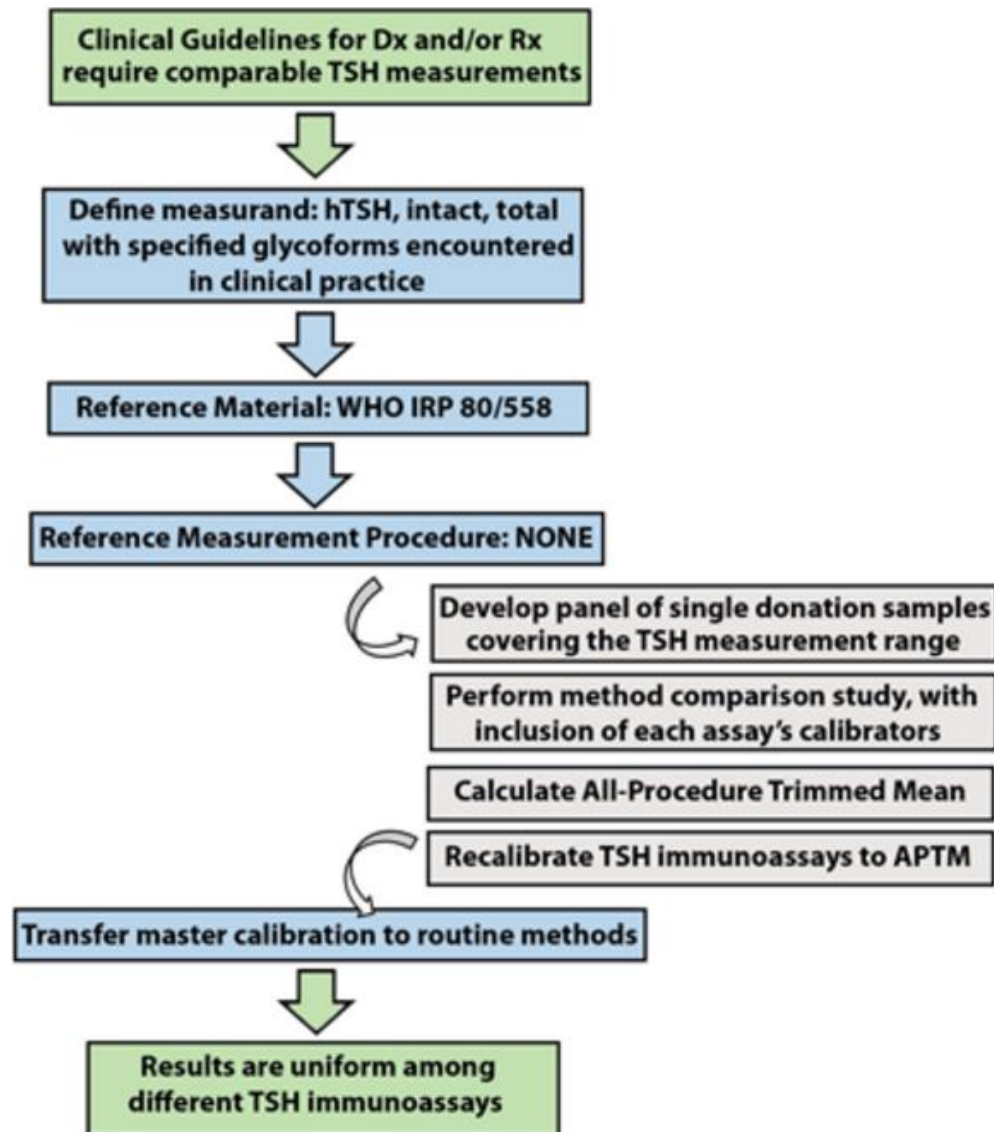
Please Think about TSH Harmonization !?

TSH Harmonization

(Standardization Not Available)

- **Goal:** Measurement results be close to each other.
(Standardization: Measurement results be comparable between laboratories and methods, over time with common reference intervals.)
- **Definition:** To bring into an agreement, (to reach to a consensus)
- **Requirements:**
 - ✓ Applying Statistical Methods (All-Procedure Trimmed Mean=APTM)
 - ✓ Recalibration of Methods / Kits against consensus values
 - ✓ Manufactures contribution

TSH Harmonization Steps (IFCC C-STFT)



TSH Harmonization

(A Progress Report of the IFCC Committee for Standardization of Thyroid Function Tests)

Table 1. Characteristics of the FT4 and TSH serum panel

	FT4 panel	TSH panel
Number of samples	74	94
Target setting	ED ID-LC/tandem MS	APTM
Concentration range	3–77 pmol/l	0.04–80 mIU/l
Inclusion criteria	<p>Individuals were at least 18 years old and competent to give informed consent, as considered by the physician, study nurse or other health care professional interviewing the patient</p> <p>Individuals being evaluated for a thyroid disorder and classified into one of the following groups (if possible evenly distributed):</p>	
	<p>D: hyperthyroid (n = 30)</p> <p>Patients with FT4 values >28 pmol/l up to 40 pmol/l^a</p>	<p>A: hyperthyroid (n = 30)</p> <p>A1: 10 patients with suppressed TSH, around 0.01 mIU/l</p> <p>A2: 10 patients with TSH values between 0.01 and 0.1 mIU/l</p> <p>A3: 10 patients with TSH values between 0.1 and 0.3 mIU/l^a</p>
	<p>E: euthyroid (n = 120)</p> <p>Patients with FT4 values between 10 and 28 pmol/l^a</p>	<p>B: euthyroid (n = 30)</p> <p>Patients with TSH values between 0.3 and 3.0 mIU/l^a</p>
	<p>F: hypothyroid (n = 30)</p> <p>Patients with FT4 values between 3 and 10 pmol/l^a</p>	<p>C: hypothyroid (n = 40)</p> <p>C1: 20 patients with TSH values between 3.0 and 50 mIU/l^a</p> <p>C2: 20 patients with TSH values >50 mIU/l up to 100 mIU/l</p>
	<p>Donors treated for thyroid dysfunction were included, provided information on the type of treatment and start of the treatment was available</p> <p>Note: samples were measured for their endogenous analyte concentration, hence subjects treated with L-thyroxine were only included in the TSH panel and vice versa for patients treated with recombinant TSH</p>	
Exclusion criteria	<p>Individuals previously enrolled into this clinical study</p> <p>Individuals diagnosed with a severe NTI, defined as a state of dysregulation where levels of T3, T4, FT3, and/or FT4 are abnormal although the thyroid gland does not appear to be dysfunctional</p> <p>Individuals with known pregnancy</p>	

