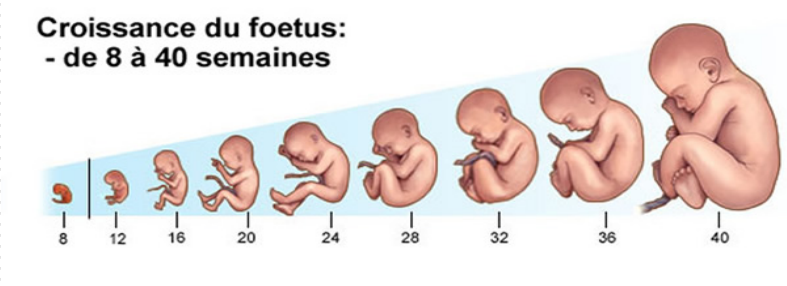
Croissance et maturations fœtales

Données Biométriques

Dr G ANDRE (CHU Bordeaux)

Dr J AZIZA (CHU Toulouse)



- Le développement du fœtus comprend
  - **La croissance** : aspect quantitatif
  - **La maturation** : différenciation des types cellulaires

  Phénomènes complexes et interdépendants

- **Croissance staturale** (taille, cm)
- **Croissance pondérale** (Poids, g)

  indissociable de la croissance placentaire

Différents âges du fœtus

- **Chronologique** : DG échographique
- **Statural** : longueur des os longs
- **Viscéral** : maturation viscérale (reins , poumons, encéphale …..)
- **Osseux** : apparition et développement des points osseux

Age gestationnel

Hypotrophie – Eutrophe – Macrosomie

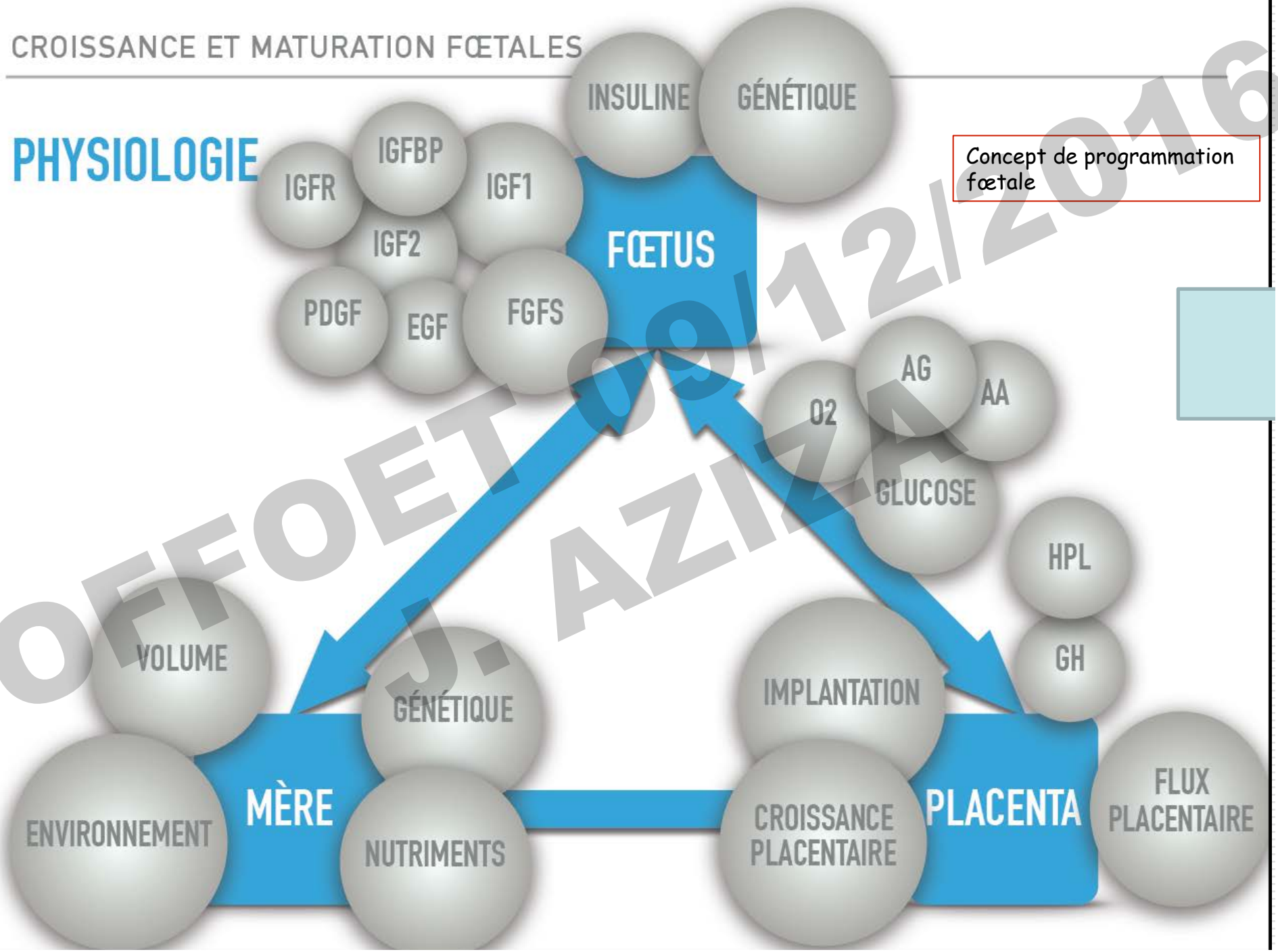
Retard ou avance de maturation

↓

diagnostic étiologique

CROISSANCE ET MATURATION FŒTALES

PHYSIOLOGIE



Concept de programmation fœtale

- **Maturation fœtale**
  - **Glucocorticoides**
    - Neurologique
    - Pulmonaire
  - **Hormones thyroïdiennes**
    - Neurologique
    - Osseuse

