

# C-Reactive Protein (CRP) C反應蛋白 發炎指數的力量



艾利動物醫院  
主治獸醫師 林辰柔

- 了解系統性發炎反應
- 急性反應期蛋白  
Acute phase proteins(APPs)
- 什麼是C-Reactive Protein (CRP)
- 病例分享

講座大綱



# Systemic Inflammation



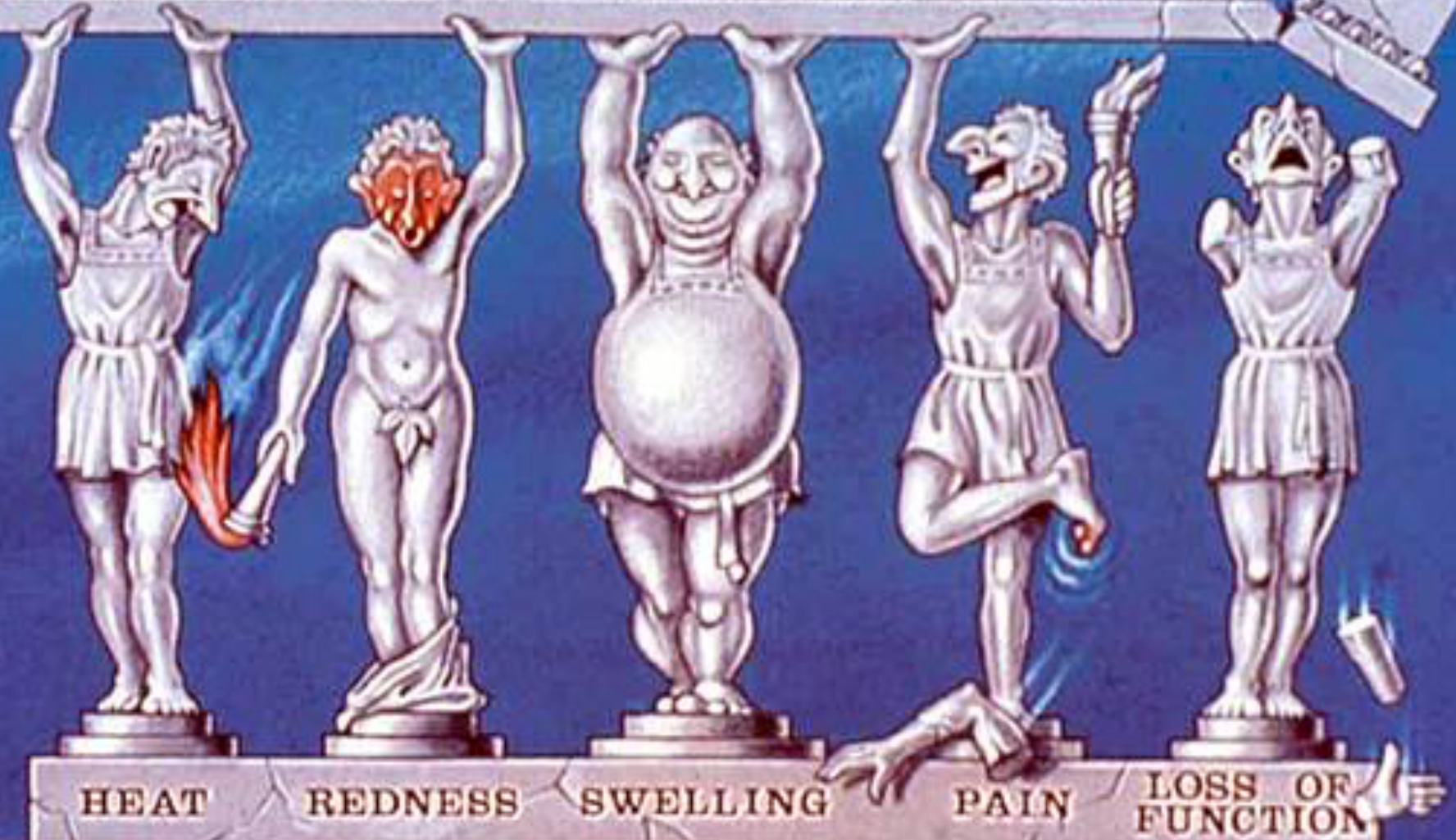
**Systemic  
inflammation**

**SIRS: Systemic inflammatory  
response syndrome**

**MODS:  
Multiple organ dysfunction**

**Death**

# INFLAMMATION



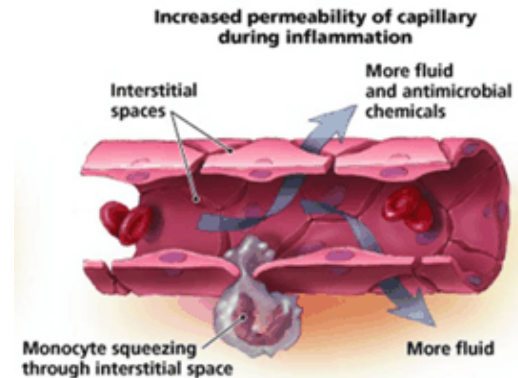
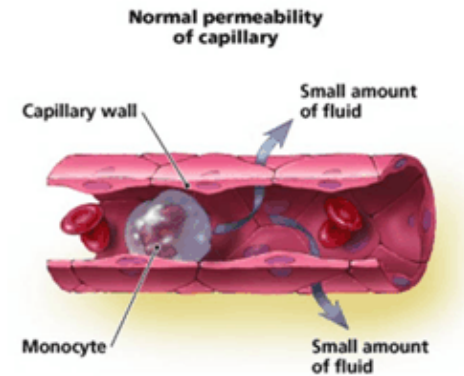
Aulus Cornelius Celsus (ca 25 BC—ca 50)

- 白血球的改變

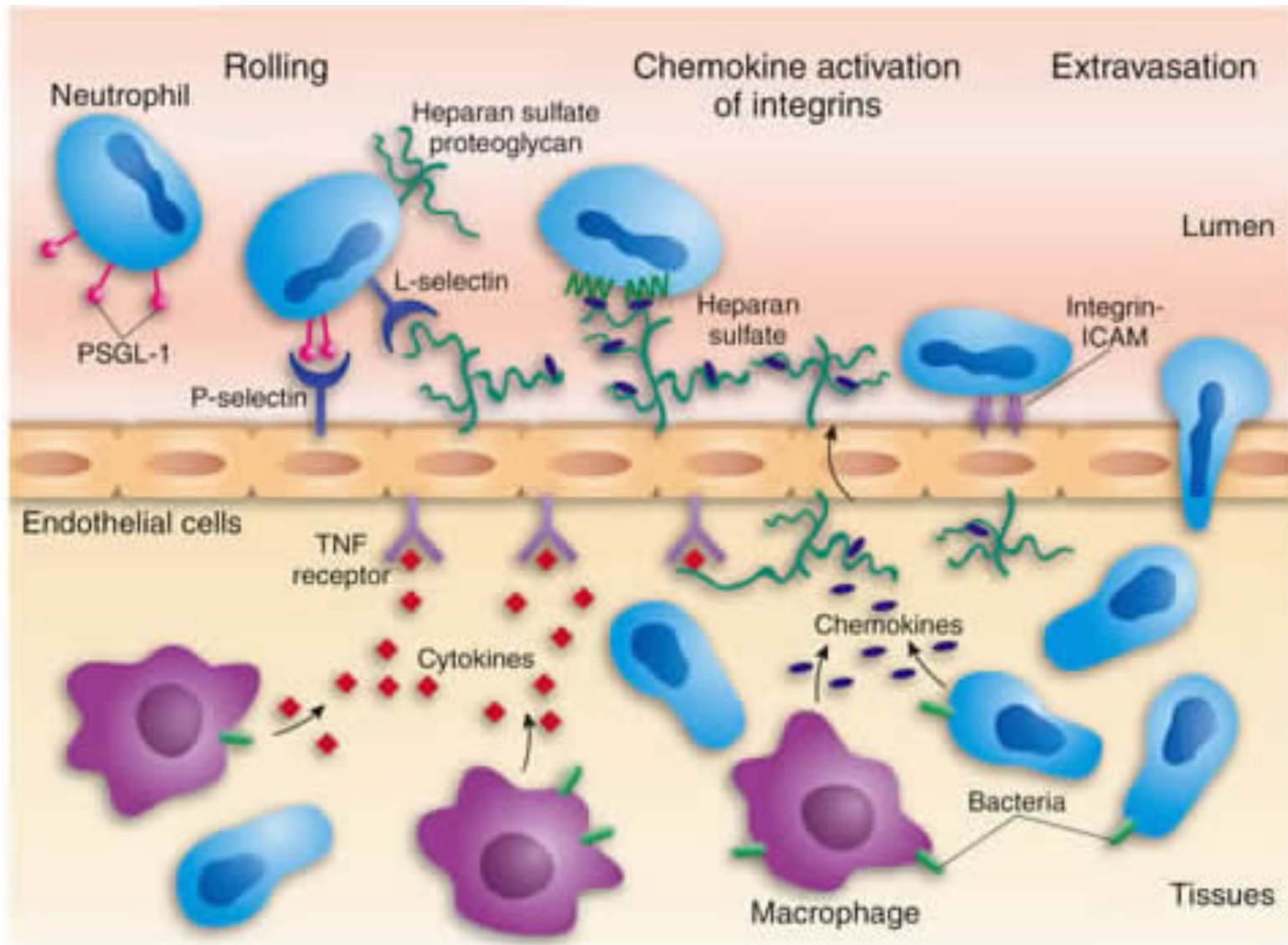
- 白血球外滲
- 白血球吞噬
- Cell-derived mediators

- 血管的改變

- 血管口徑增加
- 增加血管滲透性
- Plasma cascade systems
- Plasma-derived mediators

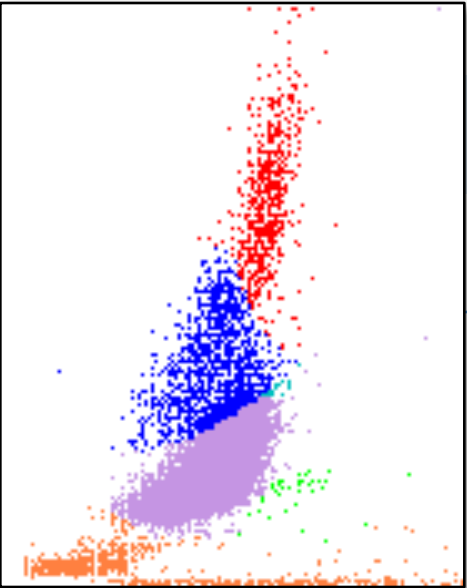
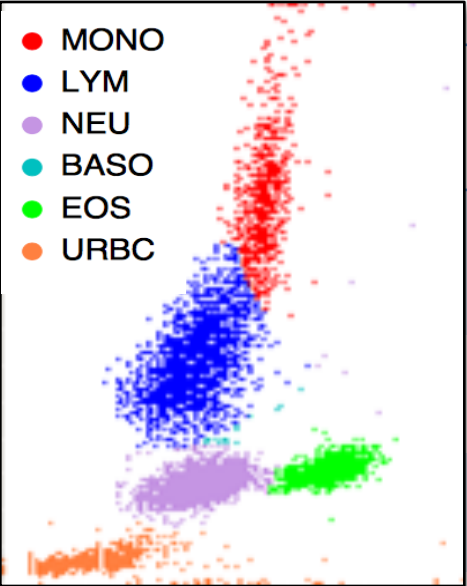


# 發炎引起的組織變化

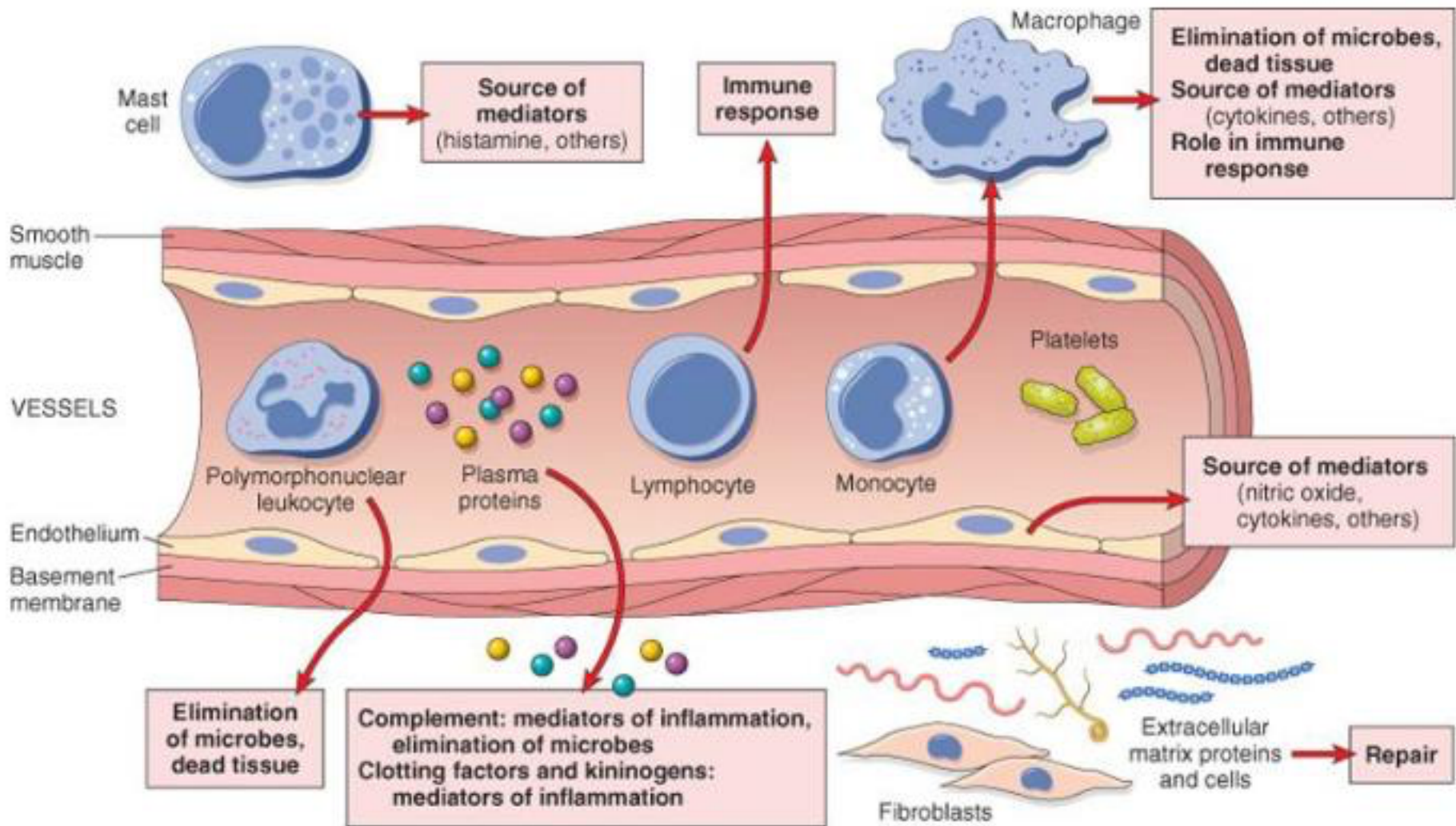


細胞性質的改變（白血球）

Leukocyte type	Moderate inflammation	Glucocorticoids ("stress")
Mature neutrophil	↑-↑↑	↑-↑↑
Band neutrophil	↑-↑↑	N
Lymphocyte	↓-↓↓	↓↓
Monocyte	N-↑↑	N-↑
Eosinophil	↓	↓
Basophil	N-↑	N



