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POSTER PRESENTATION CERTIFICATE

We hereby certify that:

Timothy Bilash

has presented the poster N° **P-0546**

Title :

THYROID STIMULATING HORMONE (TSH) AND FREE THYROXINE LEVELS (FT4) IN PREGNANT FEMALES >25 WEEKS GESTATION AND NON-PREGNANT FEMALES WHO HAVE CLINICAL PROBLEMS AND HYPOTHYROID SYMPTOMS: EVIDENCE SUPPORTING POOR CORRELATION BETWEEN TSH AND FT4

on the occasion of the :

14th International Thyroid Congress
which has been held at the
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These are slides from the 2010 Poster with additional clarification

25. Clinical thyroidology – Case reports

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Preferred Presentation Method: Poster Presentation

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Thyroid Stimulating Hormone (TSH) and Free Thyroxine Levels (FT4) In Pregnant Females >20 weeks gestation and Non-Pregnant Females who have Clinical Problems and Hypothyroid Symptoms: Evidence Supporting Poor Correlation between TSH and FT4.

Abstract:

METHOD:

14 Pregnant Females at greater than 20 weeks gestation and 14 Non-Pregnant Female patients in an upstate New York rural community Obstetrics and Gynecology office presented with a variety of clinical problems in Pregnancy (preterm labor, obesity, gestational diabetes, supraventricular tachycardia, pyelonephritis) and Non-Pregnancy [oligomenorrhea, infertility, bleeding, uterine myoma, atrial arrythmia, ovarian cyst) and were screened at the time of presentation with Serum Thyroid Stimulating Hormone and Free Thyroxine Assays (AxSym, Abbott Laboratories, Abbott Park, IL). Some patients were treated with Levo-Thyroxine. Test results and clinical observations were tabulated.

RESULTS: In these problem patients:

For the Pregnant patients,

Thyroid Stimulating Hormone [0.51-5.08, Mean=1.94, SD=1.32 MIU/L] and

Free Thyroxine [0.57-0.92, Mean=0.69, SD=0.11 ng/dl] were both found to be uncorrelated with Gestational Age at greater than 20 weeks gestation.

For the Non-Pregnant patients,

Thyroid Stimulating Hormone range was 0.96-7.35 [Mean=3.71, SD=1.95] and

Free Thyroxine range was 0.51-0.99 [Mean=0.81, SD=0.15].

For the Pregnant patients compared to Non-Pregnant ones,

Thyroid Stimulating Hormone averaged -1.77 MIU/L lower (SE=0.10) and

Free Thyroxine was -0.12 ng/dl lower [SE=0.01).

Free Thyroxine level also appeared to be independent of Thyroid Stimulating Hormone level in both the Pregnant patients greater than 20 weeks gestation and Non-Pregnant patients.

DISCUSSION:

The often described inverse log-linear relationship between serum FT4 and TSH (FT4 = -logTSH at TSH setpoint) focuses on regulation about the TSH setpoint, describing the control mechanism for TSH when FT4 moves away from equilibrium. Little is understood about the control mechanism in Pregnancy which may alter the TSH setpoint itself. These findings indicate a possible alteration in the TSH Pituitary setpoint rather than feedback to or suppression of the Thyroid Gland itself, particularly because neither FT4 nor TSH was correlated with Gestational Age at greater than 20 weeks gestation.

TT4(FT4)

pituitary

pituitary

of

due to HCG

when HCG is constant, ~1/2 the max at 10 weeks

Some patients (both Pregnant and Non-Pregnant) were treated with low doses of Levo-Thyroxine and showed improvement of their immediate clinical problems.

Additional Clinical Observations:

1) T4, T3, T2 and HCG all supress TSH.

2) Pregnant patients with a higher TSH may actually drop their FreeT4 if dosing is inadequate by supression of TSH to more normal values.

NAME	AGE	DX	DATE	PREG wks	TSH .49-4.67	FT4 .71-1.85	FT4calc .6+.06*TSH	FT4-calc *delta*	FT3 2.3-4.2	TT4 4.5-12.0	T3 UP .6-1.27	FSH LH 0-20 0-20	TT4/FT4	OTHER COMMENTS	TSH's	FT4's	T3U's	TT4
PREGNANT/(WITH PROBLEMS)																		
F-1	40	4wk SAB early no site, G2P1	09/12/02	4	1.32	0.93	0.68	*0.25*						Low FSH,LH;Rhneg,bHCG=8(9/10),=2(9/11)				
	24	5wk SAB,BTL failure	09/13/02	5	3.22	0.83	0.79	*0.04*		5.7	3.50		6.87	HCG=43, bleeding				
F-2	35	6wk SAB/D&C,+ACA11,-ANA	08/24/02	6	6.84	1.05	1.01	*0.04*						start LT50				
	-		09/18/02	7										sxs, increase to 75 (ACA=11 on 9/27)	4.59	0.99		
F-3	29	8wk SAB/D&C,hxhypoth/GDM-pregs	09/09/02	8	5.22	1.01	0.91	*0.10*						stopped LT(0.88)wks4-7,BlgtOvum				
F-4	28	20wk	01/24/02	20	3.61	0.88	0.82	*0.06*						-				
	-	40wk GBS+,arestdil,chorio	07/02/02	40										on LT50	1.5			
T-1	26	27wk pyelonephritis,+UGBS,++fatigue	09/24/02	27	1.56	0.60	0.69	*-0.09*						start LT75,^HC/AC,improved9/26				
T-2	21	29wk pyelo,eatdis,ptl	08/29/02	29	0.51	0.76	0.63	*0.13*	2.8	11.8			15.53	start LT50,recurrent UTI,mg1.1,hiTBG,loUI2	0.79	0.8		
	-	+ BV	09/12/02	31										hydro,dil fetal renal				
T-3	29	DM	08/16/02	30										CR=1.1,CrCl=106				
	-	pyelo(8/22)	08/30/02	32	1.26	0.69	0.68	*0.01*						ST50				
	-	PTL	09/12/02	33										on ST50,^LT75,improved,Cr1.2,Mg1.0	1.31	0.58		14
T-4	32	hthsxs,UTI,breech,GDM,urethdivert [EGA?]	08/14/02	32	1.90	0.58	0.71	*-0.13*						start 50 9/4,ABneg,fet wtgain,prevCS				
	-	-	09/19/02	36										on LT50,improved	0.61	0.69		
T-5	29	PTL,dehydration	09/27/02	33	0.70	0.70	0.64	*0.06*						mg1.5				
T-6	29	34wk SVT,PTL,UTI,IUGR	08/20/02	34	1.52	0.57	0.69	*-0.12*		9.0			15.79	ST50 to NSR				
	-	-	08/23/02	34										SVT recurred off LT4 (8/22)	1.63	0.72		11
	-	Palpitations	08/25/02	34										restart LT4 50				
	-	PTL,HCT26,GDM,Rh-	09/10/02	36										start LT4 75,fetus70%EFW,Cr1.2,CrCl232				
	-	-	09/12/02	36										on LT75,emesis,glu contrl	1.31	0.58		
T-7	32		08/29/02	34	1.37	0.87	0.68	*0.19*						start LT50				
	-		09/28/02	36										Cr=1.1				
T-8	35	35wk obese,fatigue,UTI,PTL,vagbld,330#	10/02/02	35	5.08	0.63	0.90	*-0.27*		11.7			18.57	ST 75,staph,SVDx6,mg1.4				
T-9	32	35wk fetal demise,adrenal hypoplasia	09/23/02	35	1.90	0.75	0.71	*0.04*						thrmbphl/cellulitis,hx depr,thyrsx,hx Hth				
T-9	27	37wk MObesity,++c/o's	09/24/02	37	0.97	0.58	0.66	*-0.08*						SocEmotProbs,hx skin infects/rnl stne/?PE				
T-10	21	40wk cleft lip,chorioEColi,margabrupt	09/29/02	40	2.10	0.76	0.73	*0.03*	3.4					marginsert,URI,neg thyrab,remoteHepC,mg1.5				
T-11	21	PPD1,HTN,TOB2PPD	09/24/02	40	2.16	0.60	0.73	*-0.13*						Alb1.8,hxBV				
T-12	22	1CS FTP,41weeks,10#4,funisitis,mg=1.2	10/06/02	41	4.24	0.92	0.85	*0.07*						bradcard pp,hx Hthyr?,wtloss on depo,905gmsPL				
				wks			STDevdiff=	*0.13*										

	TSH/FT4 Ratio		TSH .49-4.67	FT4 .71-1.85	FT4calc .6+.06*TSH	FT4-calc *delta*	TT4 4.5-12.0
PREGNANCY AVERAGE (WITH PROBLEMS)	3.3	<<<<	2.53	0.76	0.75	*0.01*	9.6
		STDev	1.79	0.18	0.11	*0.19*	
PREG AVG (for TSH<2)	1.9	<<<<	1.30	0.70	0.68	*0.02*	10.4
PREG AVG (for TSH>2)	4.9	<<<<	4.06	0.84	0.84	*0.01*	8.7
TSH (TSH<2 minus TSH>2) Differences =	-3.0		-2.76	-0.13	-0.17	*0.03*	1.7
		STDev	1.95	0.09	0.12		
PREG AVG (for <20wks)	4.3	<<<<	4.04	0.94	0.84	*0.10*	5.7
PREG AVG (for >20wks) ft4too low?	2.8	<<<<	1.94	0.69	0.72	*-0.02*	10.8
WKS (<20wks minus >20wks) Differences =	1.5		2.10	0.25	0.13	*0.12*	-5.1
		STDev	1.48	0.17	0.09		
STD >20 weeks			1.32	0.11			
Preg Avg >20wks/TSH <2	1.9		1.30	0.68	0.68	*0.00*	
Preg Avg >20wks/TSH >2	4.7		3.40	0.73	0.80	*-0.08*	
TSH (TSH<2 minus TSH>2) Differences for WKS>20wks	-2.8		-2.10	-0.05	-0.13	*0.08*	

for pregnant sick patients average FT4 is low, TSH hi

evidence for inadequate TSH, fails to augment FT4
average FT4 calc is predicted from TSH (inadequate TSH)

<<< I2def?

higher TSH has *higher* FT4 overall

expected TSH lower <20 weeks

TBG higher >20weeks

TSH, FT4 are *higher* <20 weeks (*T4* is *lower*)

TSH, FT4 *decrease/* T4 *increases* with GA

TABLE 1 PREGNANT PROBLEMS PATIENTS

NON-PREGNANT/(WITH PROBLEMS)

