# Package 'SPINA'

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**Title** Structure Parameter Inference Approach

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**Description** Calculates constant structure parameters of endocrine homeostatic systems from equilibrium hormone concentrations. Methods and equations have been described in Dietrich et al. (2012) <doi:10.1155/2012/351864> and Dietrich et al. (2016) <doi:10.3389/fendo.2016.00057>.

**License** BSD_3_clause + file LICENSE

**Depends** R (>= 3.0.0)

**URL** http://spina.sf.net/

**BugReports** https://sourceforge.net/p/spina/bugs/

**NeedsCompilation** no

**Repository** CRAN

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## Contents

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`estimated.GD` *Calculated Sum Activity of Step-Up Deiodinases (SPINA-GD)*

---

## Description

Calculate total step-up deiodinase activity (SPINA-GD) from equilibrium free hormone concentrations.

## Usage

```
estimated.GD(FT4, FT3)
```

## Arguments

| | |
|---|---|
| `FT4` | Free thyroxine (FT4) concentration in pmol/L. |
| `FT3` | Free triiodothyronine (FT3) concentation in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns step-up deiodinase activity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in nmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, SPINA.GDTT, estimated.GDTT, SPINA.sGD, estimated.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# estimated.GDTT *Calculated Sum Activity of Step-Up Deiodinases (SPINA-GD)*

---

## Description

Calculate total step-up deiodinase activity (SPINA-GD) from equilibrium total hormone concentrations.

## Usage

```
estimated.GDTT(T4, T3)
```

## Arguments

| | |
|---|---|
| T4 | Total thyroxine (TT4) concentration in nmol/L. |
| T3 | Total triiodothyronine (TT3) concentation in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns step-up deiodinase activity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in nmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, SPINA.sGD, estimated.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI

---

# estimated.GT *Calculated Thyroid's Secretory Capacity (SPINA-GT)*

---

## Description

Calculate thyroid's secretory capacity (SPINA-GT) from equilibrium TSH and free T4 concentrations.

## Usage

```
estimated.GT(TSH, FT4)
```

## Arguments

| | |
|---|---|
| TSH | Thyrotropin (TSH) concentration in mIU/l |
| FT4 | Free thyroxine (FT4) concentration in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns thyroid's secretory capacity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in pmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, estimated.GDTT, SPINA.sGD, estimated.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# estimated.GTT *Calculated Thyroid's Secretory Capacity (SPINA-GT)*

---

## Description

Calculate thyroid's secretory capacity (SPINA-GT) from equilibrium TSH and total T4 concentrations.

## Usage

```
estimated.GTT(TSH, T4)
```

## Arguments

| | |
|---|---|
| TSH | Thyrotropin (TSH) concentration in mIU/l |
| T4 | Total thyroxine (TT4) concentration in nmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns thyroid's secretory capacity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in pmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

`SPINA.GT`, `estimated.GT`, `SPINA.GTT`, `SPINA.GD`, `estimated.GD`, `SPINA.GDTT`, `estimated.GDTT`, `SPINA.sGD`, `estimated.sGD`, `estimated.TSHI`, `estimated.sTSHI`, `estimated.TTSI`

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# `estimated.sGD` *Calculated Sum Activity of Step-Up Deiodinases (SPINA-GD) in standardised form*

---

## Description

Calculate total step-up deiodinase activity (SPINA-GD) from equilibrium free hormone concentrations in standardised form resulting from z-transformation.

## Usage

```
estimated.sGD(FT4, FT3, mean = 30, sd = 5)
```

## Arguments

| | |
|---|---|
| FT4 | Free thyroxine (FT4) concentration in pmol/L. |
| FT3 | Free triiodothyronine (FT3) concentation in pmol/L |
| mean | mean value of population sample for standardised (z-transformed) tests |
| sd | standard deviation of population sample for standardised (ztransformed) tests |

## Details

This function is able to do vectorised calculations.

## Value

This function returns step-up deiodinase activity in standardised form representing a single value or a vector, depending on the vector length of the arguments. Results are z-transformed and therefore without unit of measurement.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, estimated.GDTT, SPINA.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

`estimated.sTSHI` *Jostels TSH index in standardised form*

## Description

Calculate Jostels TSH index in standardised form resulting from z-transformation.

## Usage

```
estimated.sTSHI(TSH, FT4, mean = 2.7, sd = 0.676)
```

## Arguments

| | |
|---|---|
| `TSH` | Thyrotropin (TSH) concentration in mIU/l |
| `FT4` | Free thyroxine (FT4) concentration in pmol/L |
| `mean` | mean value of population sample for standardised (z-transformed) tests |
| `sd` | standard deviation of population sample for standardised (ztransformed) tests |

## Details

This function is able to do vectorised calculations.