# 常見白血球相

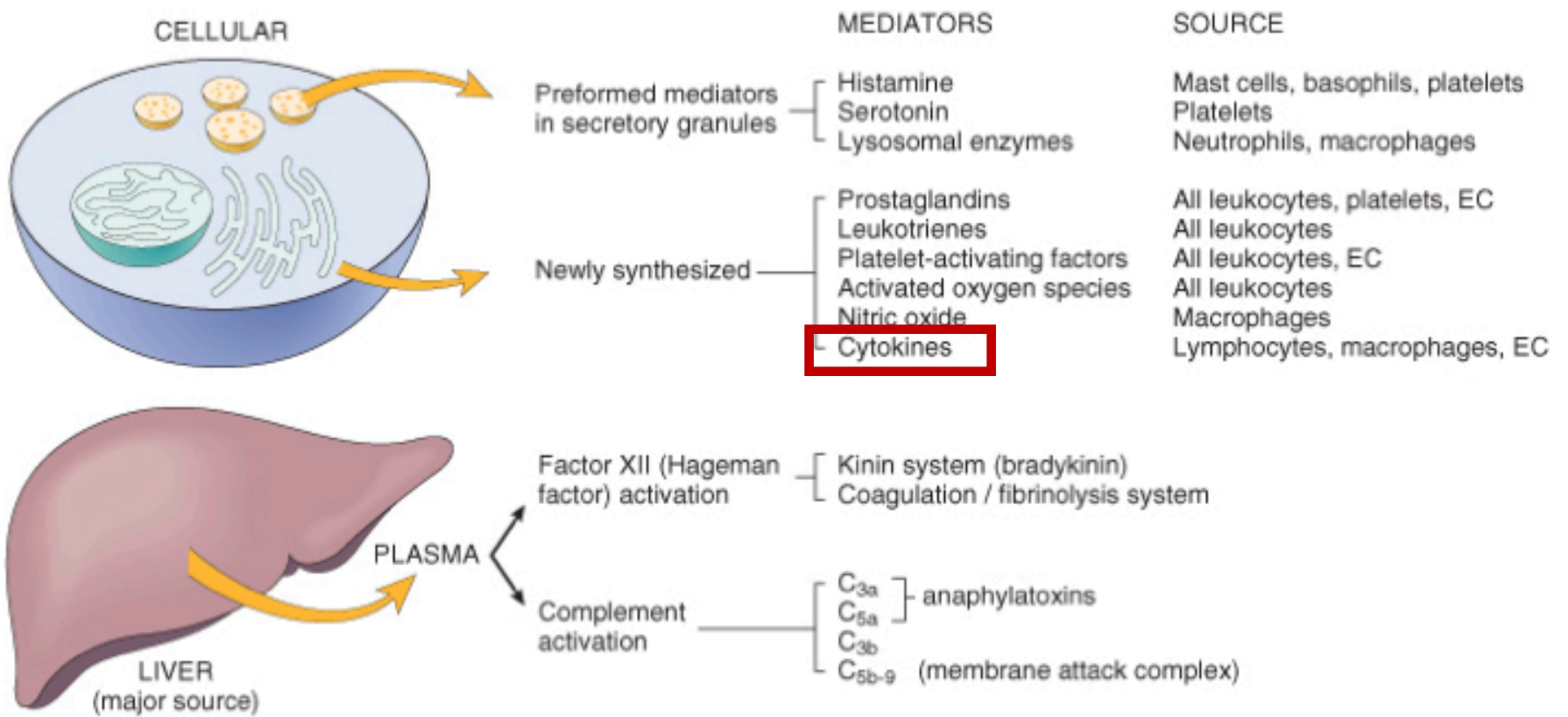


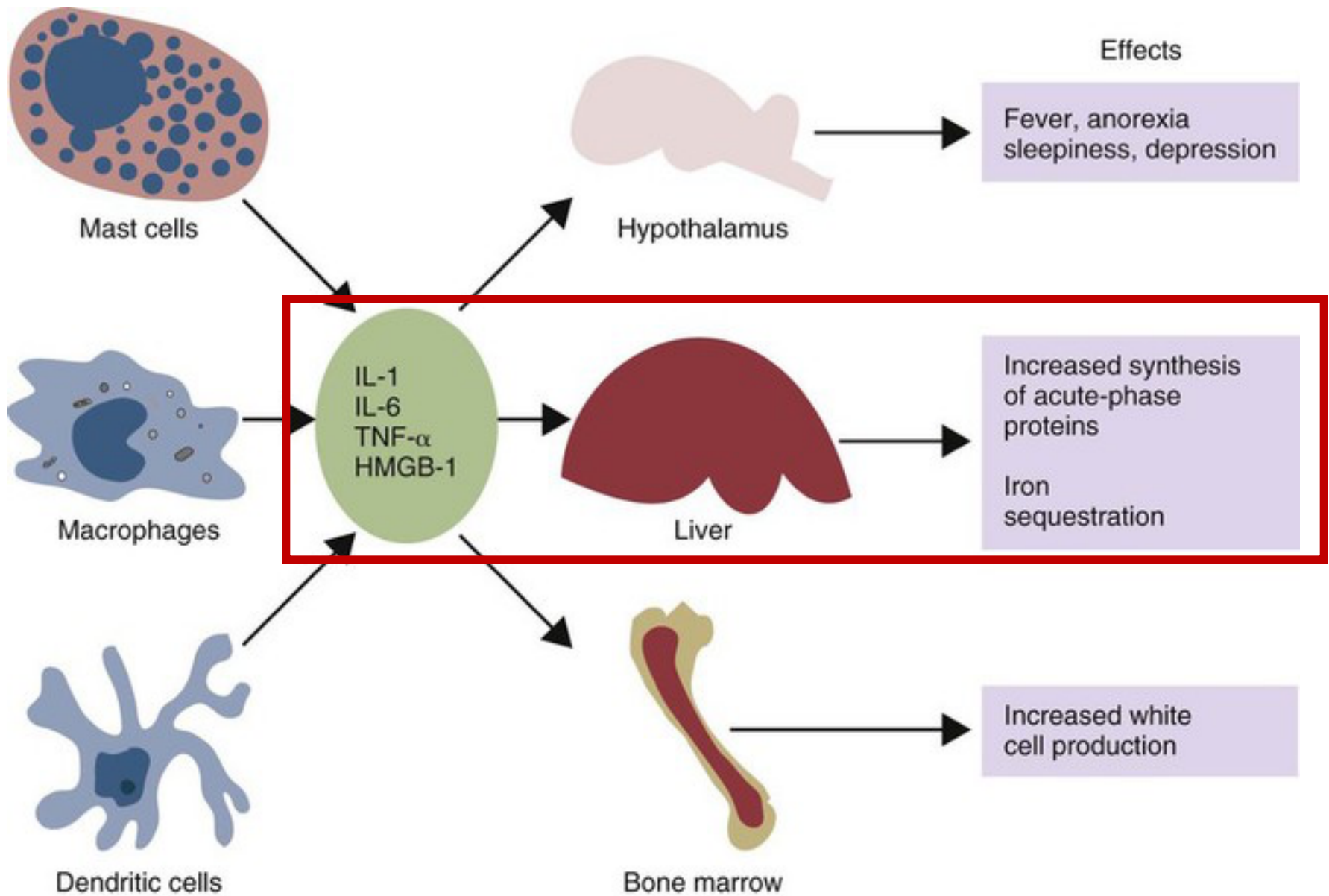
© Elsevier. Kumar et al: Robbins Basic Pathology 8e - www.studentconsult.com

# 發炎反應

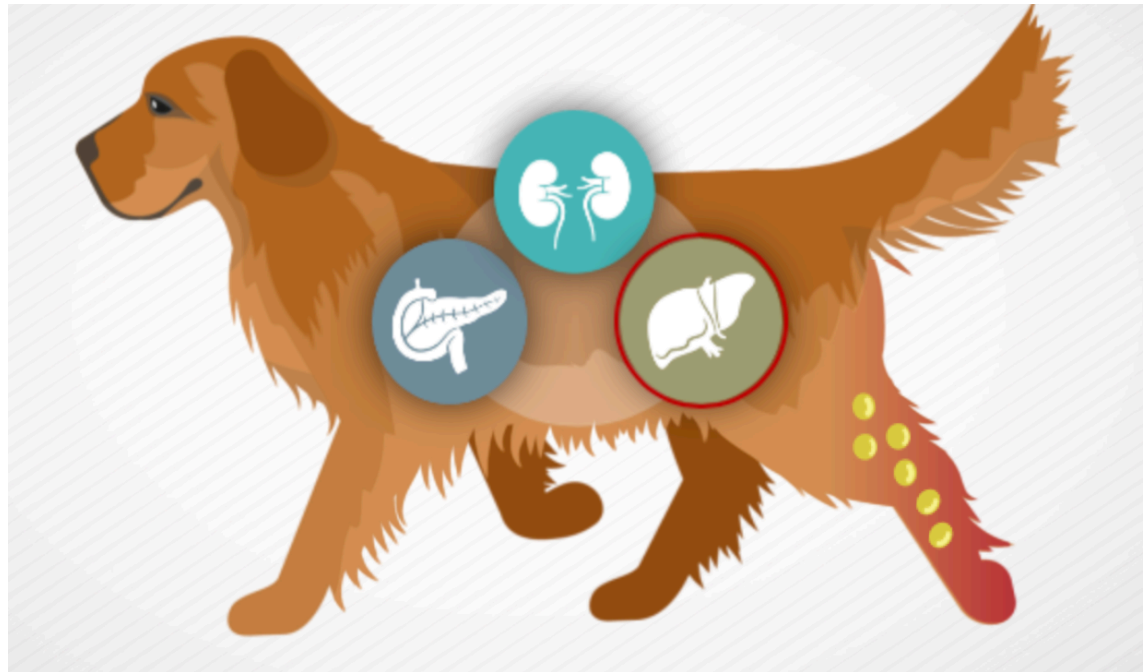


# Inflammatory mediators



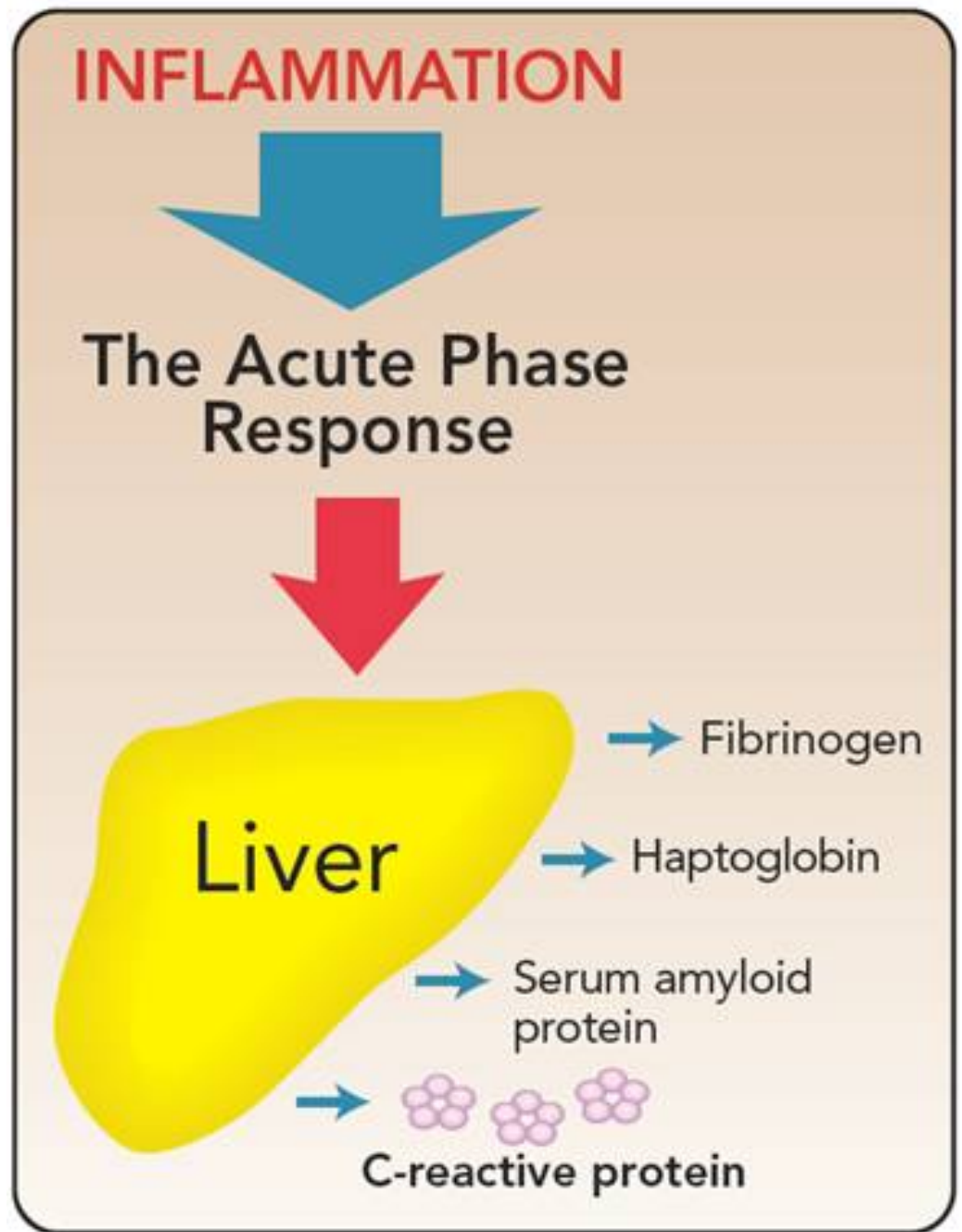
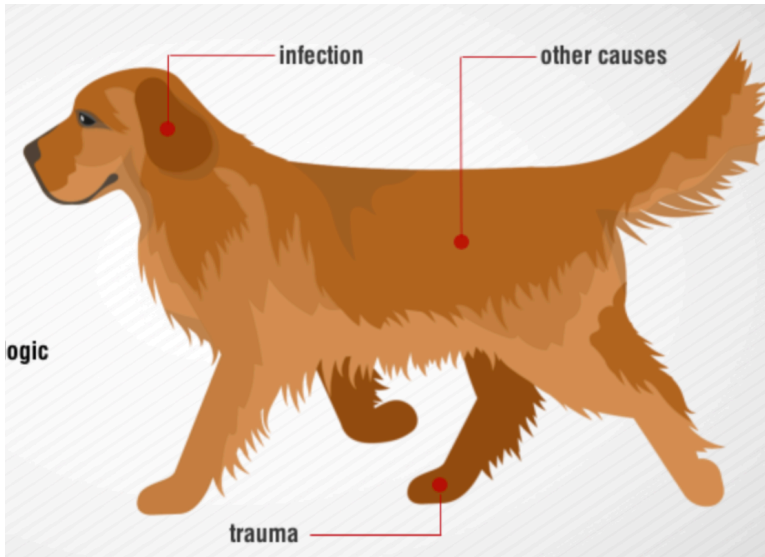