NAME	AGE	DX	DATE		TSH .49-4.67	FT4 .71-1.85	FT4-AVG *delta*	FT3 2.3-4.2	TT4 4.5-12.0	T3 UP .6-1.27	FSH 0-20	LH 0-20		OTHER COMMENTS	TSH's	FT4's	T3U's	TT4
NP-1	21	Infert,anov	5/28/02		6.36	0.89	*0.08*				6.4	15		subclin,insulin=18(6-27)				
-	-		7/24/02											on LT4 50	1.62			
-	-		8/22/02											offT4(7/30-8/4),restart 8/5,start clomid	1.93	0.89		
NP-2	22	hx SAB,fatigue,anov/bicorut/anemia/SVD	9/11/02		0.96	0.78	*-0.03*				7	6.8		irreg menses,recurr ov cysts				
NP-3	26	IrregMenses	10/2/02		1.92	0.87	*0.06*				3	5.9		anovulation				
NP-4	43	hthsxs,loBMD,permnpsx,BV,scarpain	9/24/02		1.93	0.66	*-0.15*				4.2	3.4		Fibr/TAH,BV,constp,0.05/premphase(10/5)				
NP-5	46		9/4/02		3.06	0.91	*0.10*				13	7.3						
NP-6	51	mnpse,fatigue,fibroids,bleeding	7/26/02		1.67				7.2	1.20	42	30	7.91	bleeding on cycHRT(7/26?)				
-	-		9/17/02			0.65	*-0.16*							st ST4 50 9/30, improved 10/2				
	56	menopause,depress,RA,SLE	8/8/95								47	105		on prempro5(7/16?)	0.2		0.75	
-	-		8/8/02							0.75				prempro start?				
NP-7	-	afib,MVA,pneumonia,vagbld	9/1/02		7.35	0.51	*-0.30*							MVA(1wk), stop prempro,heparin,+BCstaph				
-	-	cx polyp	9/7/02					1.9	7.4				14.62	NSR on ST4 50 (9/2),restart prempro,cr=2		1.6		
NP-8	50	menpse,IregMense,SVT	8/22/02		4.85	0.96	*0.15*				100	80						
NP-9	46	IregMenses	9/4/04		2.40	0.95	*0.14*											
NP-10	50	fibroids,chrnpain,fatigue,anemia,constp,hair	7/30/02		5.01	0.68	*-0.13*							st LT4 25,BV,b12=326,fol nl(macrocytes on pap)				
-	-		8/29/02								5.4	3.7		atrophic cx, prolif endom(7/24),Uincont	4.22	0.79		
NP-11	64	++hthsxs,brst cysts,numbness	9/9/02		2.59	0.73	*-0.08*							TVH,startcycHRT,st LT4 25(9/19),rpt6mo				
NP-12	54	menpse,hth sx's,ov cyst,BV	10/2/02		5.61	0.99	*0.18*				68	42		bellpalsy,strtprmphse, imprvd/st 25(10/2)				
	65	PMB,fibroids,weak,BV	10/1/02											maintenance125,Aygestin5bid	0.61	1.3		
NP-13	66	menpse sxs,kidstn,hrtvlvrepl	9/23/03		4.79	0.81	*0.00*				63	28		constp,insomnia,premphase9/30,0.075(9/30)				
NP-14	24	(4wks **PP**) recurSAB	08/30/02	4wPP	3.46	0.97	*0.16*				1	0.8		sx,recurBV				
	-	(8wks **PP**) anovulation	09/26/02	8wPP							2.2	9.1		start LT4 50,-ACA	5.96	0.87		
						STDevdiff=	*0.15*											
NON-PREG AVERAGE (WITH PROBLEMS)			TSH/FT4 4.6	STDev	3.71 (1.95)	0.81 (0.15)			7.3									

PREGNANT vs NON-PREGNANT (WITH PROBLEMS) COMPARISON

NAME / AGE / DX		TSH/FT4		TSH .49-4.67	FT4 .71-1.85		FT3 2.3-4.2	TT4 4.5-12.0	T3 UP .6-1.27	FSH 0-20	LH 0-20	OTHER COMMENTS	TSH's	FT4's	T3U's	TT4
PREGNANT *AVERAGE*		3.3	<<<<	2.53	0.76			9.6								
NON PREG *AVERAGE*		4.6	<<<<	3.71	0.81			7.3								
PREG+NON *AVERAGE*		3.9	<<<<	3.03	0.78			9.0	0.17							
PREG-NON *DIFFERENCE*	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	*-1.3*	>>>>	*-1.18*	*-0.05*		>>>>	*2.3*	2.53							
[Preg<20wk-NON] *DIFF*	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	*0.3*	>>>>	*0.33*	*0.13*		>>>>	*-1.6*				<20 weeks HCG effect maintains FT4?				
[Preg>20wk-NON] *DIFF***	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	*-1.8*	>>>>	*-1.77*	*-0.12*		>>>>	*3.5*				<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<|||||||||||||||||||				
	[Preg<20wk->20wk] *DIFF* =	*1.5*	>>>>	*2.10*	*0.25*		>>>>	*-5.1*								
[PregTSH<2-NON] *DIFF*	>>>>>>>>>>>>>>>>>>> [<2-NON] =	*-2.4*	>>>>	*-2.41*	*-0.11*		>>>>	*3.1*								
[PregTSH>2-NON] *DIFF*	>>>>>>>>>>>>>>>>> [>2-NON] =	*0.3*	>>>>	*0.35*	*0.02*		>>>>	*1.4*								

Table 1 non-pregnant

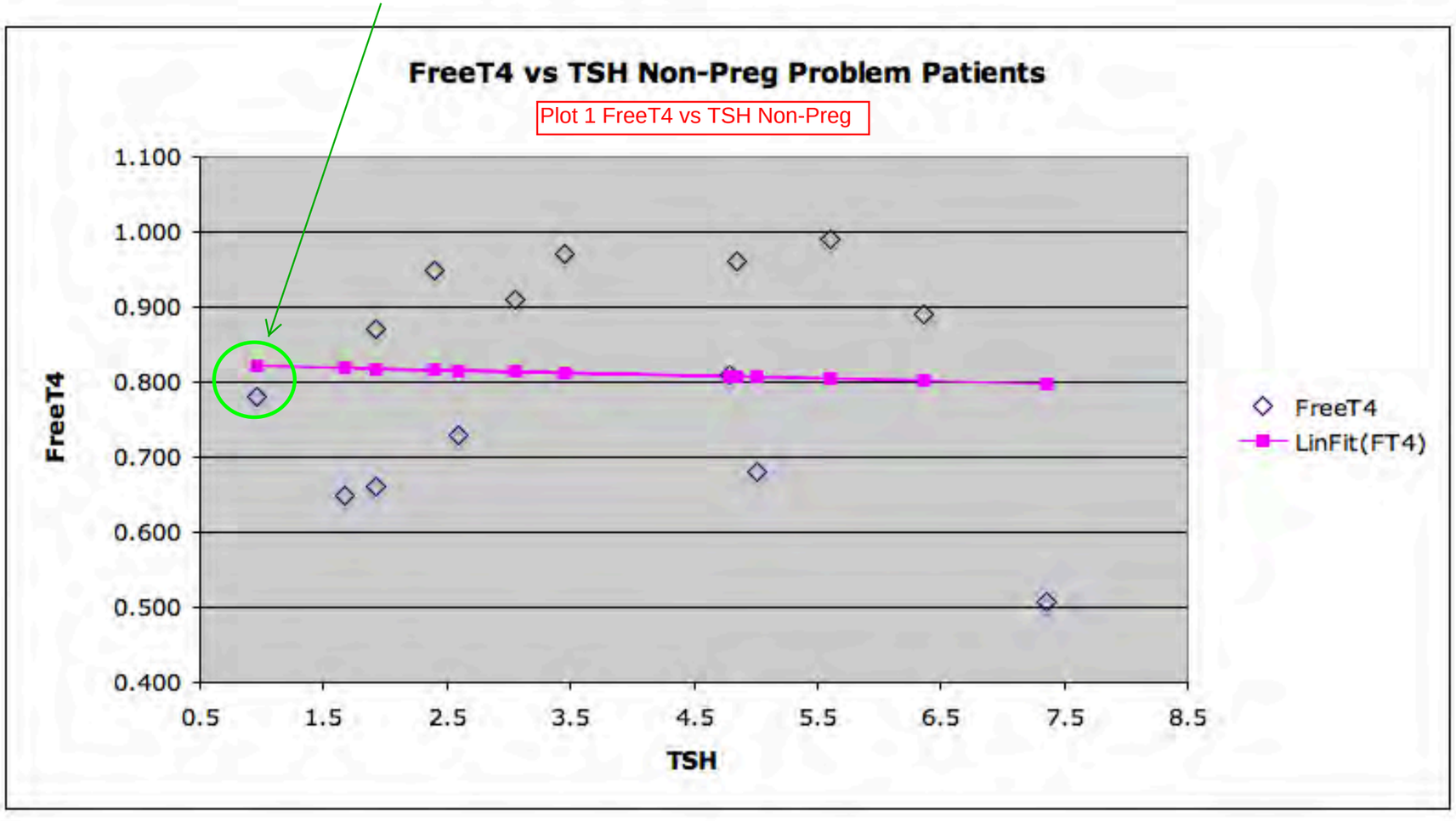
TABLE 2 Non-Pregnant Problem Patients

Above is the tabulation of patients with clinical problems, lab values and treatment comments. Averages and Differences for patients 20-41 weeks of Pregnancy and Non-Pregnancy are calculated. Five additional patients at 4-8 weeks Gestation (presenting with spontaneous miscarriage) are also tabulated.

Table 1,2 Description

	TSH	FreeT4	LinFit(FT4)	
1	7.35	0.506	0.798	-0.292
	1.67	0.650	0.819	-0.169
	1.93	0.660	0.818	-0.158
	5.01	0.680	0.806	-0.126
	2.59	0.730	0.815	-0.085
	0.96	0.780	0.821	-0.041
	4.79	0.810	0.807	0.003
	1.92	0.870	0.818	0.052
	6.36	0.890	0.802	0.088
	3.06	0.910	0.814	0.096
	2.40	0.950	0.816	0.134
	4.85	0.960	0.807	0.153
	3.46	0.970	0.812	0.158
14	5.61	0.990	0.804	0.186

Correl=	-0.047902
t=r*sqrt[(n-2)/(1-r*r)] =	-0.16613
FreeT4avg=	0.811



$$FreeT4 = 0.825 - 0.004 * TSH$$

from TSH = 1 setpoint

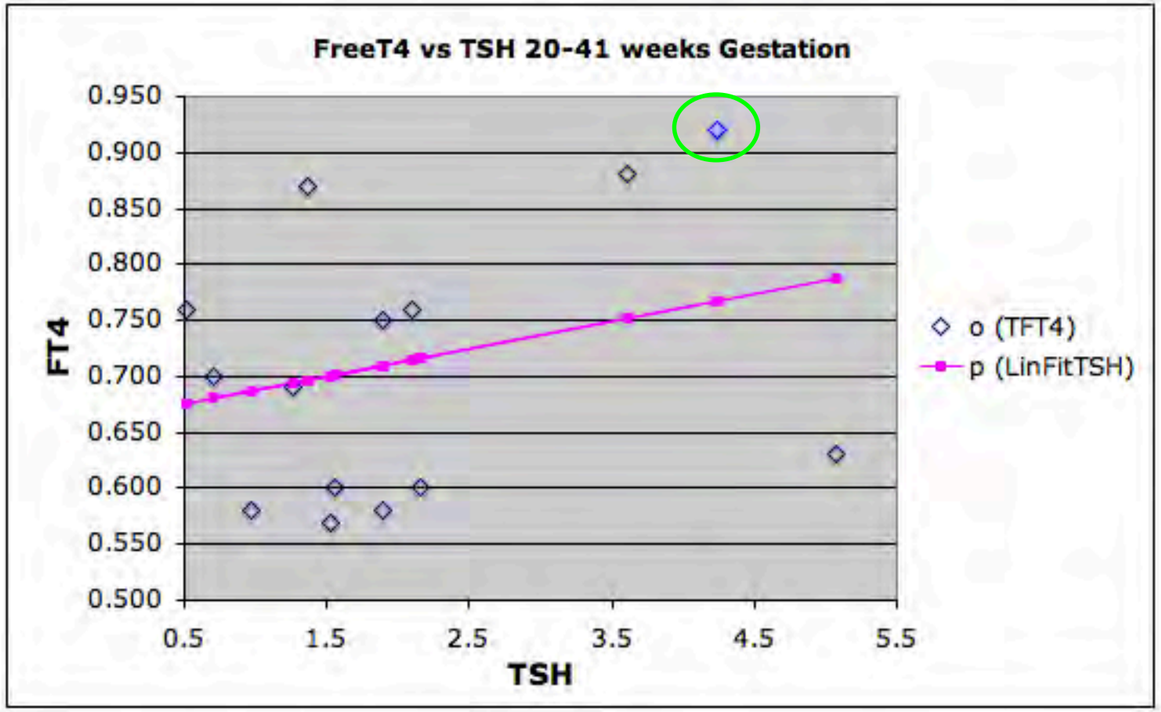
from delta TSH modulation about setpoint

