

千葉大学大学院医学薬学府 博士課程

Chiba University Graduate School of Medical and Pharmaceutical Sciences Doctor Course

令和7年10月入学

Entry in October 2025

令和8年4月入学第1回

Entry in April 2026. 1st

入学試験問題

The questions for the entrance examination

【専門科目】

Specialty Subject

注 意 事 項 (Notes :)

1. この冊子は、監督者から解答を始めるよう合図があるまで、開いてはいけません。

You do not open this booklet until there are directions of the starting test by a test proctor.

2. すべての解答用紙に受験番号を忘れずに記入してください。

Please fill in all the answer sheets with your examinee's number.

3. この問題冊子は、試験終了後、持ち帰って結構です。

You may take this booklet with you after the examination.

令和7年10月入学・令和8年4月入学第1回
医学薬学府博士課程入学試験問題 Question Sheet
専門科目 Specialty Subject 2025.8.6 (Wed) 実施

Read the text below and answer the questions in English.

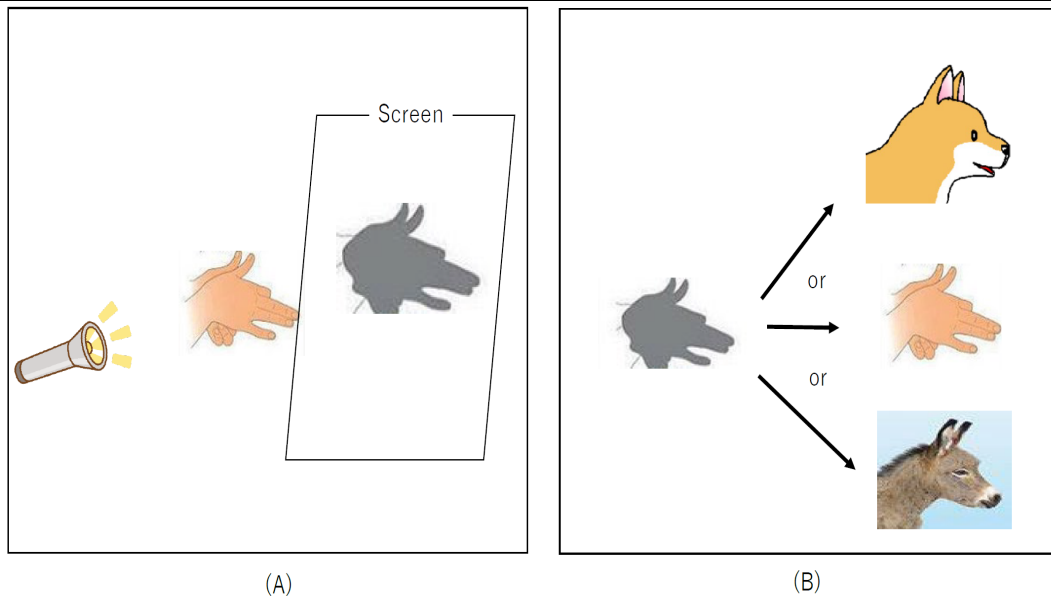


Figure 1

By combining both hands together and putting them in front of a light, you can create a silhouette of a head of a dog on a screen (Figure 1-A). Conversely a silhouette cannot tell you the source of the silhouette. It might be a dog, hands, or a donkey (Figure 1-B).

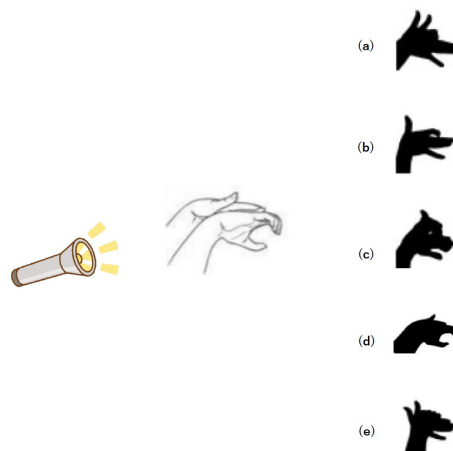


Figure 2

Q1: Look at the Figure 2.

What silhouette is going to be created by the hands? Choose the proper answer from (a) to (d).

