

PROGRESSION



BIOMECHANICS OF BIRTH

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Biomechanics of Birth



Movements and forces involved in the process of birth, including the interaction between **the fetus** and the **maternal birth canal** and the **forces of uterine contraction and gravity**.

Recommended Reading: Grimm M. J. (2021). Forces Involved with Labor and Delivery-A Biomechanical Perspective. *Annals of biomedical engineering*, 49(8), 1819–1835.
<https://doi.org/10.1007/s10439-020-02718-3>

Biomechanics of Birth

For a successful normal birth, a coordinated interaction of five factors, known as the “5 Ps”, is essential:

Passenger - fetus and the assessment of its size, position and attitude (relationship of the fetal parts to each other)

Passageway - birth canal, including the pelvis, cervix and vagina

Powers - uterine contractions and the mother's pushing efforts

Position - mother's position which significantly influences the birth process. Certain positions can optimize the dimensions of the pelvis, facilitate the descent of the fetus and increase comfort during childbirth. Upright positions, such as standing, walking, squatting or using a birthing ball, can take advantage of gravity, allowing the fetus to move downwards more easily

Psyche - woman's emotional and neuro-endocrine response, which is influenced by the level of relaxation and confidence of the birthing woman

(Gimovsky, et al, 2013)



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- During pregnancy, increased levels of relaxin, estrogen and progesterone result in a change in collagen metabolism.
- The relaxation is due to the breakdown of collagen in the connective tissue, which is replaced by a modified form containing a higher water content.
- The **malleability and extensibility of the connective tissue increases.**



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- The ligaments are predisposed to relaxation with a resulting reduction in the passive stability of the joints.
- **Relaxation of the ligaments reaches its maximum in the second trimester.**
- The pubic symphysis and sacroiliac joints are particularly affected.



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Biomechanical changes in the spine and pelvic joints can involve:

- an increase in the sacral promontory
- an increase in the lumbosacral angle
- an anterior rotatory movement of the iliacus
- downward and forward rotation of the pubic symphysis

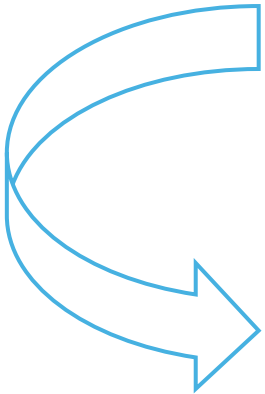
Biomechanics of Birth

- The normal range of the pubic symphysis is 4-5 mm, with an average increase of 3 mm during pregnancy.
- Relaxation of the pelvic joints begins at around 10 weeks of pregnancy, with a maximum near term, returning to normal between 4 and 12 weeks after delivery.
- Relaxation of the ligaments can continue for up to six months after delivery.



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- The hormonal action of relaxin
- Laxer ligaments
- More elastic and flexible joints
- Greater capacity for movement between the bones of the pelvis



NUTATION OF THE SACRUM

CONTRANUTATION OF THE SACRUM

ILIAC ABDUCTION

ILIAC ADDUCTION



Biomechanics of Birth

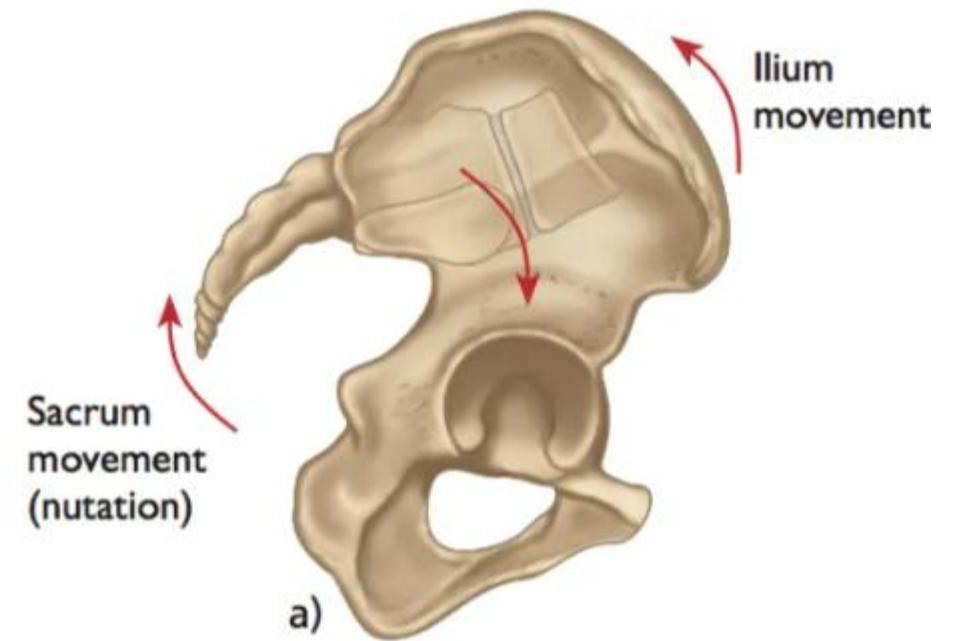
NUTATION OF THE SACRUM

Description of the movement

- The sacrum is rotated forward in relation to the iliac bones
- Anterior inclination of the sacrum in which the promontory protrudes anteriorly approaching towards the pubic symphysis
- The coccyx protrudes posteriorly