	F (TSH)	o (TFT4)	p (LinFitTSH)
34	1.52	0.570	0.701
32	1.9	0.580	0.710
37	0.97	0.580	0.687
27	1.56	0.600	0.702
40	2.16	0.600	0.716
35	5.08	0.630	0.787
32	1.26	0.690	0.694
33	0.70	0.700	0.681
32	1.90	0.750	0.710
29	0.51	0.760	0.676
40	2.10	0.760	0.715
34	1.37	0.870	0.697
20	3.61	0.880	0.751
41	4.24	0.920	0.767

correl= 0.284337

t=r*sqrt[(n-2)/(1-r*r)] = 1.027377

FreeT4avg= 0.706



Plot2

PLOT 2,3
FreeT4 vs TSH > 20 weeks

Free T4 vs TSH All Patients

Free T4 = 0.664 + 0.024 * TSH

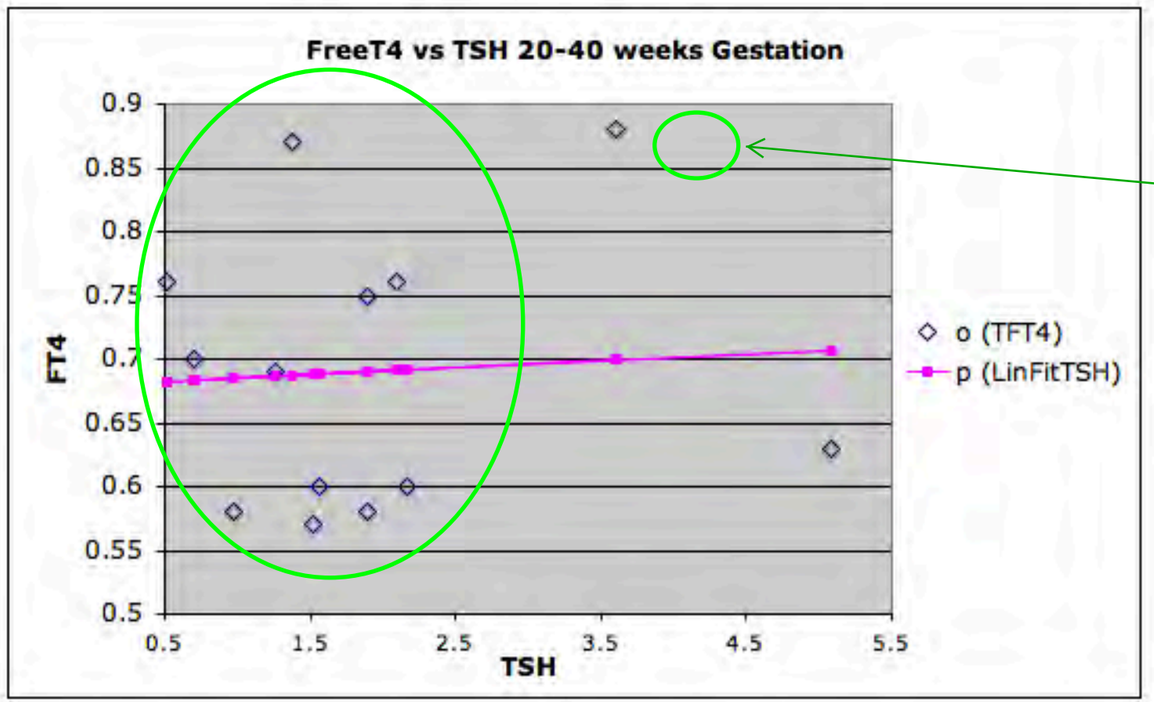
equilibrium?

	F (TSH)	o (TFT4)	p (LinFitTSH)
34	1.52	0.570	0.688
32	1.9	0.580	0.690
37	0.97	0.580	0.685
27	1.56	0.600	0.688
40	2.16	0.600	0.691
35	5.08	0.630	0.707
32	1.26	0.690	0.687
33	0.70	0.700	0.684
32	1.90	0.750	0.690
29	0.51	0.760	0.683
40	2.10	0.760	0.691
34	1.37	0.870	0.687
20	3.61	0.880	0.699

correl= 0.061398

t=r*sqrt[(n-2)/(1-r*r)] = 0.20402

FreeT4avg= 0.690



Plot3

Free T4 vs TSH Omitting 41 week patient

Free T4 = 0.680 + 0.005 * TSH

Shown above is FreeT4 vs TSH for the Non-Pregnant, and Pregnant patients at 20-41 weeks. Regression lines are shown, and no significant correlation is noted (particularly for TSH < 2.0).

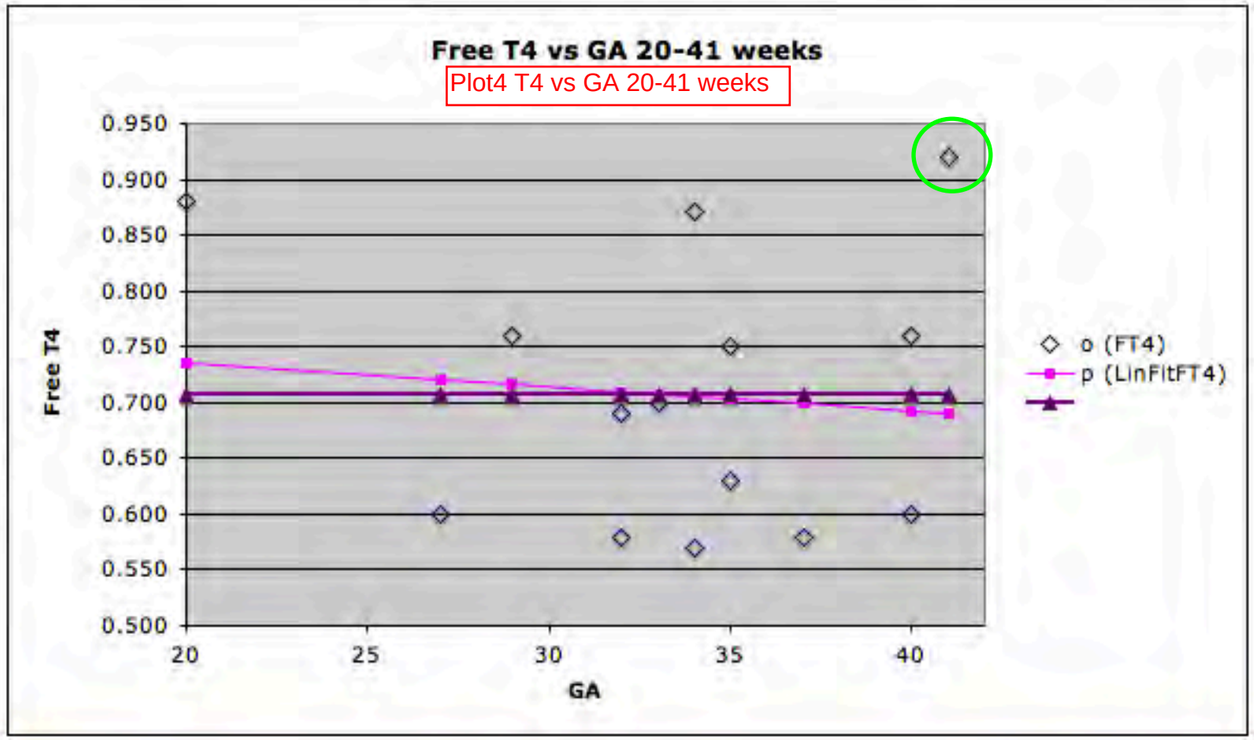
Plot2,3 Description

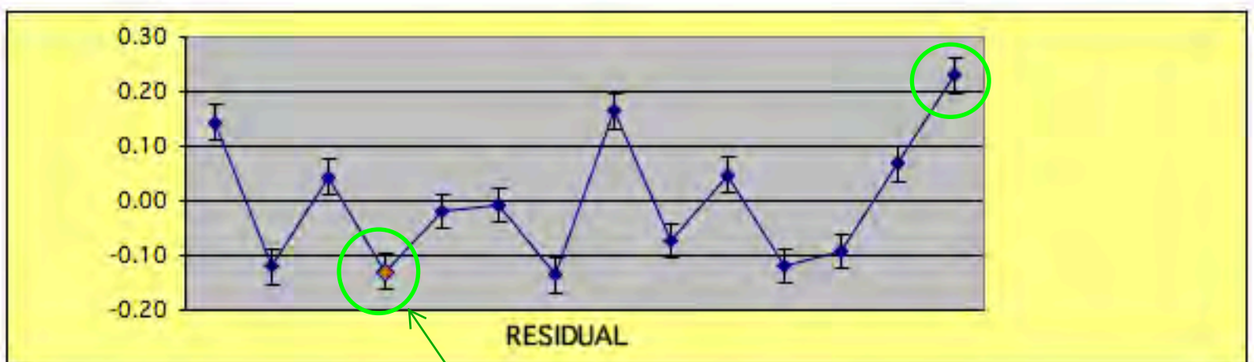
	F (GA)	o (FT4)	p (LinFitFT4)	
1	20	0.880	0.736	0.706
	27	0.600	0.721	0.706
	29	0.760	0.716	0.706
	32	0.580	0.710	0.706
	32	0.690	0.710	0.706
	33.00	0.700	0.708	0.706
	34.00	0.570	0.705	0.706
	34.00	0.870	0.705	0.706
	35.00	0.630	0.703	0.706
	35.00	0.750	0.703	0.706
	37.00	0.580	0.699	0.706
	40.00	0.600	0.692	0.706
	40.00	0.760	0.692	0.706
14	41.00	0.920	0.690	0.706