- 傳統評估：白血球，血漿蛋白（球蛋白）
- 新評估法：急性反應期蛋白  
Acute phase proteins



## 發炎反應的評估

急性反應期蛋白  
Acute phase proteins  
(APPs)



**Positive APPs**

**Negative APPs**

C-reactive protein (CRP)

Albumin

Serum Amyloid A (SAA)

Transferrin

Haptoglobin (Hp)

Transthyretin

Ceruloplasmin

Retinol-binding protein

$\alpha$ 2-Macroglobulin









$\alpha$ 1-Acid glycoprotein (AGP)

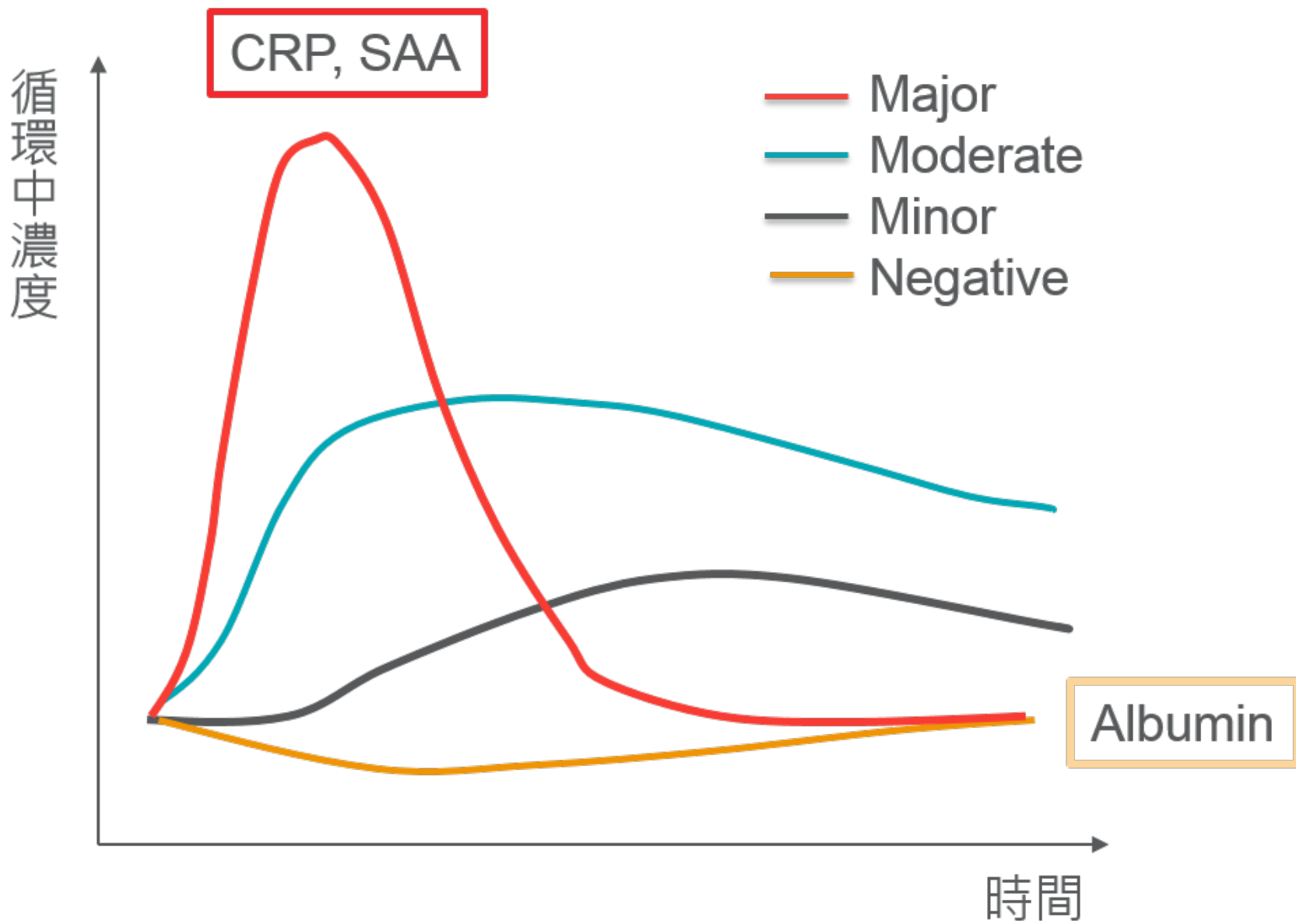
Fibrinogen

Complement (C3, C4)

**Acute phase proteins (APPs)**

# Acute phase proteins

Major	 10- to 100-fold	 24 - 48 hours	 decrease rapidly
Moderate	 1- to 10-fold	 48 - 72 hours	 decrease slower
Minor	 slightly	 gradual	



# Acute phase proteins

## Major

## Moderate



- $\alpha$ 1-acid glycoprotein
- serum amyloid A

- haptoglobin



- CRP
- serum amyloid A

- $\alpha$ 1-acid glycoprotein
- ceruloplasmin
- haptoglobin



- haptoglobin
- serum amyloid A

- $\alpha$ 1-acid glycoprotein
- CRP
- fibrinogen

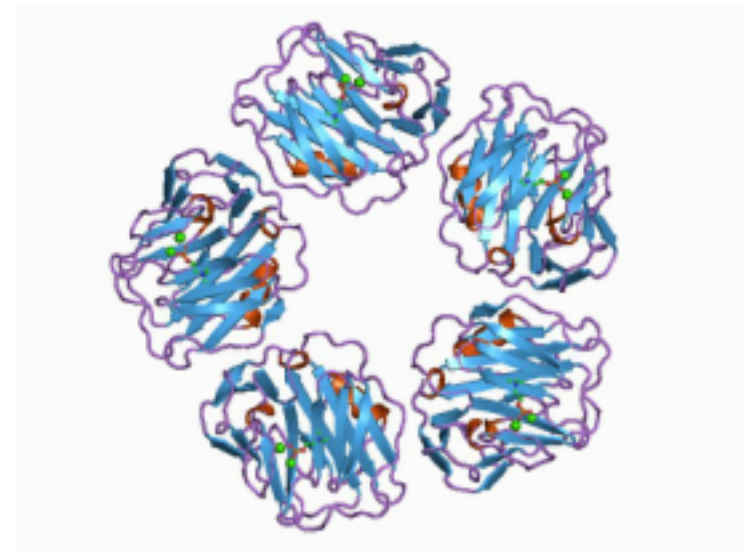


- serum amyloid A

- fibrinogen
- haptoglobin



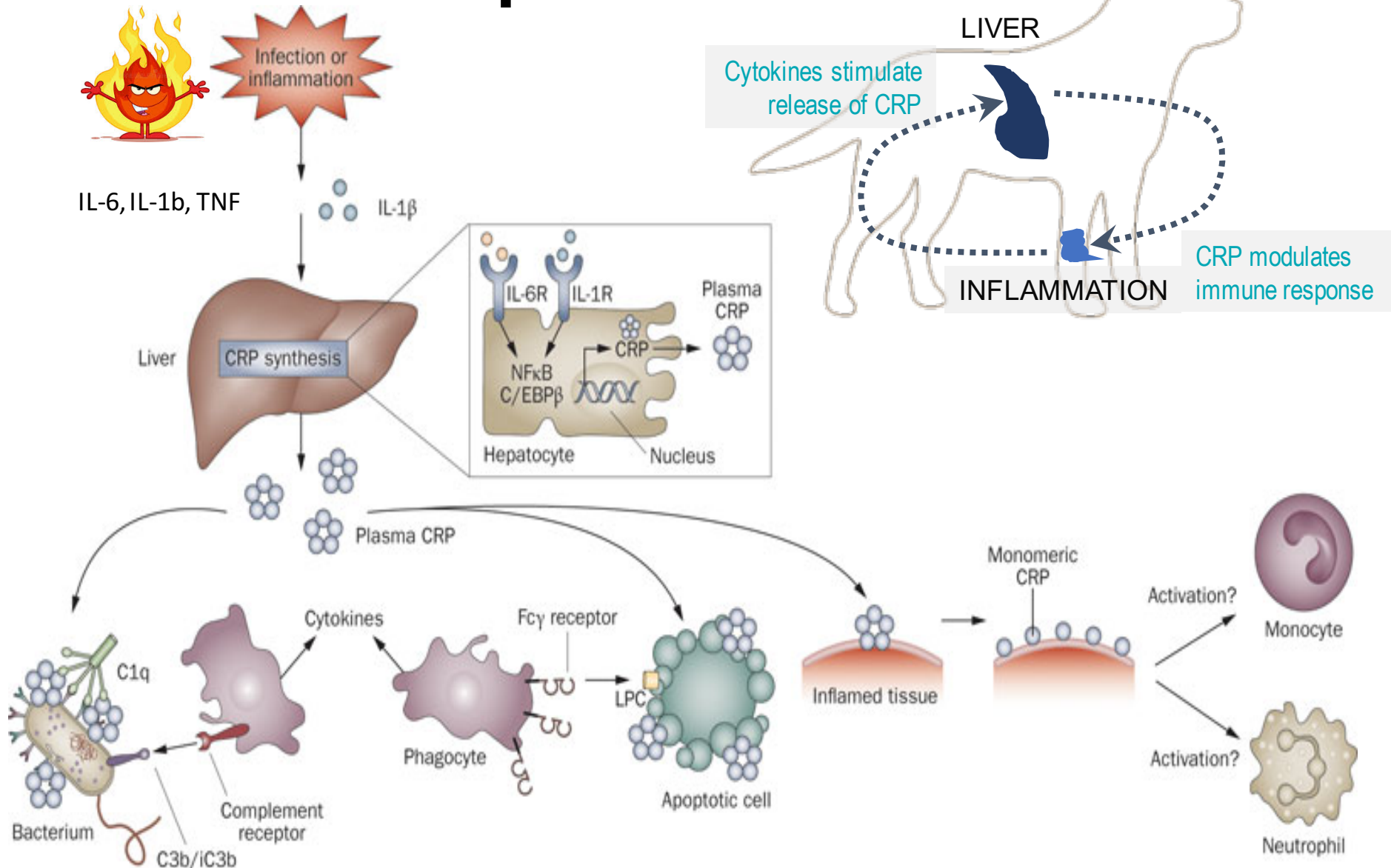
- 發炎指數
- 5 subunits of 20 kD each
- 100-150 kDa
- 肝臟生成的血漿蛋白

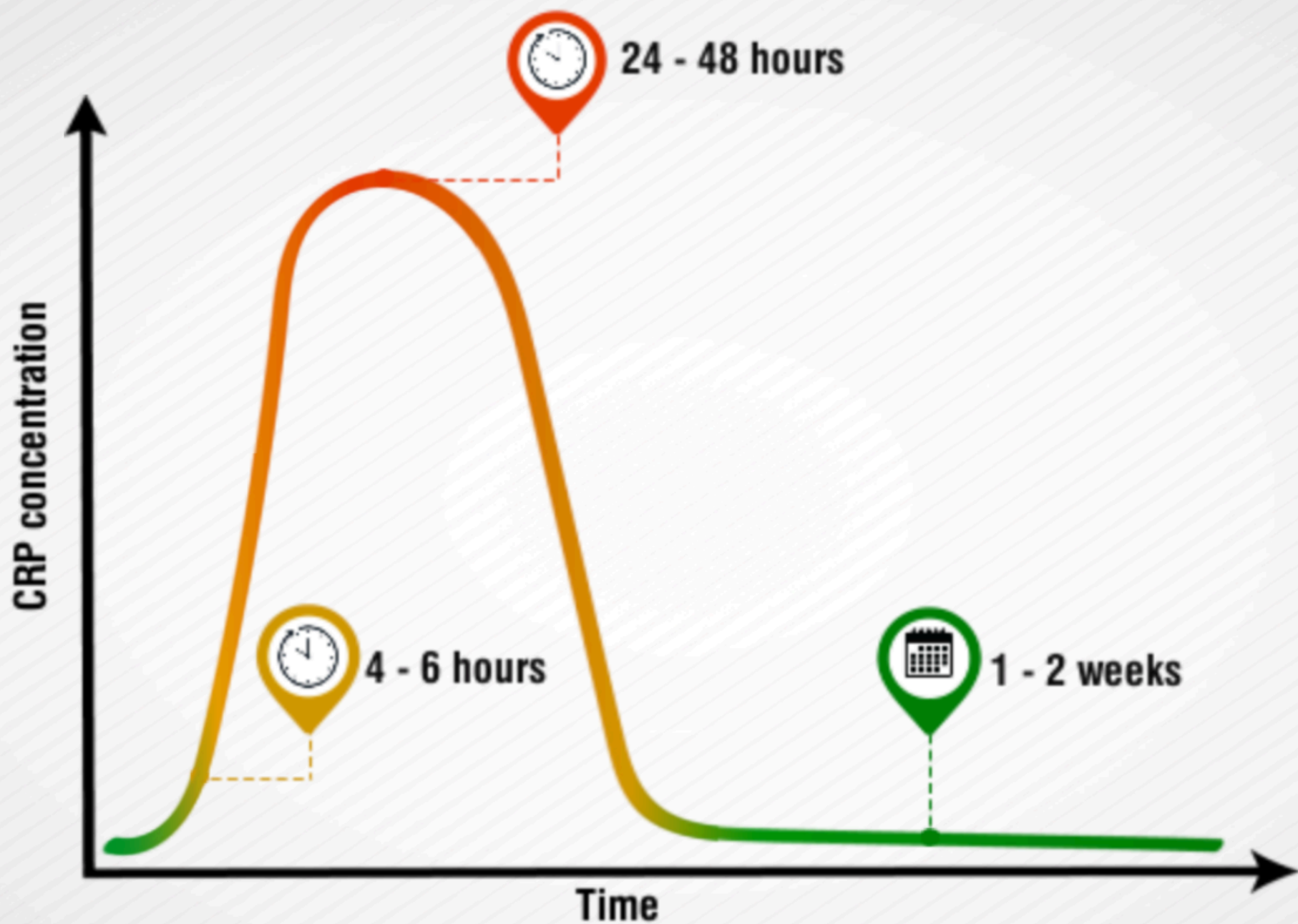


- 急性發炎蛋白 Acute phase proteins (APPs)
- Major APPs
- 只有人和狗狗可以使用
- Dog: <1.0mg/dL

## C-Reactive Protein (CRP)

# C-reactive protein



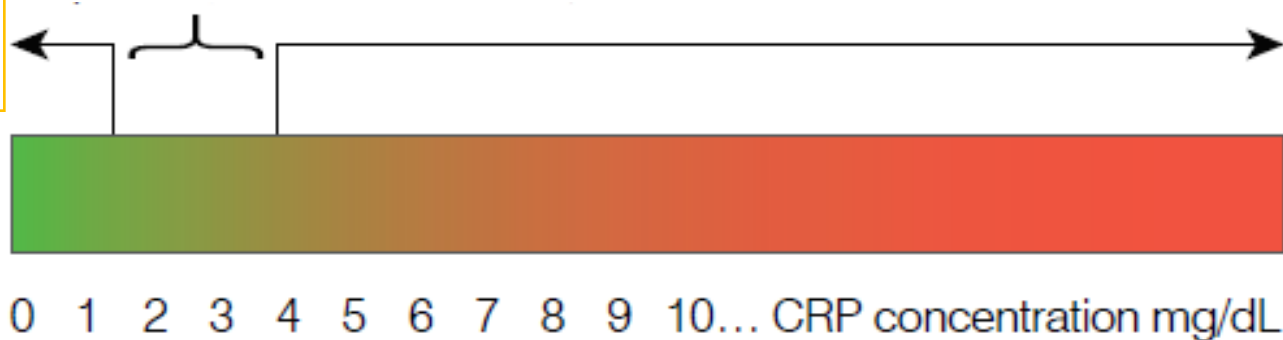


- **偵測**是否有系統性發炎反應的存在
- 定量評估系統發炎反應的**嚴重程度**
- 持續的測量，**監控**其病程進展
- 在許多疾病，CRP已被當成**預後因子**的指標  
( 胰臟炎，發炎性腸病..... )