croissance fœtale
critères d'appréciation quantitatifs :
Biométrie fœtale

Poids fœtal /viscères
Vertex-Talon
Vertex – Coccyx
Périmètre Céphalique
Périmètre Thoracique
Longueur du pied

Hypoplasie pulmonaire
>28 SA P poumons/P fœtal <0,012
<28 SA P poumons/P fœtal <0,015

Pediatric and Developmental Pathology 5, 559–578, 2002
DOI: 10.1007/s10024-002-0036-7

Organ Weights in Human Fetuses after Formalin Fixation: Standards by Gestational Age and Body Weight

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4000/ **673 fœtus**
Exclus
G Gemellaire
F Macérés
Diabète
F Polymalformés
infections graves

Pediatric and Developmental Pathology 8, 204–217, 2005
DOI: 10.1007/s10024-004-7084-0

Autopsy Standards of Body Parameters and Fresh Organ Weights in Nonmacerated and Macerated Human Fetuses

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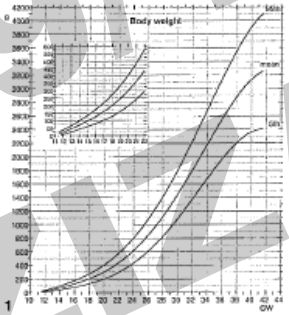
Table 4. Mean, standard deviation, and 5th and 95th percentiles of body dimensions (mm) in relation to gestational age

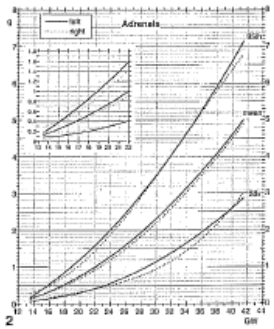
Age interval (GW)	Mean	SD	5th percentile	95th percentile
Crown–heel length				
11–12	91.7	14.6	67.6	115.8
13–14	131.8	15.4	106.4	157.2
15–16	170.4	16.2	143.7	197.1
17–18	207.4	17.0	179.4	235.4
19–20	242.9	17.8	213.6	272.2
21–22	276.8	18.6	246.2	307.4
23–24	309.2	19.4	277.3	341.1
25–26	340.0	20.2	306.8	373.2
27–28	369.3	21.0	334.8	403.8
29–30	397.0	21.8	361.2	432.8
31–32	423.2	22.6	386.1	460.3
33–34	447.8	23.4	409.4	486.3
35–36	470.9	24.2	431.2	510.7
37–38	492.5	24.9	451.4	533.5
39–40	512.5	25.7	470.1	554.8
41–42	530.9	26.5	487.3	574.6
Crown–rump length				
11–12	62.1	11.2	43.6	80.5
13–14	89.6	11.7	70.4	108.9
15–16	116.2	12.2	96.1	136.2
17–18	141.7	12.7	120.9	162.5
19–20	166.2	13.1	144.6	187.9
21–22	189.8	13.6	167.4	212.2
23–24	212.3	14.1	189.1	235.5
25–26	233.8	14.6	209.9	257.8
27–28	254.4	15.1	229.6	279.1
29–30	273.9	15.5	248.3	299.5
31–32	292.4	16.0	266.1	318.8
33–34	309.9	16.5	282.8	337.1
35–36	326.5	17.0	298.5	354.4
37–38	342.0	17.5	313.3	370.7
39–40	356.5	17.9	327.0	386.0
41–42	370.0	18.4	339.7	400.3
Foot length				
11–12	8.9	2.8	4.3	13.0
13–14	14.0	2.9	9.0	19.0
15–16	19.0	3.0	14.0	24.0
17–18	25.0	3.2	19.0	30.0
19–20	30.0	3.3	25.0	36.0
21–22	36.0	3.5	30.0	42.0
23–24	42.0	3.6	36.0	48.0
25–26	48.0	3.8	41.0	54.0
27–28	53.0	3.9	47.0	59.0
29–30	58.0	4.1	51.0	65.0
31–32	63.0	4.2	56.0	70.0
33–34	67.0	4.4	60.0	74.0
35–36	71.0	4.6	63.0	78.0
37–38	74.0	4.7	66.0	82.0
39–40	76.0	4.9	68.0	84.0
41–42	77.0	5.1	69.0	86.0

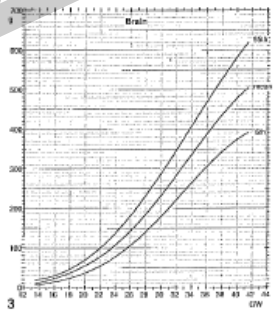
(continued)