TSH Harmonization

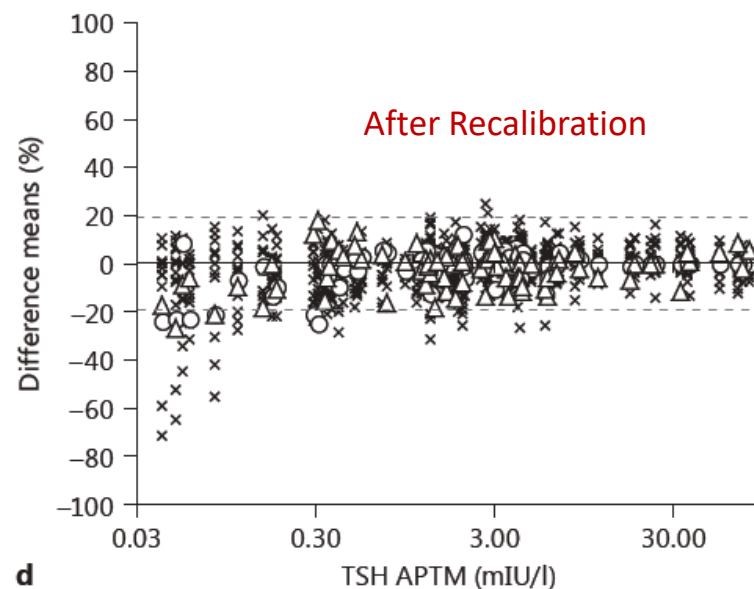
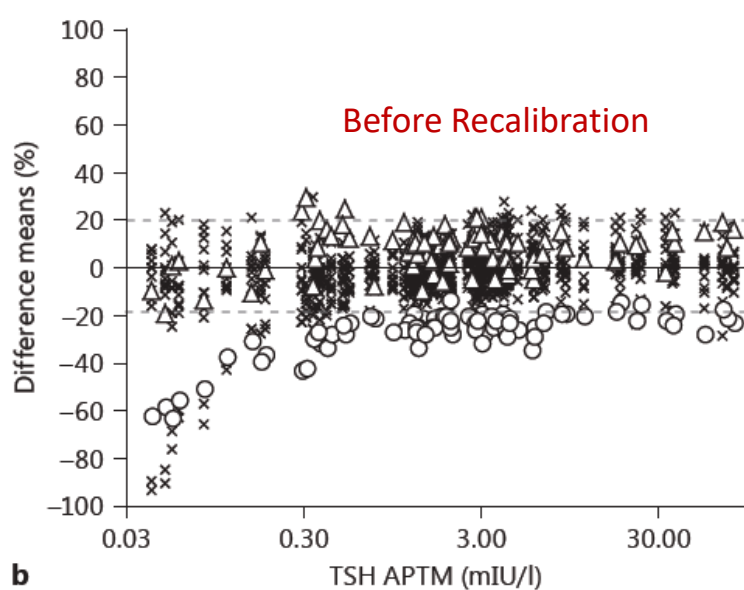
(A Progress Report of the IFCC Committee for Standardization of Thyroid Function Tests)

Table 2. Study participants and assays

Assay manufacturer	Assay	Analyte
Abbott Diagnostics (Abbott Park, Ill., USA)	Architect i2000SR	FT4 and TSH
Beckman Coulter, Inc. (Brea, Calif., USA)	Access 2	FT4 and TSH
bioMérieux s.a. (Marcy-l'Etoile, France)	VIDAS FT4	FT4
	VIDAS TSH & TSH3	TSH
DiaSorin S.p.A. (Saluggia, Italy)	Liaison	FT4 and TSH
Ortho-Clinical Diagnostics (Buckinghamshire, UK)	VITROS Immunodiagnostic Systems (ECiQ and 3600)	FT4 and TSH
Roche Diagnostics GmbH (Mannheim, Germany)	Elecsys	FT4 and TSH
Siemens Healthcare Diagnostics Inc. (Deerfield, Ill., USA)	ADVIA Centaur	FT4
	ADVIA Centaur TSH3-UL	TSH
	Dimension RxL	FT4 and TSH
	Dimension EXL with LOCI module	FT4
	Dimension EXL with LOCI module (3rd generation)	TSH
	Dimension Vista 1500	FT4 and TSH
	IMMULITE 2000	FT4
	IMMULITE 2000 (Third Generation TSH)	TSH
Tosoh Corporation (Tokyo, Japan)	AIA-2000 (ST AIA-PACK)	FT4 and TSH

TSH Harmonization

(A Progress Report of the IFCC Committee for Standardization of Thyroid Function Tests)



TSH assay	Before recalibration			After recalibration		
	0.03–0.5 mIU/l	0.5–5 mIU/l	>5 mIU/l	0.03–0.5 mIU/l	0.5–5 mIU/l	>5 mIU/l
I	-33	-23	-21	-10	0.8	-1.1
A	-7.7	-8.4	-17	-5.9	5.0	5.2
J	-10	-6.2	-2.3	4.3	1.4	-0.4
M	-8.7	-5.4	-0.3	-8.3	-6.7	-3.3
L	-3.6	-3.8	-6.8	-2.0	-0.7	-0.5
F	-19	-1.9	-0.3	-19	-2.7	1.8
H	-7.4	-1.9	7.4	-2.8	0.0	-0.3
N	-3.7	-1.4	3.5	-0.8	-3.0	-0.3
D	4.4	0.7	-1.2	5.6	1.4	-0.2
G	-19	1.2	4.6	-21	-0.3	3.8
E	7.6	7.7	7.6	-2.0	-0.9	-1.9
K	12	8.3	12	-3.6	-1.5	-1.4
C	-2.1	9.4	8.4	-10	1.5	-1.2
B	4.4	11	-17	-15	1.4	6.0

98

TSH Assay Sensitivity



Hipro[®]
Hipro Biotechnology Co., Ltd

Hurricane
POCT Immunoassay System

HP083/4-II

- 4 individual test channels
- Rapid whole blood test
- Simple, Rapid, Accurate
- Portable near to patient

Lifotronic

eCL8000
Electro-chemiluminescence Immunoassay (ECLIA) System

Advantages of Electro-chemiluminescence Immunoassay

- Controlable Optical Signal
- High Sensitivity and Precision
- Wide Range of Measurement: Internally No Need for Standards
- Compatible with Small Sample Volumes
- High Stability for Reagents
- One of the ECLIA Systems in the World

شرکت بنیان درمان
تاسیس: ۱۳۸۷

JAL TAJHIZ MEHRAN
WWW.JALTAJHIZCO.COM
(دفتر تهران)

(طراحی - مشاوره - اجرا و ساخت تجهیزات آزمایشگاهی و تحقیقاتی)
با مجوز از وزارت بهداشت درمان و آموزش پزشکی و معادن صنایع و معادن استان تهران

IDEAL
Immunodiagnostic Equipment for Laboratory

» Tumor Markers » Thyroid » Growth Hormone »

Fertility » **ایدهال** » Steroids »

Anemia » **ایدهال** » Allergy »

» Rheumatology » Vitamin D » Infectious Diseases »