沒有系統性  
炎症反應的  
證據

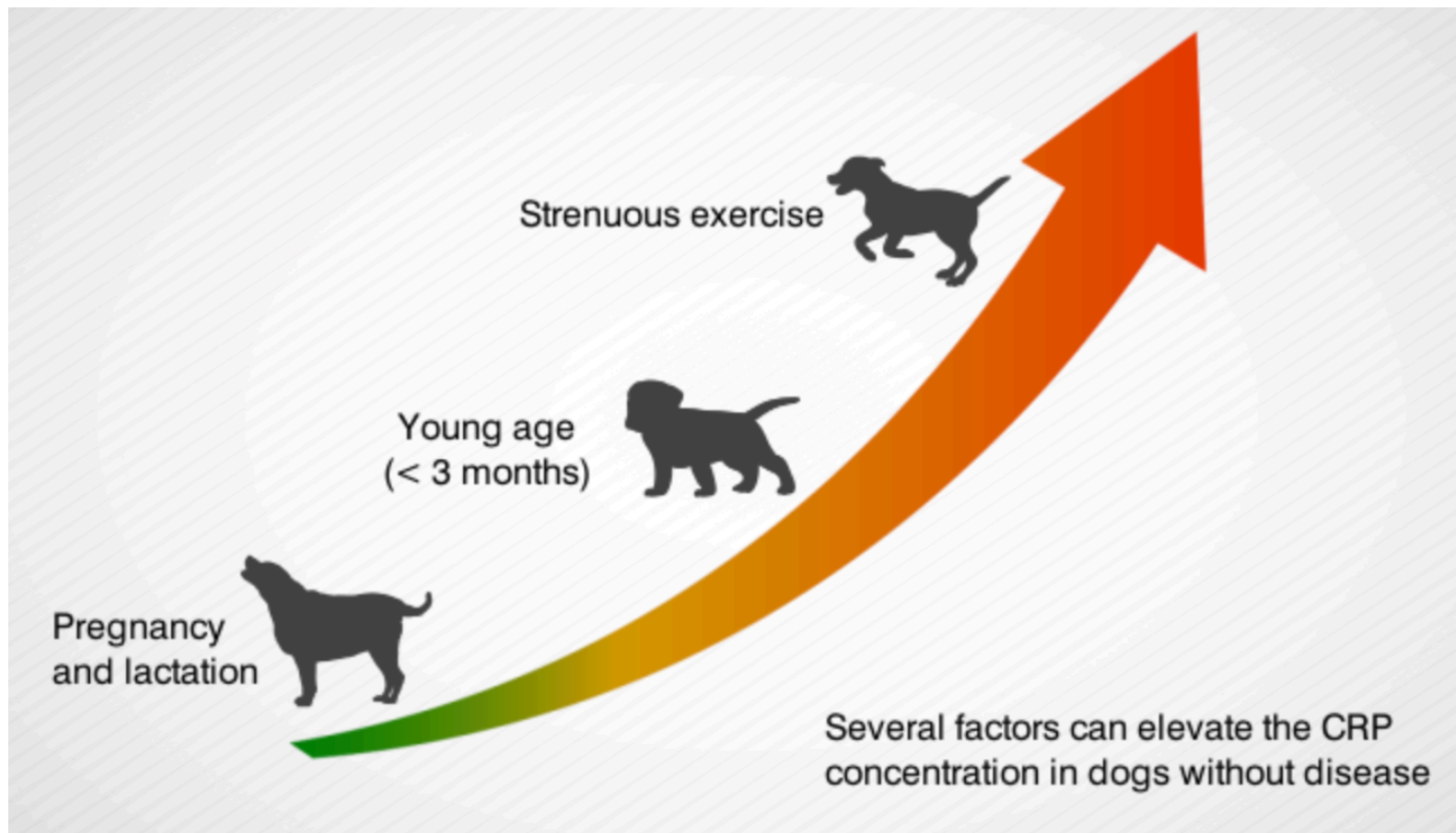
早期、輕微或正在下降

>3, 強列證據顯示有系統性炎症反應的發生



## CRP 的臨床應用

- 與品種，性別，緊迫，飲食，白晝波動都無相關性



## CRP 影響因子

*Veterinary Research Communications*, 17 (1993) 259–266  
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## **CANINE C-REACTIVE PROTEIN (CRP) DOES NOT SHARE COMMON ANTIGENICITY WITH HUMAN CRP**

S. YAMAMOTO<sup>1</sup>, S. MIYAJI<sup>1</sup>, N. ABE<sup>1</sup>, K. OTABE<sup>1</sup>, E. FURUKAWA<sup>2</sup> AND  
M. NAIKI<sup>3</sup>

<sup>1</sup>Department of Immunology, Faculty of Environmental Health, Azabu University,  
Fuchinobe, Sagamihara, Kanagawa 229, Japan

<sup>2</sup>Sanwa Kagaku Kenkyusyo Co. Ltd., Higashiku, Nagoya, Aichi 461, Japan

<sup>3</sup>Department of Veterinary Science, The National Institute of Health, Shinjuku,  
Tokyo 162, Japan

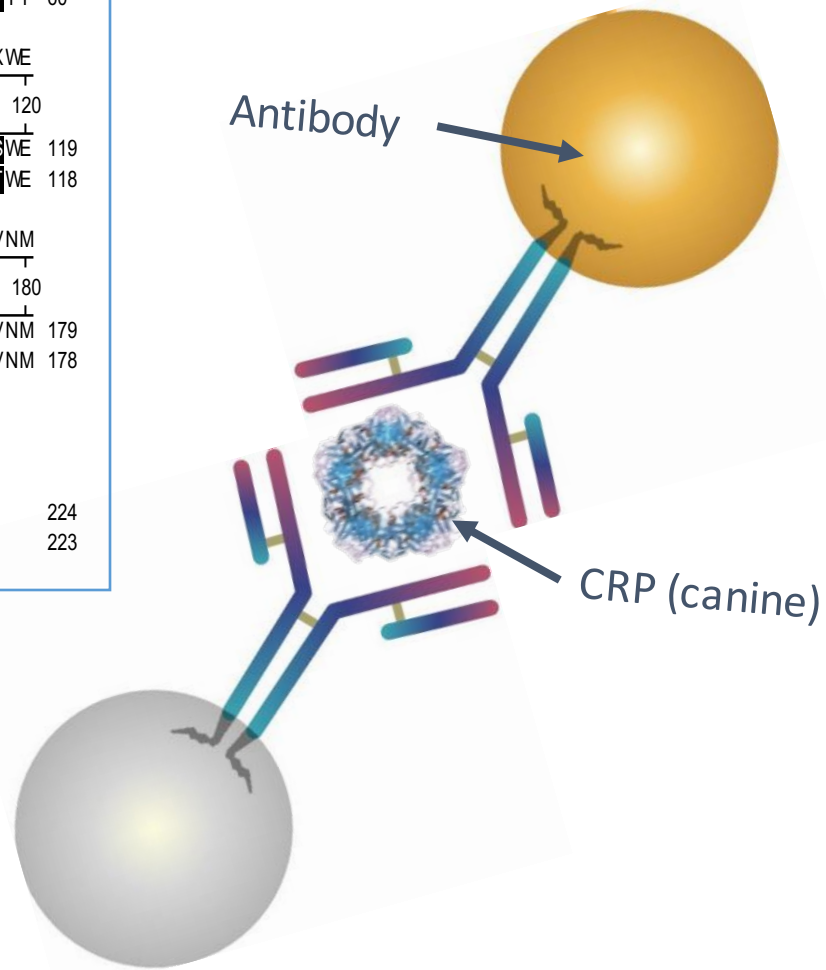
Western blotting analysis

# 物種專一性的CRP

Majority	MEKLXXCXLVLLXXLXXAFQXQDXXXKAFVFPXESXXSYVXLXXXLXKPXKAFVCLXXYT	
	10 20 30 40 50 60	
CRP Human.pro	MEKL L C F L V L T S L S H A F C Q T D M S R K A F V F P K E S D T S Y V S L K A P L T K P L K A F T V C L H F Y T	59
CRP Canine.pro	MEKL W P C L L V L M N L P G A F L Q I D L D E K A F V F P R E S E N S Y V I L F P C L G K P M K A F T V C L Q V Y T	60
Majority	XLXTRXXSXF SYATKXQXNEI LXFXXXXXXXXSXVGGSSXXXXXXXXPXXXXAPXHXCXW	
	70 80 90 100 110 120	
CRP Human.pro	E L S S T R G Y S I F S Y A T K R Q D N E I L I F W S K D I G Y S F T V G G S E I L F F E V P E V T M A P V H I C T S W E	119
CRP Canine.pro	D L T T R P H S L F S Y A T K S Q S N E I L L F K E R P G L F S V S V G G S D A F I N F P Q K F Y A P C H F C V T W E	118
Majority	SXXGXXEXWWDGKPVXRSLXXGYTVGXXASI XLGQEQDSF GGXFXXXQSLVGD I XXVNM	
	130 140 150 160 170 180	
CRP Human.pro	S A S G I V E F W D G K P F V R K S L K K G Y T V G A E A S I L G Q E Q D S F G G N F E G S Q S L V G D I G N V N M	179
CRP Canine.pro	S V T G L T E L W D G K P M V R A S L R R G Y T V G S C A S I V L G Q E Q D S F G G C F D K N Q S L V G D I E D V N M	178
Majority	WDFVLSPXXI XTXYXXXXXSPNVLNWRXLXYEXXGEVFXKXXLWX	
	190 200 210 220	
CRP Human.pro	W D F V L S P D E I N T I Y L G G P F S P N V L N W R A L K Y E V C G E V F T K P C L W P	224
CRP Canine.pro	W D F V L S P S C I L T L Y T T R A L S P N V L N W R N L R Y E T R G E V F L K K E L W S	223

犬和人的CRP都含有205個胺基酸。  
但相似度只有59%。

# 物種專一性的CRP



# 溶血

# 脂血

# 黃疸

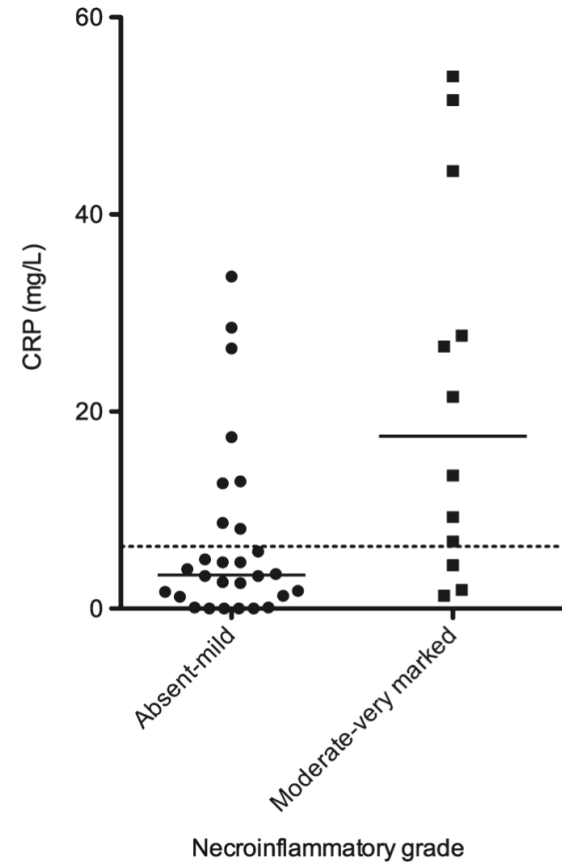
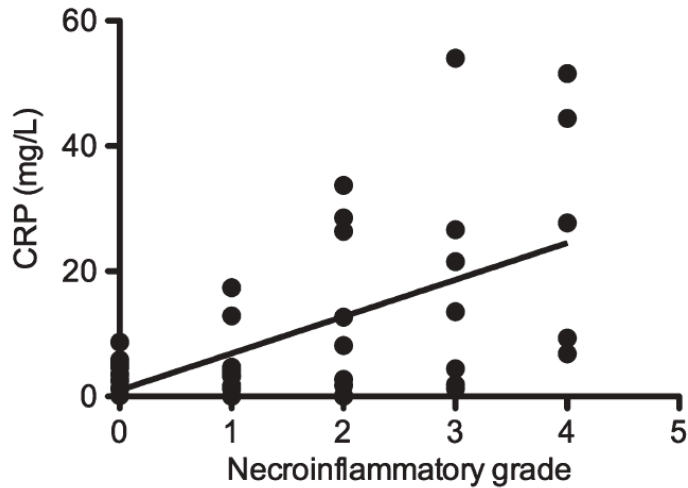
Hemolysis		Lipemia		Icterus	
Hemoglobin concentration (mg/dL)	Mean CRP concentration (mg/dL)	Intralipid concentration (mg/dL)	Mean CRP concentration (mg/dL)	Ditaurobilirubin concentration (mg/dL)	Mean CRP concentration (mg/dL)
Not spiked	1.7	Not spiked	1.7	Not spiked	1.7
32	1.6	125	1.7	1.25	1.7
68	1.7	250	1.6	2.5	1.8
125	1.6	500	1.6	5	1.7
250	1.7	1,000	1.7	10	1.8
375	1.7			15	1.8
500	1.6			20	1.7

干擾物質影響的測試 by Catalyst



# Serum C-reactive protein and S100A12 concentrations in dogs with hepatic disease

S. M. CRAIG\*, J. K. FRY\*, A. RODRIGUES HOFFMANN†, P. MANINO\*, R. J. M. STEINER‡, H. A. HOTTINGER\*, S. L. HUNTER\* AND J. A. LIDBURN\*