correl=	-0.10184
t=r*sqrt[(n-2)/(1-r*r)] =	-0.35464
FreeT4avg=	0.706

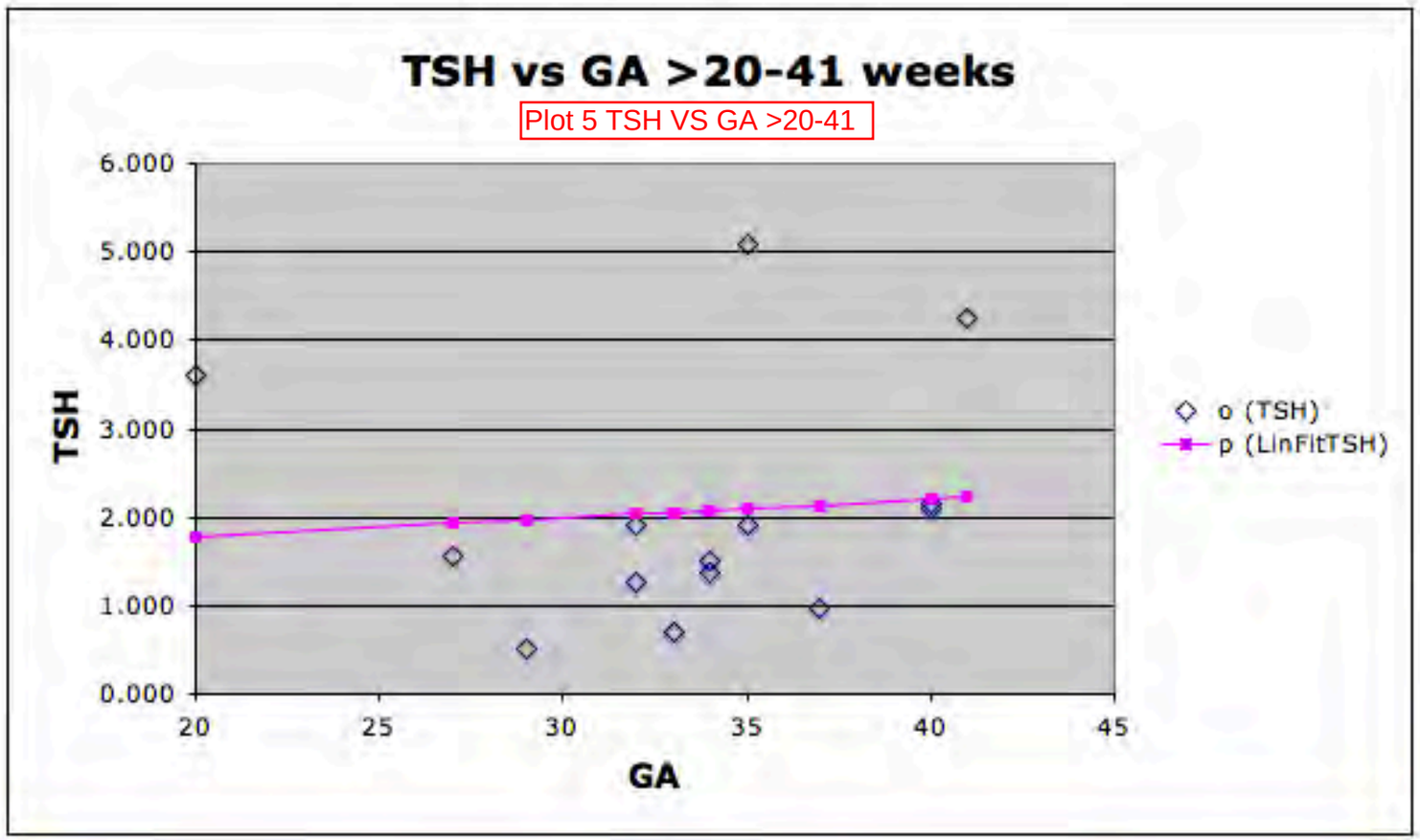
Free T4 = 0.780 - .002 * TSH

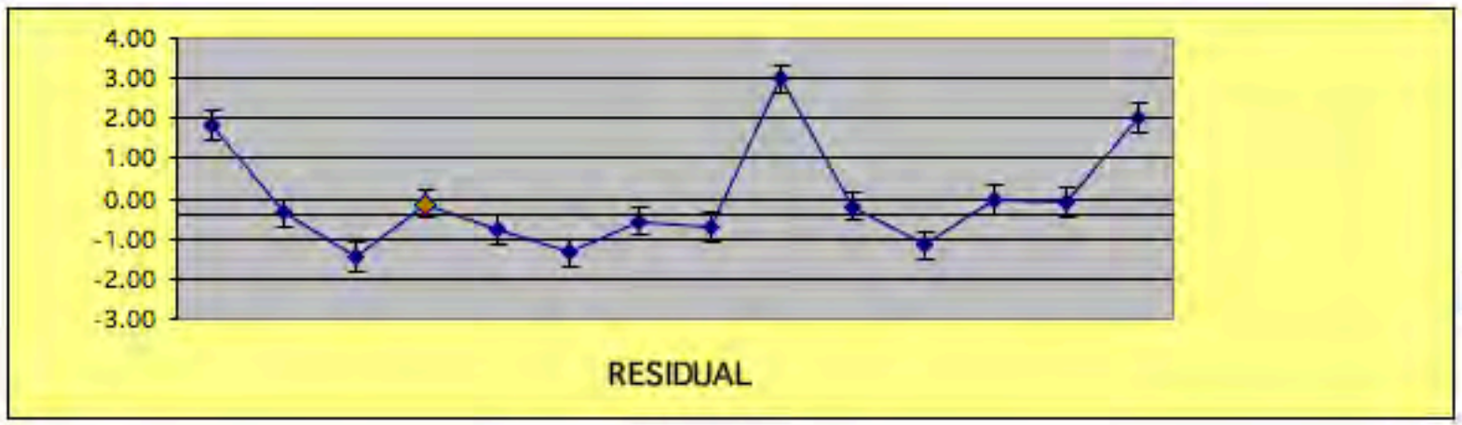
constant





	F (FT4)	o (TSH)	p (LinFitTSH)
1	20	3.610	1.780
	27	1.560	1.927
	29	0.510	1.969
	32	1.900	2.031
	32	1.260	2.031
	33.00	0.700	2.052
	34.00	1.520	2.073
	34.00	1.370	2.073
	35.00	5.080	2.094
	35.00	1.900	2.094
	37.00	0.970	2.136
	40.00	2.160	2.199
	40.00	2.100	2.199
14	41.00	4.240	2.220
		correl=	0.087
		t=r*sqrt[(n-2)/(1-r*r)]	0.277
		TSHavg=	2.063





Plot 5 TSH VS GA >20-41Description

Above is the Plot of FreeT4 and TSH vs Gestational Age (GA) for 20-41 weeks of Pregnancy with regressions lines. No significant correlation is noted for either with Gestational Age, and the data is well represented by the Mean values.

not important for

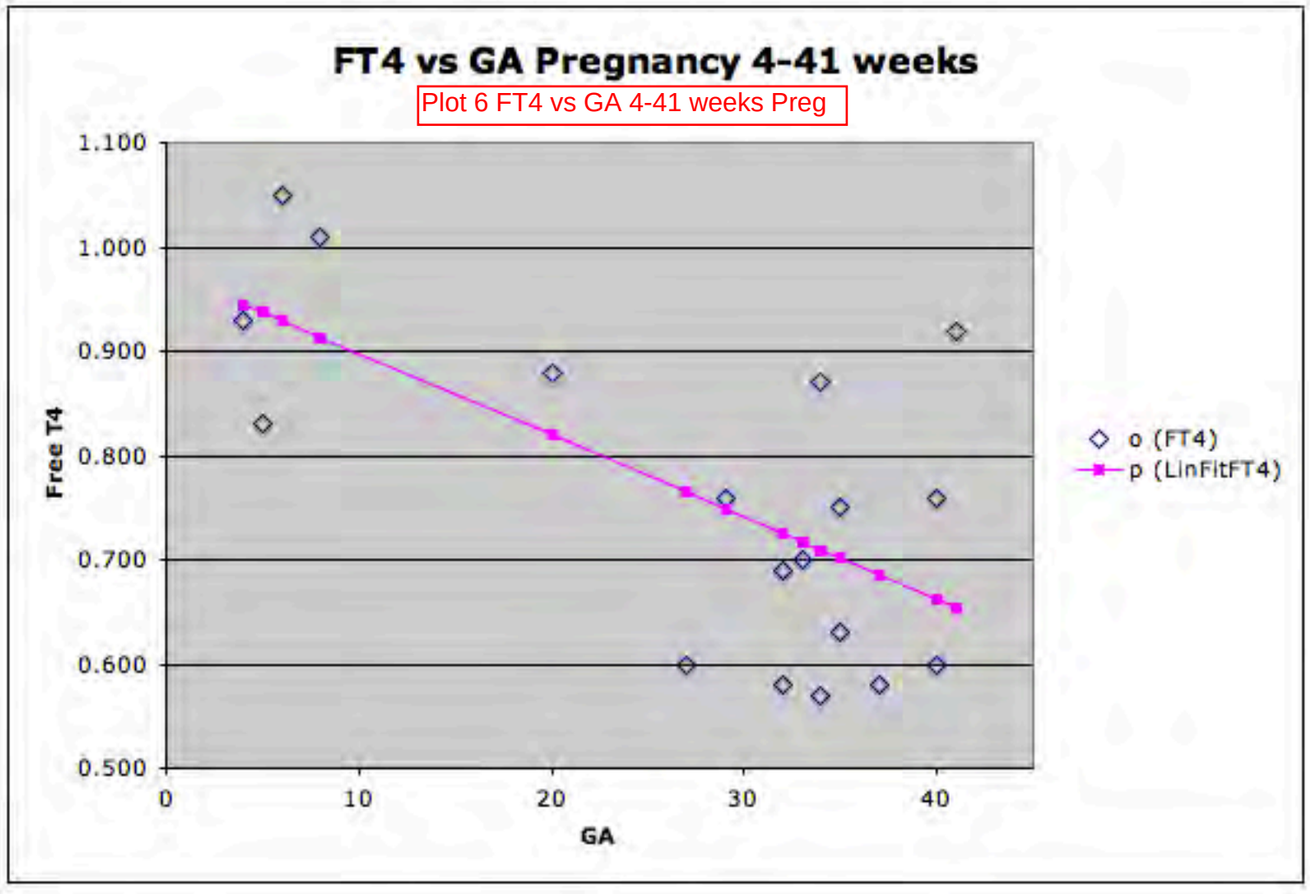
In an effort to better understand these findings, a regression fit was performed including early pregnancies 4-8 weeks. They represent Spontaneous Miscarriages. When these are included, the regression from 2-41 weeks indicates a global decrease in FreeT4 with Gestational Age from early to late pregnancy, contrary to the findings for 20-41 weeks, and consistent with reports in the literature. below

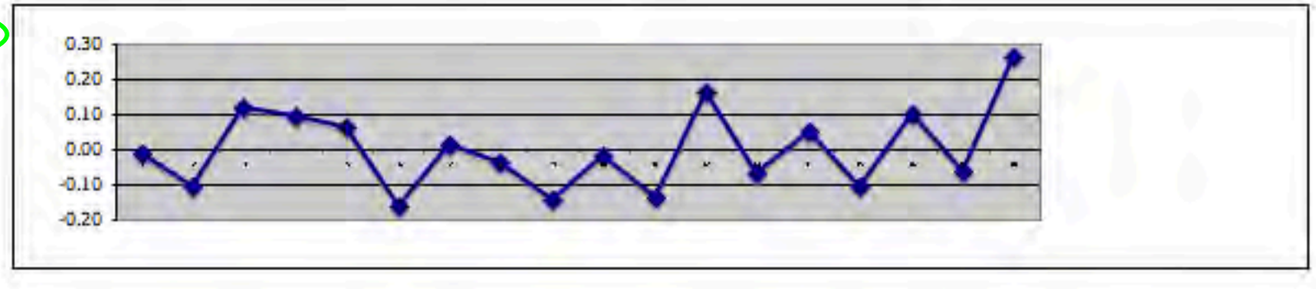
Plot 6 FT4 vs GA 4-41 weeks Preg Description

	GA	o (FT4)	p (LinFitFT4)
	4	0.930	0.945
	5	0.830	0.937
	6	1.050	0.929
	8	1.010	0.913
1	20	0.880	0.819
	27	0.600	0.764
	29	0.760	0.749
	32	0.690	0.725
	32	0.580	0.725
	33.00	0.700	0.717
	34.00	0.570	0.709
	34.00	0.870	0.709
	35.00	0.630	0.701
	35.00	0.750	0.701
	37.00	0.580	0.686
	40.00	0.760	0.662
	40.00	0.600	0.662
14	41.00	0.920	0.654

