

**4 months**  
(18 weeks LMP)

5½ inches long  
5 oz. in weight

Nostrils and toenails become visible. The baby may suck her thumb, turn somersaults and has a firm grip. The ovaries of girls contain beginnings of eggs. She begins to develop sleeping habits.<sup>32</sup> At about 4½ months she is able to experience pain.<sup>36, 37</sup>



4 months (16 weeks)  
18 weeks LMP

**5 months**  
(22 weeks LMP)

7½ inches long  
14 oz. in weight

The testes descend in boys. Mom may feel the baby kick, turn or hiccup and may be able to identify a bulge as an elbow or head.<sup>38</sup> Each side of the brain has a billion nerve cells now.<sup>36</sup>



5 months (20 weeks)  
22 weeks LMP

**6 months**  
(26 Weeks LMP)

9 inches  
1 lb. 12 oz. in weight

The baby will be able to hear by next week.<sup>39</sup> The child sleeps and wakes, nestling in her favorite positions to sleep, and stretches upon waking up.<sup>40</sup>

**7 months**  
(30 Weeks LMP)

10½ inches  
3 lb. 5 oz.

The eyelids begin to reopen, preparing to see the outside world.<sup>41</sup> Eyelashes have now become well developed.<sup>42</sup>

**8 months**  
(34 Weeks LMP)

12 inches  
5 lbs.

Skin becomes pink and smooth. The pupils of eye respond to light. Fingernails reach to the tip of the finger.<sup>42</sup> The baby is really getting cramped now.

**9½ months**  
(40 Weeks LMP)

13 inches  
"Greatest Length" or about 20" all stretched out  
7½ lb.

The child triggers labor and birth occurs, an average of 264-270 days after conception.<sup>43</sup>

And not until the baby has gone through all these events on the inside can we see the new child on the outside.



# Milestones of Early Life

Carnegie Developmental Stages, developed by Streeter and O'Rahilly, are used universally to categorize the growth of the embryo into 23 stages during the first 8 weeks of life. Carnegie Stages are based on morphology - the form and structures within of the embryo. From embryo to baby, the days required to get to each stage can vary slightly. Also, O'Rahilly has suggested some changes in the days relating to each stage due to in vivo ultrasound studies.<sup>43</sup> Selected differences as reported by O'Rahilly are detailed below.

## Primary References:

- Carlson, B., Human Embryology & Developmental Biology, Toronto: Mosby Publication, 3rd edition, 2004.
- Moore, K. and Persaud, T., The Developing Human, Clinically Oriented Embryology, 6th Edition, Philadelphia: W.B. Saunders, 1998.
- O'Rahilly, R. and Muller, F., Human Embryology and Teratology, 3rd Edition, New York: John Wiley and Sons, Inc., 2001.
- Tsiaras, A. and Werth, B., From Conception to Birth, a Life Unfolds, New York: Doubleday, 2002.

1. Age in this brochure is given two ways: 1) days after fertilization or days from conception given by the top red number, and 2) days from last menstrual period, or LMP for short, given by the lower red number. Doctors use "LMP" because it is hard to know just when conception occurred. Here, we emphasize the age of the new life as it unfolds. Add 14 days to post-fertilization days to convert to the LMP days.

2. "Life Before Birth," Life Magazine, Apr. 30, 1965, p. 13. 3. Moore, K. and Persaud, T., p. 37-45.

4. Moore, K. and Persaud, T., p. 42-48, 76. 5. O'Rahilly, R. and Muller, F., p. 23.

6. Mitchell, B. and Sharma, R., Embryology, New York: Churchill Livingstone, Dec. 2004, p. 4. Note: Carlson and Moore concur that the neural plate, fold and groove are forming around 18-20 days.

7. Estimates vary for when the heart begins to beat: 21-22 days, Moore, K. and Persaud, T., p. 77; at least by 23 days from transvaginal ultrasound results, O'Rahilly, R. and Muller, F., p. 183; 21-22 days, Carlson, B., p. 117; 18 days, Tanner, J. and Taylor, G. and the editors of Time-Life Books, Growth, New York: Life Science Library, 1965, p. 64 (a 40 year old source).