Table 4. *(Continued)*

Age interval (GW)	Mean	SD	5th percentile	95th percentile
Head circumference				
11–12	60.3	11.5	41.4	79.2
13–14	89.2	11.8	69.7	108.7
15–16	116.7	12.2	96.6	136.8
17–18	142.8	12.6	122.1	163.5
19–20	167.5	12.9	146.2	188.8
21–22	190.9	13.3	169.0	212.8
23–24	212.8	13.7	190.3	235.3
25–26	233.4	14.0	210.3	256.5
27–28	252.7	14.4	229.0	276.4
29–30	270.5	14.8	246.2	294.8
31–32	287.0	15.1	262.1	311.9
33–34	302.1	15.5	276.5	327.6
35–36	315.8	15.9	289.7	341.9
37–38	328.1	16.2	301.4	354.8
39–40	339.1	16.6	311.7	366.4
41–42	348.6	17.0	320.7	376.6







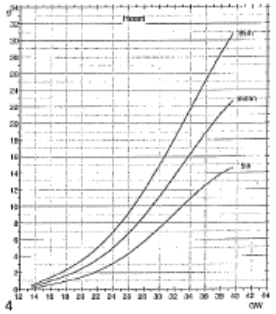


Figure 1. Body weight (BW) by gestational week (GW). **Inset:** detail of the chart for ages below 22 GW.
Figure 2. Adrenal weights by GW. **Inset:** detail of the chart for ages below 22 GW.
Figure 3. Brain weight by GW.
Figure 4. Heart weight by GW.

Guilhard Costa 2002

Table 2. Mean, standard deviation, and 5th and 95th percentiles of organ weight in relation to gestational age

Age interval (GW)	Mean	SD	5th percentile	95th percentile
Body weight				
11–12	9.1	7.9	−3.8	22.0
13–14	55.8	14.4	32.2	79.4
15–16	108.6	24.7	68.0	149.3
17–18	176.1	39.0	112.0	240.3
19–20	267.7	57.1	173.7	361.7
21–22	392.7	79.2	262.5	522.9
23–24	559.6	105.1	386.7	732.5
25–26	773.9	134.9	552.0	995.8
27–28	1038.2	168.6	760.9	1315.5
29–30	1350.4	206.1	1011.3	1689.5
31–32	1702.5	247.6	1295.2	2109.7
33–34	2080.2	292.9	1598.3	2562.0
35–36	2460.8	342.1	1898.0	3023.7
37–38	2813.1	395.3	2162.9	3463.3
39–40	3095.1	452.2	2351.2	3839.1
41–42	3254.9	513.1	2410.9	4099.0
Brain				
13–14	9.09	2.49	5.00	13.18
15–16	18.98	4.60	11.42	26.54
17–18	31.37	7.11	19.67	43.06
19–20	47.93	10.03	31.43	64.43
21–22	69.90	13.35	47.93	91.87
23–24	97.98	17.08	69.88	126.08
25–26	132.43	21.21	97.53	167.33
27–28	172.98	25.75	130.62	215.34
29–30	218.89	30.69	168.41	269.38
31–32	268.95	36.04	209.67	328.23
33–34	321.43	41.79	252.69	390.17
35–36	374.13	47.94	295.27	453.00
37–38	424.37	54.50	334.72	514.02
39–40	468.96	61.46	367.85	570.07
41–42	504.23	68.83	391.01	617.46
Heart				
13–14	0.24	0.13	0.02	0.46
15–16	0.82	0.23	0.45	1.20
17–18	1.44	0.37	0.83	2.05
19–20	2.21	0.56	1.29	3.12
21–22	3.23	0.79	1.93	4.52
23–24	4.55	1.07	2.79	6.30
25–26	6.21	1.39	3.92	8.49
27–28	8.20	1.76	5.31	11.09
29–30	10.48	2.17	6.90	14.05
31–32	12.98	2.63	8.65	17.31
33–34	15.60	3.14	10.44	20.76

(continued)