correl=	-0.64994
t=r*sqrt[(n-2)/(1-r*r)] =	-2.96254
FreeT4avg=	0.762

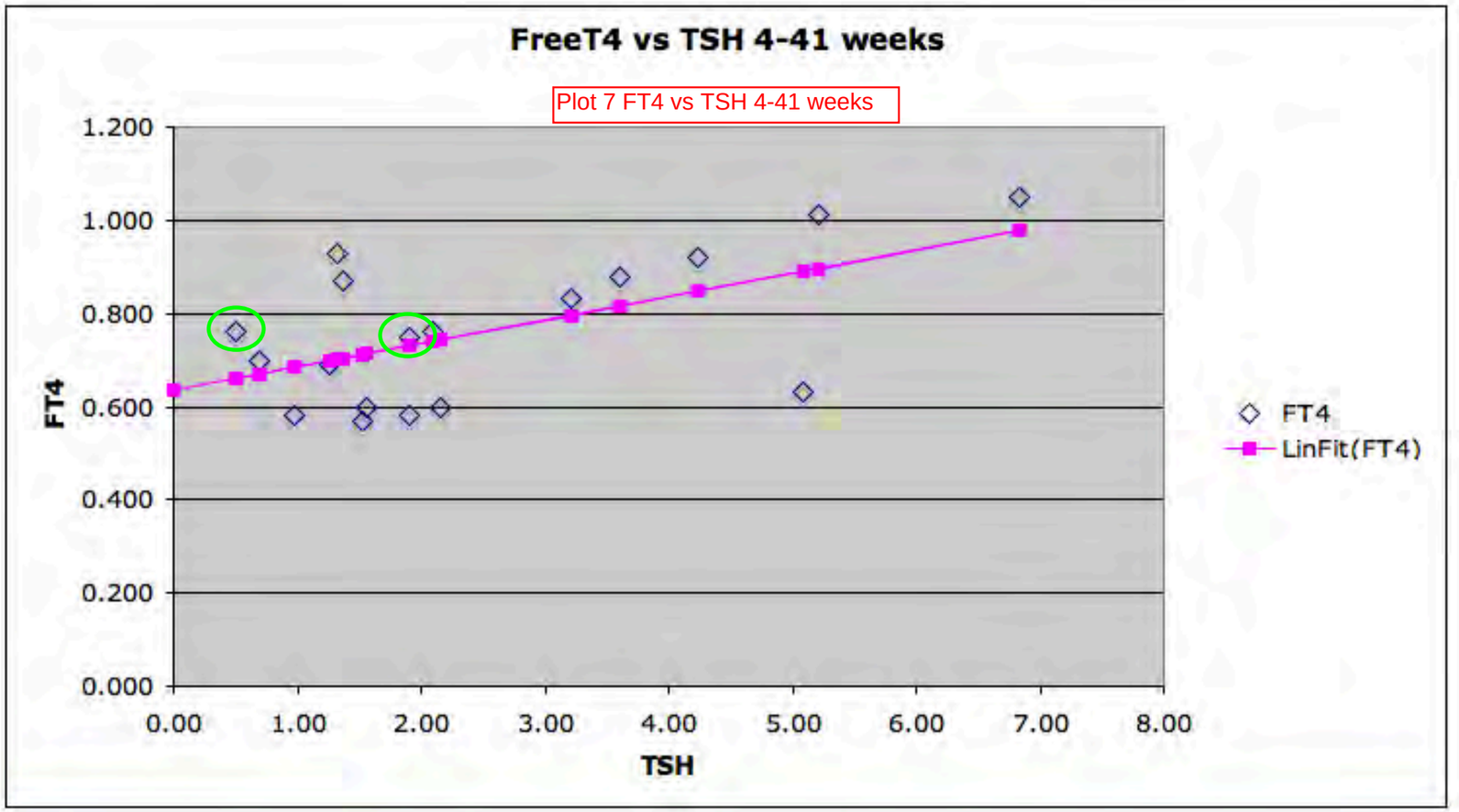
Free T4 = 0.000785 - 0.008 * TSH

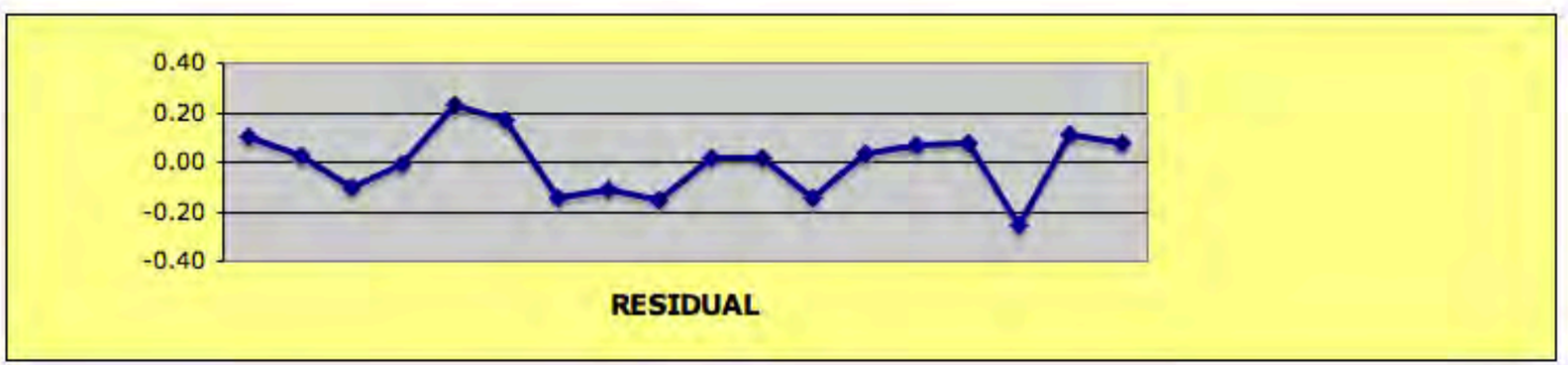




GA	TSH	FT4		LinFit(FT4)
4		0.51	0.760	0.661
5		0.7	0.700	0.670
6		0.97	0.580	0.684
8		1.26	0.690	0.698
20		1.32	0.930	0.701
27		1.37	0.870	0.704
29		1.52	0.570	0.711
32		1.56	0.600	0.713
32		1.9	0.580	0.730
32		1.9	0.750	0.730
33		2.1	0.760	0.740
34		2.16	0.600	0.743
34		3.22	0.830	0.796
35		3.61	0.880	0.816
37		4.24	0.920	0.847
40		5.08	0.630	0.889
40		5.22	1.010	0.896
41		6.84	1.050	0.978
		0		0.635

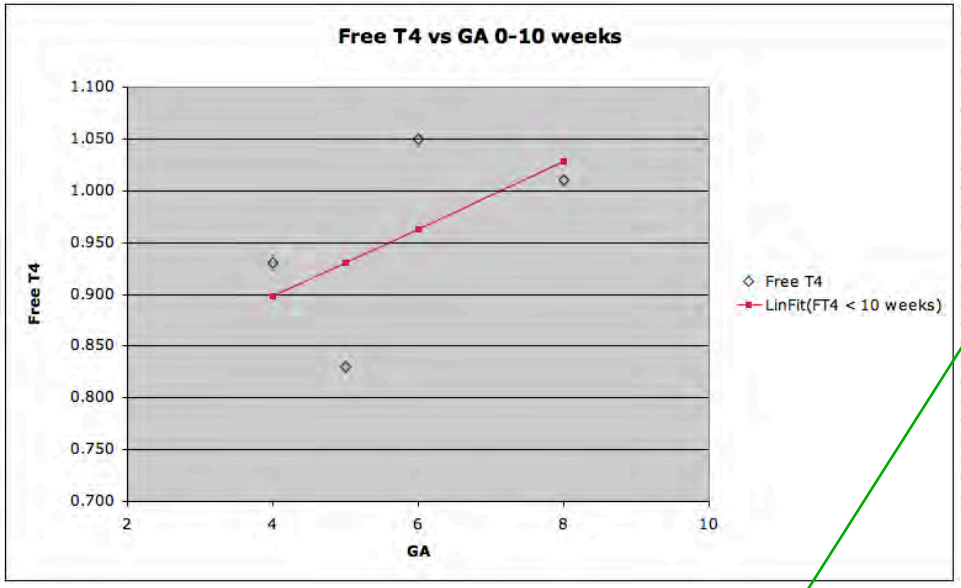
correl=	0.5756
t=r*sqrt[(n-2)/(1-r*r)] =	2.4385
FreeT4avg=	0.762

