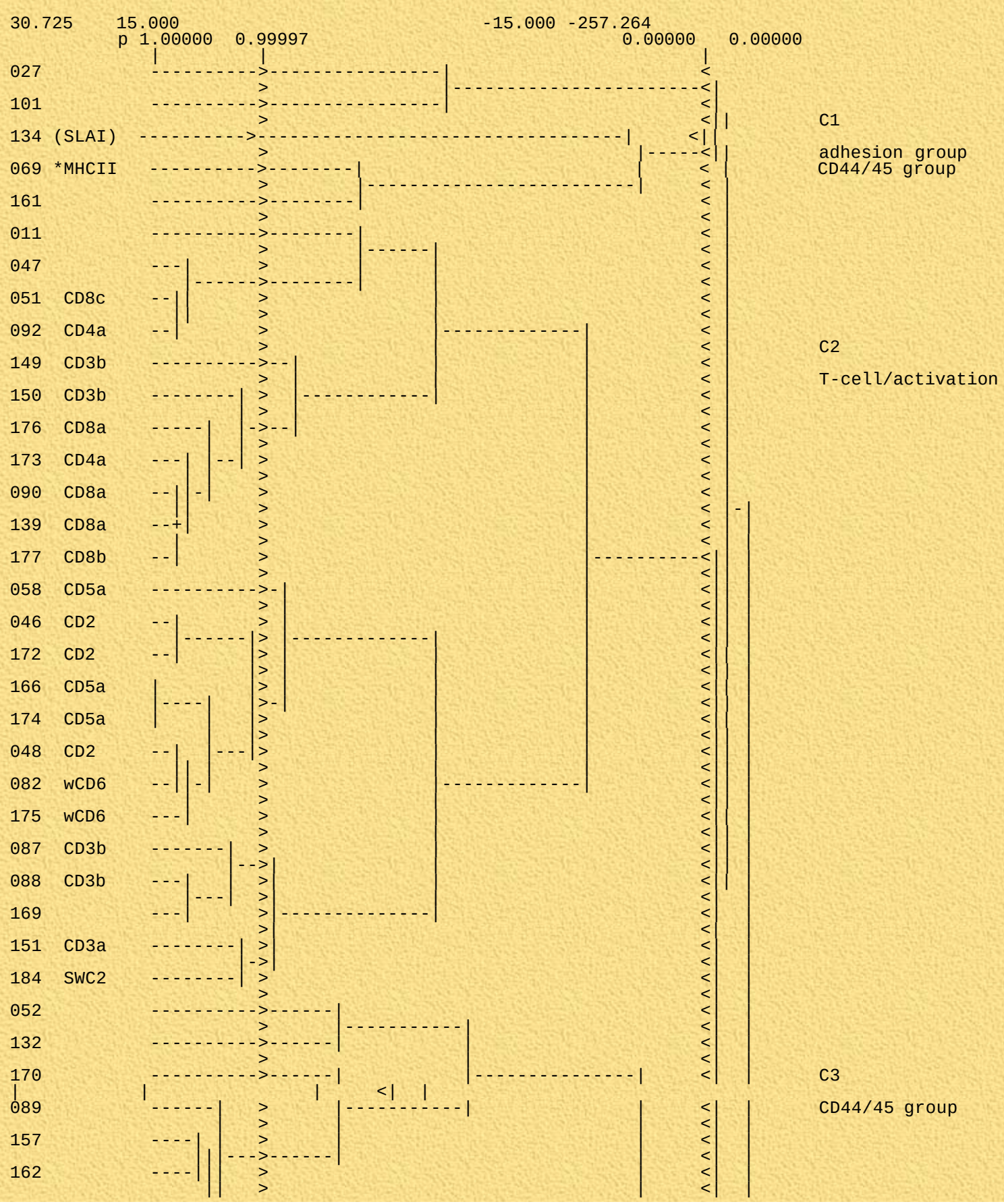
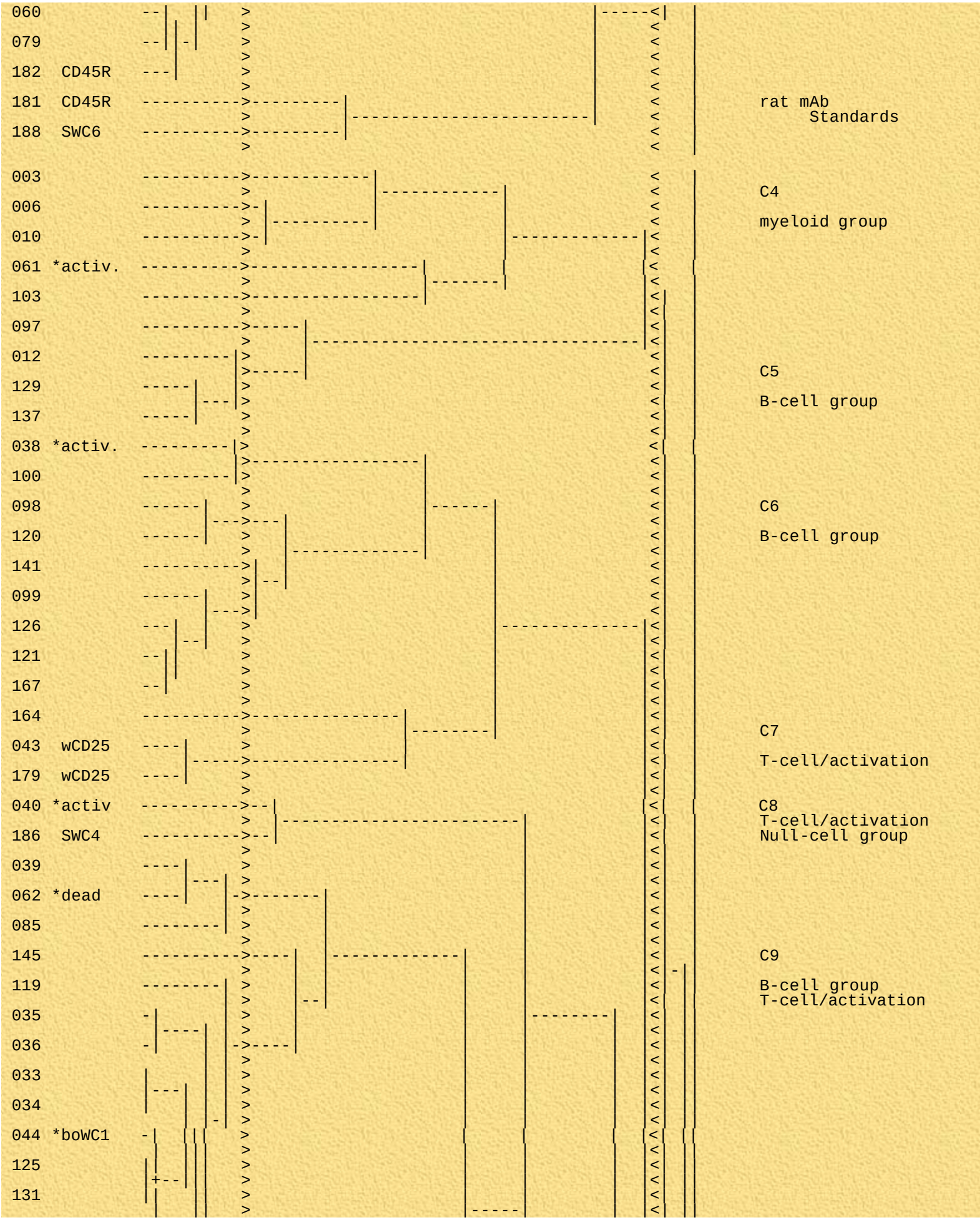
Figure 1. Leucocyte Typing Database IV. Cluster Analysis of mAb submitted to the Second Swine CD Workshop




060
079
182 CD45R
181 CD45R
188 SWC6
rat mAb
Standards
003
006
010
061 *activ.
103
097
012
129
137
038 *activ.
100
098
120
141
099
126
121
167
164
043 wCD25
179 wCD25
040 *activ
186 SWC4
039
062 *dead
085
145
119
035
036
033
034
044 *boWC1
125
131
C4
myeloid group
C5
B-cell group
C6
B-cell group
C7
T-cell/activation
C8
T-cell/activation
Null-cell group
C9
B-cell group
T-cell/activation

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158                 -|    |     >                     |                 |   |<| ||
                             |     >                     |                 |   |<| ||
115                 ---|     |     >                     |                 |   |<| ||
                        -|         >                     |                 |   |<| ||
168                 ---|         >                     |                 |   |<| ||
                             |     >                     |                 |   |<| ||

021                 --|         >                     |                 |   |<| ||
                       |------|>                     |                 |   |<| ||
041                 --|         >                     |                 |   |<| ||
                             |>---------|            |                 |   |<| ||
019                 ------|    |>          |            |                 |   |<| ||
                           --|>          |            |                 |   |<| ||
017                 ---|    |>          |            |                 |   |<|         C10
                       --|    >          |            |                 --|<|
042                 ---|         >          |            |                 |   |<|         Null-cell group
                             |     >          |            |                 |   |<| ||
084 *adhes.         -----|     >          |-----------|                 |   |<| ||
                             |     >          |                         |   |<| ||
093                 ----|----->--|          |                         |   |<| ||
                             |     >  |          |                         |   |<| ||
020                 |    |     >  |          |                         |   |<| ||
                    |-|  |     >  |          |                         |   |<| ||
022                 | -|      >  |          |                         |   |<| ||
                             |     >  |------|                         |   |<| ||
122                 --|         >  |                                 |   |<| ||
                             |     >  |                                 |   |<| ||
096                 ------|    >  |                                 |   |<| ||
                           --->--|                                 |   |<| ||
018                 --|    |     >                                 |   |<| ||
                       |---|     >                                 |   |<| ||
187  SWC5           --|         >                                 |   |<| ||
                             |     >                                 |   |<| ||
152                 ---------->-----|                               |   |<| ||
                             |     >                 |-----------------------|   |<| ||         C11
057 *activ.         ---------->---| |                       |       |   |<| ||
     SWC7                    |     >   |-|                     |       |   |<| ||         T-cell/activation
024                 --------|>    |                       |       |   |<| ||         B-cell group
                             |>---|                       |       |   |<| ||
154                 -----|    |>                          |       |   |<| ||