NEW KITS

ANA	ALPHA	GCP	CA 125	CA19-9
AMH	Folate	PTH	CA15-3	

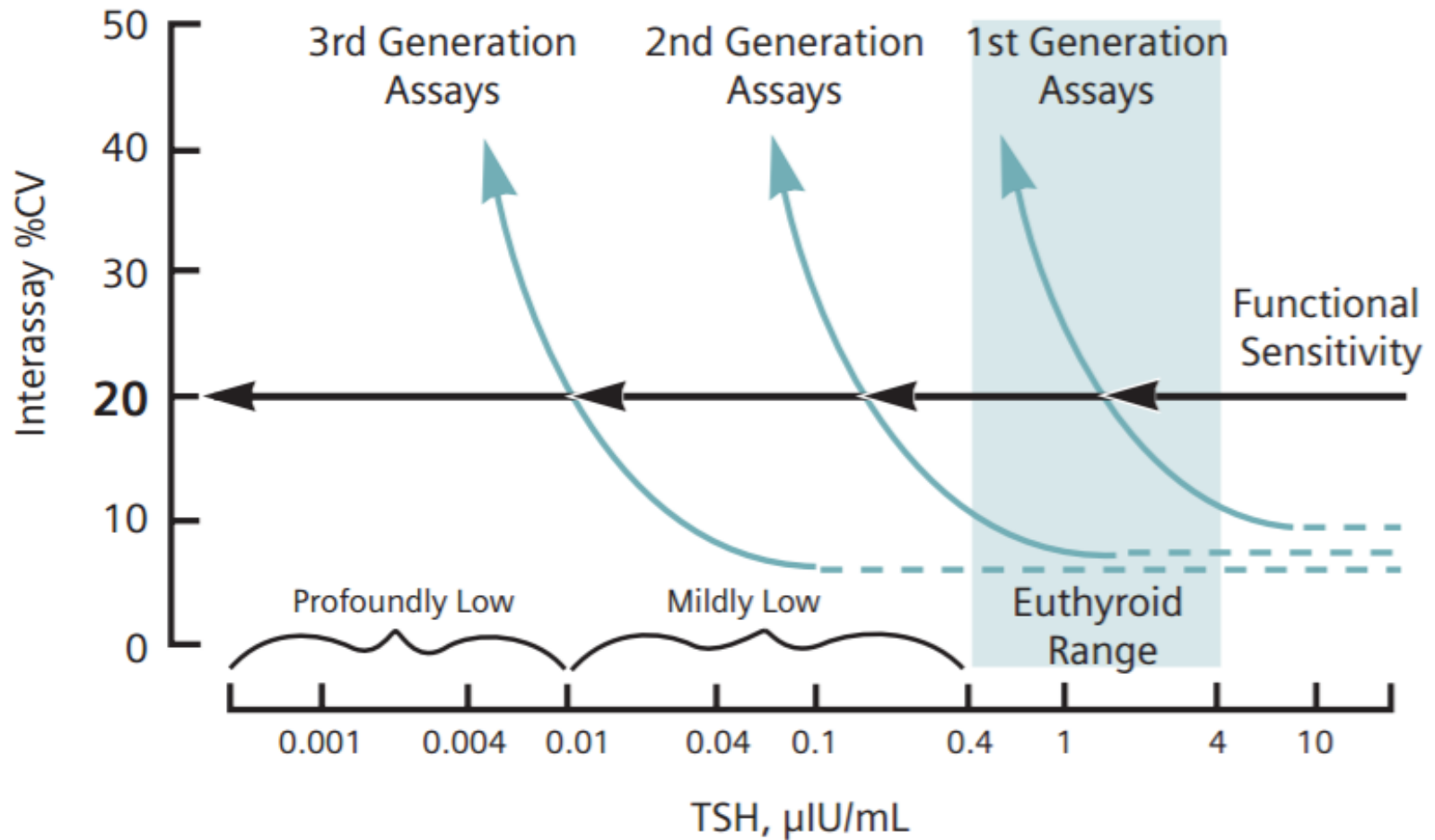
ایدهال سیستم

TSH Assay Generations

Generation	Functional Sensitivity*
First	1 – 2 μ IU/mL
Second	0.1 – 0.2 μ IU/mL
Third	0.01 – 0.02 μ IU/mL

*<20% interassay precision within these ranges.

TSH Assays Evolving Performance Characteristics



TSH Assay Interferences

Magnüs
microscopes



- Anti fungus optics
- Plan superior imaging
- Rackless stage for durability and ease of use
- Ergonomic and compact design for user convenience
- Aspheric light relay system for bright and uniform illumination

MX21i
CLINICAL MICROSCOPE

Optional Accessories

- Dual Filter (B&O)
- Triocular Head With USB Digital Camera

شرکت بیان دروان
تلفن: ۰۲۰۰۸۸۷ (خط ۱)



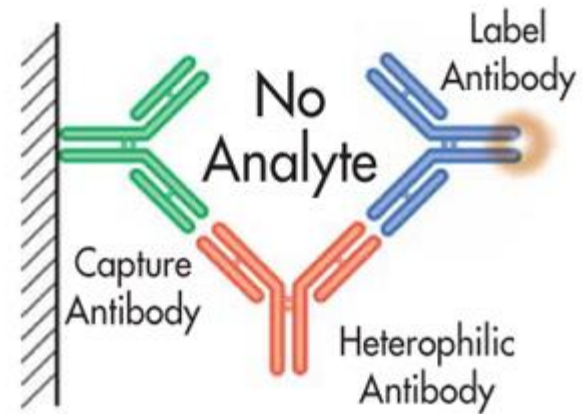
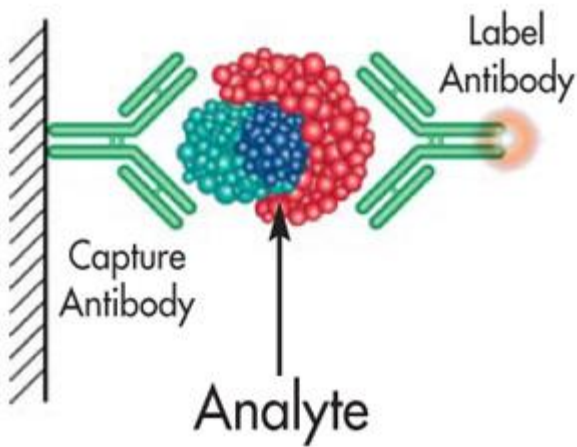
Products	Thyroid Panel			Tumor Markers		
	TSH (mIU/L)	T3 (nmol/L)	T4 (nmol/L)	CEA (ng/mL)	CA125 (U/mL)	CA19-9 (U/mL)
	T3 (nmol/L)	T4 (nmol/L)	T4 (nmol/L)	AFP (ng/mL)	PSA (ng/mL)	PSA (ng/mL)
	T3 (nmol/L)	T4 (nmol/L)	T4 (nmol/L)	AFP (ng/mL)	PSA (ng/mL)	PSA (ng/mL)
Infectious Diseases	Steroids Panel			Vitamin D		
	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)
	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)
	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)
Rheumatology	Allergy			SARS-CoV-2		
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
Anemia	SARS-CoV-2			SARS-CoV-2		
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)



Products	Growth Hormone			ParaThyroid Hormone		
	GH (mIU/L)	GH (mIU/L)	GH (mIU/L)	PTHrP (pmol/L)	PTHrP (pmol/L)	PTHrP (pmol/L)
	GH (mIU/L)	GH (mIU/L)	GH (mIU/L)	PTHrP (pmol/L)	PTHrP (pmol/L)	PTHrP (pmol/L)
	GH (mIU/L)	GH (mIU/L)	GH (mIU/L)	PTHrP (pmol/L)	PTHrP (pmol/L)	PTHrP (pmol/L)
Infectious Diseases	Fertility Panel			Vitamin D		
	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)
	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)
	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	Anti-HIV (1-4) (mIU/mL)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)	25-Hydroxy Vitamin D (nmol/L)
Rheumatology	Allergy			SARS-CoV-2		
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
Anemia	SARS-CoV-2			SARS-CoV-2		
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)
	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	Anti-IgE (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)	SARS-CoV-2 (mIU/mL)