8. O'Rahilly, R. and Muller, F., p. 183.

9. Carlson, B., p. 292, 308. O'Rahilly, p. 456, 471 puts the appearance of the eye at about 28 days.

10. Moore, K. and Persaud, T., p. 259.

11. Moore, K. and Persaud, T., p. 435-437. O'Rahilly, R. and Muller, F., p. 382 place this at 30 days, Carlson, B., p. 211 at 4 weeks.

12. O'Rahilly, R. and Muller, F., p. 235-236, Carlson, B., p. 321-323.

13. Moore, K. and Persaud, T., p. 235-242, Tsiaras, A. and Werth, B., p. 88.

14. O'Rahilly, R. and Muller, F., p. 345-348, 183, 236, 107. Tsiaras, A. and Werth, B., p. 102.

15. O'Rahilly, R. and Muller, F., p. 459.

16. O'Rahilly, R. and Muller, F., p. 429, Carlson, B., p. 267-271.

17. Moore, K. and Persaud, T., p. 437. 18. Tsiaras, A. and Werth, B., p. 102, 114, 119.

19. O'Rahilly, R. and Muller, F., p. 409-411.

20. Moore, K. and Persaud, T., p. 592. O'Rahilly, R. and Muller, F., p. 102.

21. Moore, K. and Persaud, T., p. 592. O'Rahilly, R. and Muller, F., p. 238.

22. Tsiaras, A. and Werth, B., p. 140.

23. Carlson, B., p. 483-484, Tsiaras, A. and Werth, B., p. 199, 200.

24. Moore, K. and Persaud, T., p. 169, 174.

25. Tsiaras, A. and Werth, B., p. 183, 185. O'Rahilly, R. and Muller, F., p. 87.

26. Moore, K. and Persaud, T., p. 409, 414.

27. Moore, K. and Persaud, T., p. 333, Tsiaras, A. and Werth, B., p. 203, 206. Carlson, B., p. XIV.

28. Moore, K. and Persaud, T., p. 514, 519, 23; Tsiaras, A. and Werth, B., p. 206, 30. Carlson, B., p. 482, XIV.

29. Tsiaras, A. and Werth, B., p. 210, Moore, K. and Persaud, T., p. 234.

30. Vainan, H. and Pearson, J., "What the fetus feels," British Medical Journal, January 26, 1980.

31. Moore, K. and Persaud, T., p. 517, 34. Tsiaras, A. and Werth, B., p. 219.

32. O'Rahilly, R. and Muller, F., p. 156.

33. Anand, K. and Hickey P., Pain and Its Effects in the Human Neonate and Fetus," The New England Journal of Medicine, (1987) 317:1321-1329; Pain at 20 weeks, perhaps as early as 16 weeks.

34. Anand, K., Report to U. S. Federal Court as expert witness January 15, 2004.

35. Tsiaras, A. and Werth, B., p. 229, Carlson, B., p. XV.

36. O'Rahilly, R. and Muller, F., p. 413, 40. Tsiaras, A. and Werth, B., p. 235.

37. Carlson, B., p. 305, 42. Carlson, B., p. XV.

38. O'Rahilly, R. and Muller, F., p. 88-92. Birth occurs at about 38 weeks post-fertilization or 40 weeks LMP. The average from ovulation to parturition is about 264-270 days and the range about 250-285.

39. Measurements and weights from: O'Rahilly, R. and Muller, F., p. 491. Lengths of the baby are given in GL, or Greatest Length, which excludes the limbs. GL closely follows CR or crown to rump measurements, but can also be used for very young embryos. GL is also the measurement used in ultrasonography.

For more information:

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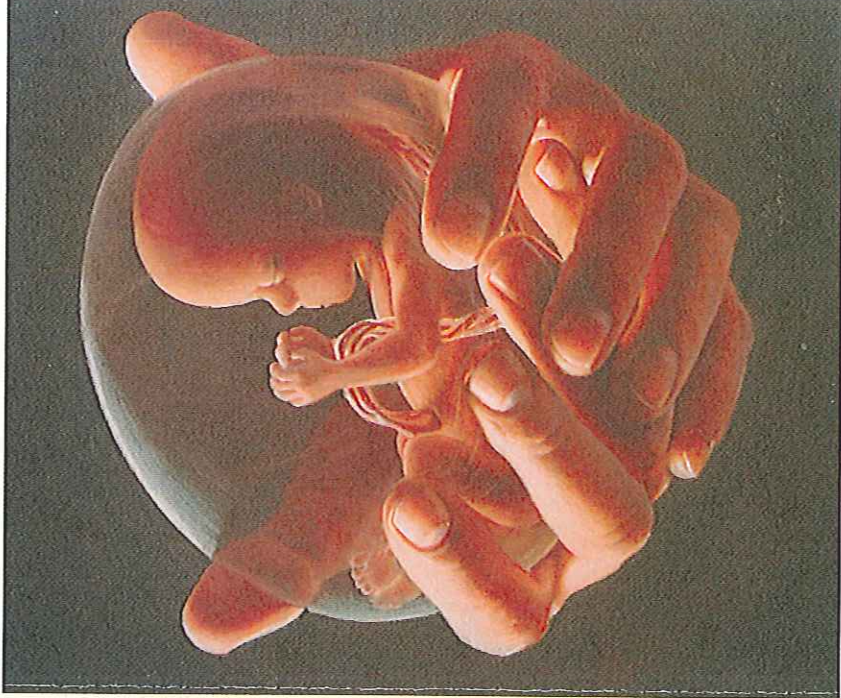
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## How You Began Your Journey





# Milestones of Early Life

At no time in your life does more growth and change occur than in the first nine months before birth. Here are the amazing milestones of that time in your life:

**Day 1**  
(14 days LMP)

Size of baby:  
→ .005 in.

**Conception:** Of the 200,000,000 sperm that try to penetrate the mother's egg cell, only one succeeds.<sup>2</sup> At that very moment, a new and unique individual is formed. All of the inherited features of this new person are already set — whether it's a boy or girl, the color of the eyes, the color of the hair, the dimples of the cheeks and the cleft of the chin. He or she is smaller than a grain of sugar, but the instructions are present for all that this person will ever become.

The first cell soon divides in two. Each of these new cells divides again and again as they travel toward the womb in search of a protected place to grow.<sup>3</sup>

**Day 6-14**  
(22-28 LMP)

→ .006 in.

The new individual at first attaches loosely to the wall of the womb, then burrows deeply and attaches securely to it over the next week. Sensitive pregnancy tests can now show positive, but this depends on the level of hormone produced by the new life. By the end of the second week, the mother's menstrual period is suppressed by this hormone (hCG) which is produced by her child.<sup>4</sup>

**Day 17**  
(31 LMP)

→ .008 in.

Blood vessels begin to form.<sup>4</sup> Remarkably, the future sex cells that will give rise to sperm or eggs for a new generation begin to group together — only 17 days after this new life is alive itself.<sup>5</sup>

**18-20**  
(32-34 LMP)

The foundations of the brain, spinal cord, and nervous system are laid.<sup>6</sup>

**Day 21**  
(35 LMP)

Size when the heart first beats:  
→ .03 in.

The heart begins to beat,<sup>7</sup> unsurely at first, gaining strength day by day. The heart beats 70 times per minute at first, reaching a maximum of 170-190 at seven weeks, and slowing a bit to 160-180 at 9 weeks.<sup>8</sup> A day later the eyes begin to develop. The earliest stages of the ears are now present.<sup>9</sup>

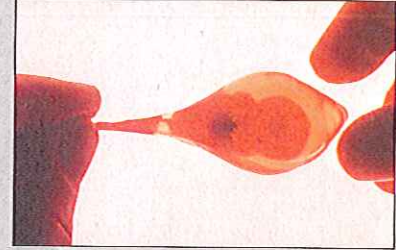
**Day 26-27**  
(40-41 LMP)

The lungs now begin to form.<sup>10</sup>

**Day 28-32**  
(42-46 LMP)

¼ inch long

Two tiny arms make their appearance and budding legs follow two days later.<sup>11</sup> The beginnings of the mouth take shape.<sup>12</sup> The nose starts to develop.<sup>13</sup> The thyroid gland begins to grow. Blood flows in the baby's veins but stays separate from the mother's blood. The tongue now begins to form. The face now makes its first appearance.<sup>14</sup>