CRP的濃度 不受肝臟功能影響

# 與CRP有關的疾病

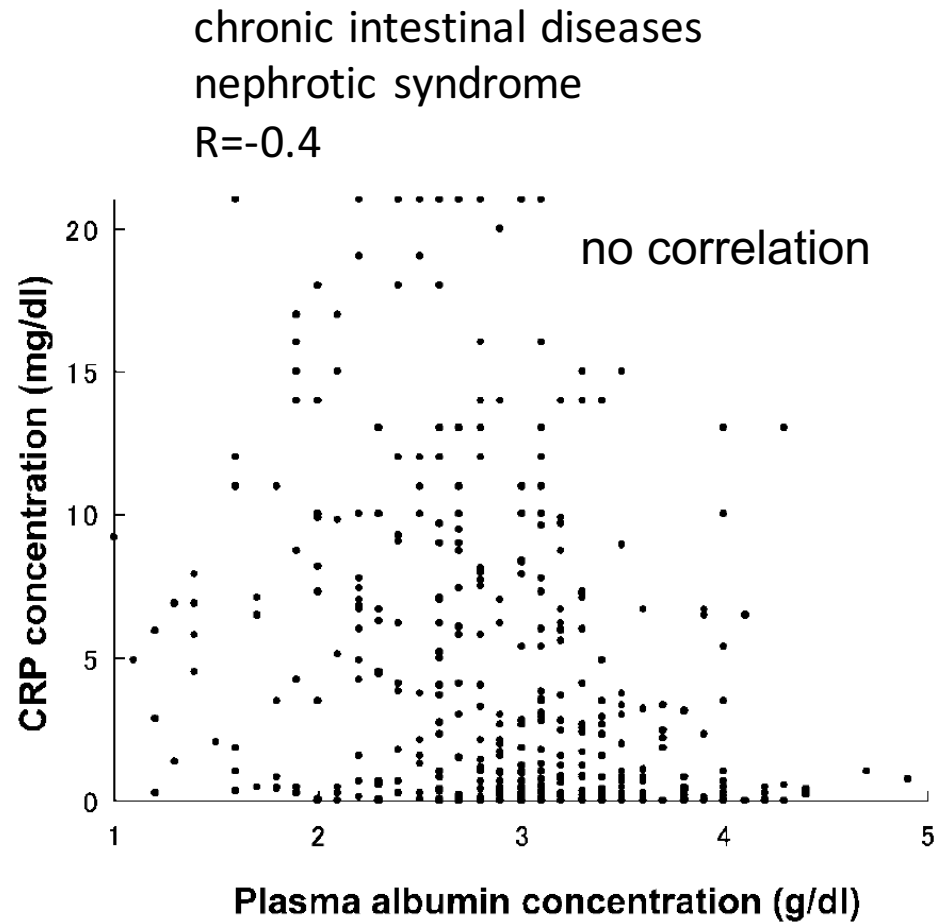
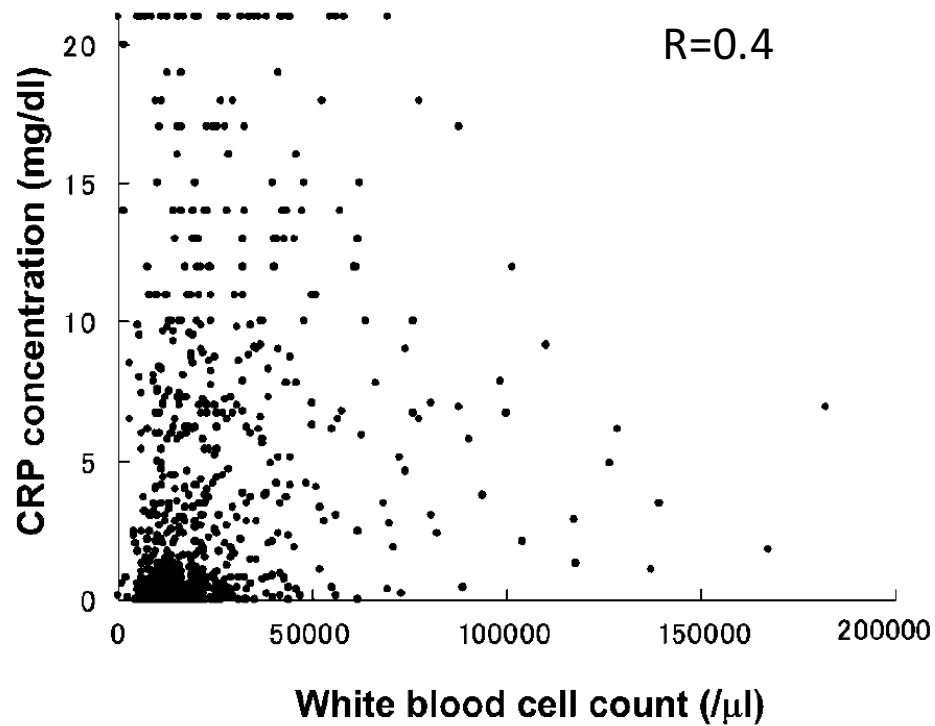
Diseases*	(n)	CRP (mg/dl)			Number of dogs	
		Median**	Min.	Max.	≥1 mg/dl (%)	≥10 mg/dl (%)
Pyometra	7	20.0	3.5	>20	7 (100%)	5 (71%)
Sterile nodular panniculitis	7	20.0	10.0	>20	7 (100%)	5 (100%)
Acute pancreatitis	5	15.0	6.1	>20	5 (100%)	3 (60%)
Idiopathic polyarthritis	31	13.0	1.7	>20	31 (100%)	21 (67%)
Hemangiosarcoma	5	7.6	3.1	16	5 (100%)	2 (40%)
Nasal adenocarcinoma	5	6.7	0.1	9	4 (80%)	0 (0%)
Immune-mediated hemolytic anemia	35	6.5	0	>20	30 (86%)	9 (26%)
Cholangiocellular carcinoma	7	6.3	0.1	19	6 (86%)	2 (29%)
Acute lymphoblastic leukemia	6	4.5	0.1	>20	5 (83%)	1 (17%)
Malignant histiocytosis	16	4.3	0.3	>20	11 (69%)	4 (25%)
Lymphoma	127	3.5	0	>20	91 (72%)	26 (21%)
Bronchopneumonia/Pneumonia	16	3.3	0.2	11	12 (75%)	1 (6%)
Malignant mesothelioma	7	2.7	0.7	15	5 (71%)	1 (14%)
Demodicosis	7	2.6	0	7.1	5 (71%)	0 (0%)
Chronic hepatitis	7	1.6	0	9.7	4 (57%)	0 (0%)
Cardiac tamponade	6	1.5	0.7	6.7	3 (50%)	0 (0%)
Myelodysplastic syndrome	5	1.3	0	14	3 (60%)	1 (20%)
Intestinal adenocarcinoma	13	1.0	0	14	8 (62%)	3 (23%)
Immune-mediated thrombocytopenia	7	1.0	0	12	4 (57%)	1 (14%)

N=928

Nakamura, M., et al. 2008

# 與CRP無關的疾病

Diseases*	(n)	CRP (mg/dl)			Number of dogs
		Median	Min.	Max.	≥1 mg/dl (%)
Epilepsy	33	0	0	0.7	0 (0%)
Atlantoaxial subluxation	5	0	0	0.4	0 (0%)
Hypothyroidism	5	0	0	0.5	0 (0%)
Urolithiasis	5	0	0	0.7	0 (0%)
Brain tumor	8	0	0	1.0	1 (13%)
Intervertebral disk protrusion	22	0.1	0	3.0	3 (14%)
Hyperadrenocorticism	11	0.1	0	1.5	1 (9%)
Tracheal collapse	11	0.1	0	0.7	0 (0%)
Rhinitis	8	0.1	0	0.7	0 (0%)
Mitral valve insufficiency	10	0.2	0	2.1	1 (10%)
Necrotizing meningoencephalitis	9	0.2	0	0.8	0 (0%)
Hypoadrenocorticism	7	0.2	0	7.2	1 (14%)
Portosystemic shunt	13	0.3	0	3.0	2 (15%)
Bronchitis	6	0.3	0	1.8	2 (33%)
Megaesophagus	5	0.3	0	0.6	0 (0%)
Hydrocephalus	10	0.3	0	1.1	1 (10%)
Allergic bronchitis	5	0.4	0.1	0.8	0 (0%)
Diabetes mellitus	5	0.4	0.2	0.5	0 (0%)
Leiomyosarcoma	6	0.4	0.2	2.7	1 (17%)



- CRP對於進行性發炎，較WBC為更敏感的指標
- CRP不受骨髓造成的WBC動力學而影響
- CRP 相較於WBC在使用類固醇或NSAID不會造成誤導的判讀
- 發炎性的白血球相無法像CRP有良好的定量
- CRP 和CBC無法互相取代

## CRP vs CBC



有了好工具，準備上戰場

- 心臟病，皮膚病，慢性胰臟炎約1-2年
- 昨天晚上突然怪怪，有嘔吐的動作
- 吃得比較慢
- 體溫較高

- 當日一大早早就診
- PE: BCS: 6/9, ARB,
- 腹痛，高燒 39.9°C, 6% dehydration
- LNs: NSF,



**Coco 13 y/o poodle FS**

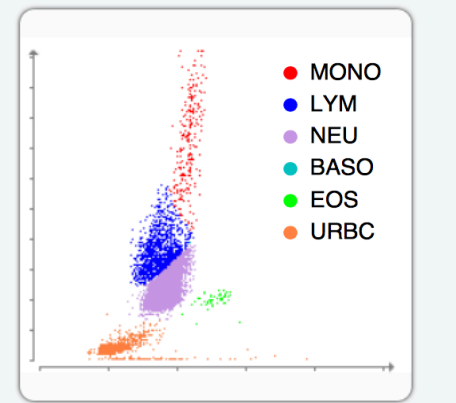
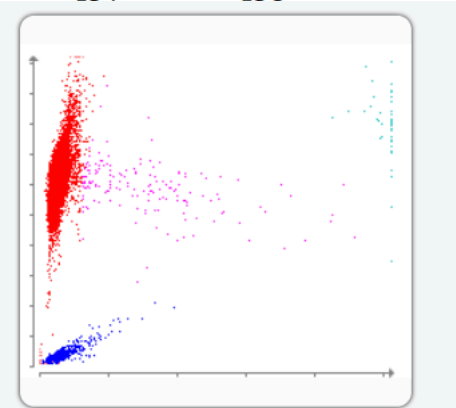
6/4/18 9:49 AM

4/29/18  
4:26 PM

1/23/18  
7:43 PM

TEST	RESULT	REFERENCE VALUE	
RBC	6.73	5.65 - 8.87 M/ $\mu$ L	
Hematocrit	46.6	37.3 - 61.7 %	
Hemoglobin	16.4	13.1 - 20.5 g/dL	
MCV	69.2	61.6 - 73.5 fL	
MCH	24.4	21.2 - 25.9 pg	
MCHC	35.2	32.0 - 37.9 g/dL	
RDW	16.5	13.6 - 21.7 %	
% Reticulocyte	0.6	%	
Reticulocyte	42.4	10 - 110 K/ $\mu$ L	
Reticulocyte Hemoglobin	25.2	22.3 - 29.6 pg	
WBC	10.64	5.05 - 16.76 K/ $\mu$ L	
% Neutrophil	81.6	%	
% Lymphocyte	15.3	%	
% Monocyte	2.5	%	
% Eosinophil	0.6	%	
% Basophil	0.0	%	
Neutrophil	8.68	2.95 - 11.64 K/ $\mu$ L	
Lymphocyte	1.63	1.05 - 5.1 K/ $\mu$ L	
Monocyte	0.27	0.16 - 1.12 K/ $\mu$ L	
Eosinophil	0.06	0.06 - 1.23 K/ $\mu$ L	
Basophil	0	0 - 0.1 K/ $\mu$ L	
Platelet	246	148 - 484 K/ $\mu$ L	
PDW	13.2	9.1 - 19.4 fL	
MPV	10.0	8.7 - 13.2 fL	
Plateletcrit	0.25	0.14 - 0.46 %	

7.41      7.58



326      347  
14.9      17.1  
10.8      11.4  
0.35      0.39



# Chemistry



6/4/18  
9:59 AM



1/23/18  
7:53 PM



>  Glucose	104	70 - 143 mg/dL	112	
>  Creatinine	1.3	0.5 - 1.8 mg/dL	1.7	
>  BUN	16	7 - 27 mg/dL	19	
> BUN: Creatinine Ratio	12		12	
>  Phosphorus	3.4	2.5 - 6.8 mg/dL	3.2	
>  Calcium	9.9	7.9 - 12.0 mg/dL	10.4	
>  Sodium	152	144 - 160 mmol/L	157	
>  Potassium	4.4	3.5 - 5.8 mmol/L	4.4	
> Na: K Ratio	34		36	
>  Chloride	115	109 - 122 mmol/L	115	
>  Total Protein	6.8	5.2 - 8.2 g/dL	7.2	
>  Albumin	3.1	2.2 - 3.9 g/dL	3.6	
>  Globulin	3.7	2.5 - 4.5 g/dL	3.6	
> Albumin: Globulin Ratio	0.8		1.0	
> <b>ALT</b>	<b>256</b>	<b>10 - 125 U/L</b>	99	
> <b>ALP</b>	<b>274</b>	<b>23 - 212 U/L</b>	176	
>  GGT	3	0 - 11 U/L	0	
>  Bilirubin - Total	0.2	0.0 - 0.9 mg/dL	0.5	
>  Cholesterol	156	110 - 320 mg/dL		
> <b>Amylase</b>	<b>1,616</b>	<b>500 - 1,500 U/L</b>		
>  Lipase	1,170	200 - 1,800 U/L		
Osmolality	303	mmol/kg		