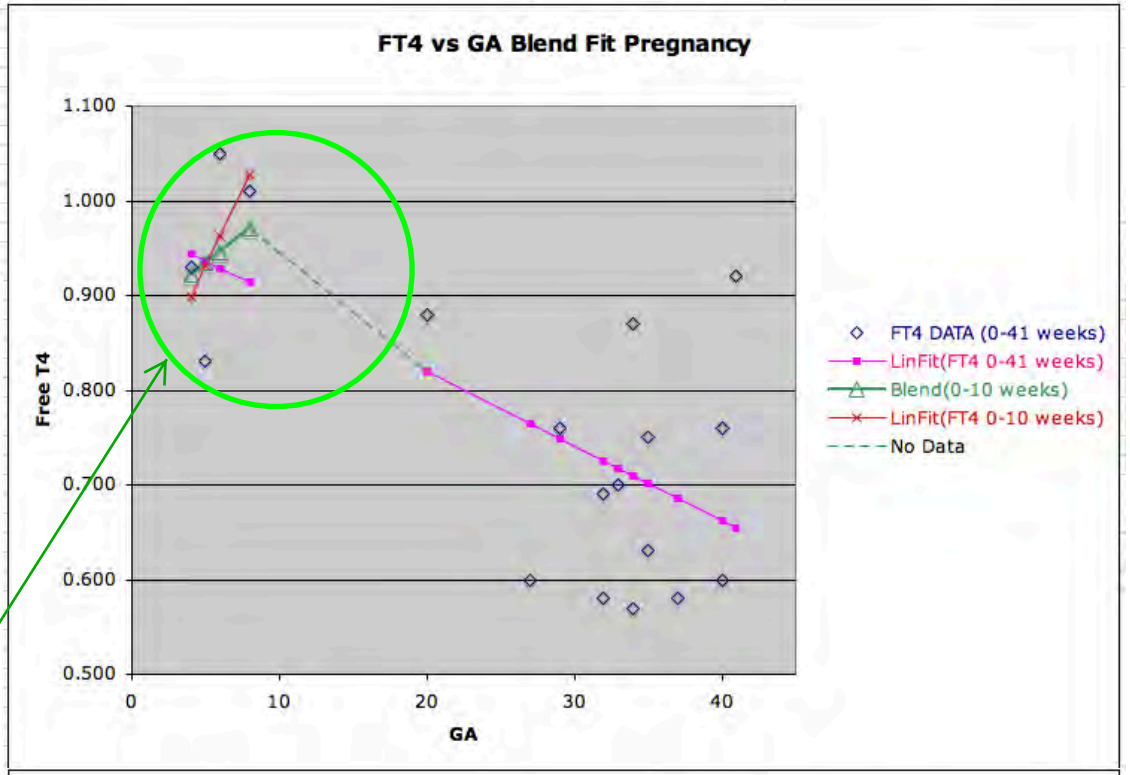


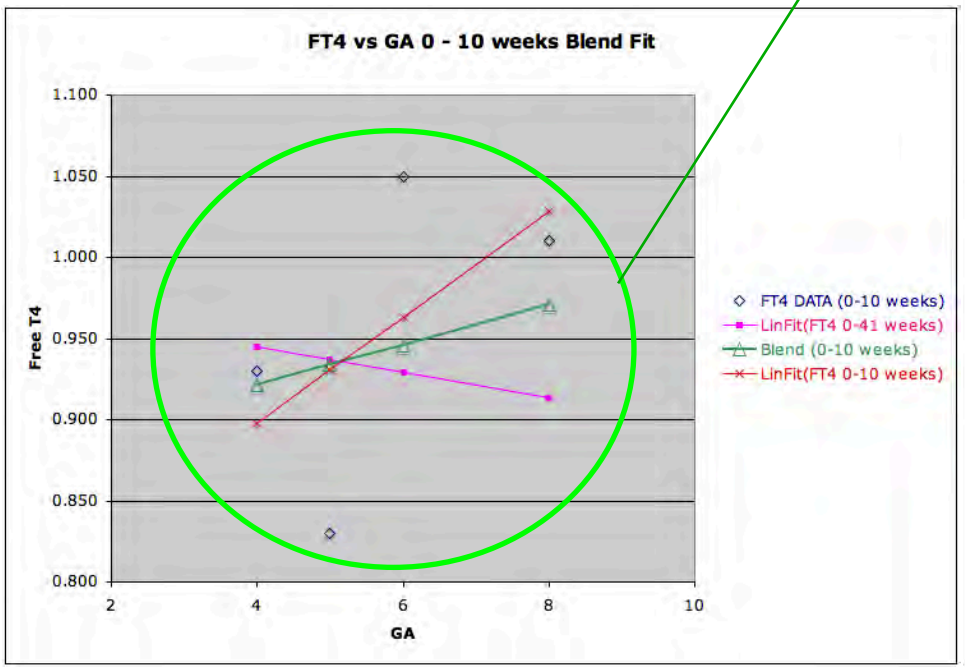


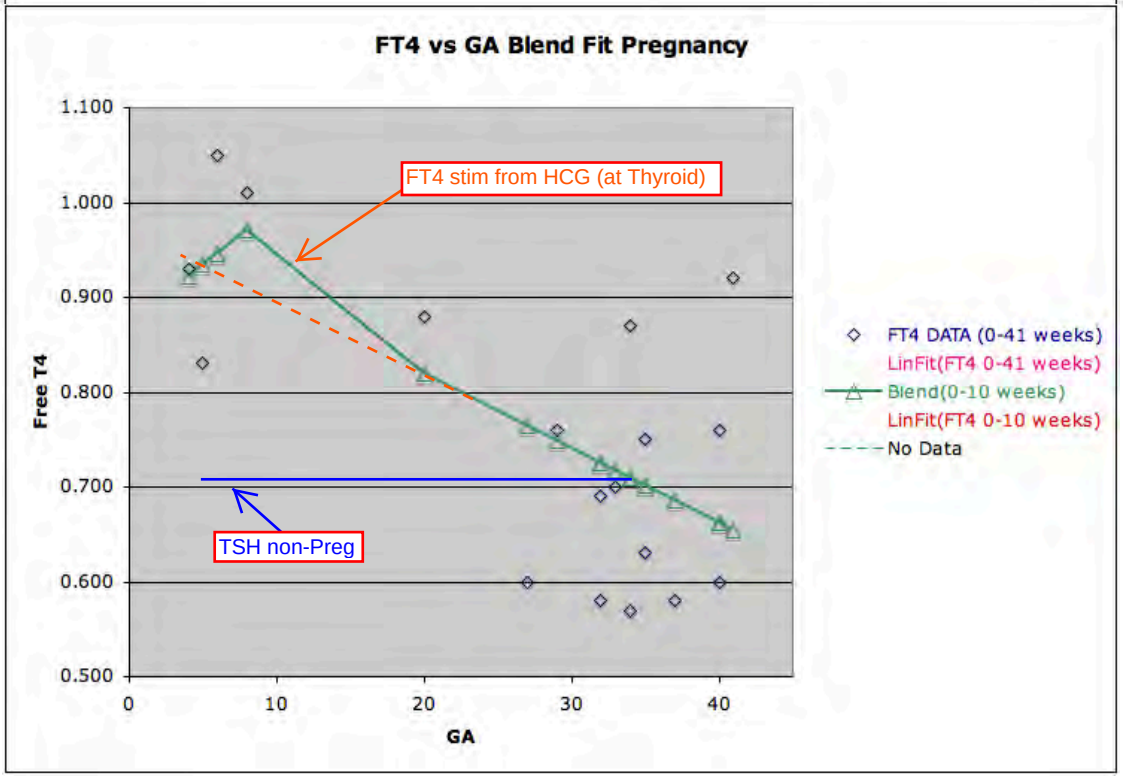
However, a finer look a the data by graphing the Linear Fit <10 weeks Pregnancy with the Linear Fit >20 weeks produces a plot which simulates the data, noting a break at 15 weeks, shown below [Blend Fit]:

Free T4 vs GA 0-41 weeks Blend Fit









Estimation of HCG Stimulation of Free T4 in Early Pregnancy

TSH 0.8 to 1.4
0f 0.6 =.04 FreeT4

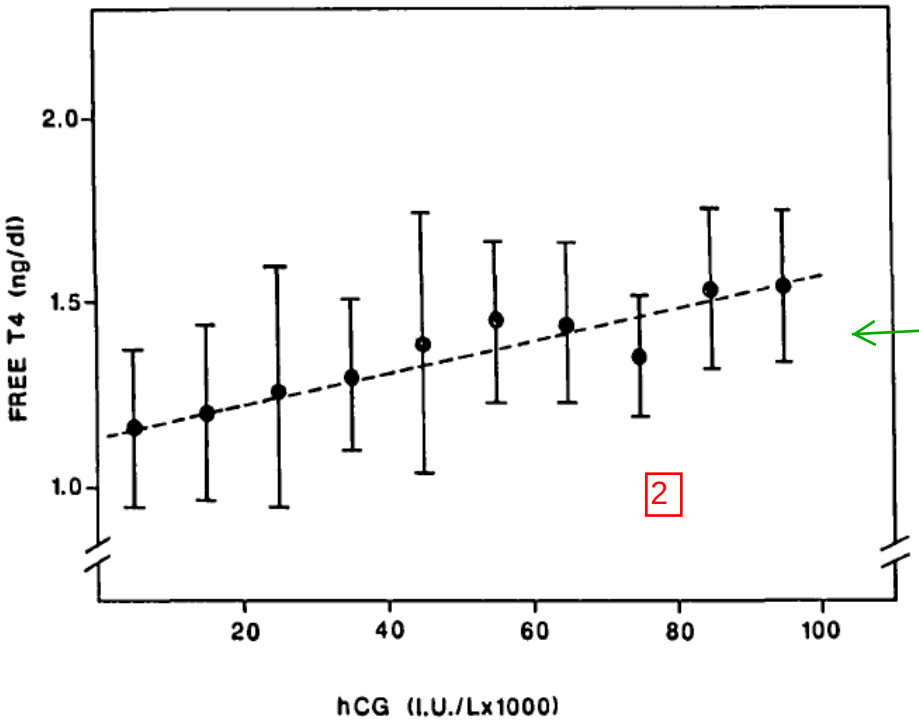


FIG. 7. Scattergram of free T_4 in relation to hCG concentrations. Each *point* represents the mean (±1 SD) free T_4 value, determined between 6-20 weeks gestation, for 10,000 IU/L increments in hCG. The *dashed line* indicates the linear regression curve.

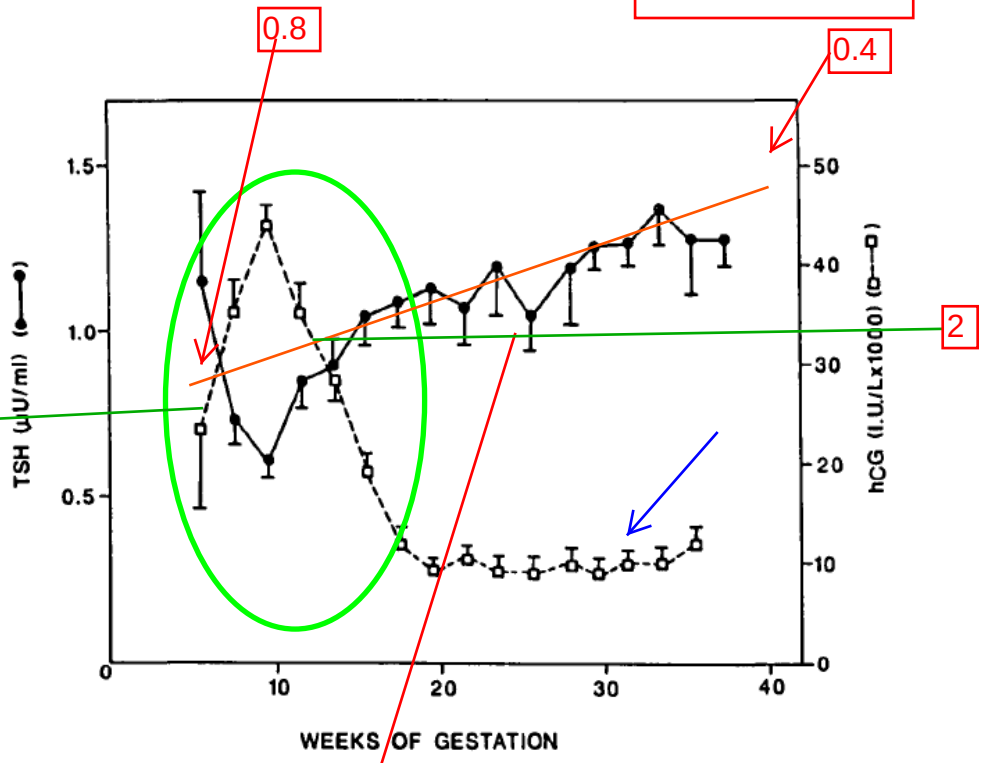


FIG. 6. Serum TSH and hCG as a function of gestational age. Serum hCG was determined at initial evaluation, and TSH at initial evaluation and during late gestation. The symbols give the mean value (±SE) for samples pooled for 2 weeks of gestation. Each *point* corresponds to the average of 33 determinations for hCG and 49 for TSH.

Free T4 is linear with HCG
in Early Pregnancy

Free T4 Stim = $(1.5-1.2) / (1\times10^{-5} * [HCG])$

= $3\times10^{-6} * HCG$

HCG changes with GA, peaking at
10 weeks, and decreasing to
a constant after 20 weeks

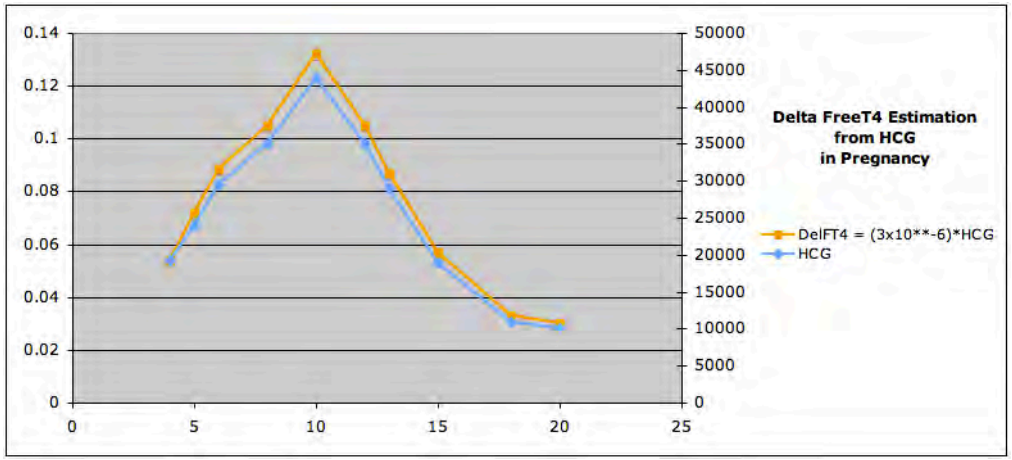
(adapted from Glinoer et al 1990)