But a silhouette can give you some information. That is degree of rotation. When you stand to the south of a house and look at a weathercock on a roof, you can tell that the wind is blowing from the east by the size of the silhouette of the weathercock (Figure 3-A)

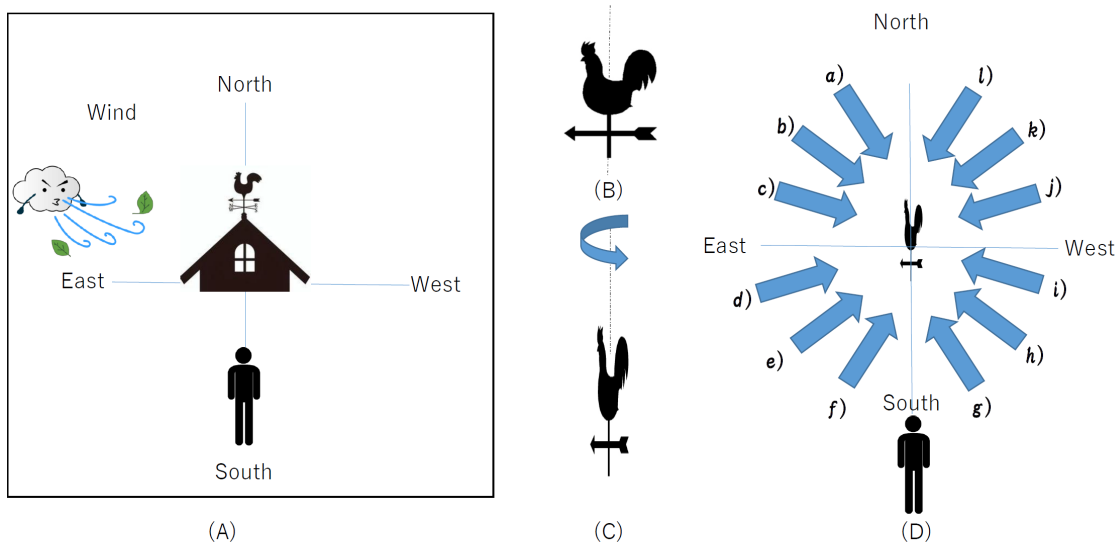


Figure 3

Q2: Look at the Figure3-B.

A weathercock is designed to indicate the direction of wind so that the head of the cock facing the coming wind. Because the left half of the body of the weathercock is () than that of the right half in terms of axial moment around vertical rotational axis. Put a proper word in a bracket.

Q3: Figure3-B showed how the weathercock looked like when the wind is blowing from the east. If you see the weathercock like Figure 3-C, in which direction the wind is coming? Select all the proper options from a) to l) in Figure 3-D.