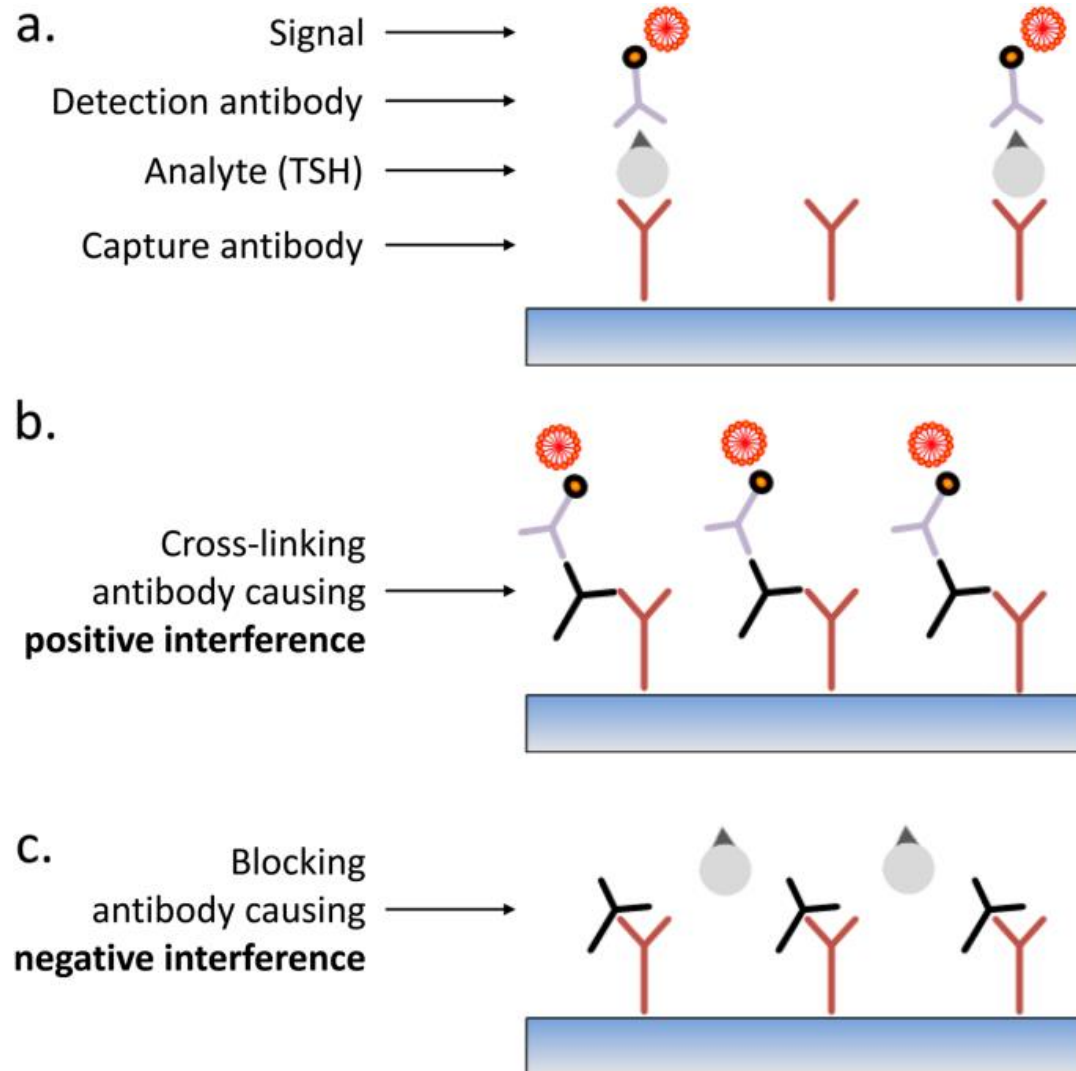
TSH Assay Interference

(HAAs & Immunometric methods)



Thyroid Stimulating Hormone

(Assay Interference)



TSH Assay Interference

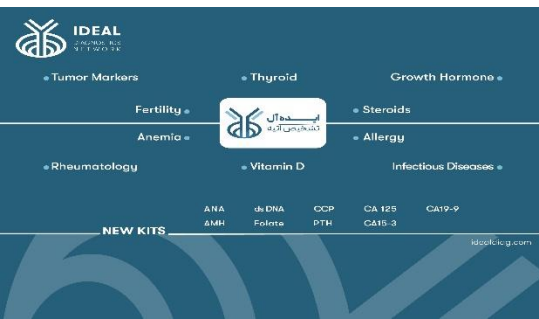
(Heterophilic Antibody Sources)

- Exposure to animals (e.g. animal technicians, veterinarians, animal handlers)
- Alternate animal contact therapy (e.g. thymic cells, sheep cells, embryonic cells)
- Exposure to animal products (e.g. food preparation)
- Special diets (e.g. cheese)
- Deliberate immunization (e.g. therapies, vaccinations, certain imaging treatments)
- Blood transfusions
- Autoimmune diseases, e.g Graves' Disease
- Dialysis
- Patent medicines (OKT3)
- Maternal transfer
- Cardiac Myopathy
- G.I. Disease (E. Coli)
- **Rheumatoid factors can also act as heterophilic antibodies**

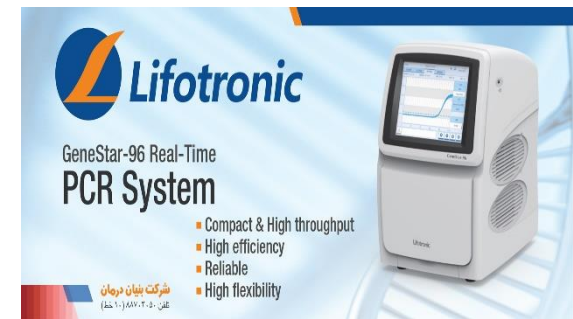
Heterophilic Antibodies

(Existence confirmation)

1. Discordant TSH results in an assay that utilizes different antibody pairs, or incubation times;
2. Altered TSH result following immunosubtraction [using polyethylene glycol (PEG) or protein G/A];
3. Nonlinear TSH measurement following sample dilution



Clinical Endocrinology (2011) 74, 673–678



PEG Test for TSH

1. Read TSH
2. PEG Solution: 25% PEG 6000 in DW
3. Serum:PEG Sol. 1:1 V/V
4. Mix
5. Centrifuge 3000 X for 5 min.
6. Read Sup TSH

- **Recovery= $2 \times \text{TSH (after absorption)} / \text{TSH (before absorption)}$**
- **A Recovery < 40 % suggests the influence of high molecular weight proteins, such as immunoglobulins in the specimen**

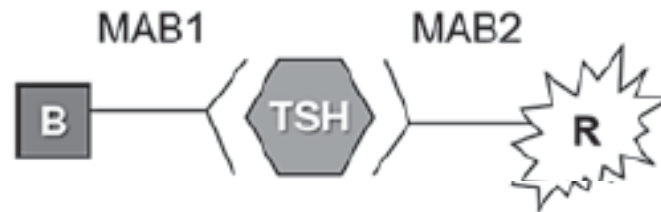
Falsely elevated TSH due to macro TSH, Hiroyuki Sakai, et.al, Endocrine Journal 2009, 56(3), 435-440

Biotin Interference

Immunometric TSH assay

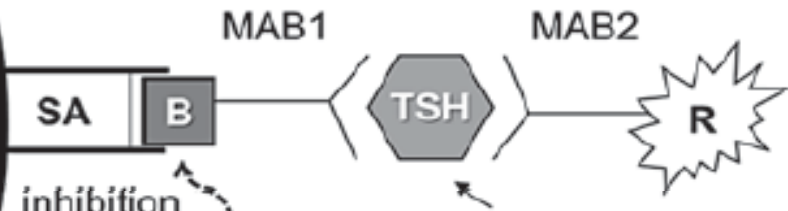
Assay steps

1.



Sandwich complex formation

2.