                           ---|>                          |       |   |<| ||
160                 -----|    >                          -------|   |<| ||
                             |     >                                 |<| ||
108                 -----|    >                                 |<| ||            C12
                           ----->-----------|                    |<| ||
109                 -----|    >           |-|                    |<|   -----|   B-cell group
                             |     >           | |                    |<| |       |   Null-cell group
147  wCD21          ---------->-----------| |                    |<| |       |
                             |     >                 |--------------|<| |       |
074                 ---------->----|                 |              |<| |       |
                             |     >    |--------|                  |<| |       |
178  wCD21          --------| >    |                              |<| |       |
                            |->----|                              |<| |       |
189  SWC7           --------| >                                   |<| |       |
                             |     >                                 |<| ||      |
008 *myeloid        ---------->-----------------|                   |<| ||      |
                             |     >                 |                   |<| ||      |
032 *activ.         --------| >                 |                   |<| ||      |   C13
                            |->----------|        |-------------------|<| ||      |
086 *activ.         --------| >          |        |                   |<| ||      |   Null-cell group
                             |     >          |        |                   |<| ||      |
013                 -----|    >          |        |                   |<| |       |
                           ---|>          |-------|                   |<| |       |
140                 -----|    |>          |                           |<| |       |
                             |     >          |                           |<| |       |
050                 -|         |>----------|                           |<| |       |
                      |         |>                                      |<| |       |
091                 -+-------|>                                      |<| |       |
                      |         >                                      |<| |       |
153                 -|         >                                      |<|       |
                             |     >                                      |<|       |
001  CD14           ---------->-|                                      |<|       |
                             |     > |---------------|                  |<|       |
016                 ---------->-|                 |---|               |<|       |   C14
                             |     >                 |   |               |<|       |
102                 ---------->-----------------|   |               |<|       |   myeloid group
                             |     >                     |               |<|       |
002                 ---------->---------|             -----------------|<| |       |
                             |     >          |---|                     |<| |       |
123                 --------| >          |   |                     |<| |       |
                            |->---------|   |-------|                 |<|   ||      |
```

```
124          --------| >             |                          <  ||      |
                     >             |                          <  ||      |
191          ----------->-------------|                          <  ||      |
                     >                                          <  ||      |
037          ----------->--------------------------------|       <  ||      |   C15
                     >                                 |-------<| ||      |   T-cell/activation