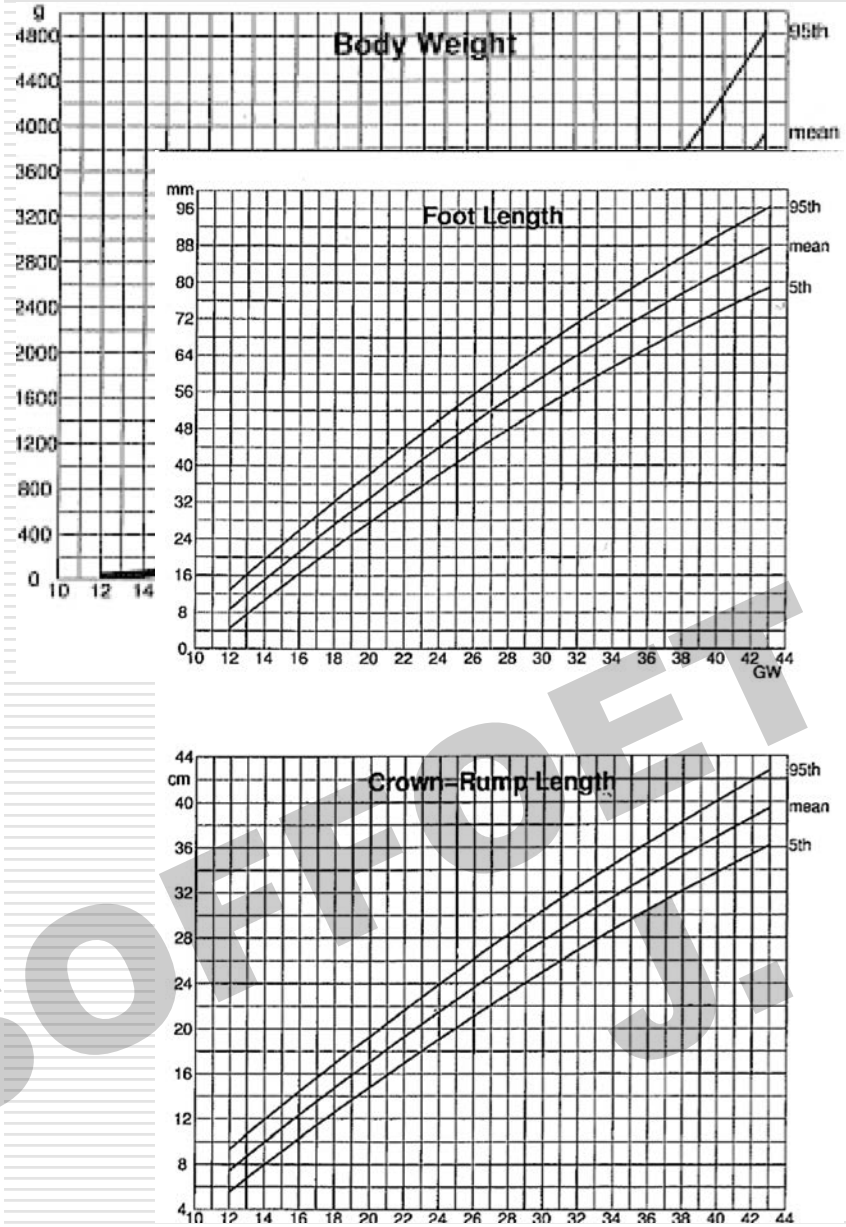
Table 3. Mean, standard deviation, and 5th and 95th percentiles of organ weight in relation to body weight

Body weight (g)	Mean	SD	5th percentile	95th percentile
Brain				
1–200	25.2	7.9	12.3	38.1
201–400	55.0	11.2	36.5	73.5
401–600	85.6	14.6	61.5	109.7
601–800	117.0	18.0	87.3	146.6
801–1000	149.0	21.4	113.8	184.2
1001–1200	181.4	24.8	140.7	222.2
1201–1400	214.1	28.2	167.8	260.5
1401–1600	246.9	31.6	195.0	298.8
1601–1800	279.4	34.9	221.9	336.8
1801–2000	311.2	38.3	248.2	374.2
2001–2200	342.1	41.7	273.5	410.7
2201–2400	371.5	45.1	297.3	445.7
2401–2600	399.1	48.5	319.3	478.8
2601–2800	424.3	51.9	338.9	509.6
2801–3000	446.5	55.2	355.6	537.4
3001–3200	465.2	58.6	368.8	561.6
3201–3400	479.7	62.0	377.7	581.7
3401–3600	489.4	65.4	381.8	597.0
3601–3800	496.9	68.8	383.7	610.0
3801–4000	504.4	72.2	385.7	623.1
4001–4200	511.9	75.6	387.6	636.1
Heart				
1–200	9.4	5.1	1.0	17.8
201–400	25.3	7.1	13.6	37.1
401–600	41.0	9.2	26.0	56.1
601–800	56.5	11.1	38.2	74.8
801–1000	71.8	13.0	50.4	93.3
1001–1200	86.9	14.9	62.3	111.4
1201–1400	101.8	16.8	74.2	129.3
1401–1600	116.4	18.6	85.9	146.9
1601–1800	130.8	20.3	97.4	164.2
1801–2000	145.1	22.0	108.8	181.3
2001–2200	159.1	23.7	120.1	198.0
2201–2400	172.8	25.3	131.2	214.5
2401–2600	186.4	26.9	142.2	230.6
2601–2800	199.8	28.4	153.0	246.5
2801–3000	212.9	29.9	163.7	262.1
3001–3200	225.9	31.4	174.3	277.4
3201–3400	238.6	32.8	184.7	292.5
3401–3600	251.1	34.1	195.0	307.2
3601–3800	263.4	35.4	205.1	321.7
3801–4000	275.5	36.7	215.1	335.8
4001–4200	287.3	37.9	224.9	349.7