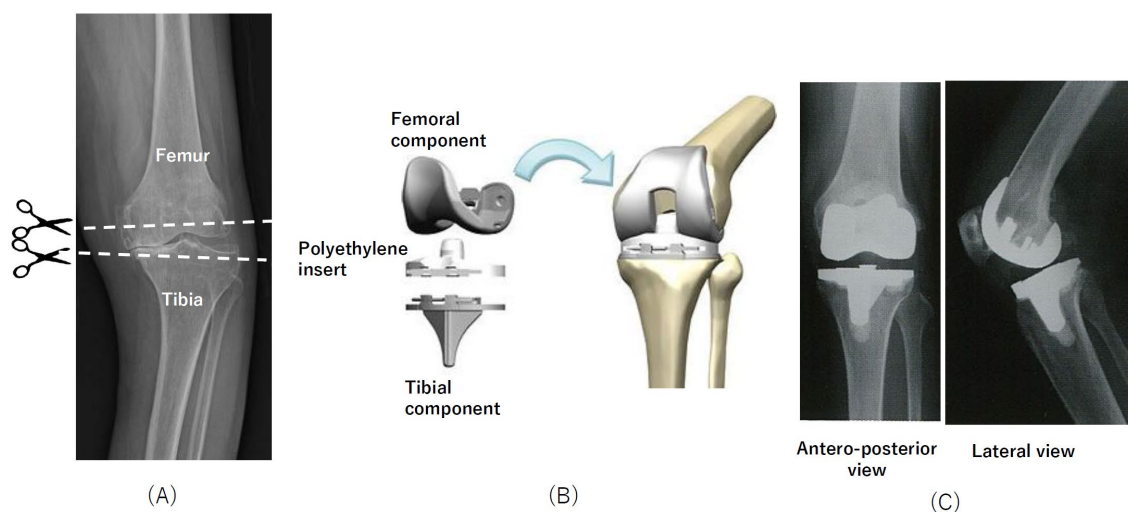


Figure 4

The same idea as above is utilized to examine the knee motion after an artificial knee joint replacement surgery. Fig 4-A showed x-ray of a deformed right knee joint. In performing knee joint replacement surgery, distal end of the femur and proximal end of the tibia are surgically cut out. Then the femoral component and tibial component are to be implanted on the surface of corresponding each bone. A polyethylene insert is placed between the two components. As the two components are made of metal, x-ray of post-surgery showed the shape of two components just like the silhouette.

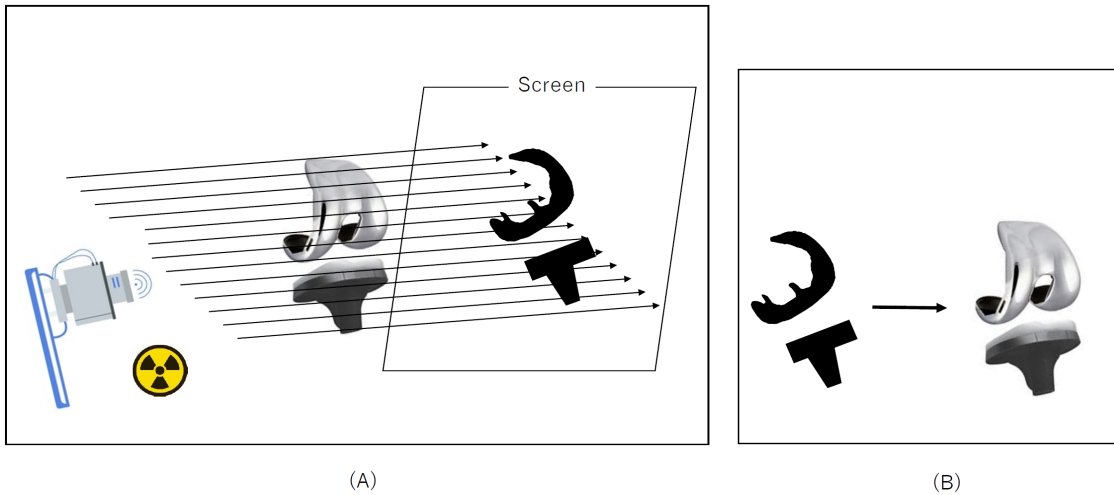


Figure 5

Using x-ray beam instead of a light, metal components make specific silhouette on the screen (Fig 5-A). Unlike Fig 1-B, shape and size of the origin of the silhouette is known, researchers can estimate how the two components face each other (Fig 5-B). By acquiring multiple x-ray images in various flexion angles of the knee joint, analysis of *in vivo* knee joint motion is possible (Fig 6).

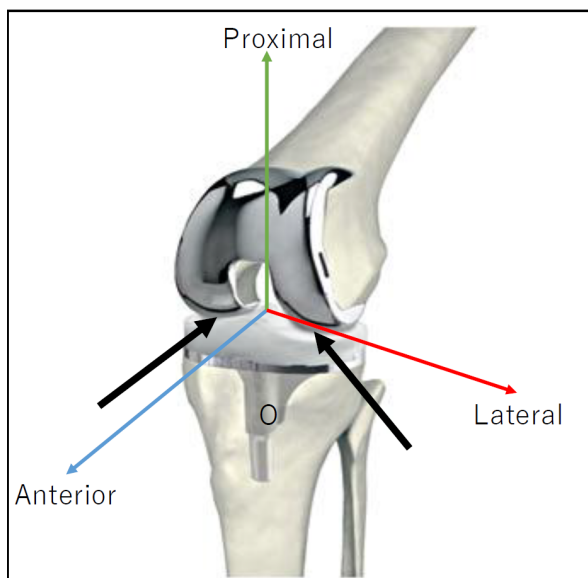
著作権の都合上、公開できません。

出典：T. Yamazaki et al. , *European Journal of Radiology* 53 (2005) 84–89

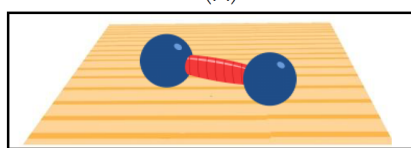
Figure 6

Q4: Which of the figure showed status of the knee joint flexed at 90 degrees? Choose the proper answer from (a) to (e) in the Figure 6-B.