014          ----------->-----------|                    |       <| ||      |   B-cell group
                     >             |--------------------|       <| ||      |   myeloid group
171  wCD1    ----------->-----------|                            <| ||      |
                     >                                          <| ||      |

009          -------|  >                                         <| ||      |
                    || >                                         <| ||      |   C16
073          -------||->---------------------------|             <|-||      |
                    | >                           |             <|  |      |   adhesion group
094          --------| >                           |             <|  |      |   CD44/45 group
                     >                           |-----------|<|  |      |   myeloid group
113          ----------->----|                     |           |<|  |      |
                     >    |----------------------|           |<|  |      |
114          ----------->----|                                 |<|  |      |
                     >                                        |<|  |      |
144          ----------->--------------------------|            |<|  |      |
                     >                           |------------|<|  |      |
192          ----------->--------------------------|            <|  |      |
                     >                                        <|  |      |
004          ----------->-|                                     <|  |      |
                     >  |---------------|                      <|  |      |
023          ----------->-|               |                      <|  |      |   C17
                     >                 |----------------------<|  |      |
111          ----------->---------------|  |                    <|  |      |   myeloid group
                     >               |-|                      <|  |      |   adhesion group
118          ----------->---------------|                       <|  |      |
                     >                                        <|  |      |
005          ----------->-------|                               <|  |      |
                     >       |----------|                      <|  |      |
007          ----------->-------|          |                    <|  |      |
                     >                  |----------------------<|  |      |
054          ----------->----|             |                    <|  |      |
                     >    |-------------|                      <|  |      |
142          ----------->----|                                 <|  |      |
                     >                                        <|  |      |
055          ----------->--------------|                        <|  |      |
                     >               |------------------------|<|  |      |
070          ----------->-------|      |                        |<|  |      |   C18
                     >       |------|                        |<|  |      |
078          ----------->-------|                               |<|  |      |   myeloid group
                     >                                        |<|  |      |   adhesion group
063          ----------->--------------|                        |<|  |      |
                     >               |-|                      |<|  |      |
143          ----------->--------------| |                      |<|  |      |
                     >                 |----------------------|<|--|      |
155          ----------->--------|       |                      |<|  |      |
                     >        |-------|                      |<|  |      |
159          ----------->--------|                               |<|  |      |
                     >                                        |<|  |      |
127          ----------->-----|                                 |<|  |      |
                     >    |-------------|                      |<|  |      |