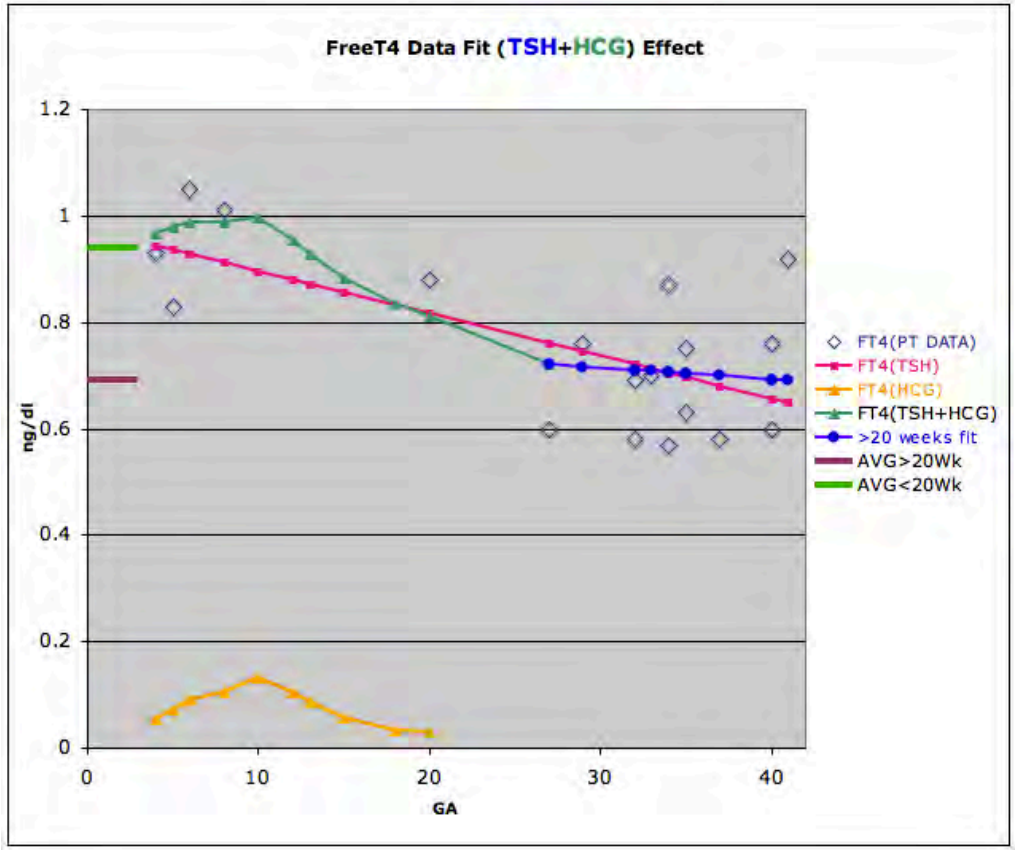
FreeT4 (preg) = 0.2 - .06TSH

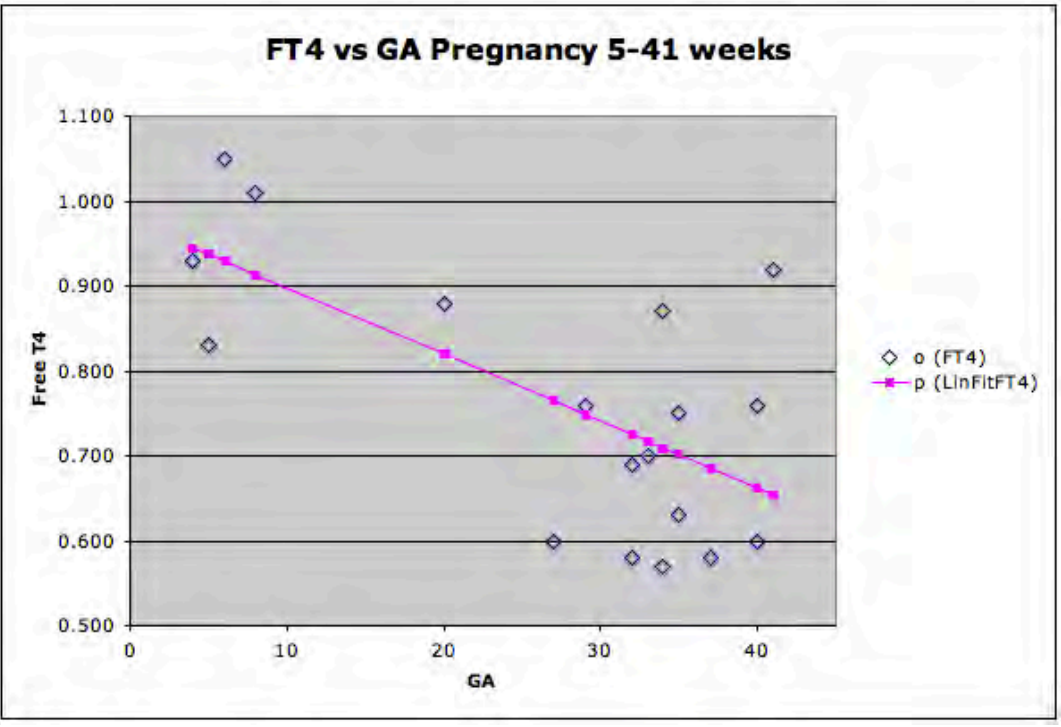
FreeT4 in Early Pregnancy is noted to have a linear relationship with HCG (Glinoer 1990, J. Clin. Endocrinol. Metab. 1990 71: 276-287). From this an expected change in FreeT4 = (1.5-1.2)x10-5 = [$3x10^{-6}$ * HCG] can be estimated. Using the HCG change as a function of Gestational Age, an expected change in FreeT4 with Gestational Age can be estimated. This calculation is plotted below.

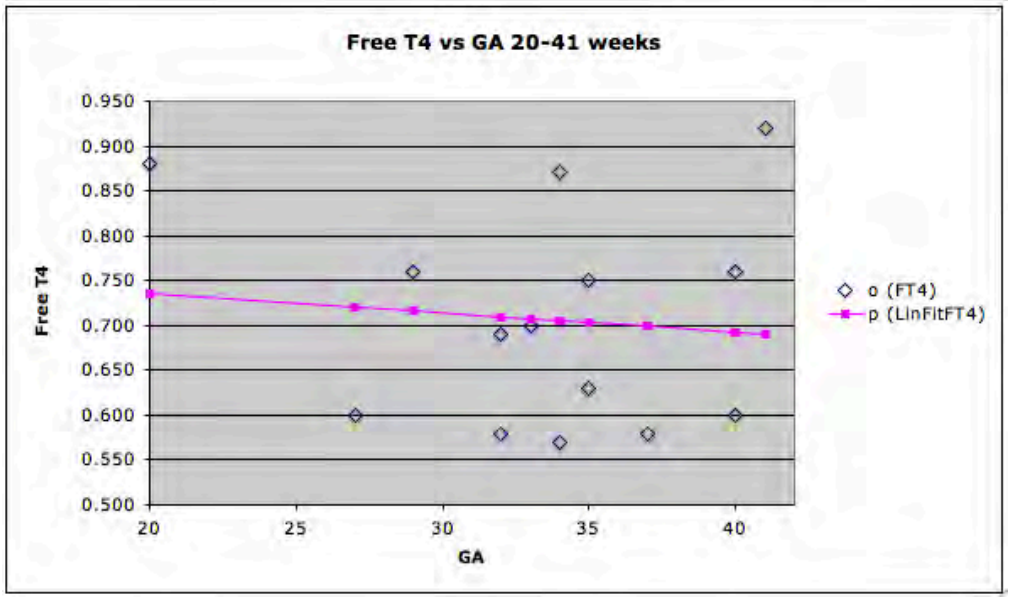
Estimation of Free T4
Adding HCG Stimulation < 20 weeks

Free T4 Linefit + HCG Stim (0-20 weeks)
Free T4 Linefit (20-41 weeks)









Estimation of Free T4
Adding HCG Stimulation < 20 weeks

Free T4 Linefit + HCG Stim (0-20 weeks)

Free T4 Linefit (20-41 weeks)

FT4 = -logTSH

1NP = 0.825

4delP= -0.1

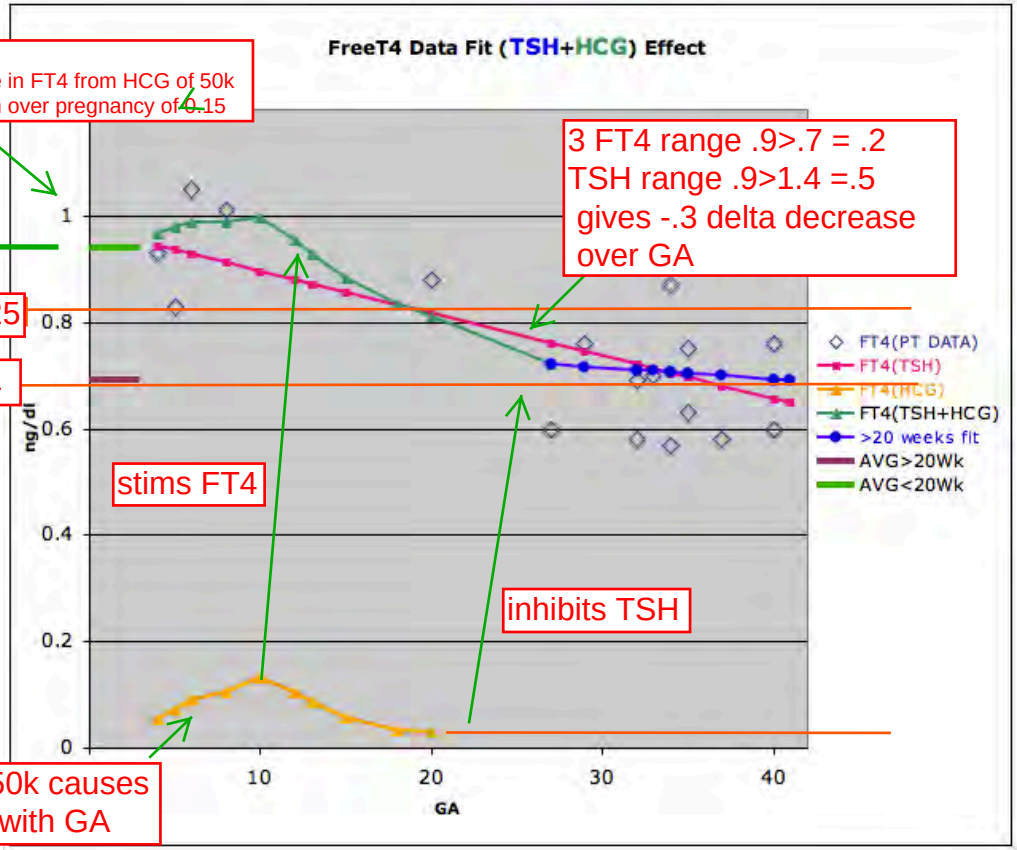
5 Preg = 1
shift increase in FT4 from HCG of 50k
constant stim over pregnancy of 0.15

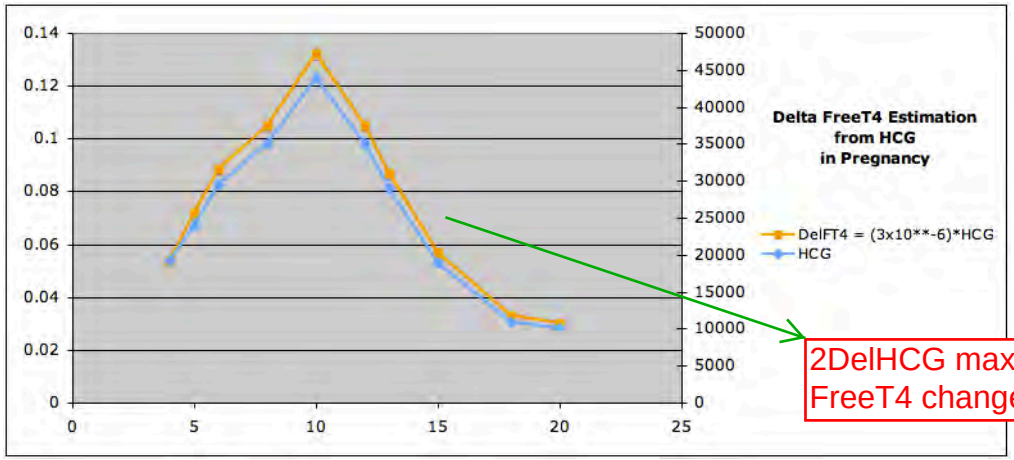
3 FT4 range .9>.7 = .2
TSH range .9>1.4 =.5
gives -.3 delta decrease
over GA

