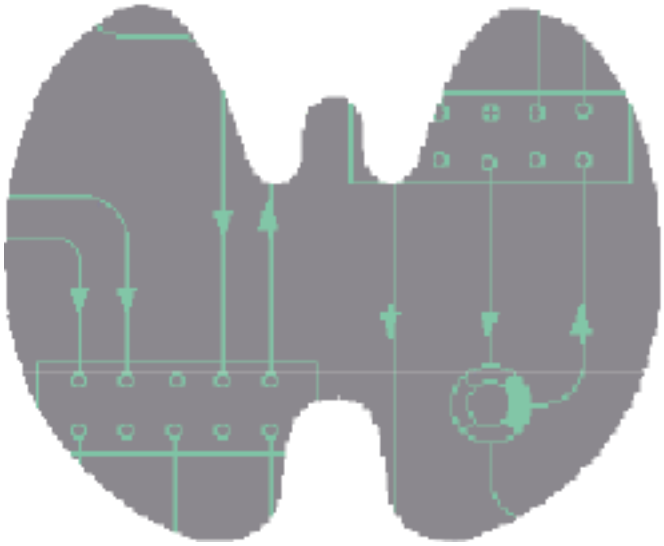
SPINA Thyr 3.3

Short introduction



Johannes W. Dietrich

Documentation version 3.3.1
Last Change: 2013-03-11, 19:14:33

SPINA (structure parameter inference approach) is a method for calculating constant structure parameters of endocrine feedback control systems *in vivo* from hormone levels that have been obtained from serum or plasma specimens. The method is based on mathematical and cybernetic modelling of processing structures [1, 2].

A first successful implementation applies to evaluation of thyroid function. It allows for calculating the thyroid's maximum secretory capacity (G_T) and the sum activity of peripheral 5'-deiodinases (G_D) from levels of TSH, (F)T4 and (F)T3 that have been determined once only (SPINA Thyr).

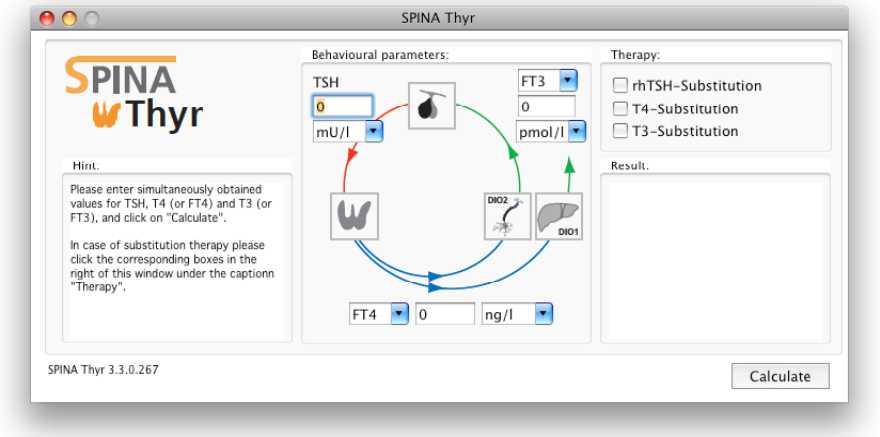
G_T has been demonstrated to correlate with thyroid function [3, 4] and gland volume as obtained via ultrasonography [5]. Its retest reliability is higher than that of TSH, FT4 or FT3 [6].

G_D is reduced in nonthyroidal illness syndrome (NTIS) and increased in states of hyperdeiodination [7, 8].

These structure parameters may therefore contribute to diagnosis of rare or at least less obvious thyroid disorders.

Starting SPINA

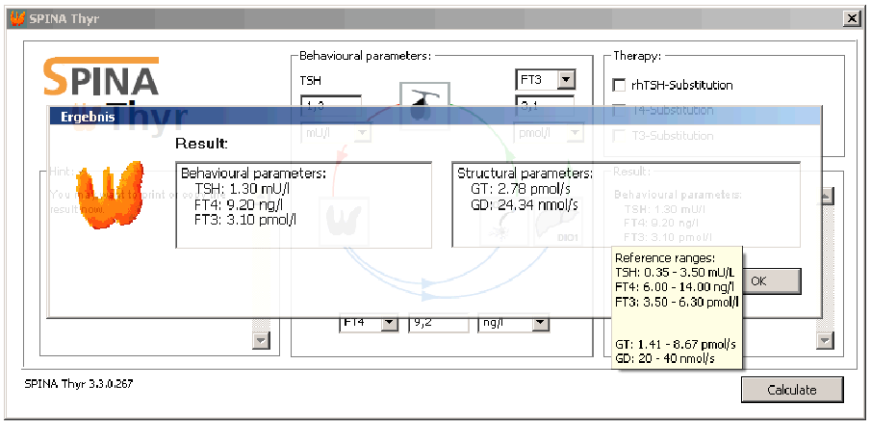
Start SPINA Thyr by double-clicking its icon. After a short while a dialog box asking for hormone values is presented:



When first run SPINA creates a set of new preferences including standard reference values for structure parameters and measurement units.