128          ----------->-----|             |                    |<|  |      |   C19
                     >                  |                    |<|  |      |
029  SWC8    --|      >                  |                    |<|  |      |   adhesion group
             |--|    >                  |--------------------|<|  |      |
065          --|  |----->----|             |                    <|  |      |
                 |    >    |             |                    <|  |      |
077  SWC8    -----|    >    |-------------|                    <|  |      |
                     >    |                                    <|  |      |
163          ----------->----|                                 <|  |      |
                     >                                        <|  |      |
095          ----------->------------|                          <|  |      |
                     >            |                          <|  |      |
049          -------|  >            |-----------------------|  <|  |      |
                    |-->-----|      |                       |  <|  |      |
053          -------|  >     |      |                       |  <|  |      |   C20
                     >     |------|                       |  <|  |      |
110          ----|     >     |                              |  <|  |      |   myeloid group
                 |------>-----|                              |  <|  |      |
138          ----|     >                                    |  <|  |      |
                     >                                    |  <|  |      |
030          ----------->---|                                |  <|  |      |
                     >   |----------|                      |  <|  |      |
075          -------|  >   |          |                      |  <|  |      |
```

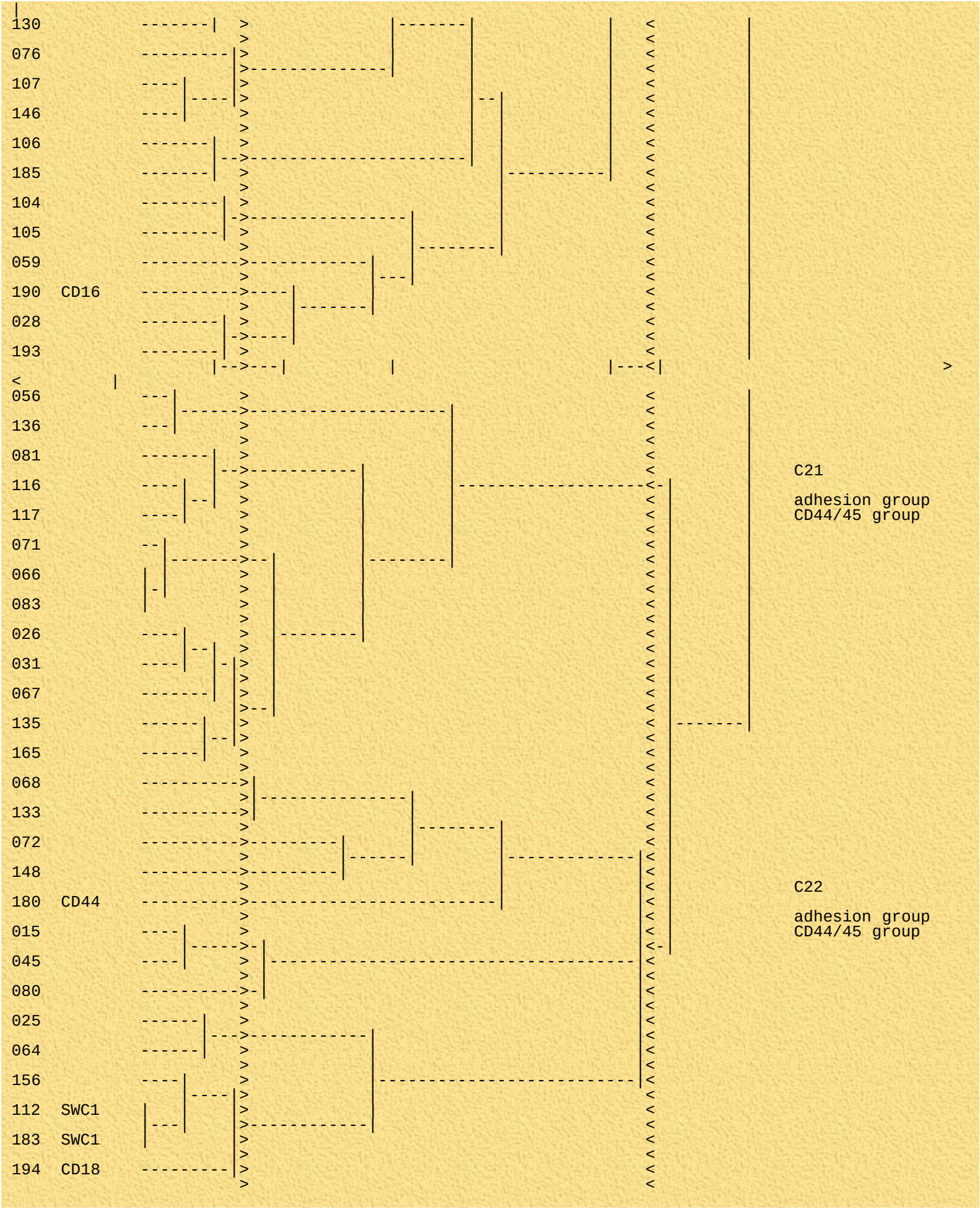
130
076
107
146
106
185
104
105
059
190 CD16
028
193
056
136
081
116
117
071
066
083
026
031
067
135
165
068
133
072
148
180 CD44
015
045
080
025
064
156
112 SWC1
183 SWC1
194 CD18
C21
adhesion group
CD44/45 group
C22
adhesion group
CD44/45 group

Table 2. Contribution of the participants to the Second International Swine CD workshop

Name	Country	Analyses round 1/2 (a)	Co-Chair/ co-worker (b)	#mAb submitted new mAb/Standards (c)
Aasted	Denmark	1/2	T cells/activation/MW	1
Sachs/Arn	USA, MA	1/2	T cells/activation	8
Bianchi/Zwart	The Netherlands	-/2	B-cells/myeloid cells	11
Binns/Licence	United Kingdom	-/-		0/ 4
Blecha	USA, KA	-/2	myeloid cells	
Chen	USA, CA	-/2	reactivity of anti-human mAb	
Chu	Taiwan	1/2	T cells/activation	2
Davis	USA, WA	1/2	null cells	40
Denham/Whittall	United Kingdom	-/2	B cells	7
Dominguez	Spain	-/2	myeloid cells/T cells/MW	19
Horstick	Germany	-/2	Adhesion molecules	
Howard/Sopp	United Kingdom	-/2	reactivity of anti-human mAb	6/ 2
Kim	USA, IL	1/2	myeloid cells	6
Lipp	Austria	-/2	Adhesion molecules	
Lunney	USA, MD	1/2	cochair/T cells/activation	0/ 5
Mackay	USA, MA	-/-		0/ 2
Magyar	Hungary	-/-		0/ 1
McCullough	Switzerland	1/2	myeloid cells	
Murtaugh	USA, MI	1/2	B cells/myeloid cells	
Nielsen	Denmark	1/2	T cells/activation	
Novikov	Russia	-/2	T cells/activation	
Pescovitz	USA, IN	1/2	T cells/activation	5
Saalmüller	Germany	1/2	chair	0/ 7
Schuberth	Germany	-/2	reactivity on fixed cells	
Schütt	Germany	-/-		3
Shimizu	Japan	-/-		25
Stokes/Haverson	United Kingdom	1/2	Adhesion molecules	12/ 1
Tlaskalova	Czech Republic	1/2	B cells	
Trebichavsky	Czech Republic	-/2	T cells/activation	
Yang	United Kingdom	-/-		16
Valpotic	Croatia	-/2	T cells/activation	
Walker/Lee	Australia	-/2	T cells/activation	
Zuckermann	USA, IL	-/2	CD44/45, adhesion molecules	12
Total				**176/19**

(a) Analyses of the whole panel of antibodies were performed in a first round; in a second round only a panel of mAb preselected by the first round clustering were analysed by the respective subset groups.

(b) Subset groups performed the second round analyses with a preselected panel of mAb.