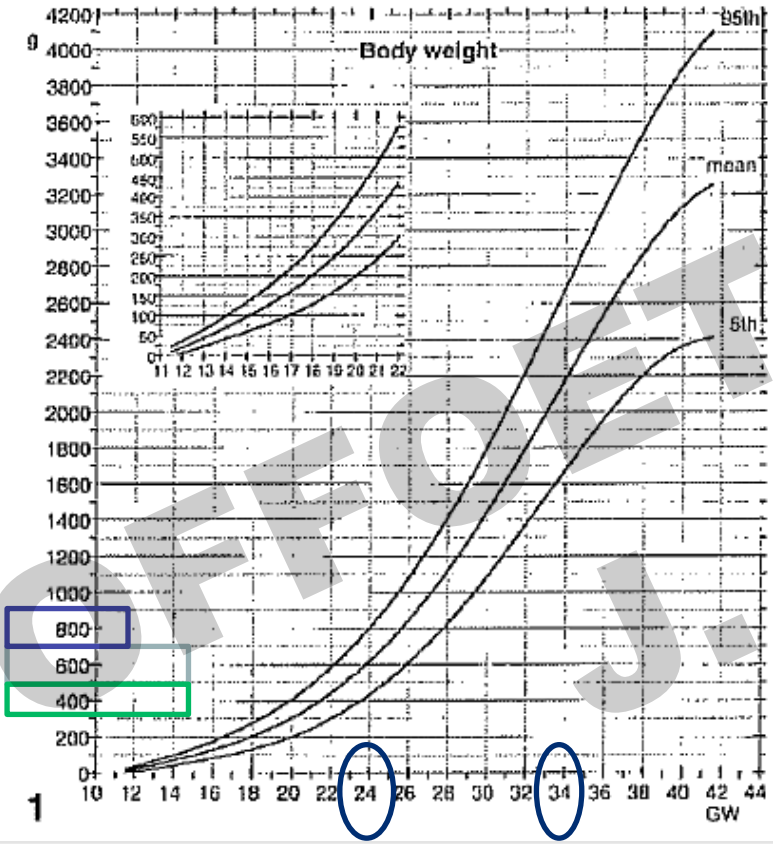
(continued)

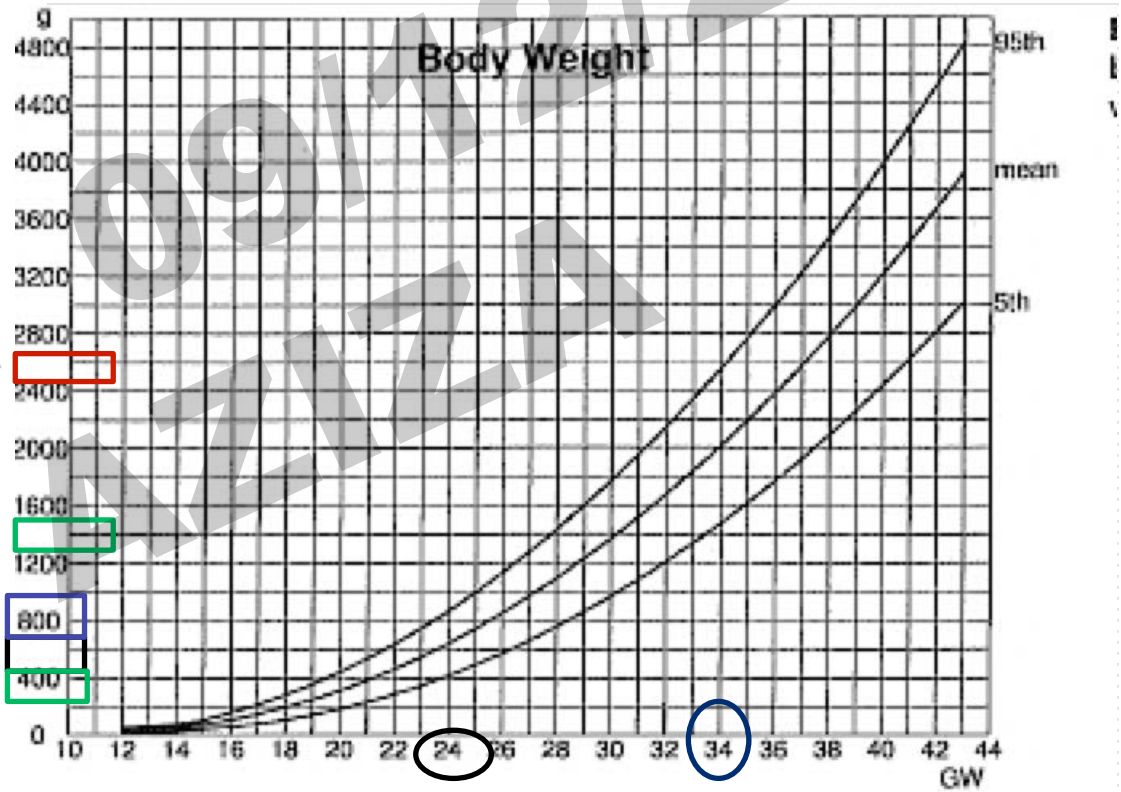
Guilhard Costa 2002

Cerveau/cœur/foie/reins/poumons/thymus /rate /surrénales/ Pancréas/thyroide.