6 weeks (8 weeks LMP) ectopic pregnancy, Robert Wolfe

**Day 36**  
(50 LMP)

The baby's eyes develop their first color in the retina (see photo above, right).<sup>15</sup>

**Day 40**  
(54 LMP)

The baby makes her first reflex movements. Touching around the mouth with a fine bristle causes her to flex her neck.<sup>16</sup>

**Day 41**  
(55 LMP)

The fingers begin to form, followed by the toes a few days later.<sup>17</sup>

**Day 42**  
(56 LMP)

½ inch long

The baby develops nerve connections that will lead to a sense of smell. The brain is now divided into 3 parts — one to experience emotion and understand language, one for hearing and one for seeing.<sup>18</sup> Joints begin to form.<sup>19</sup> Mother now misses second period.

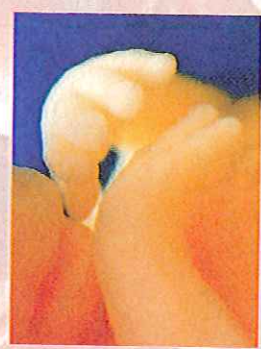
**Day 44**  
(58 LMP)

Buds of milk teeth appear. Facial muscles develop.<sup>20</sup> Eyelids begin to form, protecting the developing eyes.<sup>21</sup> Elbows take shape. Internal organs are present, but immature. 99% of muscles are present; each with its own nerve supply.<sup>22</sup>

**Day 52**  
(66 LMP)

1 inch long

Spontaneous movement begins. The baby then develops a whole collection of moves over the next 4 weeks including hiccupping, frowning, squinting, frowning the brow, pursing the lips, moving individual arms and legs, head turning, touching the face, breathing (without air), stretching, opening the mouth, yawning, and sucking.<sup>24</sup>



7 weeks (9 weeks LMP)

**8 weeks**  
(10 weeks LMP)

1½ inch long  
.03 oz. in weight

Note: all lengths are GI or "greatest length" which does not include the legs

The baby is now well-proportioned, and about the size of a thumb. Every organ is present. The liver is making blood, the kidneys function, and the heart beats steadily. The skull, elbows, and knees are forming. Of the 4500 structures in the adult body, 4000 are already present.<sup>25</sup> The skeleton of the arms and legs and the spine begins to stiffen as bone cells are added.<sup>26</sup>



8 weeks (10 weeks LMP)

**9 Weeks**  
(11 weeks LMP)

1½ inches long  
.08 oz. in weight

if prodded, the baby's eyelids and hands close. Genitalia that were forming in the 7th week now become visible, indicating whether it's a boy or girl. However, the doctor won't be able to tell by ultrasound until the 12th to 20th week. Early muscular movements begin. The thyroid gland turns on.<sup>27</sup>

**10 Weeks**  
(12 weeks LMP)

2 inches long  
.8 oz. in weight

Fingerprints begin their 7 week long formation. The fingernails begin to develop. The eyelids now fuse together until month 7, protecting the delicate eyes.<sup>28</sup> The number of connections between nerves and muscles has tripled since last week.<sup>29</sup>

**11 Weeks**  
(13 weeks LMP)

2½ inches long  
1.4 oz. in weight

The baby now "practices" breathing, since she will have to breathe air immediately after birth. The baby urinates. Her stomach muscles can now contract.<sup>30</sup> Vocal chords and taste buds form.<sup>31</sup> She can make complex facial expressions and even smile.<sup>32</sup>



11 weeks (13 weeks LMP)

**12 Weeks**  
(14 weeks LMP)

3 inches long  
2 oz. in weight

Fine hair begins to grow on the upper lip and chin and eyebrows.<sup>33</sup> The baby swallows and responds to skin stimulation.<sup>32</sup>



12 weeks (14 weeks LMP)

**13 Weeks**  
(15 weeks LMP)

4 inches long  
3 oz. in weight

The face is prettier, and facial expressions may resemble the parents'. The baby is active, but mom doesn't feel anything yet.<sup>34</sup>



14 weeks (16 weeks LMP)

**15 Weeks**  
(17 weeks LMP)

A wild production of nerve cells begins and continues for a month. A second surge will occur at 25 weeks.<sup>35</sup>