(c) Internal standards were mAb with known reactivity, which were assigned by the First International Swine CD workshop (Lunney, 1993; Lunney et al., 1994).

Table 3. Panel of mAb submitted to the Second Swine CD Workshop

Wkshp #a	mAb Nameb	CD#/. SWC#.c	1st round clusterd	Original description red/nr	Pig MWe kDa	Ig species isotype	Donor	Availability	Cross-Rxn.f	Ref.
001	TÜK4	CD14	C14 (M)	human CD14		m IgG2a	Aasted	commercial	hu,mo,ct	[1]
002	SwNL 516.1		C14 (M)	Mo, G, PBMC (90%)		m IgG1	Bianchi	collab	sh,gt,dg	
003	SwNL 517.2		C4 (M)	Mo, PBMC (4%)		m IgG1	Bianchi	collab		
004	SwNL 552.1		C17 (A/M)	Mo		m IgM	Bianchi	collab		
005	SwNL 552.2		C17 (A/M)	Mo, PBMC (3%)		m IgM	Bianchi	collab		
006	SwNL 552.3		C4 (M)	Mo		m IgM	Bianchi	collab		
007	SwNL 517.3		C17 (A/M)	endothels, PBMC (9%)		m IgM	Bianchi	collab		
008	SwNL 553		C13 (N*M)	Kupfer cells, liver		m Ig	Bianchi	collab		
009	SwNL 554.1	wCD8c	C16 (A/D/M)	endothels, PBMC (63%)		m IgM	Bianchi	collab		
010	SwNL 554.2		C4 (M)	endothels, PBMC (2%)		m IgG1	Bianchi	collab		
011	SwNL 554.3		withdrawn							
012	SwNL 555		C5 (M)	B, thymocytes		m IgG1	Bianchi	collab		
013	PG103A		C13 (N)	T, 40-50% PBMC		m IgM	Davis	collab		
014	PG107A		C14 (T/B/M)	40-50%, down on blasts		m IgM	Davis	collab		
015	PG1A		C22 (A/D)	~50% T cells		m IgG1	Davis	comm/collab		
016	PG130A		C14 (M)	Mo, 10% PBMC		m IgM	Davis	comm/collab		
017	PG84A		C10 (N)	10% PBMC, gdTcR cells		m IgG1	Davis	comm/collab	ct	
018	PG92A		C10 (N)	10% PBMC, gdTcR cells		m IgM	Davis	comm/collab	ct	
019	PG94A		C10 (N)	10% PBMC, gdTcR cells		m IgM	Davis	collab		
020	PT14A		C10 (N)	25-35% PBMC, gdTcR cells		m IgG2a	Davis	collab		
021	PT79A		C10 (N)	25-35% PBMC, gdTcR cells		m IgG2a	Davis	comm/collab		
022	MUC127A		C10 (N)	25-35% PBMC, gdTcR cells		m IgG2a	Davis	comm/collab		
023	MUC106A		C17 (A/M)	10-50% PBMC, G, B cells		m IgM	Davis	comm/collab		
024	PG104A		C11 (T/B)	20-30% PBMC		m IgM	Davis	collab		
025	MUC76A	CD18a	C22 (A/D)	all leucocytes		m IgG2a	Davis	comm/collab		
026	MUC93A		C21 (A/D)	leucocytes, E, platelets		m IgG1	Davis	collab		
027	MUC54A		C1 (A)	all leucocytes		m IgG1	Davis	collab		
028	RH1A		C20 (M)	Mo, G	20-25/--	m IgG3	Davis	comm/collab	hu,ct,ho	
029	MUC20A	SWC8	C19 (A)	10-20% PBMC		m IgG1	Davis	collab	dg,ca	
030	MUC21A		C20 (M)	Mo, G		m IgM	Davis	collab		
031	PT25A		C21 (A/D)	leucocytes, platelets		m IgG3	Davis	collab		
032	PG139		C13 (N*T)	activation molecule		m Ig	Davis	comm/collab		
033	GB16A		C9 (T/B)	activation molecule		m IgG1	Davis	comm/collab	hu,ct,gt	
034	PGB70A		C9 (T/B)	activation molecule		m IgM	Davis	comm/collab		
035	PGB84A		C9 (T/B)	activation molecule		m IgG1	Davis	comm/collab		
036	PGB89A		C9 (T/B)	activation molecule		m IgG1	Davis	comm/collab		
037	PGBL2A		C15 (T/B/M)	activation molecule		m IgG1	Davis	comm/collab		
038	PGBL7A		C6 (B*T)	activation molecule		m IgM	Davis	comm/collab		
039	PGBL11A		C9 (T/B)	activation molecule		m IgM	Davis	comm/collab		
040	PGBL16A		C8 (T/N)	activaiton molecule		m IgM	Davis	comm/collab		
041	PGBL22A		C10 (N)	dg, ca cells		m IgG1	Davis	comm/collab	ct	
042	PGBL24A		C10 (N)	gdTcR cells		m IgM	Davis	comm/collab		
043	PGBL25A	wCD25	C7 (T)	only blast cells		m IgG1	Davis	collab		
044	PGBL31A		C9 (T/B)	gdTcR cells		m IgG1	Davis	comm/collab	ct(BoWC1)	
045	PGB95A		C22 (A/D)	T cells		m IgG2b	Davis	comm/collab		
046	PGBL6A	CD2a	C2 (T)	T cells, CD2		m IgG2a	Davis	comm/collab		

047 PGBL13A C2 (T) T cells m IgM Davis comm/collab
048 PGBL23A CD2a C2 (T) T cells, CD2 m IgG1 Davis comm/collab
049 PG68A C20 (M) G m IgG1 Davis comm/collab
050 PG74B C13 (N) T cells m IgM Davis comm/collab
051 PG164A wCD8c C2 (T) subset of CD8+ cells m IgG2a Davis comm/collab