Maroun et Al
2004





Guilhard et al,

Maroun LL

Appréciation de la maturation viscérale

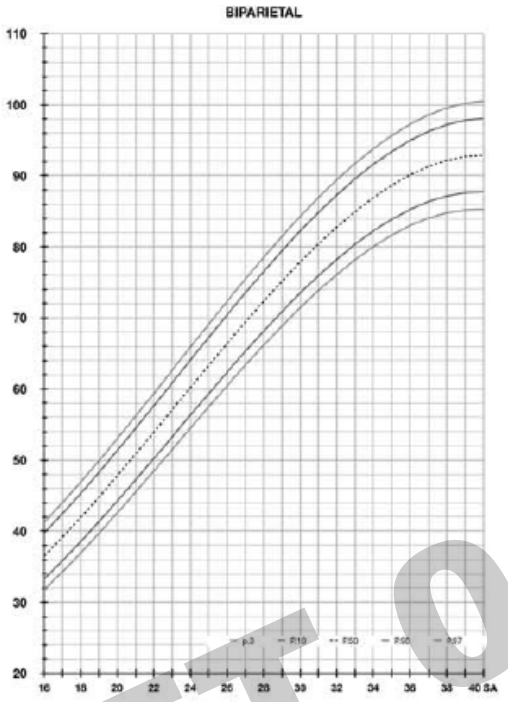
- Poumons : 4 stades de maturation
- Reins : comptage des glomérules immatures (sous capsulaires) ou matures (entre les colonnes de Bertin)
- Cervelet : aspect du cortex cérébelleux

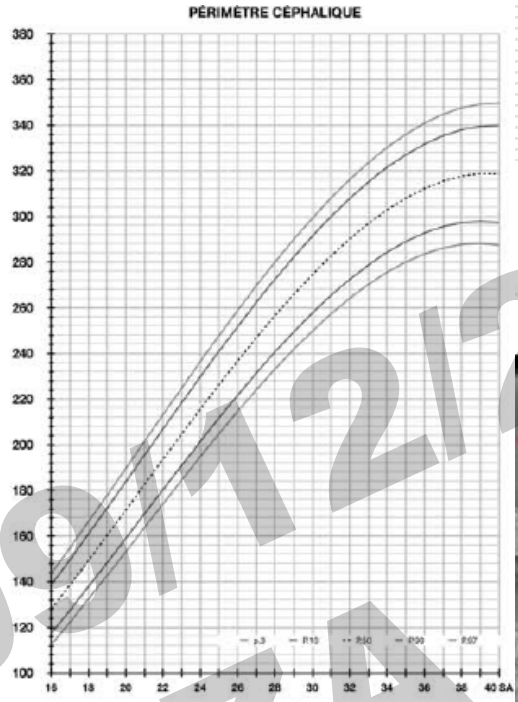
- Foie, surrénales, muscles

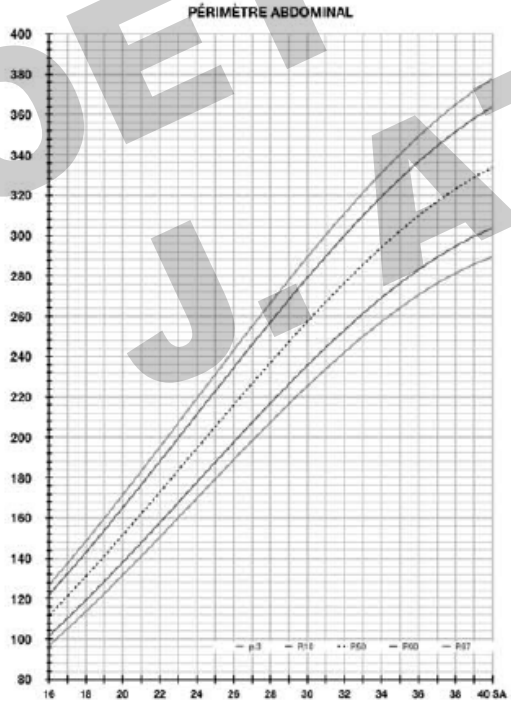
Repères biométriques osseux

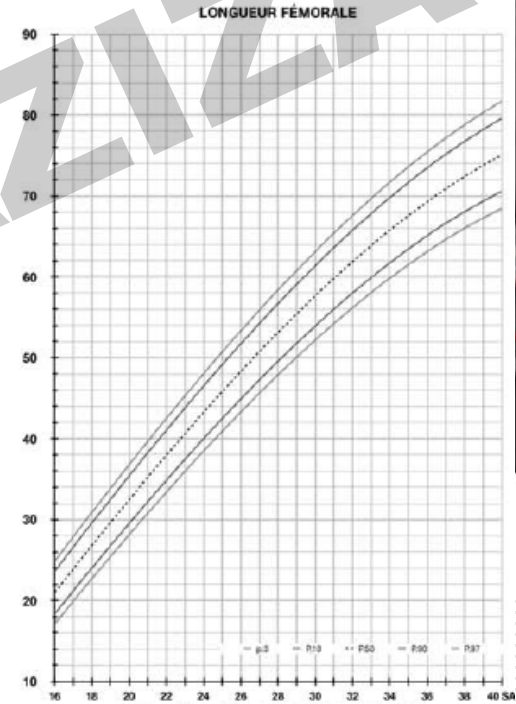
BIOMÉTRIES

- BIP
- FO
- LF
- LH
- OPN









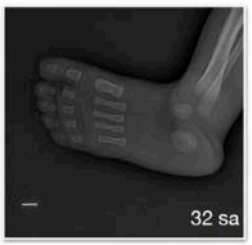
L. J. Salomon, M. Deeme, J. Crépaut, G. Breduy, C. Talmant, N. Friez, M. Althuser
CFEF – Collège Français d'Echographie Fœtale - Ultrasound Obstet Gynecol 2009; 28: 193–198