SNAP cPL

Abnormal

## Immunology



6/4/18

10:35 AM



>  **C-Reactive Protein (CRP)**

d

**16.6**

0.0 - 1.0 mg/dL



d

分析儀的最新分析測試結果已乘以4個總部分的稀釋倍數。

**C 反應蛋白 (C-Reactive Protein, CRP)**

CRP 濃度 >3.0 mg/dL 指示具有顯著臨床意義的全身性發炎。

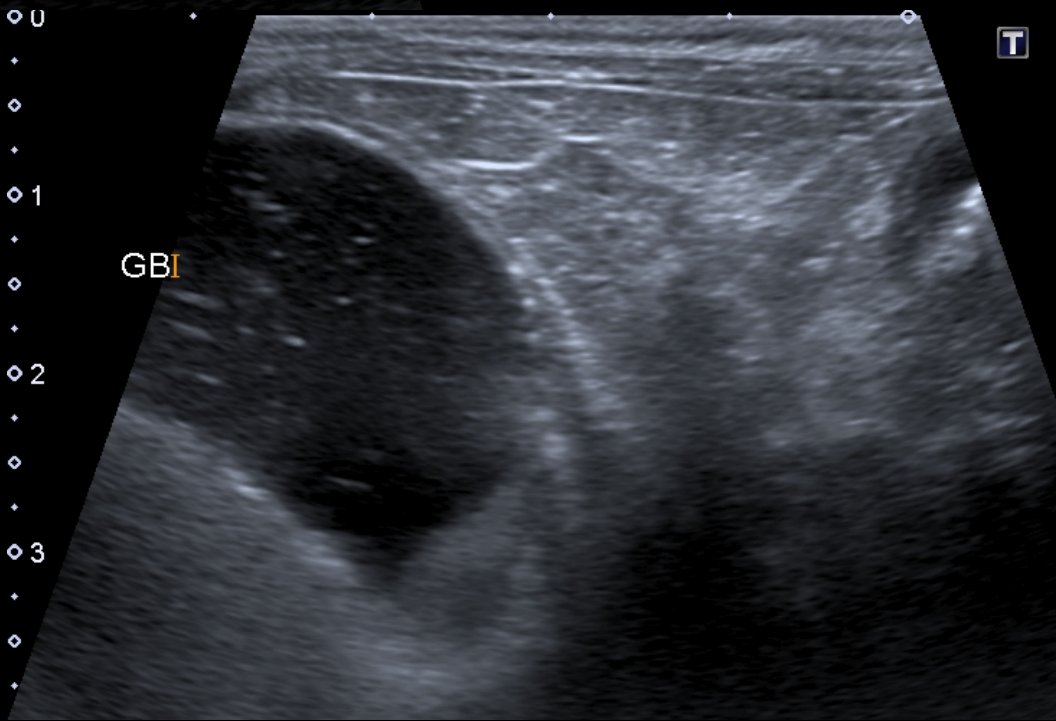
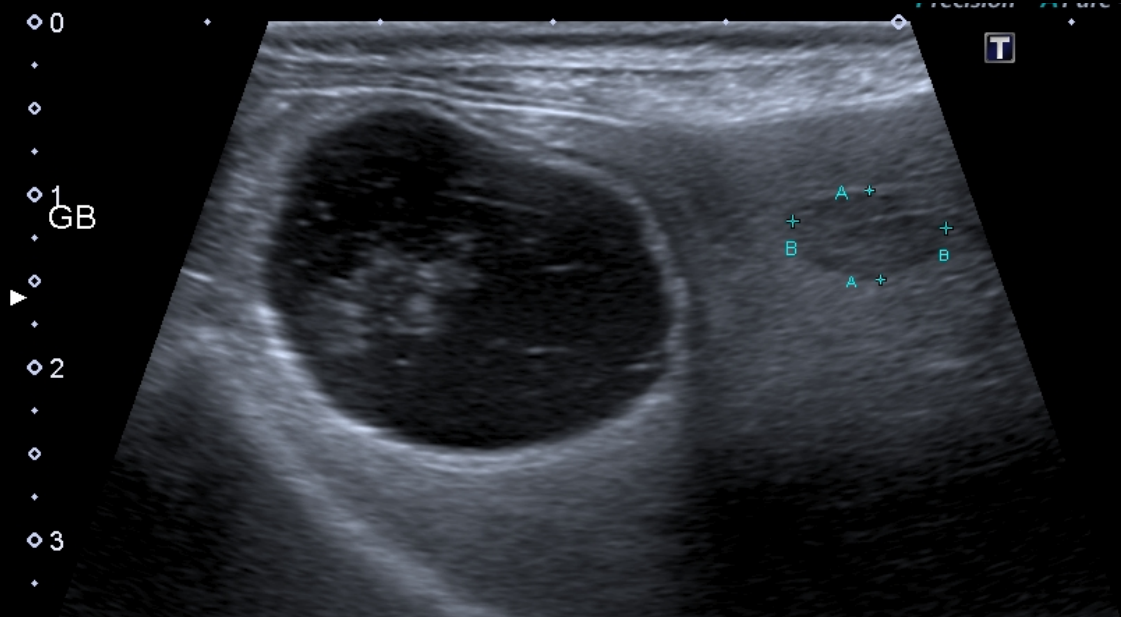
# 丸彈了！！CRP 哪裡來！！

R recumbency



R VD





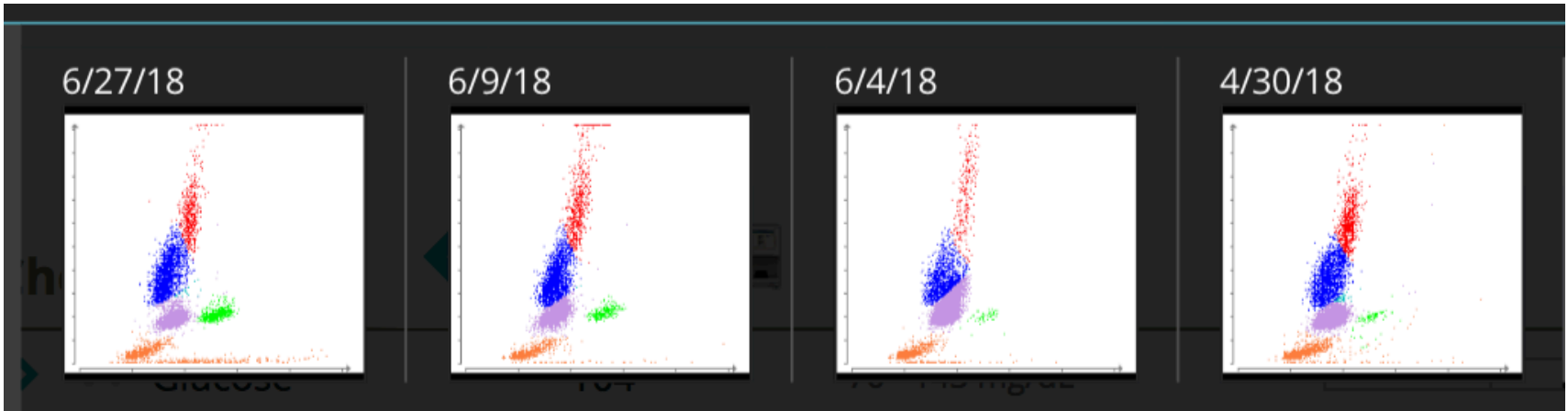
- Ddx: 急性膽囊炎，胰臟炎，腸胃炎
- 內科治療
  - Enrofloxacin
  - Augmentin
  - metronidazole
  - Urso
  - Silymarin
- Cerenia



# 治療計劃

Immunology

	6/26/18 4:19 PM	6/17/18 3:09 PM	6/8/18 5:02 PM	6/5/18 1:36 PM	6/5/18 1:25 PM	6/4/18 10:35 AM	
C-Reactive Protein (CRP)	a 0.6	b 0.8	c <b>2.9</b>	d <b>11.9</b>	e <b>&gt;10.0</b>	f <b>16.6</b>	0.0 - 1.0 mg/dL



WBC: 9.46

WBC: 8.97

WBC: 10.64

WBC: 13.38

Chemistry

	6/17/18 3:09 PM	6/8/18 5:02 PM	6/4/18 10:25 AM
ALT	86	<b>160</b>	<b>256</b>
ALP	206	173	<b>274</b>

追蹤

- 覺得怪怪的 ain' t doing right
- CRP > 3mg.dL 提供下一步檢查的力量
- 比白血球反應快及強烈
- 追蹤監控，強而有力的證據



可可 小總結



- 8歲 MN maltese
- 免疫性血小板低下症數年
- 對類固醇反應良好，low dose azathioprine
  
- 就診三天前 被壁蝨叮咬
- 虛弱，食慾下降
  
- PE: depressed, NSF,
- Well-hydration
- Skin: NSF

奶茶



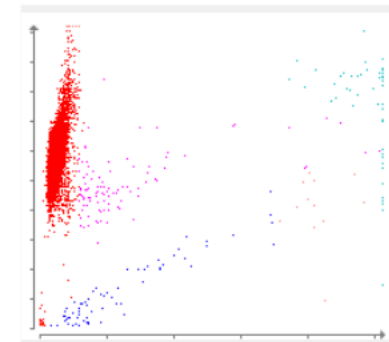
# Hematology



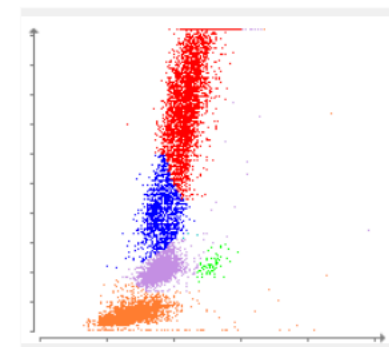
8/5/18

10:41 AM

TEST	RESULT	REFERENCE VALUE	
<b>RBC</b>	<b>5.15</b>	<b>5.65 - 8.87 M/<math>\mu</math>L</b>	L
<b>Hematocrit</b>	<b>33.4</b>	<b>37.3 - 61.7 %</b>	L
<b>Hemoglobin</b>	<b>11.6</b>	<b>13.1 - 20.5 g/dL</b>	L
MCV	64.9	61.6 - 73.5 fL	
MCH	22.5	21.2 - 25.9 pg	
MCHC	34.7	32.0 - 37.9 g/dL	
RDW	15.2	13.6 - 21.7 %	
% Reticulocyte	0.4	%	
Reticulocytes	18.5	10 - 110 K/ $\mu$ L	
<b>Reticulocyte Hemoglobin</b>	<b>18.7</b>	<b>22.3 - 29.6 pg</b>	L
WBC	10.09	5.05 - 16.76 K/ $\mu$ L	
% Neutrophils	43.7	%	
% Lymphocytes	13.3	%	
% Monocytes	42.3	%	
% Eosinophils	0.7	%	
% Basophils	0.0	%	
Neutrophils	4.41	2.95 - 11.64 K/ $\mu$ L	
Lymphocytes	1.34	1.05 - 5.1 K/ $\mu$ L	
<b>Monocytes</b>	<b>4.27</b>	<b>0.16 - 1.12 K/<math>\mu</math>L</b>	H
Eosinophils	0.07	0.06 - 1.23 K/ $\mu$ L	
Basophils	0	0 - 0.1 K/ $\mu$ L	
<b>Platelets</b>	<b>1</b>	<b>148 - 484 K/<math>\mu</math>L</b>	L
PDW	- --	9.1 - 19.4 fL	
MPV	- --	8.7 - 13.2 fL	
Plateletcrit	- --	0.14 - 0.46 %	



[Download](#)



# Chemistry





















8/5/18

10:51 AM



>  Glucose	103	74 - 143 mg/dL	
> <b>Creatinine</b>	<b>0.3</b>	0.5 - 1.8 mg/dL	
> <b>BUN</b>	<b>44</b>	7 - 27 mg/dL	
> BUN: Creatinine Ratio	134		
>  Phosphorus	4.9	2.5 - 6.8 mg/dL	
>  Calcium	8.8	7.9 - 12.0 mg/dL	
>  Sodium	149	144 - 160 mmol/L	
>  Potassium	3.5	3.5 - 5.8 mmol/L	
> Na: K Ratio	43		
>  Chloride	110	109 - 122 mmol/L	

74 - 143 mg/dL

>  Chloride	110	109 - 122 mmol/L	
>  Total Protein	6.6	5.2 - 8.2 g/dL	
>  Albumin	2.5	2.3 - 4.0 g/dL	
>  Globulin	4.1	2.5 - 4.5 g/dL	
> Albumin: Globulin Ratio	0.6		
>  ALT	70	10 - 125 U/L	
>  <b>ALP</b>	<b>511</b>	<b>23 - 212 U/L</b>	
>  GGT	6	0 - 11 U/L	
>  Bilirubin - Total	0.2	0.0 - 0.9 mg/dL	
>  Cholesterol	214	110 - 320 mg/dL	
Osmolality	304	mmol/kg	

## Immunology



8/5/18

11:13 AM



>  **C-Reactive Protein (CRP)**

<sup>b</sup>

**6.1**

0.0 - 1.0 mg/dL



## Serology

8/5/18

10:57 AM



Heartworm Antigen

Negative

Ehrlichia canis / ewingii

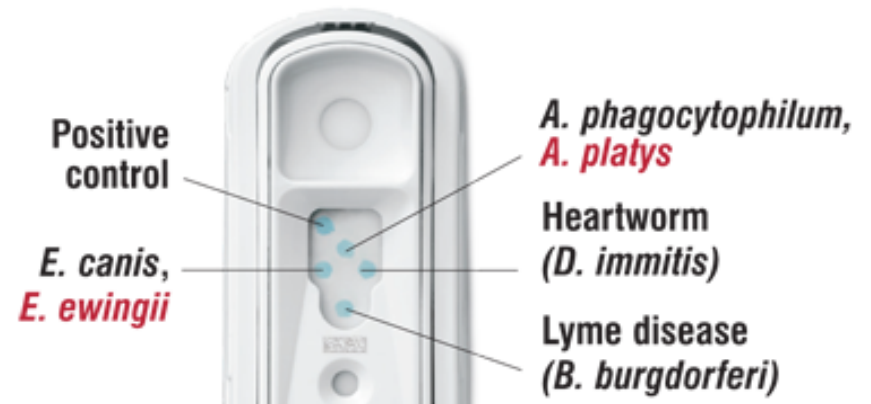
Negative

Lyme (Borrelia burgdorferi)

Negative

Anaplasma phagocytophilum / platys

Negative



- Ddx: IMT 復發
- Plan: 住院監控觀察症狀，出血證據  
血液寄生蟲篩檢  
免疫性血清學篩檢
- Rx: methylprednisolone, famotidine
- POM: Prednisolone, Doxycycline, Silymarin

住院治療



# Hematology



8/6/18

8:05 AM

8/5/18

10:41 AM

TEST	RESULT	REFERENCE VALUE		
<b>RBC</b>	<b>4.93</b>	<b>5.65 - 8.87 M/<math>\mu</math>L</b>	L	<b>5.15</b>
<b>Hematocrit</b>	<b>33.3</b>	<b>37.3 - 61.7 %</b>	L	<b>33.4</b>
<b>Hemoglobin</b>	<b>11.1</b>	<b>13.1 - 20.5 g/dL</b>	L	<b>11.6</b>
MCV	67.5	61.6 - 73.5 fL		64.9
MCH	22.5	21.2 - 25.9 pg		22.5
MCHC	33.3	32.0 - 37.9 g/dL		34.7
RDW	15.1	13.6 - 21.7 %		15.2
% Reticulocyte	0.4	%		0.4
Reticulocytes	21.7	10 - 110 K/ $\mu$ L		18.5
Reticulocyte Hemoglobin	23.6	22.3 - 29.6 pg		<b>18.7</b>
<b>WBC</b>	<b>19.25</b>	<b>5.05 - 16.76 K/<math>\mu</math>L</b>	H	10.09
% Neutrophils	56.2	%		43.7
% Lymphocytes	10.4	%		13.3
% Monocytes	33.1	%		42.3
% Eosinophils	0.2	%		0.7
% Basophils	0.1	%		0.0
Neutrophils	10.81	2.95 - 11.64 K/ $\mu$ L		4.41
Lymphocytes	2.01	1.05 - 5.1 K/ $\mu$ L		1.34
<b>Monocytes</b>	<b>6.38</b>	<b>0.16 - 1.12 K/<math>\mu</math>L</b>	H	<b>4.27</b>
<b>Eosinophils</b>	<b>0.04</b>	<b>0.06 - 1.23 K/<math>\mu</math>L</b>	L	0.07
Basophils	0.01	0 - 0.1 K/ $\mu$ L		0
<b>Platelets</b>	<b>43</b>	<b>148 - 484 K/<math>\mu</math>L</b>	L	<b>1</b>
PDW	- - -	9.1 - 19.4 fL		- - -

# 奶茶外送報告



## Tick/Vector Comprehensive RealPCR™ Panel—Canine

*Anaplasma* spp., *Babesia* spp., *Bartonella* spp., Canine Hemotropic Mycoplasma, *Ehrlichia* spp., *Hepatozoon* spp., *Leishmania* spp. Quant, *Neorickettsia risticii* and Rocky Mountain spotted fever (*Rickettsia rickettsii*) RealPCR™ tests. Includes quantification of *Leishmania* if PCR positive.