Solid phase immobilisation of complex

TSH and biotin from patient sample:
More TSH = more signal
More biotin = less signal ≈ spuriously low TSH

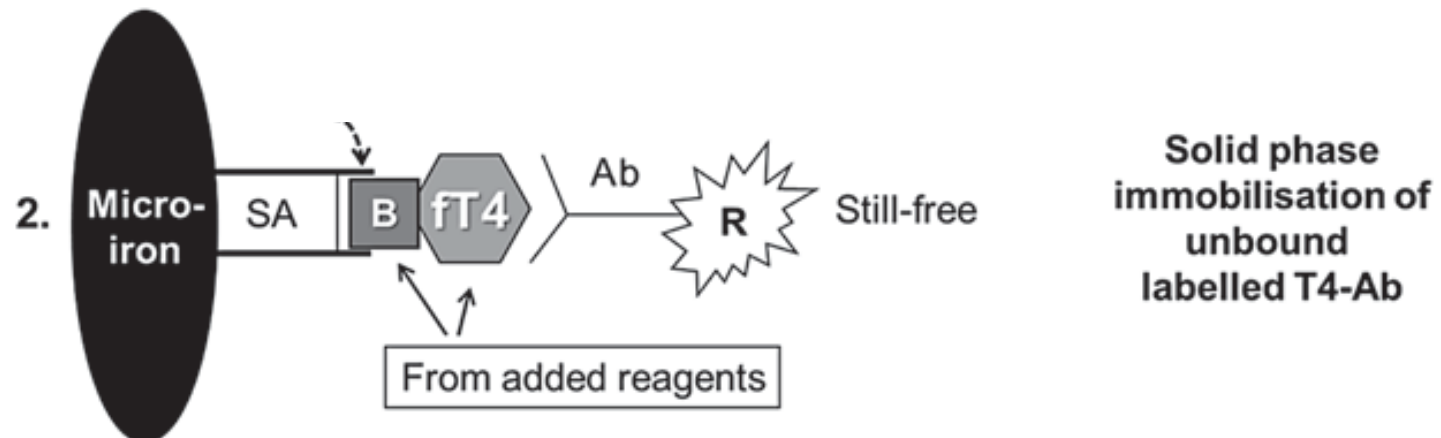
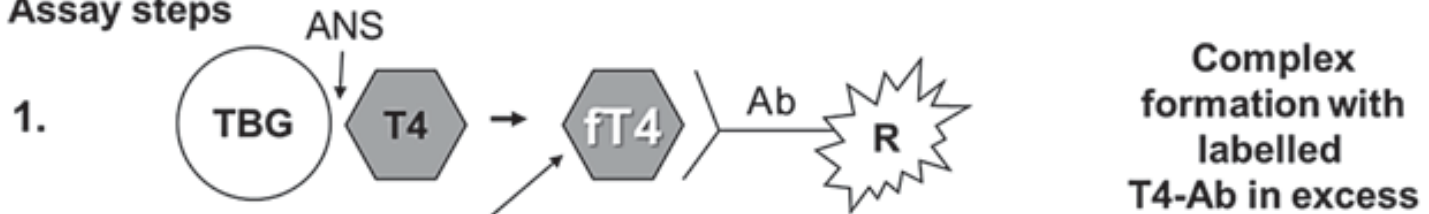
3. Magnetic immobilisation of complex on electrode + aspiration of supernatant

4. Electricity → light emission → photomultiplier → calibration curve reading

Biotin Interference

Competitive binding total T4 assay

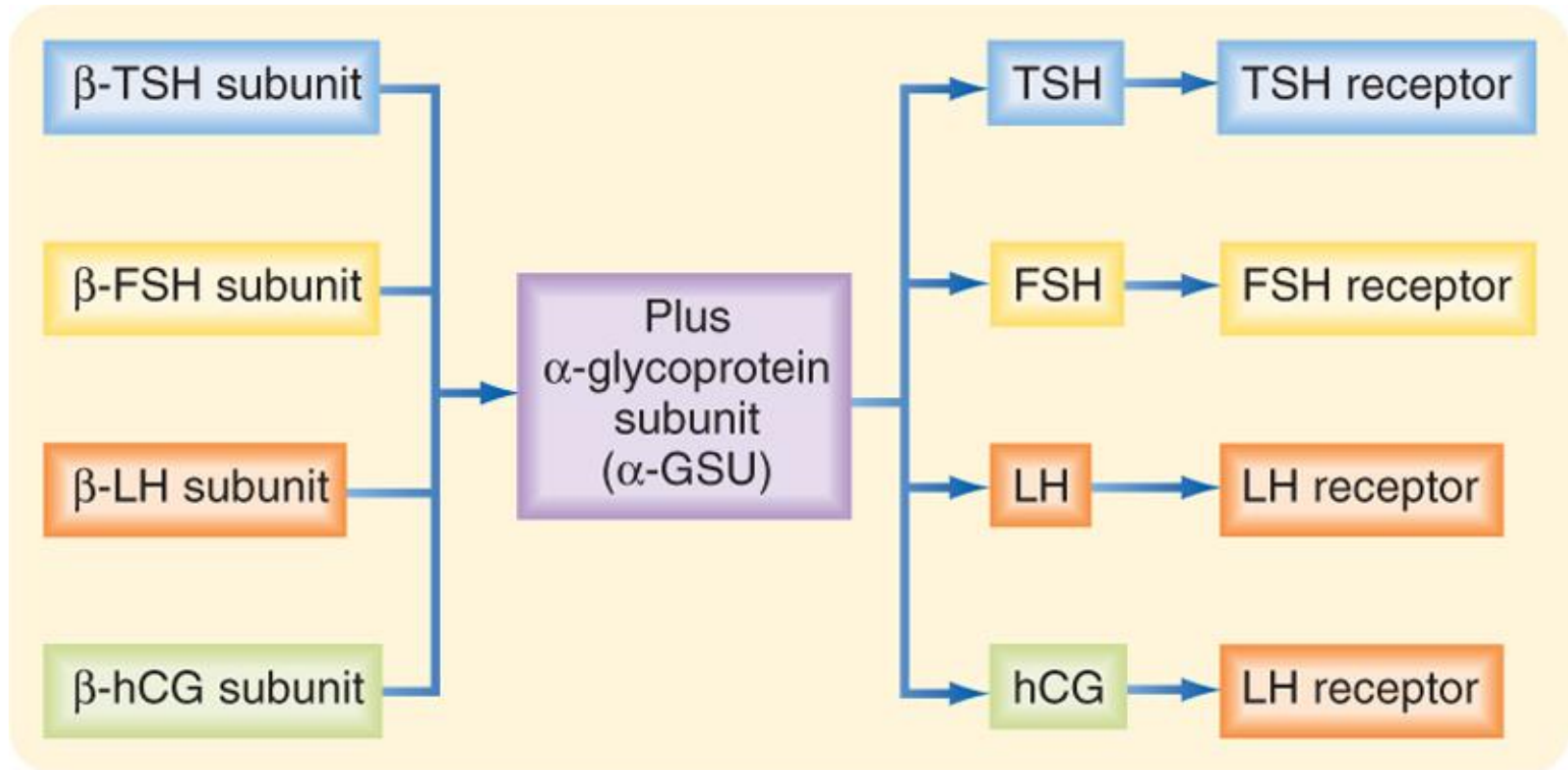
Assay steps



3. Magnetic immobilisation of complex on electrode + aspiration of supernatant
4. Electricity → light emission → photomultiplier → calibration curve reading