## Value

his function returns Jostel's TSH index as a numeric result in standardised form representing a single value or a vector, depending on the vector length of the arguments. Results are z-transformed and therefore without unit of measurement.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Jostel A, Ryder WD, Shalet SM. The use of thyroid function tests in the diagnosis of hypopituitarism: definition and evaluation of the TSH Index. Clin Endocrinol (Oxf). 2009 Oct;71(4):529-34. doi: 10.1111/j.1365-2265.2009.03534.x. PMID: 19226261.

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, estimated.GDTT, SPINA.sGD, estimated.sGD, estimated.TSHI, estimated.TTSI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# estimated.TSHI *Jostels TSH index (TSHI of JTI)*

---

## Description

Calculate Jostels TSH index (also referred to as TSHI or JTI) from equilibrium TSH and free T4 concentrations.

## Usage

```
estimated.TSHI(TSH, FT4)
```

## Arguments

| | |
|---|---|
| TSH | Thyrotropin (TSH) concentration in mIU/l |
| FT4 | Free thyroxine (FT4) concentration in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns Jostel's TSH index as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are without unit of measurement.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Jostel A, Ryder WD, Shalet SM. The use of thyroid function tests in the diagnosis of hypopituitarism: definition and evaluation of the TSH Index. Clin Endocrinol (Oxf). 2009 Oct;71(4):529-34. doi: 10.1111/j.1365-2265.2009.03534.x. PMID: 19226261.

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, estimated.GDTT, SPINA.sGD, estimated.sGD, estimated.sTSHI, estimated.TTSI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# estimated.TTSI *Thyrotroph Thyroid Hormone Sensitivity Index (TTSI)*

---

## Description

Calculate thyrotroph thyroid hormone sensitivity index (TTSI) from equilibrium TSH and free T4 concentrations.

## Usage

```
estimated.TTSI(TSH, FT4, lu)
```

## Arguments

| | |
|---|---|
| TSH | Thyrotropin (TSH) concentration in mIU/l |
| FT4 | Free thyroxine (FT4) concentration in pmol/L |
| lu | upper limit of FT4 reference range (should be in the same unit of measurement as the FT4 concentration) |

## Details

This function is able to do vectorised calculations.

## Value

This function returns thyrotroph thyroid hormone sensitivity index (TTSI) as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are without unit of measurement.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Pohlenz J, Weiss RE, Macchia PE, Pannain S, Lau IT, Ho H, Refetoff S. Five new families with resistance to thyroid hormone not caused by mutations in the thyroid hormone receptor beta gene. J Clin Endocrinol Metab. 1999 Nov;84(11):3919-28. PMID: 10566629.

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, estimated.GDTT, SPINA.sGD, estimated.sGD, estimated.TSHI, estimated.sTSHI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

pilo *Demo Data Set from Pilo et al. 1990*

## Description

Demo data set from Pilo et al. 1990.

## Details

This is a demo data set taken from a compartment-analytical study by Pilo et al. 1990.

## Value

This table contains the following slots:

| | |
|---|---|
| BSA | body surface area in m^2 |
| IDV | initial distribution volume |
| TT4 | total T4 in mcg/dl |
| TT3 | total T3 in ng/ml |
| FT4 | free T4 in pg/ml |
| FT3 | free T3 in pg/ml |
| TT4.SI | total T4 in nmol/l |
| TT3.SI | total T3 in nmol/l |
| FT4.SI | free T4 in pmol/l |
| FT3.SI | free T3 in pmol/l |
| SR | secretion rate |
| CR.F, CR.S and CR.T | conversion rate (fast pool, slow pool and total) |
| PAR | plasma apperance rate |
| PR | production rate |
| CR.6, CR.2, CR.0 | conversion ratio from 6-compartment, 2-compartment and noncompartmental model |

## References

Pilo A, Iervasi G, Vitek F, Ferdeghini M, Cazzuola F, Bianchi R. Thyroidal and peripheral production of 3,5,3'-triiodothyronine in humans by multicompartmental analysis. Am J Physiol. 1990 Apr;258(4 Pt 1):E715-26. PMID: 2333963.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GD, estimated.GT, SPINA.GT, estimated.GDTT, SPINA.GDTT, estimated.GTT, SPINA.GTT, estimated.sGD, SPINA.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI,

---

SPINA.GD *Calculated Sum Activity of Step-Up Deiodinases (SPINA-GD)*

---

## Description

Calculate total step-up deiodinase activity (SPINA-GD) from equilibrium free hormone concentrations. This is an alias for estimated.GD.

## Usage

```
SPINA.GD(FT4, FT3)
```

## Arguments

| | |
|---|---|
| FT4 | Free thyroxine (FT4) concentration in pmol/L. |
| FT3 | Free triiodothyronine (FT3) concentation in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns step-up deiodinase activity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in nmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GD, estimated.GT, SPINA.GT, estimated.GDTT, SPINA.GDTT, estimated.GTT, SPINA.GTT, estimated.sGD, SPINA.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI,

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# SPINA.GDTT *Calculated Sum Activity of Step-Up Deiodinases (SPINA-GD)*

---

## Description

Calculate total step-up deiodinase activity (SPINA-GD) from equilibrium total hormone concentrations. This is an alias for estimated.GDTT.