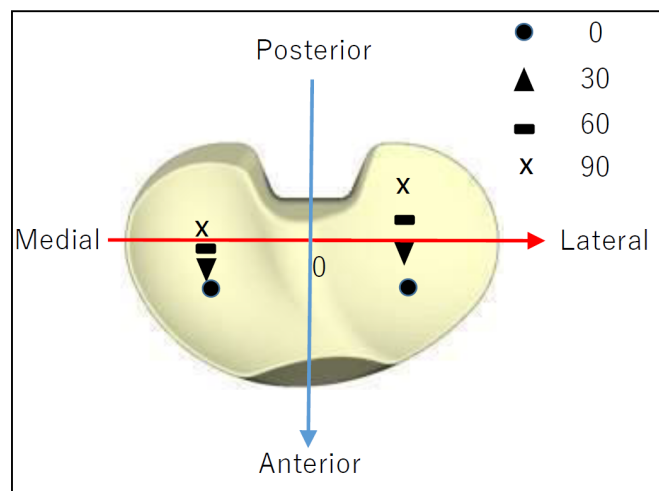
Using above mentioned technique, lateral and medial contact points of the femoral component to the polyethylene insert can be detected (Figure 7-A, tips of two black arrows). Considering spherical surface of the femoral component and approximately flat surface of polyethylene, medial and lateral contact points can be compared to the two small areas of a surface of an iron dumbbell that touch a floor (Figure 7-B). Figure 7-C shows surface of the polyethylene insert looking from proximal to distal direction, and medial and lateral contact points on the polyethylene insert at 0, 30, 60, and 90 degrees of knee flexion are marked. In addition, defining three dimensional coordinate system on the polyethylene insert (Figure 7-A), we can tell how the contact points move three dimensionally.



(A)

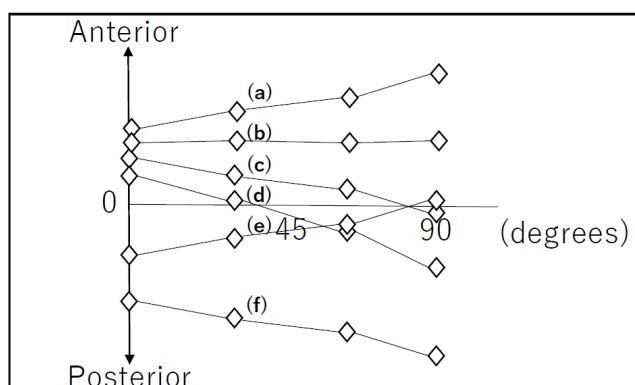


(B)

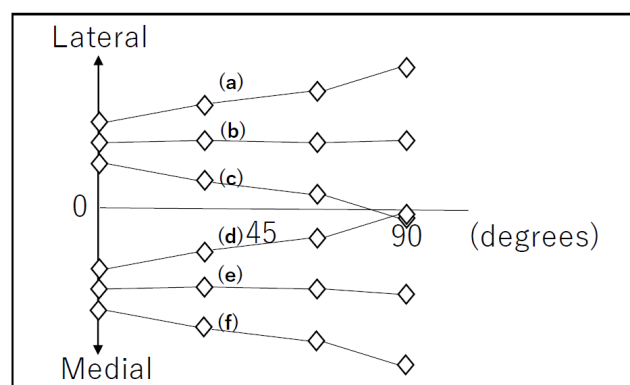


(C)

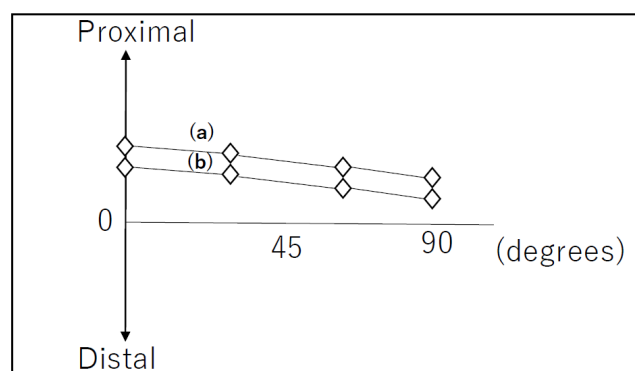
Figure 7



(A)