TSH Assay Interference

(Cross Reactivity)



Koeppen & Stanton: Berne and Levy Physiology, 6th Edition.
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Assays for Thyroid Free Hormones



dr.bakhtiari.academy



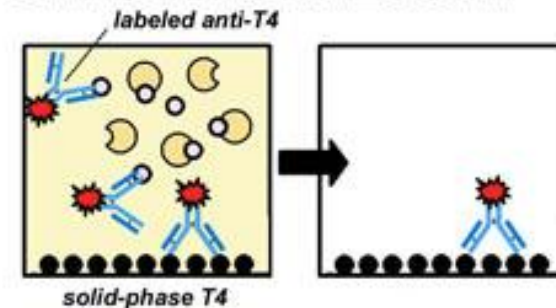
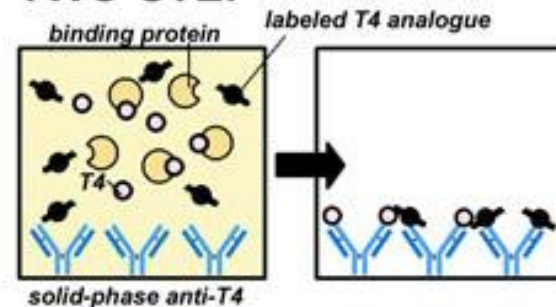
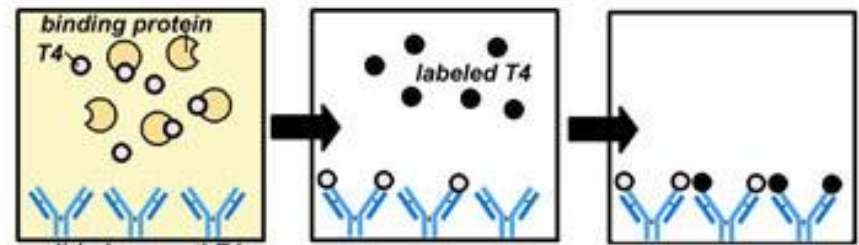
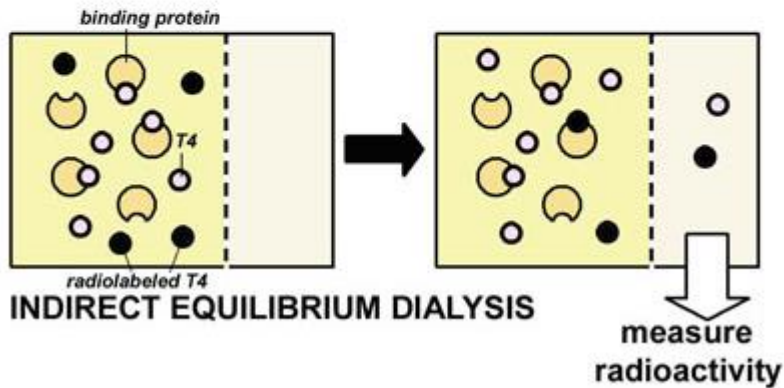
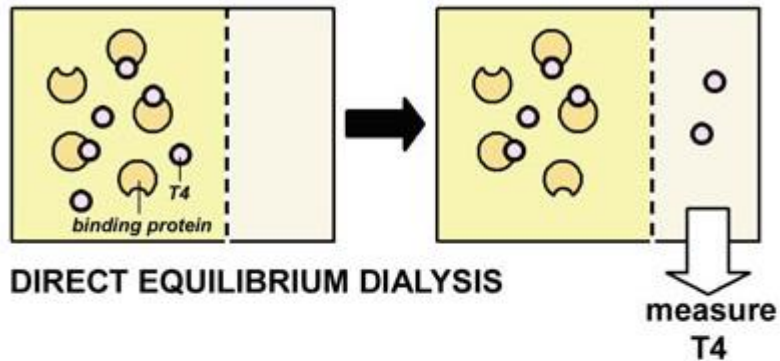
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تلفن: ۸۸۷.۲۰۵۰ (۱۰ خط)

Automated
Immunoassay SystemElectro-chemiluminescence
Immunoassay (ECLIA) System

Magnüs

Clinical & Research
Microscopes

Free T4/T3 Assays



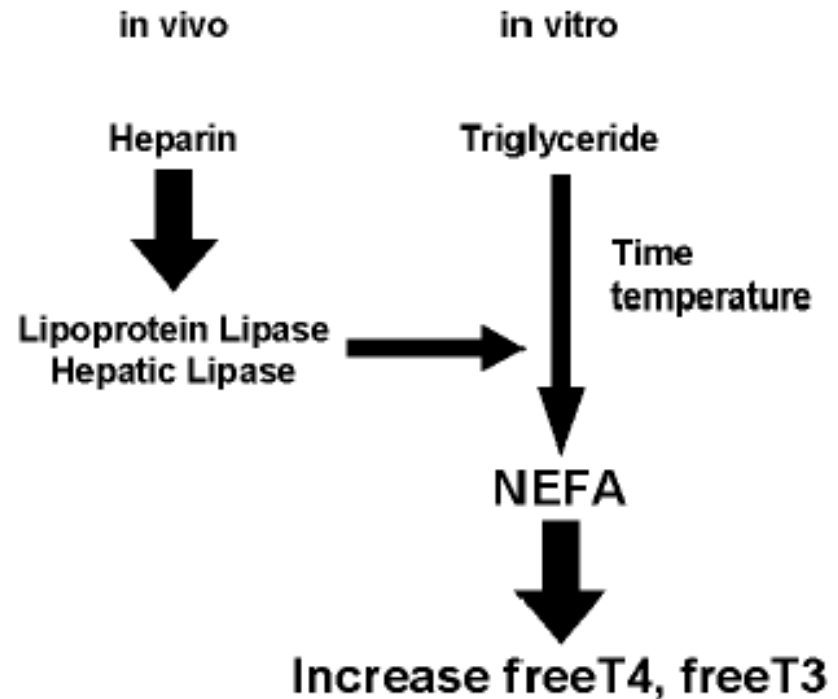
Thyroid Hormone Auto Antibodies

(THAAb)

- Prevalence: up to 40% in autoimmune thyroid diseases;
- Not necessarily lead to assay interference. (titer, specificity, affinity)
- Single-antibody technique: ↓ hormone concentrations
- Double antibody technique: apparent concentration of hormone will be spuriously high.
- 4 major approaches can assist in evaluation of assay interference:
 - (a) measure TSH by a sensitive immunometric method;
 - (b) measure THs after Ig depletion;
 - (c) use a comparative method
 - (d) test for the presence of THAAb against the hormone or analog tracer used in the assay reagents.