SOFFOET 09/12/2016
J. AZIZA

POINTS D'OSSIFICATION

Site	AG sa
Clavicules	8
Phalangettes, ailes iliaques, os longs	10
Rachis	12
Ischions	17
Incisive supérieure, CSC, odontoïde, pubis	20-21
Calcanéum	24
Talus, coccyx	28
Fémoral inf	33
Tibial sup	37
Humerus sup, cuboïde	41

OS DU PIED



- calcanéum 23 / 24 sa
- astragale 28 / 30 sa
- cuboïde 41 sa
- 25 sa contours nets
- 27 / 30 sa ovalaire

encéphale

10·4·95
July–August 1995

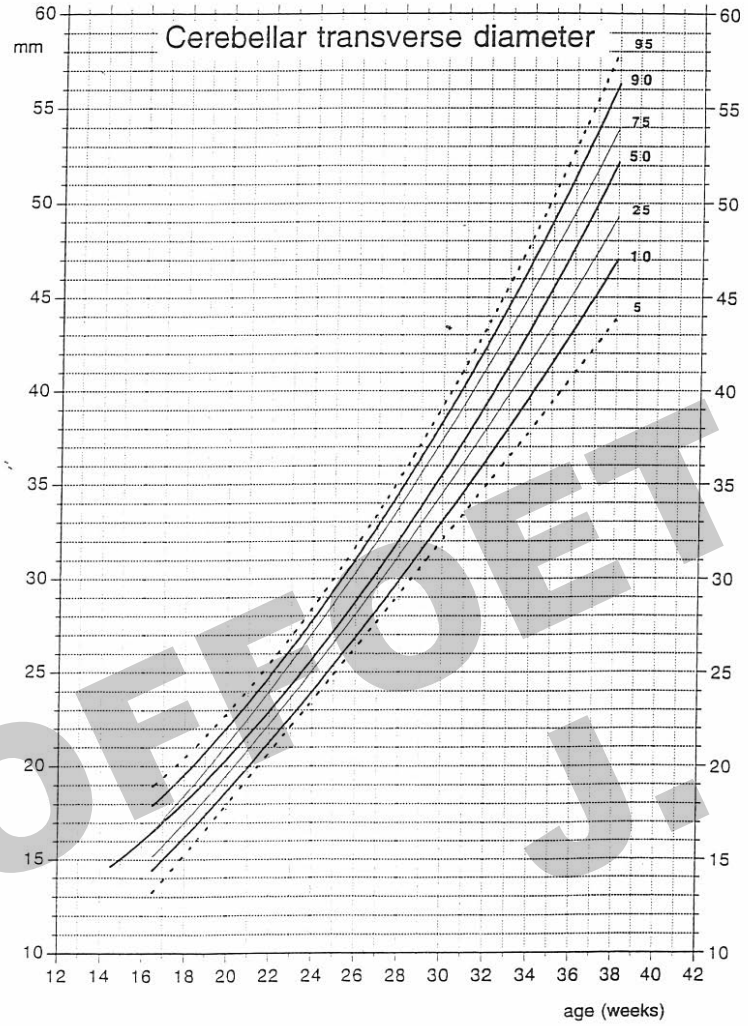
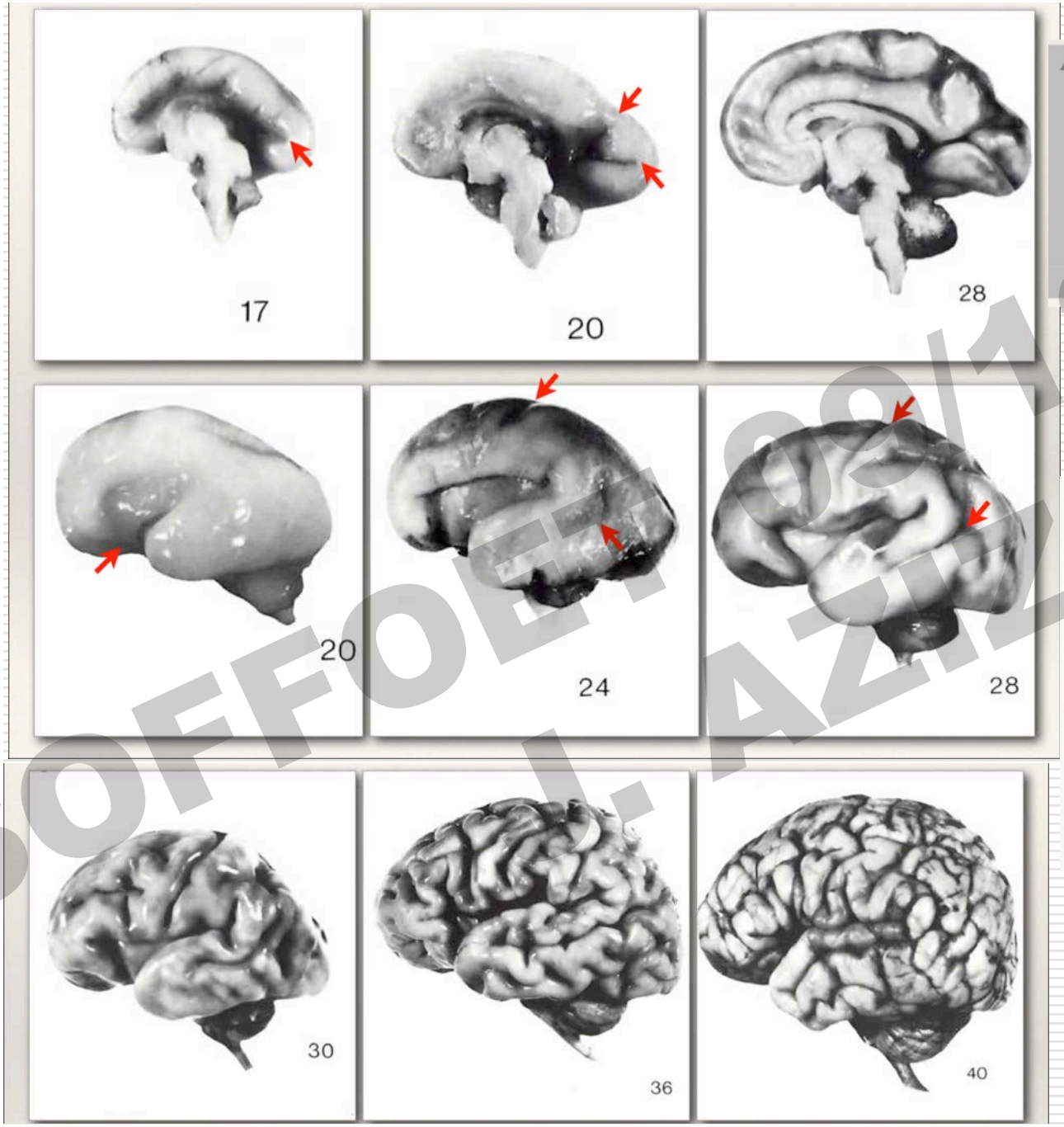