壁蝨套組：犬焦蟲陽性

Rx: Imidocarb 5mg/kg IM once

犬檢測套組 (一般件/緊急件)	單項檢測項目 (套組所含項目)	建議檢體與費用 (一般件/緊急件)
<input type="checkbox"/> CT31 壁蝨傳染 Multiple tick-born pathogens profile (2200/2400) 含分型	<input type="checkbox"/> 焦蟲分型 犬焦蟲 <i>Babesia canis canis</i> · <i>B. canis vogeli</i> · <i>Babesia canis rossi</i> 吉布松焦蟲 <i>Babesia gibsoni</i>	全血 (1550/1750)
	<input type="checkbox"/> 艾利希體分型 犬型 <i>Ehrlichia canis</i> 血小板型 <i>Anaplasma platys</i>	全血 (1550/1750)
	<input type="checkbox"/> 犬血巴東體 <i>Haemobartonella canis</i>	全血 (1450/1650)
<input type="checkbox"/> CT32 犬病毒感染 Canine viral profile (3600/3800)	<input type="checkbox"/> 小病毒 Parvovirus	糞便或全血 (1450/1650)
	<input type="checkbox"/> 冠狀病毒 Coronavirus	糞便或全血 (1550/1750)
	<input type="checkbox"/> 犬瘟熱病毒 Canine Distemper virus	眼鼻分泌物或全血 (1550/1750)
<input type="checkbox"/> CT33 人畜共通 Zoonosis profile (2200/2400) 不分型	<input type="checkbox"/> 弓蟲 <i>Toxoplasma gondii</i>	全血 (1450/1650)
	<input type="checkbox"/> 心絲蟲 <i>Dirofilaria immitis</i>	全血 (1450/1650)
	<input type="checkbox"/> 萊姆病病原 <i>Borrelia burgdorferi</i>	全血 (1450/1650)
	<input type="checkbox"/> 鉤端螺旋體 <i>Leptospira</i> spp. 不分型 包含 <i>L. interrogans</i> · <i>L. borgpetersenii</i> · <i>L. weilii</i> · <i>L. noguchii</i> · <i>L. santarosai</i> · <i>L. meyeri</i> · <i>L. kirschneri</i>	尿液或全血 (1450/1650)

ANA 陽性  
 SS-A 陽性  
 ANA titer : 320

ANA 陰性



尿檢：UPC



# Hematology



8/9/18

4:37 PM

TEST	RESULT	REFERENCE VALUE	
RBC	5.73	5.65 - 8.87 M/ $\mu$ L	
Hematocrit	39.7	37.3 - 61.7 %	
<b>Hemoglobin</b>	<b>12.9</b>	<b>13.1 - 20.5 g/dL</b>	L
MCV	69.3	61.6 - 73.5 fL	
MCH	22.5	21.2 - 25.9 pg	
MCHC	32.5	32.0 - 37.9 g/dL	
RDW	16.4	13.6 - 21.7 %	
% Reticulocyte	2.9	%	
<b>Reticulocytes</b>	<b>163.3</b>	<b>10 - 110 K/<math>\mu</math>L</b>	H
Reticulocyte Hemoglobin	25.0	22.3 - 29.6 pg	
<b>WBC</b>	<b>23.34</b>	<b>5.05 - 16.76 K/<math>\mu</math>L</b>	H
% Neutrophils	* 66.0	%	
% Lymphocytes	* 17.5	%	
% Monocytes	* 15.7	%	
% Eosinophils	0.6	%	
% Basophils	0.2	%	
<b>Neutrophils</b>	<b>* 15.42</b>	<b>2.95 - 11.64 K/<math>\mu</math>L</b>	H
Bands	* Suspected		
Lymphocytes	* 4.08	1.05 - 5.1 K/ $\mu$ L	
<b>Monocytes</b>	<b>* 3.67</b>	<b>0.16 - 1.12 K/<math>\mu</math>L</b>	H
Eosinophils	0.13	0.06 - 1.23 K/ $\mu$ L	
Basophils	0.04	0 - 0.1 K/ $\mu$ L	
Platelets	421	148 - 484 K/ $\mu$ L	
PDW	18.2	9.1 - 19.4 fL	
MPV	11.8	8.7 - 13.2 fL	

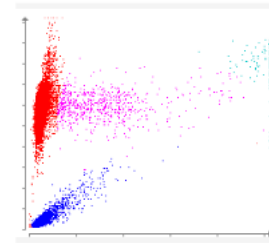


8/6/18  
8:05 AM



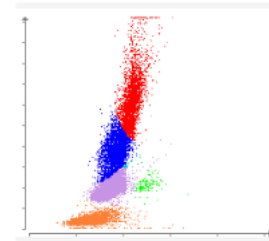
8/5/18  
10:41 AM

**4.93**      **5.15**  
**33.3**      **33.4**



- RETICS
- PLT
- RBC
- WBC
- RBC\_FRAG

Download



- LYM
- URBC
- EOS
- BASO
- MONO
- NEU

Download

10.81      4.41

**6.38**      **4.27**

**0.04**      0.07


0.01      0

**43**      **1**







- - - -      - - - -

**22.1**      - - - -


## Chemistry

Today  
4:43 PM 



>  Creatinine	0.9	0.5 - 1.8 mg/dL	
>  <b>BUN</b>	<b>35</b>	7 - 27 mg/dL	
> BUN: Creatinine Ratio	39		
>  <b>ALP</b>	<b>826</b>	23 - 212 U/L	

## Immunology

Today  
5:09 PM 




>  C-Reactive Protein (CRP)	<sup>a</sup> 0.7	0.0 - 1.0 mg/dL	
--	------------------	-----------------	---

<sup>a</sup> C 反應蛋白 (C-Reactive Protein, CRP)  
CRP 濃度 >3.0 mg/dL 指示具有顯著臨床意義的全身性發炎。











**Pred taper**

# Hematology

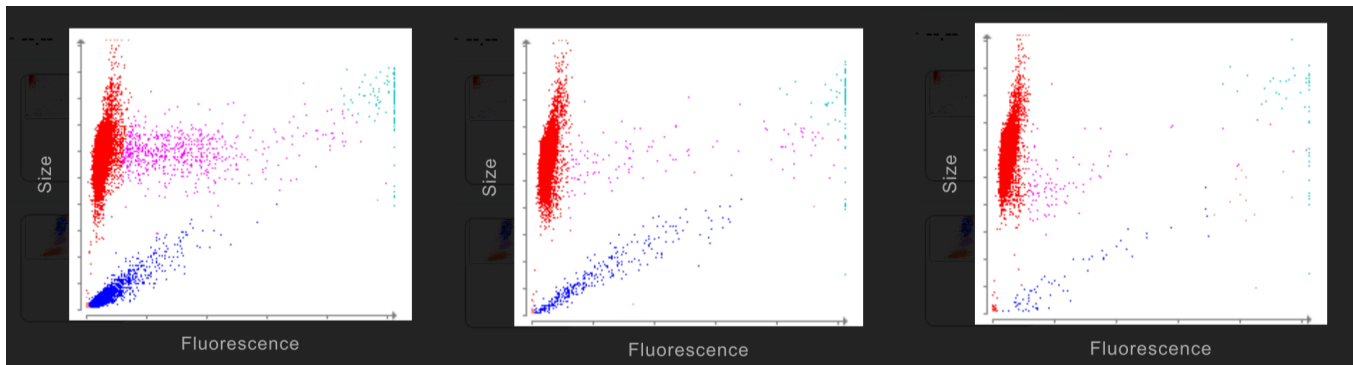
8/9/18  
4:37 PM 

8/6/18  
8:05 AM 

8/5/18  
10:41 AM 

	8/9/18	8/6/18	8/5/18
>  RBC	5.73	<b>4.93</b>	<b>5.15</b>
>  Hematocrit	39.7	<b>33.3</b>	<b>33.4</b>
>  <b>Hemoglobin</b>	<b>12.9</b>	<b>11.1</b>	<b>11.6</b>
>  MCV	69.3	67.5	64.9
>  MCH	22.5	22.5	22.5
>  MCHC	32.5	33.3	34.7
>  RDW	16.4	15.1	15.2
> % Reticulocyte	2.9	0.4	0.4
>  <b>Reticulocytes</b>	<b>163.3</b>	21.7	18.5
>  Reticulocyte Hemoglobin	25.0	23.6	<b>18.7</b>
>  Platelets	421	<b>43</b>	<b>1</b>

- RETICS
- PLT
- RBC
- WBC
- RBC\_FRAG

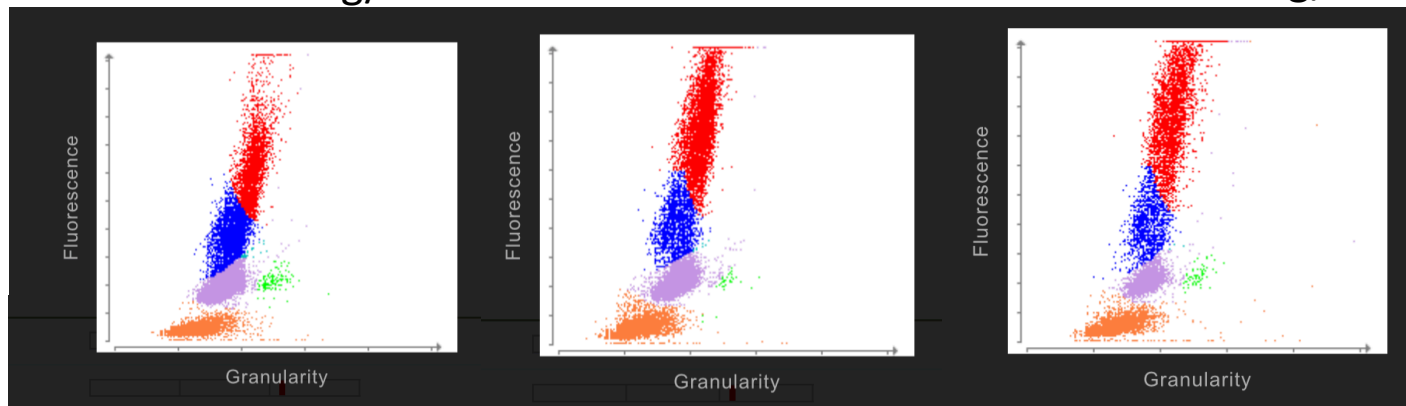


>	🦋	<b>WBC</b>	<b>23.34</b>	<b>19.25</b>	10.09
>		% Neutrophils	* 66.0	56.2	43.7
>		% Lymphocytes	* 17.5	10.4	13.3
>		% Monocytes	* 15.7	33.1	42.3
>		% Eosinophils	0.6	0.2	0.7
>		% Basophils	0.2	0.1	0.0
>	🦋	<b>Neutrophils</b>	<b>* 15.42</b>	10.81	4.41
>		Bands	* Suspected		
>	🦋	Lymphocytes	* 4.08	2.01	1.34
>	🦋	<b>Monocytes</b>	<b>* 3.67</b>	<b>6.38</b>	<b>4.27</b>
>	🦋	Eosinophils	0.13	<b>0.04</b>	0.07
>	🦋	Basophils	0.04	0.01	0

CRP:0.7mg/dL

CRP:6.9mg/dL

- LYM
- URBC
- EOS
- BASO
- MONO
- NEU



- 免疫性疾病，隨著任何刺激，可能隨時變化
- 完整全面再評估
- WBC在使用類固醇後的盲點
- CRP 快速評估發炎狀態，不受類固醇影響
- 追蹤CRP 確認類固醇劑量調整



## 奶茶 小總結

- 3y FS 北京犬
- 三個月前發現有流鼻膿，治療改善
- 一週前在其他醫院洗完牙
- 回家後食慾精神下降
  
- PE: 5.3kg
- BT: 40.3 °C 高燒
- QRB, well-hydration, NSF



兔兔

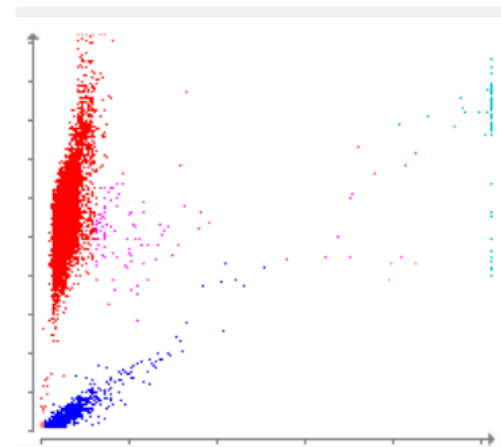
# Hematology



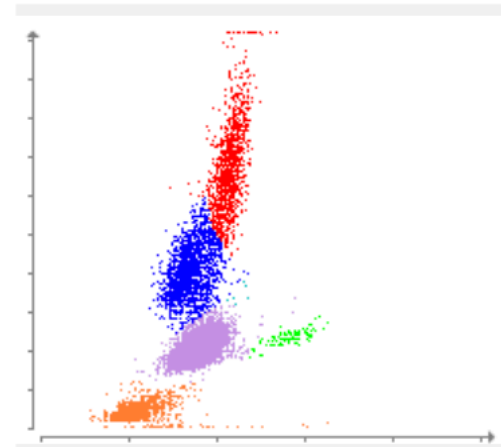
7/10/18








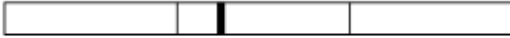




2:43 PM

TEST	RESULT	REFERENCE VALUE	
RBC	7.22	5.65 - 8.87 M/ $\mu$ L	
Hematocrit	43.5	37.3 - 61.7 %	
Hemoglobin	15.8	13.1 - 20.5 g/dL	
<b>MCV</b>	<b>60.2</b>	<b>61.6 - 73.5 fL</b>	L
MCH	21.9	21.2 - 25.9 pg	
MCHC	36.3	32.0 - 37.9 g/dL	
RDW	19.0	13.6 - 21.7 %	
% Reticulocyte	0.4	%	
Reticulocytes	29.6	10 - 110 K/ $\mu$ L	
<b>Reticulocyte Hemoglobin</b>	<b>20.5</b>	<b>22.3 - 29.6 pg</b>	L
WBC	13.79	5.05 - 16.76 K/ $\mu$ L	
% Neutrophils	74.2	%	
% Lymphocytes	15.1	%	
% Monocytes	9.9	%	
% Eosinophils	0.7	%	
% Basophils	0.1	%	
Neutrophils	10.24	2.95 - 11.64 K/ $\mu$ L	
Lymphocytes	2.08	1.05 - 5.1 K/ $\mu$ L	
<b>Monocytes</b>	<b>1.36</b>	<b>0.16 - 1.12 K/<math>\mu</math>L</b>	H
Eosinophils	0.1	0.06 - 1.23 K/ $\mu$ L	
Basophils	0.01	0 - 0.1 K/ $\mu$ L	
Platelets	419	148 - 484 K/ $\mu$ L	
PDW	13.7	9.1 - 19.4 fL	
MPV	9.8	8.7 - 13.2 fL	
Plateletcrit	0.41	0.14 - 0.46 %	