FT4 / FT3 Displacement

- Heparin Effect:**



- Altered serum binding proteins**

Altered Binding Proteins

- Quantitative (TBG excess)

1. Pregnancy, estrogens (OCPs, HRT, tamoxifen)
2. hepatic disorders
3. hereditary TBG excess

- Qualitative

1. familial dysalbuminaemic hyperthyroxinaemia (FDH)
2. transthyretin-associated hyperthyroxinaemia (TTR-AH)]

TBG Variations

Increased TBG

- **Hepatitis/ Biliary Cirrhosis**
- **OCP's**
- **Pregnancy**
- **Estrogens**
(also Tamoxifen + Raloxifene)
- **Drugs**
(Narcotics/Heroin, Methadone, Clofibrate, Major Tranquilizers, 5-FU)

Decreased TBG

- **Steroids/Glucocorticoids**
- **Hypoalbuminemia**
- **Androgens**
(Testosterone, Danazol)
- **Nephrotic syndrome**
- **Acromegaly**
- **Drugs**
(Niacin, L-asparaginase)



Automated
Immunoassay System



Electro-chemiluminescence
Immunoassay (ECLIA) System



Clinical & Research
Microscopes

• ANA • ds DNA • CCP • AMH • Folate • PTH

• CA 125 • CA 19-9 • CA 15-3

NEW KITS

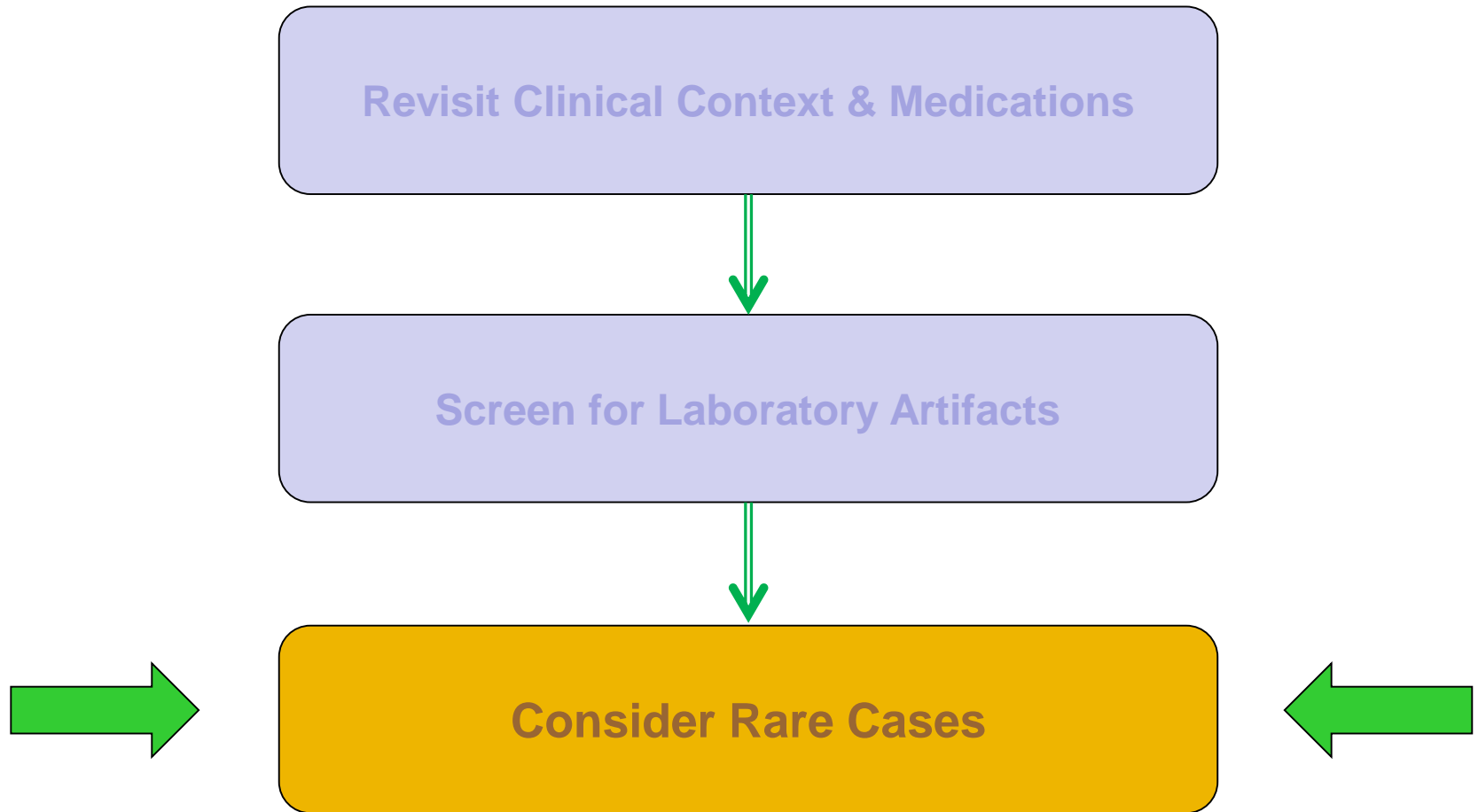
تولید کننده
آزمایشگاه تشخیص طبی آریانا



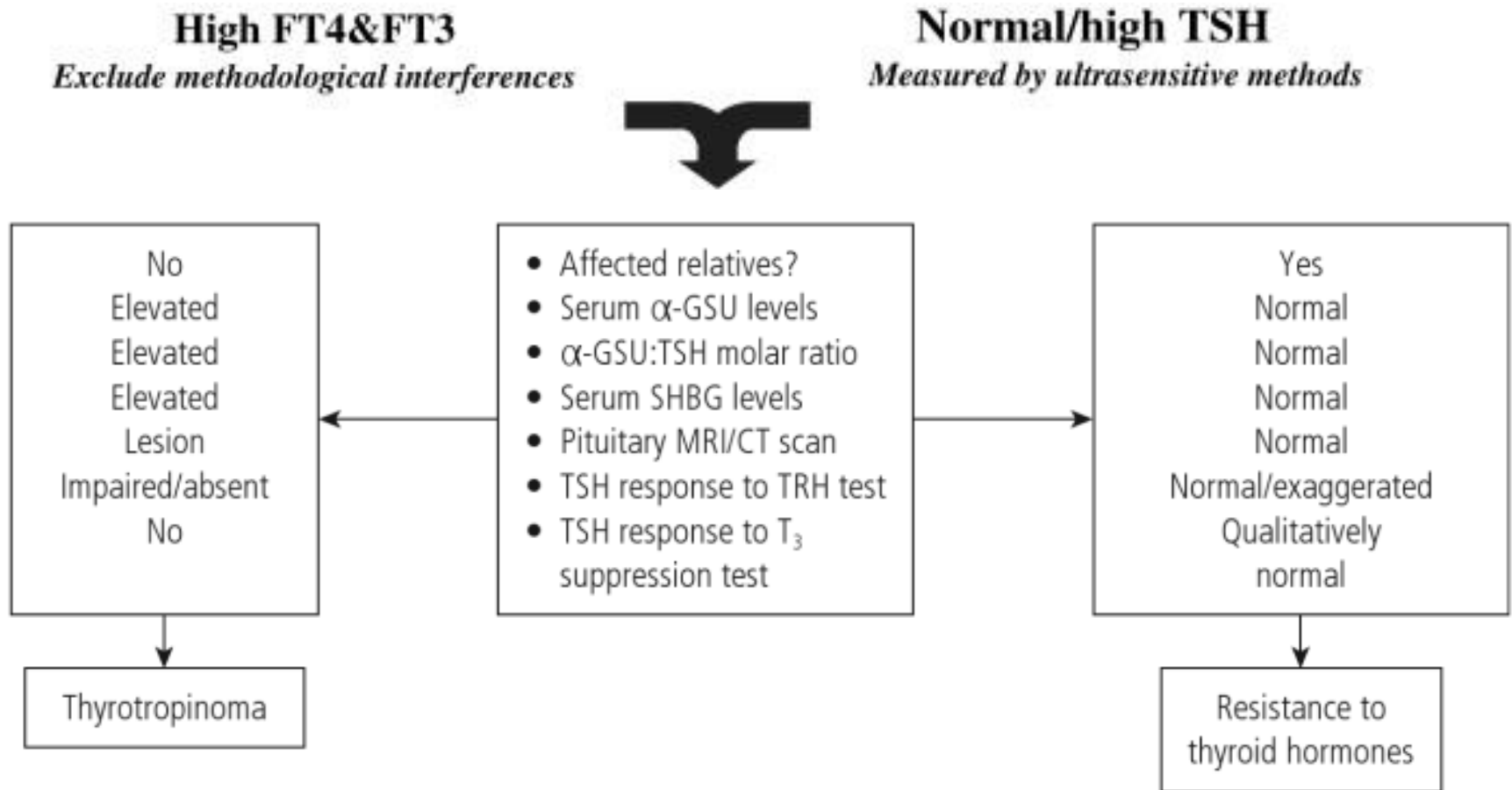
TASHEH'S AT EN

Challenging TFTs Results

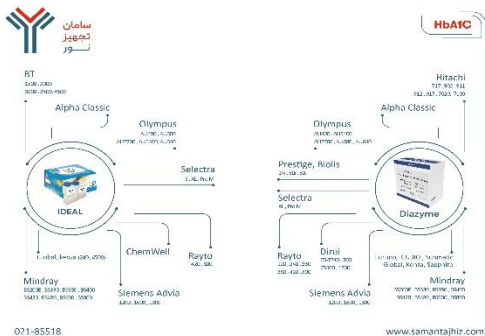
(A Systematic Approach)



Resistance to thyroid hormone (RTH) vs TSH-secreting pituitary tumor (TSHoma)



Conclusions



NEW KITS

- ANA
- ds DNA
- CCP
- AMH