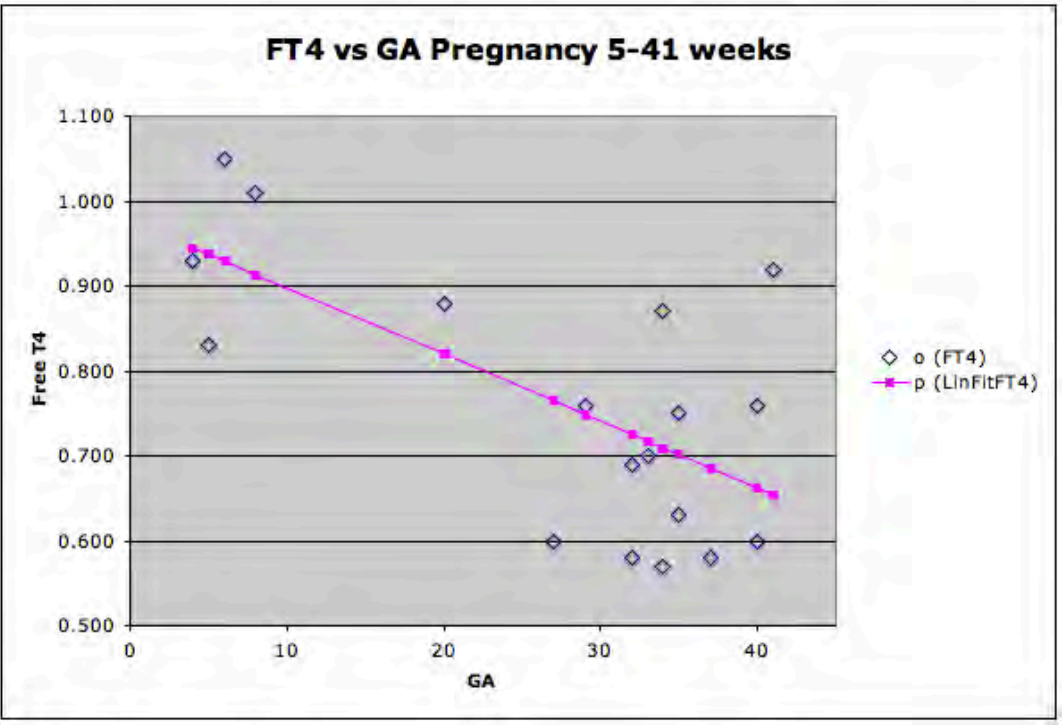
stims FT4

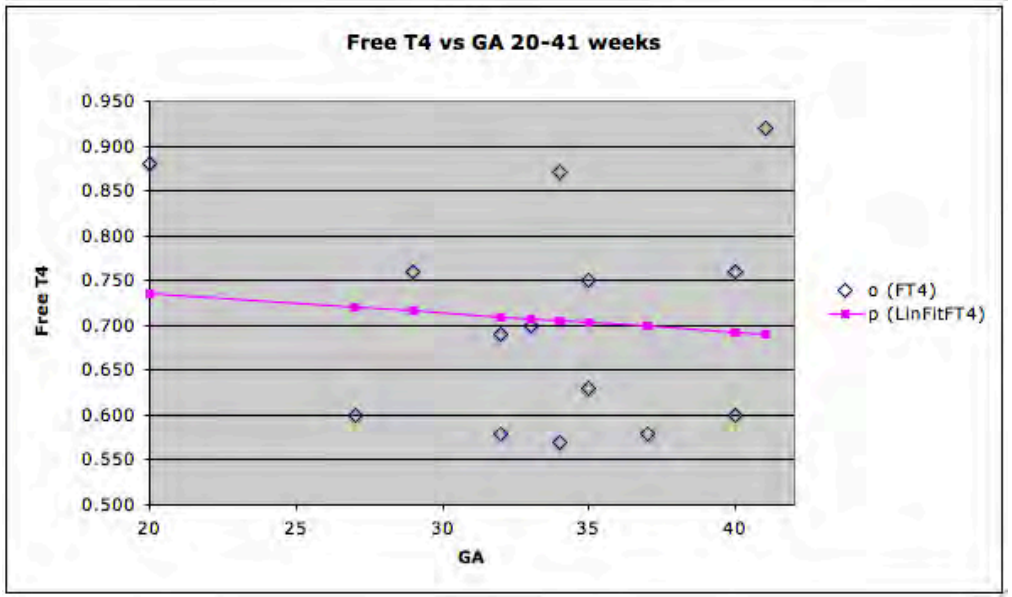
inhibits TSH

2DelHCG max 50k causes
FreeT4 change with GA



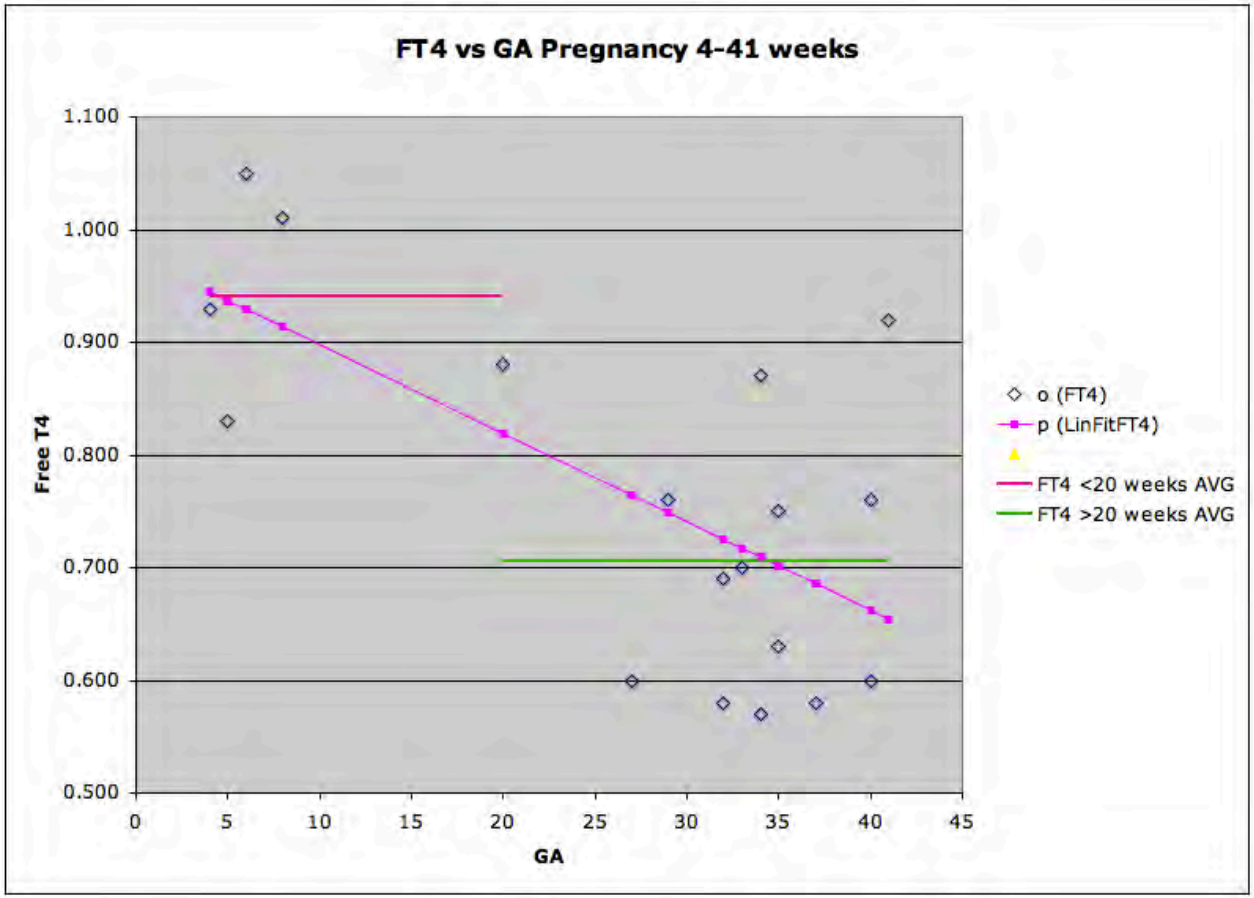


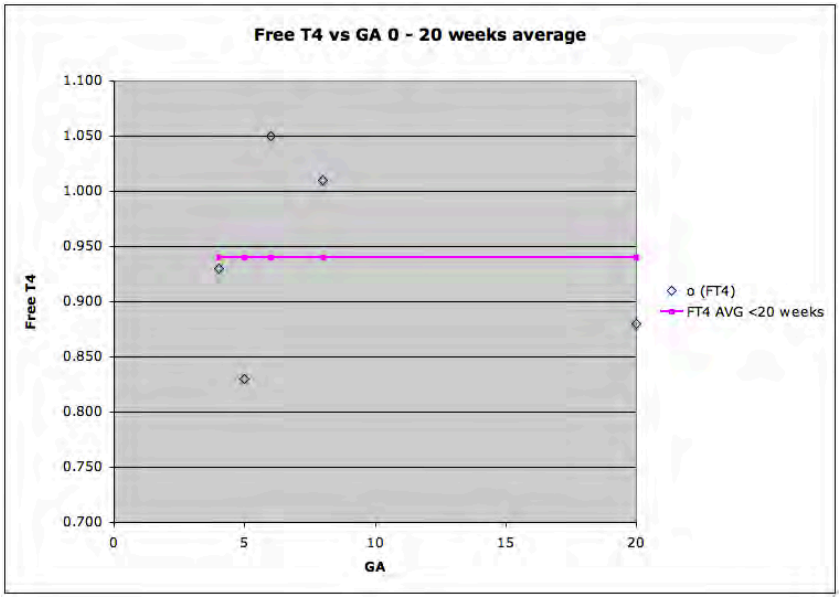


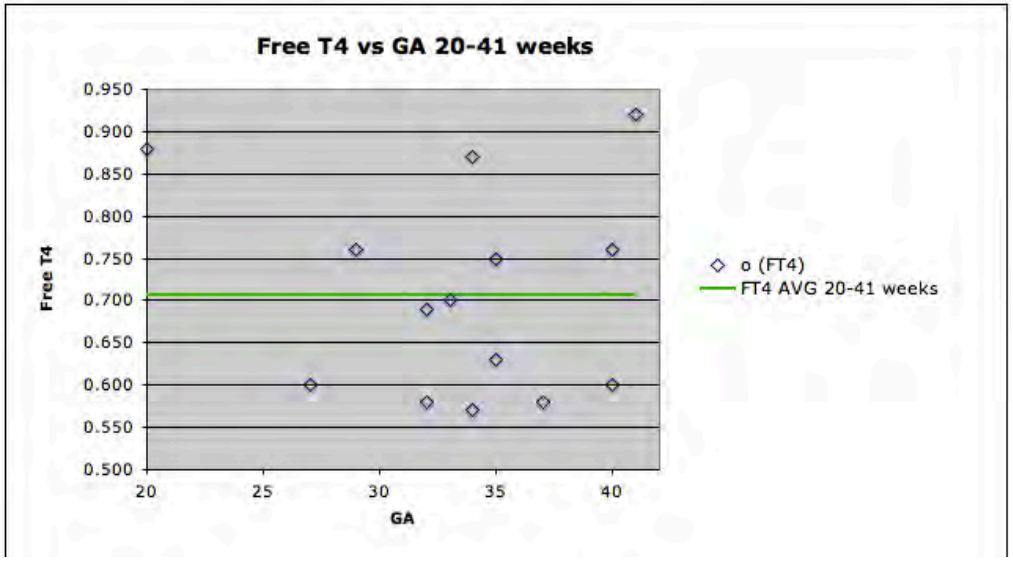


The above left graph is the estimated change in FreeT4 due to HCG in early pregnancy. When this is added to the global regression fit from 2-41 weeks, the result is a graph that approximates the data <20 weeks. This is shown at the top right above, combined with the values from the linear fit for 20-41 weeks previously shown (lower right above).

Free T4 vs GA Pregnancy
Split Fit at 20 weeks







The graph above plots the average FreeT4 for 2-20 weeks and 20-41 weeks with the patient data. Note that the difference in the means is ~0.23 ng/dl. This may provide a useful simplified approachto evaluating and treating pregnant patients with thyroid dysfunction.

The graph above plots the average FreeT4 for 2-20 weeks and 20-41 weeks with the patient data. Note that the difference in the means is ~0.23 ng/dl. This may provide a useful simplified approachto evaluating and treating pregnant patients with thyroid dysfunction.

CONCLUSION

The data presented supports the idea that FreeT4 levels in Pregnancy may be modeled by the contributions of several components:

FreeT4Pregnancy = 1 FreeT4NonPreg = +.9 ng/dl = (-.06)(logTSH) Setpoint at Pituitary
4 +TSHstim = +0.2 ng/dl = (-logTSH) Setpoint at Pituitary
2 + HCGsuppress = - TSH DelPreg setpoint at Pituitary; = -0.2 from HCG suppress
3 + HCGstim = +.2 ng/dl (HCG on Setpoint at Thyroid)
5 + FreeT4suppress = -0.06 (FT4 supress at Pituitary)

FreeT4NonPreg = Free Thyroxine Levels of the non-pregnant patient
TSHstimulation = TSH stimulation of FT4 (?Pituitary)
TSHsuppression = HCG suppression of TSH (?Pituitary)
HCGstim = HCG stimulation of FreeT4 (?Thyroid)

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University of Illinois, Urbana, USA