(B)



(C)

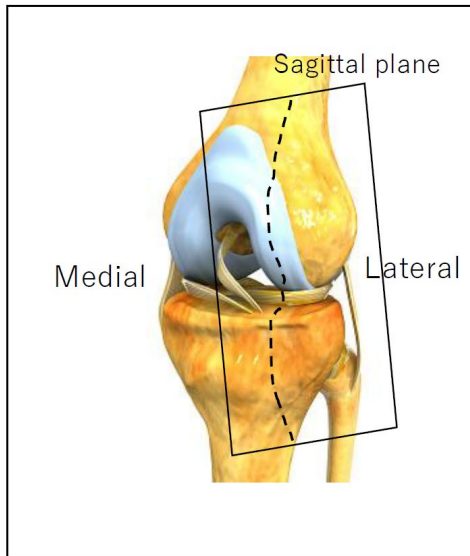
Figure 8

Q5: Which graph show the movement of lateral and medial contact points in antero-posterior direction?
Choose the proper answer from (a) to (f) in the Figure 8-A.

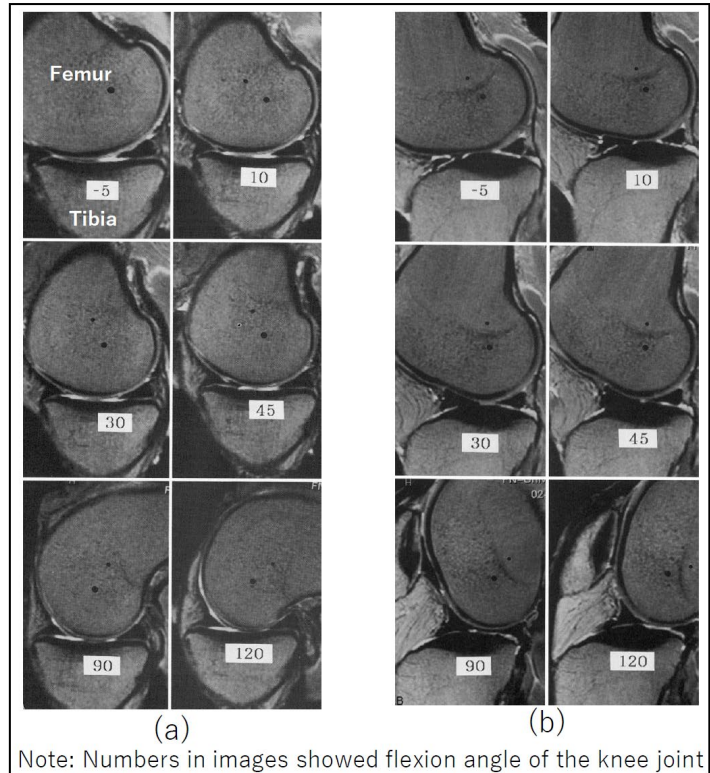
Q6: Which graph show the movement of lateral and medial contact points in lateral-medial direction?
Choose the proper answer from (a) to (f) in the Figure 8-B.

Q7: In proximal-distal direction, i.e., vertically, two contacts points showed movement as shown in Figure 8-C. The result indicate that thickness of anterior portion of the polyethylene insert is () than that of the posterior. Put a proper word in a bracket.

In vivo knee joint movement of a healthy knee is more difficult to analysis than an artificial knee joint. MRI is utilized for this purpose. It is well known that the contact points of the femur and tibia moves larger in the lateral side of the knee.



(A)



(B)

Figure 9

Q8: Figure 9-A showed how sagittal planes of MRI is created. Figure 9-B showed two sets of sagittal images with different flexion angles of a knee joint. Contact point is considered as the closest point of the surface of femur to the surface of tibia.

Which of the two sets of MRI series represent lateral side of the knee, (a) or (b)?

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< 解答例 >

Q1 (d)

Q2 smaller (lighter など小さい、軽いという意味であれば可)

Q3 a)とf)

Q4 (d)

Q5 lateral (d) medial (c)

Q6 lateral (b) medial (e)

Q7 thinner (薄いという意味であれば可)

Q8 (b)

< 出題意図 >

バイオメカニカル分野の研究手技を平易に紹介し、研究手法を俯瞰する理解力、得られた結果を示す図表を解釈する能力を問うことを意図した。