Calculating

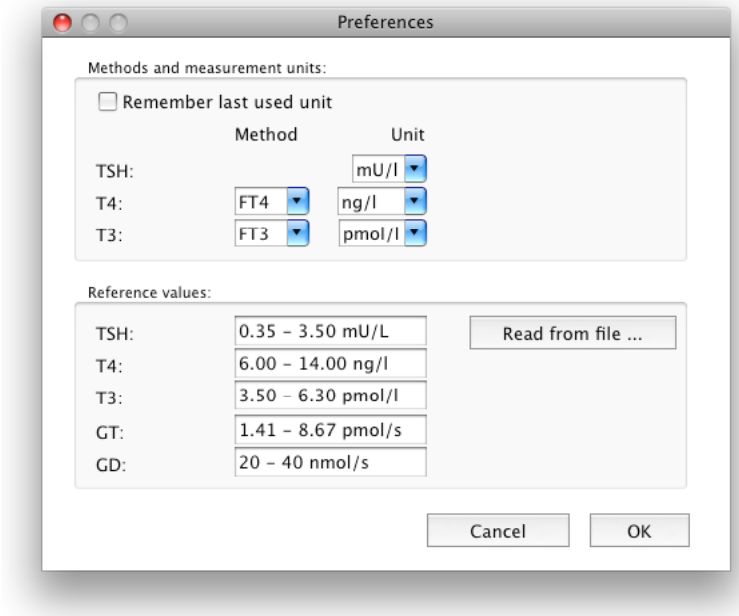
Before using SPINA it is recommended to check and adjust laboratory methods (i.e. free or total hormones) and measurement units as required. Subsequently you may enter hormone values of your patient and click the button labelled **`Calculate`**. This will cause SPINA to calculate structure parameters and to display the results in a dialog box.



You may want to print the results via corresponding commands from the menu bar or the tool button palette.

Preferences

The preferences window (accessible via the application menu on Mac OS X or the edit menu on Windows or Linux) provides you with options to adjust global measurement units. From this window you may also import reference values from XML files according to the CDISC laboratory data model (CDISC LAB Base model version 1.0.1).



Important hints

Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

Calculating G_T in patients that are treated with levothyroxine is of little, if any, value. Likewise it is not recommended to calculate G_D if the patient receives a substitution therapy with liothyronine. It may be interesting, however, to obtain a value for the unaffected structural parameter in affected cases. You may select the appropriate check boxes for substitution therapy in the upper right of the main window in this situation. This causes SPINA Thyr to suppress calculation of parameters that would be misleading.

Usage of SPINA implies that you agree to its license and conditions with respect of the council directive 93/42/EEC of the European Union. This information is available online from http://**spina**.sf.net.

References

1. Dietrich JW, Boehm BO: **Equilibrium behaviour of feedback-coupled physiological saturation kinetics**. In: *Cybernetics and Systems 2006*. Edited by Trappl R, vol. 1. Vienna: Austrian Society for Cybernetic Studies; 2006: 269-274.
2. Dietrich JW, Tesche A, Pickardt CR, Mitzdorf U: **Thyrotropic Feedback Control: Evidence for an Additional Ultrashort Feedback Loop from Fractal Analysis**. *Cybernetics and Systems* 2004, **35**(4):315-331.
3. Dietrich JW: **Thyreotoxische Krise [Thyroid storm]**. *Medizinische Klinik, Intensivmedizin und Notfallmedizin* 2012, **107**(6):448-453.
4. Midgley JE, Hoermann R, Larisch R, Dietrich JW: **Physiological states and functional relation between thyrotropin and free thyroxine in thyroid health and disease: in vivo and in silico data suggest a hierarchical model**. *Journal of clinical pathology* 2013.
5. Dietrich JW: **Der Hypophysen-Schilddrüsen-Regelkreis. Entwicklung und klinische Anwendung eines nichtlinearen Modells**, vol. 2. Berlin: Logos-Verlag; 2002.
6. Dietrich JW, Landgrafe G, Fotiadou EH: **TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis**. *Journal of thyroid research* 2012, **2012**:351864.
7. Liu S, Ren J, Zhao Y, Han G, Hong Z, Yan D, Chen J, Gu G, Wang G, Wang X *et al*: **Nonthyroidal illness syndrome: is it far away from Crohn's disease?** *Journal of clinical gastroenterology* 2013, **47**(2):153-159.
8. Rosolowska-Huszcz D, Kozlowska L, Rydzewski A: **Influence of low protein diet on nonthyroidal illness syndrome in chronic renal failure**. *Endocrine* 2005, **27**(3):283-288.

Contact

Dr. Johannes W. Dietrich, M.D., Bergmannsheil University Hospitals, Ruhr University of Bochum, Bürkle-de-la-Camp-Platz 1, D-44789 Bochum, NRW, Germany

More information and a comprehensive manual are available from http://**spina**.sf.net.