THE DISTANCE BETWEEN THE COCCYX AND THE PUBIS INCREASES



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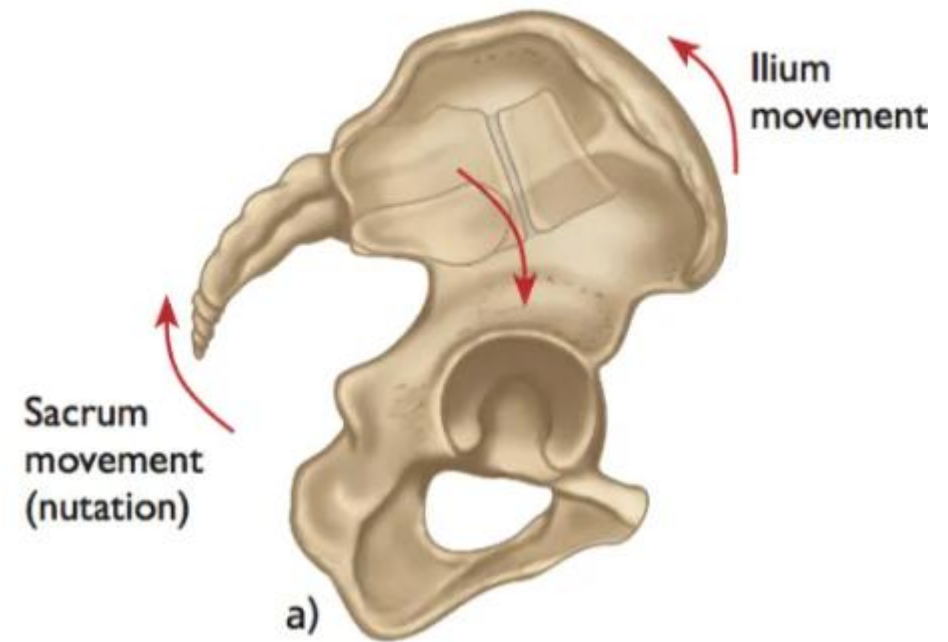
NUTATION OF THE SACRUM

Movements of the adjacent skeleton

- Great flexion of the spine, particularly the lumbar spine
- Abduction and external rotation of the leg

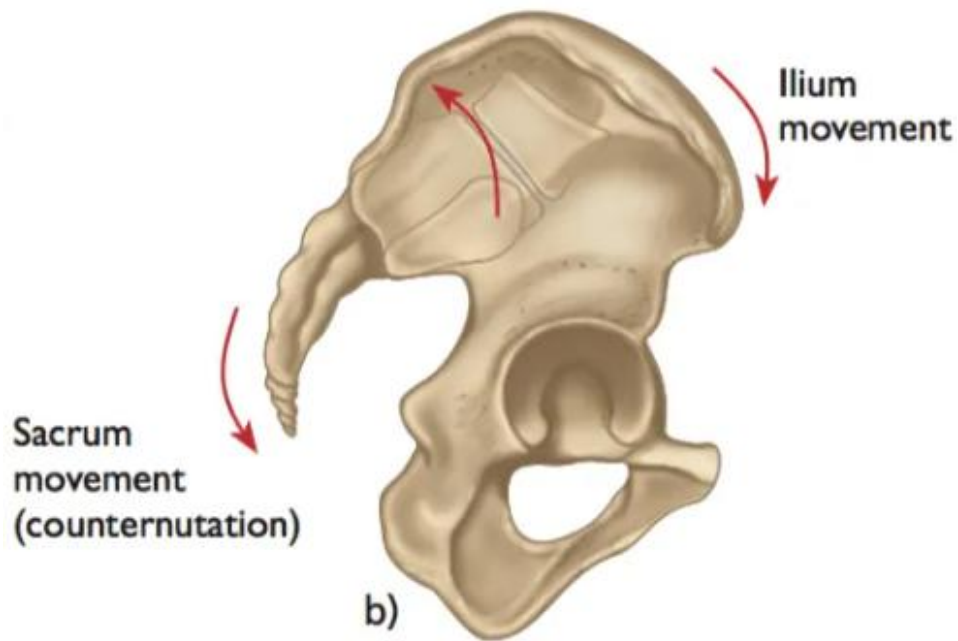
IMPORTANT

- Important movement in the last phase of the expulsion period as it widens the pelvic outlet
- Support on the lower part of the sacrum prevents nutation