052 PG173A C3 (D) gdTcR cells, B cells m IgM Davis comm/collab
053 biG10 CD14 C20 (M) Mo, G, CD14 48-53/48-53 m IgG1 Schütt on request
hu,ct,dg
054 biG13 CD14 C17 (A/M) Mo, G, CD14 48-53/48-53 m IgG1 Schütt on
request
055 RoDR withdrawn
056 4B7/8 C21 (A/D) PBMC (57%) 45/45 m IgG2a Dominguez
collab
057 2F6/8 SWC7 C11 (T/B) activation molecule m IgG2a Dominguez
collab
058 1H6/8 CD5a C2 (T) PBMC (25%) m IgG2a Dominguez collab
059 2C12/10 C20 (M) Mo, G, PBMC (12%) m IgG2b Dominguez collab
060 6E3/7 CD45RA C3 (D) PBMC (30%) >200/ >200 m IgG1 Dominguez collab
061 5A6/8 C4 (M*T) activation molecule 20/28 m IgG2a Dominguez
collab
062 6H4/7 C9 (T/B) activation molecule 32,28/30,35 m IgG1 Dominguez
collab
063 C4 C18 (A/M) Mo, G, alveolar Mo- m IgG1
Dominguez collab
064 2B8 C22 (A/D) PBMC (80%) m IgG2a Dominguez
collab
065 1G1 C19 (A) Mo, G, alveolar Mo- m IgG2b Dominguez
collab
066 6D8/8 C21 (A/D) L, Mo, G, E (>90%) m IgG1 Dominguez
collab
067 1C5 C21 (A/D) L, Mo, G, E (>90%) m IgG2a
Dominguez on request
068 1H1 C22 (A/D) L, Mo, G, P, E (>90%) m IgG Dominguez
on request
069 2F4 C1 (A) PBMC (17-24%) 33,28/33,28 m IgG2b Dominguez
on request
070 4F10 C18 (A/M) Mo, PBMC (13-22%) m IgG1
Dominguez on request
071 1D10 C21 (A/D) L, Mo,G, P, E (>90%) m IgG1
Dominguez on request
072 1B11 C22 (A/D) L, Mo, PBMC (37-52%) m IgG2b
Dominguez on request
073 1M10 C16 (A/B/M) Mo, PBMC (13-20%) m IgG1 Dominguez
on request
074 1A4 C12 (B/N) null cells, PBMC (19-25%) m IgG2a
Dominguez on request
075 MIL1 C20 (M) Mo, G m IgG2a Stokes on request
[2]
076 MIL2 C20 (M) Mo, G m IgG2b Stokes on request
[2]
077 MIL3 SWC8 C19 (A) G, T/B subset m IgM Stokes on request
[2]
078 MIL4 C18 (A/M) G, CD8dim, PBMC (10%) m IgG1 Stokes on
request hu [2]
079 MIL5 CD45RC C3 (D) B, T, PBMC (75%) --/210 m IgG1 Stokes
on request
080 MIL6 C22 (A/D) T, Mo, null, PBMC m IgG2a Stokes
on request hu
081 MIL7 C21 (A/D) T, Mo, null, PBMC m IgM Stokes
on request
082 MIL8 wCD6 C2 (T) PBMC (30-40%) m IgG2a Stokes on request
083 MIL9 C21 (A/D) leucocytes (<100%) m IgG1 Stokes
on request
084 MIL11 C10 (N*A) capillary endothelium m IgE Stokes on request
dg
085 K139.3E1 C9 (T/B) B cells (light chain) 25/-- m IgG2a Stokes
on request
086 K252.3D11 C13 (N*T) T, PBMC (20-30%) 47/-- m IgM Stokes
on request
087 STH055 C2 (T) T, PBMC (40-53%) m IgG1 Shimizu on request
088 STH164 wCD3 C2 (T) T, PBMC (60%) m IgG2a Shimizu on request
089 STH267 CD45RA C3 (D) T, PBMC (62%) m IgG1 Shimizu on request
090 STH101 wCD8a C2 (T) T, PBMC (31%) m IgG2a Shimizu on request
091 STH286 C13 (N) T, PBMC (23%) m IgM Shimizu on request
092 STH293 CD4a C2 (T) T, PBMC (21%) m IgG1 Shimizu on request
093 STH069 C10 (N) T, PBMC (19%) m IgG1 Shimizu on request
094 STH106 wCD8c C16 (A/D/M) T, PBMC (17%) m IgG1 Shimizu on request
095 STH037 withdrawn
096 STH273 C10 (N) T m IgM Shimizu on request
097 STH224 C5 (B) B?, PBMC (22%) m IgG2a Shimizu on request
098 STH083 C6 (B) B?, PBMC (21%) m IgM Shimizu on request

099 STH249 C6 (B) B?, PBMC (18%) m IgG1 Shimizu on request
100 STH234 C6 (B) B?, PBMC (11%) m IgM Shimizu on request
101 STH016 withdrawn
102 STH201 withdrawn
103 STH105 withdrawn
104 STH208 C20 (M) Mo, G m IgM Shimizu on request
105 STH277 C20 (M) Mo, G m IgM Shimizu on request
106 STH241 C20 (M) Mo, G? m IgG2a Shimizu on request
107 STH248 C20 (M) Mo, G? m IgM Shimizu on request
108 STH242 C12 (B/N) G m IgM Shimizu on request
109 STH32 C12 (B/N) G m IgM Shimizu on request
110 STH226 C20 (M) G m Ig Shimizu on request
111 STH109 withdrawn
112 335-2 SWC1 C22 (A/D) T, Mo, G m IgG2a Magyar on request
113 1038H-8-9 C16 (A/D/M) PBMC 100% 13.5/-- m IgM Sachs on request
114 1038H-6-17 C16 (A/D/M) All, b2m 12/-- m Ig Sachs on request