## Usage

```
SPINA.GDTT(T4, T3)
```

## Arguments

| | |
|---|---|
| T4 | Total thyroxine (TT4) concentration in nmol/L. |
| T3 | Total triiodothyronine (TT3) concentation in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns step-up deiodinase activity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in nmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, estimated.GDTT, SPINA.sGD, estimated.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI

---

# SPINA.GT *Calculated Thyroid's Secretory Capacity (SPINA-GT)*

---

## Description

Calculate thyroid's secretory capacity (SPINA-GT) from equilibrium TSH and free T4 concentrations. This is an alias for `estimated.GT`.

## Usage

```
SPINA.GT(TSH, FT4)
```

## Arguments

| | |
|---|---|
| TSH | Thyrotropin (TSH) concentration in mIU/l |
| FT4 | Free thyroxine (FT4) concentration in pmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns thyroid's secretory capacity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in pmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

`estimated.GT`, `SPINA.GTT`, `estimated.GTT`, `SPINA.GD`, `estimated.GD`, `SPINA.GDTT`, `estimated.GDTT`, `SPINA.sGD`, `estimated.sGD`, `estimated.TSHI`, `estimated.sTSHI`, `estimated.TTSI`

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# SPINA.GTT *Calculated Thyroid's Secretory Capacity (SPINA-GT)*

---

## Description

Calculate thyroid's secretory capacity (SPINA-GT) from equilibrium TSH and total T4 concentrations. This is an alias for `estimated.GTT`.

## Usage

```
SPINA.GTT(TSH, T4)
```

## Arguments

| | |
|---|---|
| `TSH` | Thyrotropin (TSH) concentration in mIU/l |
| `T4` | Total thyroxine (TT4) concentration in nmol/L |

## Details

This function is able to do vectorised calculations.

## Value

This function returns thyroid's secretory capacity as a numeric result representing a single value or a vector, depending on the vector length of the arguments. Results are in pmol/s.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

`SPINA.GT`, `estimated.GT`, `estimated.GTT`, `SPINA.GD`, `estimated.GD`, `SPINA.GDTT`, `estimated.GDTT`, `SPINA.sGD`, `estimated.sGD`, `estimated.TSHI`, `estimated.sTSHI`, `estimated.TTSI`

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

---

# `SPINA.sGD` *Calculated Sum Activity of Step-Up Deiodinases (SPINA-GD) in standardised form*

---

## Description

Calculate total step-up deiodinase activity (SPINA-GD) from equilibrium free hormone concentrations in standardised form resulting from z-transformation. This is an alias for `estimated.sGD`.

## Usage

```
SPINA.sGD(FT4, FT3, mean = 30, sd = 5)
```

## Arguments

| | |
|---|---|
| FT4 | Free thyroxine (FT4) concentration in pmol/L. |
| FT3 | Free triiodothyronine (FT3) concentation in pmol/L |
| mean | mean value of population sample for standardised (z-transformed) tests |
| sd | standard deviation of population sample for standardised (ztransformed) tests |

## Details

This function is able to do vectorised calculations.

## Value

This function returns step-up deiodinase activity in standardised form representing a single value or a vector, depending on the vector length of the arguments. Results are z-transformed and therefore without unit of measurement.

## Note

The software functions described in this document are intended for research use only. Hormone levels should have been obtained simultaneously in order to avoid bias by transition effects.

## Author(s)

Johannes W. Dietrich

## References

Dietrich J. W., Landgrafe G., Fotiadou E. H. 2012 TSH and Thyrotropic Agonists: Key Actors in Thyroid Homeostasis. *J Thyroid Res*. 2012;2012:351864. doi: 10.1155/2012/351864. PMID: 23365787; PMCID: PMC3544290.

Dietrich J. W., Landgrafe-Mende G., Wiora E., Chatzitomaris A., Klein H. H., Midgley J. E., Hoermann R. 2016 Calculated Parameters of Thyroid Homeostasis: Emerging Tools for Differential Diagnosis and Clinical Research. *Front Endocrinol (Lausanne)*. 2016 Jun 9;7:57. doi: 10.3389/fendo.2016.00057. PMID: 27375554; PMCID: PMC4899439.

## See Also

SPINA.GT, estimated.GT, SPINA.GTT, estimated.GTT, SPINA.GD, estimated.GD, SPINA.GDTT, estimated.GDTT, estimated.sGD, estimated.TSHI, estimated.sTSHI, estimated.TTSI

## Examples

```
TSH <- c(1, 3.24, 0.7);
FT4 <- c(16.5, 7.7, 9);
FT3 <- c(4.5, 28, 6.2);
print(paste("GT^:", SPINA.GT(TSH, FT4)));
print(paste("GD^:", SPINA.GD(FT4, FT3)));
print(paste("sGD^:", SPINA.sGD(FT4, FT3)));
```

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