In: <https://3dmusclelab.com/sacroiliac-joint/>

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CONTRANUTATION OF THE SACRUM

DESCRIPTION OF THE MOVEMENT

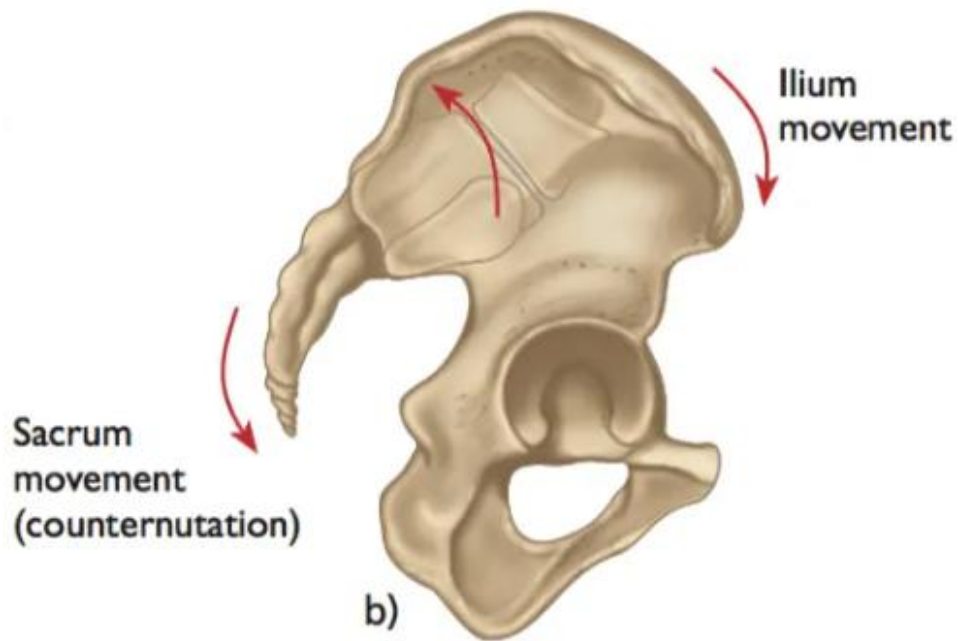
- The sacrum is rotated backwards in relation to the iliac bones
- The promontory projects posteriorly away from the pubic symphysis
- The coccyx projects anteriorly



The distance between the promontory and the pubis increases

In: <https://3dmusclelab.com/sacroiliac-joint/>

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CONTRANUTATION OF THE SACRUM

Movements of the adjacent skeleton

- Adduction and internal rotation of the leg

IMPORTANT

- At the start of dilation because it increases the diameter of the pelvic inlet
- Support on the upper part of the sacrum and contraction of the extensor muscles of the spine avoid contranutation

In: <https://3dmusclelab.com/sacroiliac-joint/>

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ILIAC ABDUCTION

Description of movement

- The anterior superior iliac spine rotates outwards and forwards
- The ischium rotates inwards and backwards
- The sacroiliac and symphysis pubis joints separate at the top and come closer together at the bottom

Movements of the adjacent skeleton

Flexion and external rotation of the leg

Drawing of pelvis movements,
similar to the one in Calais-Germain & Parés, 2010

IMPORTANT

At the beginning of dilatation as it enlarges the diameter of the pelvic inlet



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ILIAC ADDUCTION

Description of movement

- The anterior superior iliac spine rotates inwards and backwards
- The ischium rotates outwards and forwards
- The sacroiliac and symphysis pubis joints approach at the top and separate at the bottom

Movements of the adjacent skeleton

Flexion and internal rotation of the leg

Drawing of pelvis movements,
similar to the one in Calais-Germain & Parés, 2010

IMPORTANT

In the last phase of the expulsive period as it separates the ischium and widens the pubic arch



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Recommended Video:

Arthrology of the pelvis Nutation and counternutation Childbirth

In: <https://www.youtube.com/watch?v=-ZKgzMvWXVM>

Arthrology of the pelvis The sacrococcygeal joint

In: <https://www.youtube.com/watch?v=busEhjTvJJg>

References

Grimm M. J. (2021). Forces Involved with Labor and Delivery-A Biomechanical Perspective. *Annals of biomedical engineering*, 49(8), 1819–1835. <https://doi.org/10.1007/s10439-020-02718-3>

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Cherni Y, Desseauve D, Decatoire A, Veit-Rubinc N, Begon M, Pierre F, Fradet L. [Evaluation of ligament laxity during pregnancy](#). *Journal of gynecology obstetrics and human reproduction*. 2019 May 1;48(5):351-7. Accessed 21 Jul 2022.