115 1030-3-17 C9 (T/B) Platelets, dull on Mo? m IgG1 Sachs on request
116 1030H-2-7 C21 (A/D) PBMC, thymocytes m IgM Sachs on request
117 1030H-1-8 C21 (A/D) L, Mo, thymocytes m IgM Sachs on request
118 1030H-3-16 C17 (A/M) Mo, G m IgG2a Sachs on request
119 1030H-2-10 C9 (T/B) Mo, G, P m IgM Sachs on request
120 1038H-10-8 C6 (B) PBMC (15-30%) 68/-- m IgM Sachs on request
121 IAH-CC51 wCD21 C6 (B) B cells 145/-- m IgG2b Howard hyb:ATCC ct,sh(BoWC3) [3]
122 IAH-CC101 C10 (N) TcR __ cells 180/-- m IgG2a Howard hyb:ATCC ct,sh(BoWC1) [4]
123 IAH-CC100 C14 (M) PBMC (7%) m IgG1 Howard collab ct
124 IAH-CC89 C14 (M) PBMC (2%) m IgG2a Howard collab ct
125 IAH-CC57 C9 (T/B) B cells 90/-- m IgG1 Howard hyb: ATCC ct(BoWC4) [5]
126 IAH-CC55 SWC7 C6 (B) B cells 90/-- m IgG1 Howard hyb: ETACC ct(BoWC3) [5]
127 7B10 C19 (A) B,T cells (11-15%) 27/-- m IgM Chu on request
128 IG3 C19 (A) B,T cells (3-7%) 27/-- m IgM Chu on request
129 UCP2D4 C5 (B) L, Mo, G, E (<30%) m IgG1 Zuckermann collab
130 UCP2E1 C20 (M) L, Mo, G, E (<15%) m IgM Zuckermann collab
131 UCP1C10 C9 (T/B) L, Mo, G, E (< 20%) m IgM Zuckermann collab
132 UCP2D3 C3 (D) L, Mo, G, E (80%) m IgM Zuckermann collab
133 UCP1D2 wCD29 C22 (A/D) PBMC (25-70%) 1130,165/-- m IgG1 Zuckermann collab dg
134 UCP1E9 C1 (A) PBMC (60-90%) m IgM Zuckermann collab
135 UCP2G11 C21 (A/D) PBMC (90-98%) m IgG2a Zuckermann collab
136 UCP1F9 C21 (A/D) PBMC (98-100%) 42/42 m IgG1 Zuckermann collab
137 UCP2A4 C5 (B) PBMC (10-45%) m IgG1 Zuckermann collab
138 UCP1B2 C20 (M) L, Mo, G, E (10-30%) m IgM Zuckermann collab
139 UCP1H122 wCD8 C2 (T) PBMC (26%) 36/75 m IgG1 Zuckermann collab
140 UCP1H12-93 C13 (N) PBMC (10-20%) m Ig Zuckermann collab
141 IC2F10 C6 (B) PBMC (15-25%) 80/-- m IgG1 Whittall on request
142 C11 C17 (A/M) PBMC (60-70%) 120/-- m IgG1 Whittall on request ct,sh
143 IA6D2 withdrawn
144 C4 SWC9 C16 (A/D/M) alv. Mo, PBMC- 145/-- m IgG1 Whittall on request
145 C28 C9 (T/B) Mo, PBMC (7-12%) 210/--- m IgG1 Whittall on request ct
146 C25 C20 (M) PBMC (10-20%) 150,95/-- m IgG1 Whittall on request
147 C35 wCD21 C12 (B/N) PBMC (15-25%) 165/-- m IgG1 Whittall on request ct
148 FY1A3 CD3b C22 (A/D*T) T cells 24/23 m IgG1 Yang after pubn
149 FY2C1 CD3b C2 (T) T cells 24/23 m IgG1 Yang after pubn
150 FY1H2 CD3c C2 (T) T cells 24/23 m IgG1 Yang after pubn
151 FY2A11 CD3a C2 (T) T cells 24/23 m IgG1 Yang after pubn
152 FQ4G7 C11 (T/B) PBMC (65%) 80/80 m IgM Yang after pubn
153 FG2A5 C13 (N) PBMC (22%) m IgM Yang after pubn
154 FA2F12 C11 (T/B) PBMC (35%) m IgG1 Yang after pubn
155 FHAC6 C18 (A/M) PBMC (85%) 130/150 m IgG1 Yang after pubn
156 FG1F6 C22 (A/D) PBMC (80%) m IgG1 Yang after pubn
157 FG2F9 CD45RA C3 (D) PBMC (75%) 15-32/15-32 m IgG1 Yang after pubn
158 FQ3E8 C9 (T/B) PBMC (42%) m IgG3 Yang after pubn
159 FQ4E4 C18 (A/M) PBMC (52%) m IgM Yang after pubn
160 FS2H10 C11 (T/B) PBMC (25%) m IgG1 Yang after pubn

161 F21D7 C1 (A) T cells 60/60 m IgG1 Yang after pubn
162 FO1G9 C3 (D) PBMC (26%) m IgM Yang after pubn
163 FO2A7 C19 (A) PBMC (26%) m IgM Yang after pubn
164 86D withdrawn
165 FW4-101 wCD29 C21 (A/D) Mackay ATCC
166 BB6-9G12 CD5a C2 (T) PBMC (76%) 65/-- m IgG1 Pescovitz req/comm
167 BBb 11C9 wCD21 C6 (B) PBMC (34%) m IgG1 Pescovitz req/comm
168 BBb10/9/0 C9 (T/B) PBMC (21%) m IgM Pescovitz req/comm
169 BB23-8E6 CD3a C2 (T) PBMC (82%) 16/-- m IgG3 Pescovitz req/comm
170 2B11 C3 (D) PBMC (38%) m IgM Pescovitz req/comm
190 G7 CD16 C20 (M) L, Mo, G 40/40 m IgG1 Kim collab [6,7,8]
191 PNK-E C14 (M) L, Mo, G 50/200 m IgG1 Kim collab [7,8,9]
192 PM18-7 SWC9 C16 (A/D/M) Mo 130/260 m IgG1 Kim collab
193 PM16-6 C20 (M) PBMC (80-90%) m IgM Kim collab
194 PM3-15 C22 (A/D) PBMC (80-90%) 26,31/-- m IgG1 Kim collab