Fig. 45. Cerebellar transverse diameter. Smoothed curves of the 5th, 10th, 25th, 50th, 75th, 90th, 95th percentiles of the distribution.

New York · New Delhi
Bangkok · Singapore
Tokyo · Sydney

Contents



AG SA	Sillons	Vallée sylvienne
16	Calcarine	
18	Pariéto-occipitale	Dépression de l'insula
20	Rolando début	VS déprimée
24	T1 début	VS fermée en arrière
28	T1 fin	VS fermée à mi distance
30	Rolando fin	VS fermée en avant
32	Sillons secondaires	Sillon latéral formé

2. Giration

☐ Scissure inter-hémisphérique	(10 SA)
☐ Sillon péri-calleux : antérieur	(14 SA)
☐ Sillon péri-calleux : postérieur	(22 SA)
☐ Scissure de Sylvius : présente	(14 SA)
☐ Scissure de Sylvius : fermeture postérieure	(20 SA)
☐ Scissure de Sylvius : demi-fermeture	(30 SA)
☐ Scissure de Sylvius : operculisation totale	(39-40 SA)
☐ Sillon pariéto-occipital : face interne	(16 SA)
☐ Sillon pariéto-occipital : face externe	(30 SA)
☐ Scissure calcarine	(16 SA)
☐ Sillon olfactif	(16 SA)
☐ Sillon calloso-marginal antérieur	(18 SA)
☐ Sillon calloso-marginal postérieur	(29 SA)
☐ Sillon de Rolando présent	(20 SA)
☐ Sillon de Rolando complet	(30 SA)
☐ Sillon collatéral	(23 SA)
☐ Sillon temporal supérieur complet	(28 SA)
☐ Sillon précentral	(24 SA)
☐ Sillon frontal supérieur	(25 SA)
☐ Sillon post-central	(25 SA)
☐ Sillon interpariétal	(26 SA)
☐ Sillon temporal moyen	(26 SA)
☐ Sillon frontal inférieur	(28 SA)
☐ Sillon temporal inférieur	(30 SA)

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Organ weights and ratios for postmortem identification of fetal growth restriction: utility and confounding factors

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KEYWORDS: brain weight; growth restriction; liver weight; organ weight; ratio

Comment Diagnostiquer un RCIU en cas de Décès in utero ?

rapport Poids cerveau /foie: marqueur de nutrition fœtale

La macération affecte de manière différentielle le poids des organes et modifie ce rapport

Normalité : 3 à 5

Rapport cerveau/ foie sup ou égal à 6 : marqueur de RCIU d'origine placentaire

organes les plus touchés : foie et le thymus

Conclusion

- Qualité des données biométriques déjà publiées
- Confrontées aux données biométriques échographiques → ANOMALIES DE CROISSANCE

- Intérêt de compléter nos référentiels

(RCIU <3ème percentile, tronc cérébral – os longs -

… travaux dans le cadre de la Soffoet)