Download



TEST	RESULT	REFERENCE VALUE	
Glucose	96	74 - 143 mg/dL	
Creatinine	0.6	0.5 - 1.8 mg/dL	
BUN	13	7 - 27 mg/dL	
BUN: Creatinine Ratio	20		
Phosphorus	5.3	2.5 - 6.8 mg/dL	
Calcium	9.8	7.9 - 12.0 mg/dL	
Sodium	149	144 - 160 mmol/L	
Potassium	4.5	3.5 - 5.8 mmol/L	
Na: K Ratio	33		
Chloride	112	109 - 122 mmol/L	
Total Protein	7.9	5.2 - 8.2 g/dL	
Albumin	2.6	2.3 - 4.0 g/dL	
<b>Globulin</b>	<b>5.3</b>	<b>2.5 - 4.5 g/dL</b>	H 
Albumin: Globulin Ratio	0.5		
ALT	19	10 - 125 U/L	



# Chemistry (continued)

TEST	RESULT	REFERENCE VALUE	
ALP	151	23 - 212 U/L	
GGT	2	0 - 11 U/L	
Bilirubin - Total	0.1	0.0 - 0.9 mg/dL	
Cholesterol	162	110 - 320 mg/dL	
Osmolality	295	mmol/kg	

# Immunology



7/10/18

3:14 PM

TEST	RESULT	REFERENCE VALUE	
<b>C-Reactive Protein (CRP)</b>	<b>e &gt;20.0</b>	<b>0.0 - 1.0 mg/dL</b>	H

R VD



R recumbency



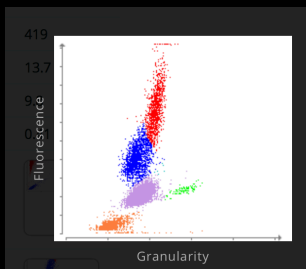
- Ddx
  - 吸入性肺炎 (麻醉?)
  - 腫瘤
- Rx: Enrofloxacin  
Amoxicillin  
Ciproheptadine
- 三天後回診追蹤

治療計畫

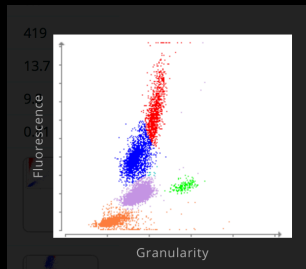




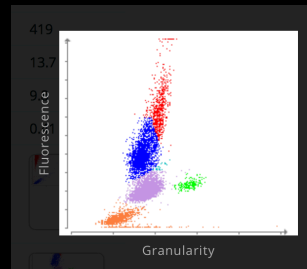
7/10  
CRP>20



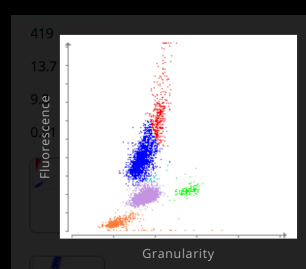
7/12  
CRP:14.6



7/18  
CRP:1.1



8/8  
CRP:0.5



- 比白血球更鮮明的發炎反應
- 超高的CRP須更密集的追蹤
- 以CRP及胸腔放射線學 搭配CBC監控追蹤
- 依照檢查結果調整藥物（ 抗生素 ）




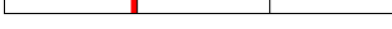








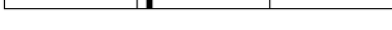







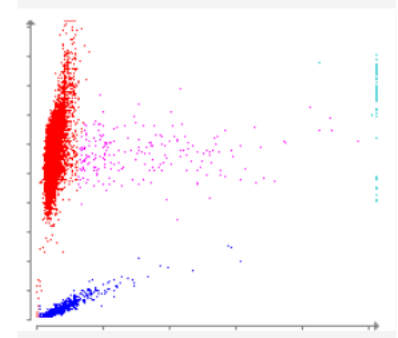
## 兔兔 小總結

- 13y/o mix FS
  - 三個月前有車禍的病史
  - 近一個月來食慾精神下降，呼吸喘
  - 轉診進一步心臟評估
- 
- PE: panting, BCS:7/9
  - 4/6 systolic heart murmur

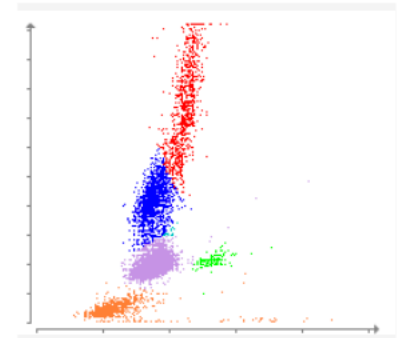


阿笨

TEST	RESULT	REFERENCE VALUE	
RBC	6.91	5.65 - 8.87 M/ $\mu$ L	
Hematocrit	42.4	37.3 - 61.7 %	
Hemoglobin	15.0	13.1 - 20.5 g/dL	
<b>MCV</b>	<b>61.4</b>	<b>61.6 - 73.5 fL</b>	L 
MCH	21.7	21.2 - 25.9 pg	
MCHC	35.4	32.0 - 37.9 g/dL	
RDW	19.6	13.6 - 21.7 %	
% Reticulocyte	0.8	%	
Reticulocytes	58	10 - 110 K/ $\mu$ L	
WBC	12.72	5.05 - 16.76 K/ $\mu$ L	
% Neutrophils	77.8	%	
% Lymphocytes	13.2	%	
% Monocytes	7.6	%	
% Eosinophils	1.2	%	
% Basophils	0.2	%	
Neutrophils	9.9	2.95 - 11.64 K/ $\mu$ L	
Lymphocytes	1.68	1.05 - 5.1 K/ $\mu$ L	
Monocytes	0.97	0.16 - 1.12 K/ $\mu$ L	
Eosinophils	0.15	0.06 - 1.23 K/ $\mu$ L	
Basophils	0.02	0 - 0.1 K/ $\mu$ L	
Platelets	221	148 - 484 K/ $\mu$ L	
PDW	15.6	9.1 - 19.4 fL	
MPV	11.0	8.7 - 13.2 fL	
Plateletcrit	0.24	0.14 - 0.46 %	



 [Download](#)







12/13/17

3:19 PM

TEST	RESULT	REFERENCE VALUE	
Glucose	96	70 - 143 mg/dL	
Creatinine	1.7	0.5 - 1.8 mg/dL	
BUN	19	7 - 27 mg/dL	
BUN: Creatinine Ratio	11		
Phosphorus	3.5	2.5 - 6.8 mg/dL	
Calcium	10.3	7.9 - 12.0 mg/dL	
Sodium	152	144 - 160 mmol/L	
Potassium	4.3	3.5 - 5.8 mmol/L	
Na: K Ratio	35		
Chloride	114	109 - 122 mmol/L	
<b>Total Protein</b>	<b>8.3</b>	<b>5.2 - 8.2 g/dL</b>	H
Albumin	2.8	2.2 - 3.9 g/dL	
<b>Globulin</b>	<b>5.5</b>	<b>2.5 - 4.5 g/dL</b>	H
Albumin: Globulin Ratio	0.5		
ALT	20	10 - 125 U/L	
ALP	188	23 - 212 U/L	
GGT	5	0 - 11 U/L	
Bilirubin - Total	0.4	0.0 - 0.9 mg/dL	
<b>Cholesterol</b>	<b>107</b>	<b>110 - 320 mg/dL</b>	L
Osmolality	302	mmol/kg	

# Immunology



12/13/17

3:19 PM

TEST

RESULT

REFERENCE VALUE

**C-Reactive Protein (CRP)**

**9.8**

**0.0 - 1.0 mg/dL**



## Serology



12/13/17

3:41 PM

TEST

RESULT

Heartworm Antigen

Negative

Ehrlichia canis / ewingii

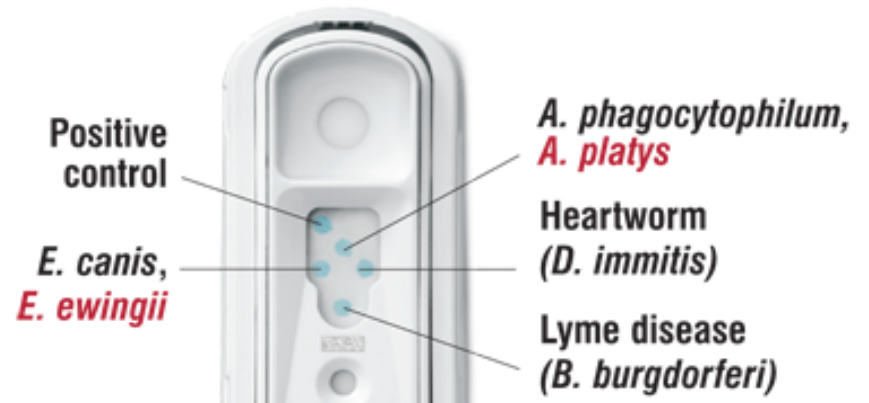
Negative

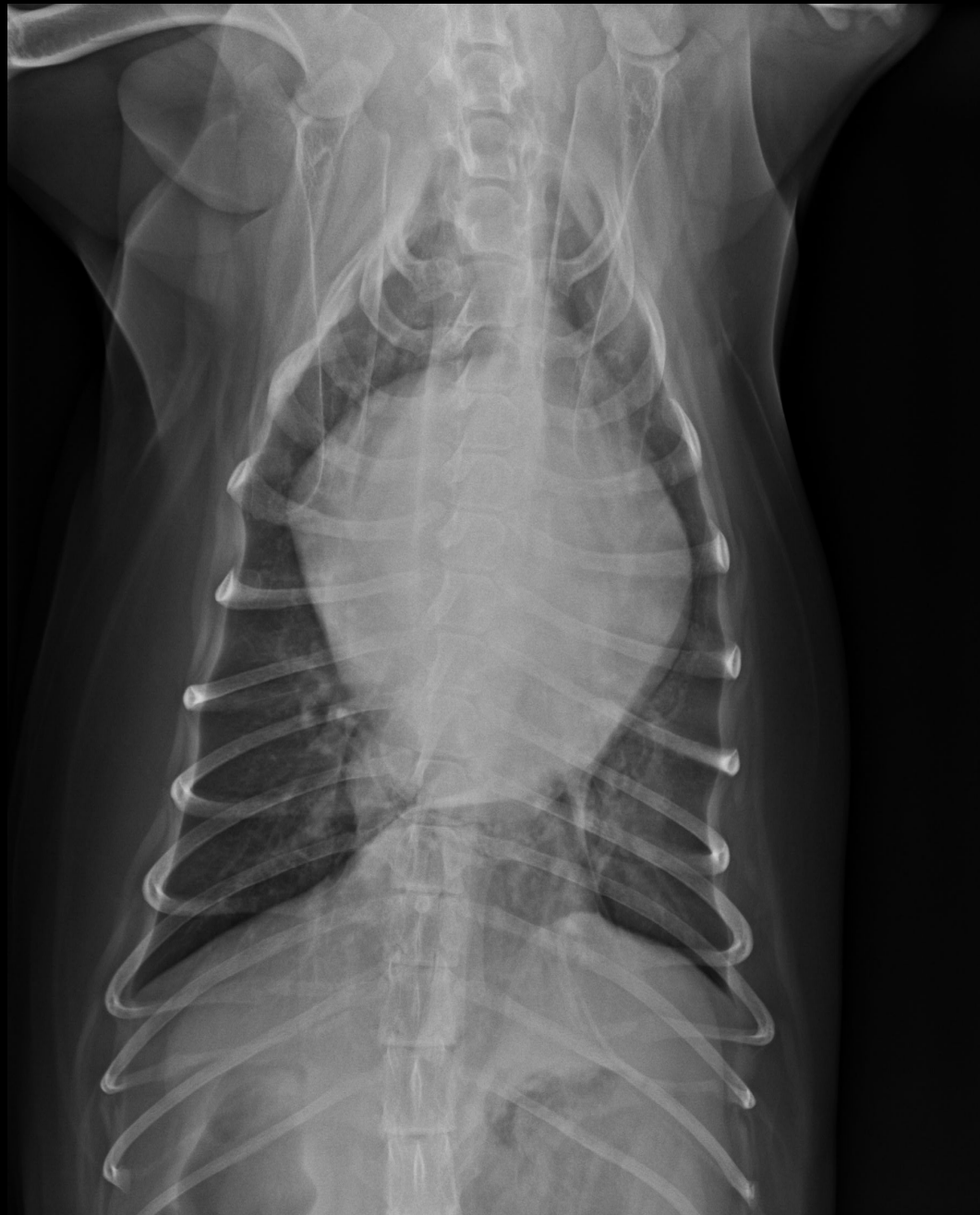
Lyme (Borrelia burgdorferi)

Negative

Anaplasma phagocytophilum / platys

Negative







L:7.5 S:6  
VHS=13.5

- Ddx: CMVD stage B2-C  
unknown organ fever  
肺炎??

- 先控制呼吸狀況

- Rx
  - Pimobendan
  - Furosemide
  - Doxycycline
  - Cyproheptadine

## 治療計劃




- 12/13: 1<sup>st</sup> visit BT: 40.7 °C
- 12/18: 呼吸食慾有改善 BT:40 °C
- 1/2: 仍較無力 BT:40.4 °C

UA

腹腔超音波

ANA

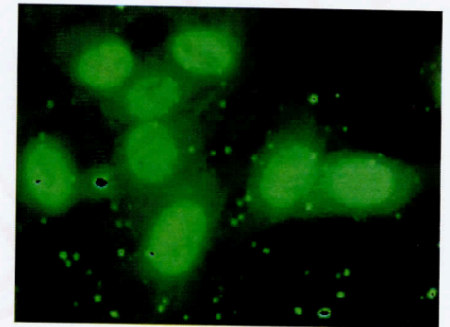
**Urinalysis**

1/16/18  
12:07 PM 

Collection	Free Catch
> Color	Straw
> Clarity	Clear
> Specific Gravity	1.014

- ANA 陽性
- SS-A 陽性
- ANA titer : 320

ANA 陰性




**Chemistry**

- Urine
- Urine
- > Urine Creat

Leukocyte Esterase      neg

- 12/13: 1<sup>st</sup> visit BT: 40.7 °C
- 12/18: 呼吸食慾有改善 BT:40 °C
- 1/2: 仍較無力 BT:40.4 °C UA，腹腔超音波 ANA test
- 1/16:BT:40.2 °C 加pred 0.5mg/kg，穩定
- 3/5:BT:38.9 °C 穩定
- 3/15 BT: 38.9 pred降劑量
- 持續調整心臟藥物
- 4/14 急性肺水腫，來院途中死亡

## Immunology

	3/15/18 11:28 AM	3/5/18 3:50 PM	1/16/18 12:07 PM	1/2/18 11:42 AM	12/18/17 3:41 PM	12/13/17 3:19 PM
>  <b>C-Reactive Protein (CRP)</b>	1.0	5.6	8.5	9.8	9.5	9.8



- 不明原因發燒，搭配 CRP 居高不下
- 感染？
- 完整地毯式搜索，找原因
- 免疫性疾病永遠需要考慮
- CRP 搭配臨床症狀，藥物調整



## 阿笨 小總結



- **SCREENING:** 區別有沒有炎症存在的工具
- **DIFFERENTIAL Dx:** 是不是急性炎症疾病?
- **MONITORING:** 追蹤炎症的發展病程
- **TREATMENT GUIDE:** 用藥是否需要調整?
- **PROGNOSTIC INDICATOR:** 動物預後指標

## CRP 應用範圍



# CRP

## 發炎反應的新利器



[darorolin@gmail.com](mailto:darorolin@gmail.com)