- Folate
- PTH
- CA 125
- CA 19-9
- CA 15-3

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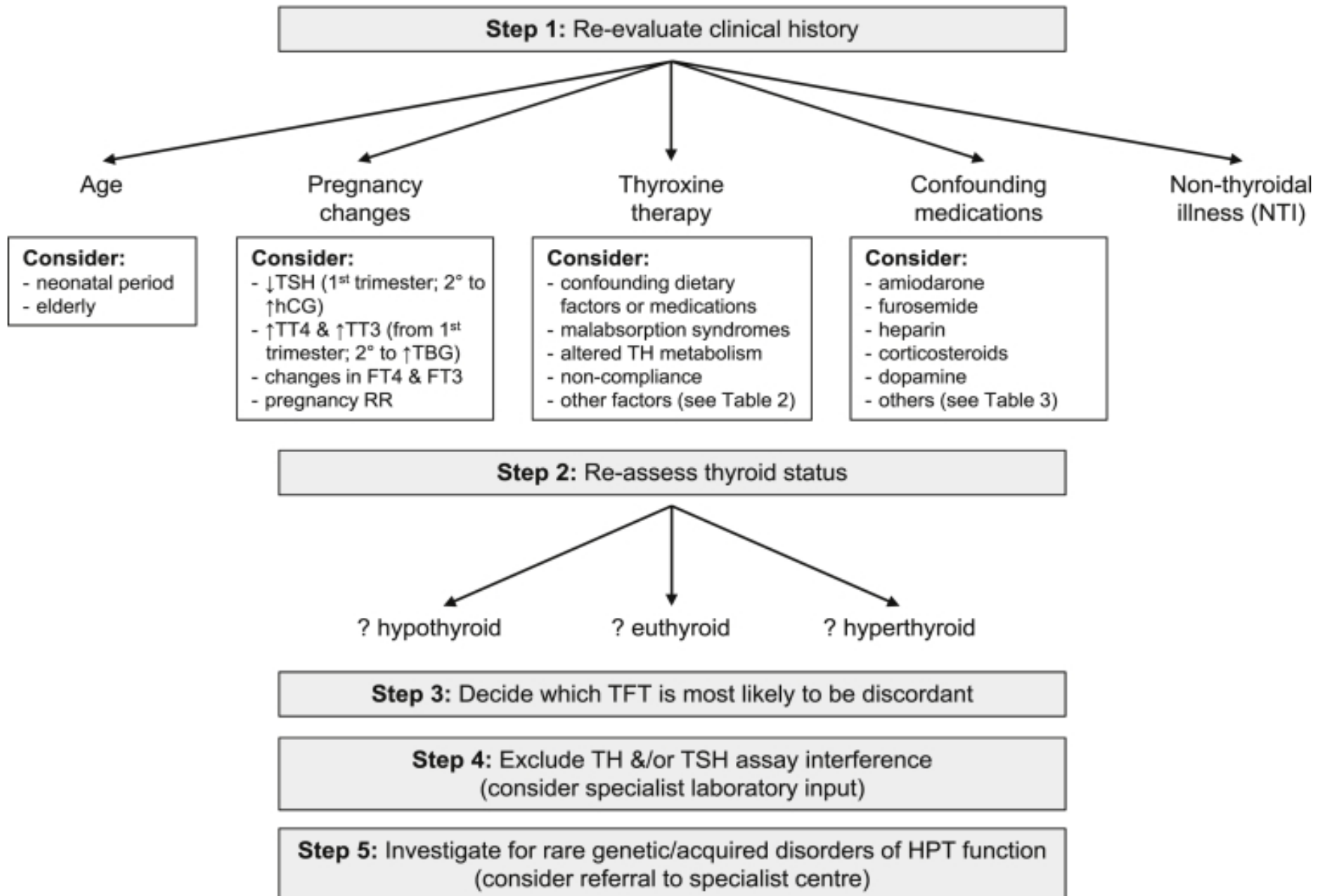
NEW Kits

- ANA
- ds DNA
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- CA 19-9
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A Systematic Approach to Challenging TFTs Results



Thank you for your Attention

Bakhtiari.09@gmail.com



dr.bakhtiari.academy



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POCT Immunoassay System



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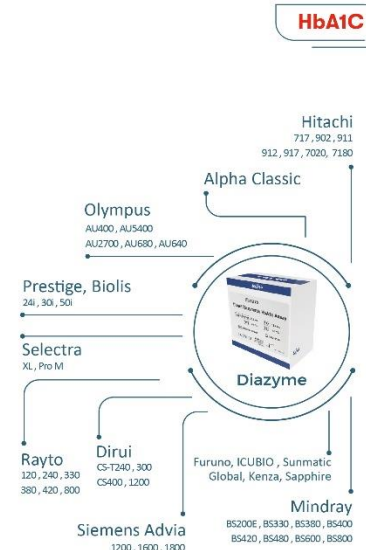
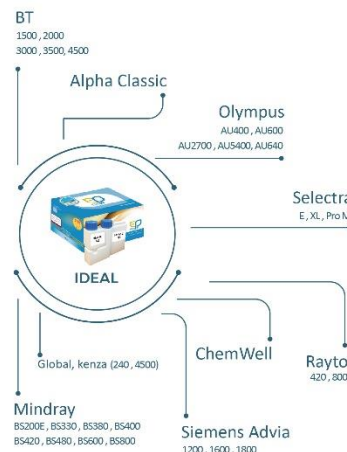
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Advantages of Electro-chemiluminescence Immunoassay

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- Compatible with Small Sample Volume
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Electro-chemiluminescence Immunoassay (ECLIA) System

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Automated
Immunoassay System



Electro-chemiluminescence
Immunoassay (ECLIA) System

Magnus

Clinical & Research
Microscopes



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NEW Kits



• ANA

• CCP

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• Folate

• CA 125

• CA 19-9

• CA 15-3



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