195 PNK-1 CD18a PBMC (90-95%) 95/95 m IgG1 Kim collab [10]

Standards for the 2nd workshop
171 76-7-4 wCD1 C14 (T/B/M) thym., B 44/44 m IgG2a Lunney hyb: ATCC [11]
172 MSA4 CD2a C2 (T) T cells 50/50 m IgG2a Lunney hyb: ATCC [12,13,14]
173 74-12-4 CD4a C2 (T) T cells 55/55 m IgG2b Lunney hyb: ATCC [11,13,15,16]
174 b53b7 CD5a C2 (T) PBMC 63/63 m IgG1 Saalmüller on request [13,17,18]
175 a38b2 wCD6 C2 (T) T cells 110/110 m IgG1 Saalmüller on request [13,19,20]
176 76-2-11 wCD8a C2 (T) T cells 35/70 m IgG2a Lunney hyb: ATCC [11,13,15,21]
177 11/295/33 wCD8b C2 (T) T cells 35/70 m IgG2a Saalmüller on request [11,21,22]
178 IAHCC51 wCD21 C12 (B/N) B cells m IgG2b Howard hyb: ATCC [3,23]
179 K231.3B2 wCD25 C7 (T) activation m IgG1 Stokes on request [13,24]
180 MAC325 CD44 C22 (A/D) r IgG2a Binns on request [25,26]
181 MAC326 CD45R r IgM Binns on request [25,26,27]
182 3a56 CD45R C3 (D) >200/-- m IgM Saalmüller on request [25,27]
183 11/8/1 SWC1a C22 (A/D) T, Mo, G m IgG2b Saalmüller on request [13,28,29]
184 b30c7 SWC2 C2 (T) T 40/40 m IgG1 Saalmüller on request [13]
185 74-22-15 SWC3a C20 (M) Mo, G >200/>200 m IgG2a Lunney hyb: ATCC [11,30]
186 MAC319 SWC4 C8 (T/N) null r IgG1 Binns on request [31,32]
187 b37c10 SWC5 C10 (N) null 180/180 m IgG1 Saalmüller on request [32]
188 MAC320 SWC6 null m IgG2a Binns on request [31,32]
189 IAHCC55 SWC7 C12 (B/N) null m IgG1 Howard hyb: ETACC [3,32]

a workshop number of the analyzed monoclonal antibody (mAb).
b original name of the mAb.
c proposed CD No. or swine workshop cluster (SWC) No.
d cluster containing the mAb after the first round analyses. The subset the respective mAb were distributed for further analyses are indicated in the parentheses (A, adhesion molecule subset; B, B-cell subset; D, CD44/CD45 group; M, myeloid marker group; N, Null cell subset; T, T-cell and activation marker group. * indicate changes of the subsets from X*(to)Y after revision of the first round analyses data by the donors of the mAb.
e molecular mass in kilodaltons (kDa) of the antigen under reducing/non reducing conditions
f cross-reactivity of the mAb with other species: hu, human; mo, monkey; ct, cattle; sh, sheep; gt, goat; dg, dog; ca, cat. Cluster determinations in other workshops are indicated (e.g. BoWC1).
g published references for the mAb.

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Table 4. Distribution of mAb for the 2nd round analyses to the respective subgroups

1st Round Cluster	no. of mAb				T cells/ act.		
Pescovitz		B cells					
Denham	myeloid						
Dominguez		null cells					
Davis	adhesion						
Stokes	CD44/45						
Zuckermann							
C1	4					C1	C1
C2	23	C2					
C3	9						C3
C4	4			C4			
C5	4		C5				
C6	9		C6				
C7	2	C7					
C8	2	C8			C8		
C9	15	C9	C9				
C10	13				C10		
C11	5	C11	C11				
C12	6		C12		C12		
C13	7				C13		
C14	6			C14			
C15	3	C15	C15		C15		
C16	7			C16		C16	C16
C17	7			C17		C17	
C18	5			C18		C18	
C19	6					C19	
C20	18			C20			
C21	13					C21	C21
C22	14					C22	C22
after revision							
by the							
mAb donors		addtional mAb					
to the respective subgroups				032			
038							
040							
045							
061							
086							
148		008					
	188	008					
044							
084	181						
total							
probes	185	57	42	48	32	59	48

Table 5. Summary of Monoclonal Antibodies Reactive with Swine Lymphoid Cell Differentiation Antigens

Cell Subset	Antigen	#mAb	Prototype mAb (Source)	Other mAb
T Cells	CD2a	7 (2)	MSA4 (Lu/Ha)	MAC80 (Bi), MAC83 (Bi), PG168A (Da), 1038-8-31(Ss), PGBL6A(Da), PGBL23A (Da)
	CD3a	2 (2)	BB23-8E6 (Pe)	FY2A11 (Ya)
	CD3b	2 (2)	FY2C1 (Ya)	FY1A3 (Ya)
	CD3c	1 (1)	FY1H2 (Ya)	
	wCD3	1 (1)	STH164 (Sh)	
	CD4a	5 (1)	74-12-4 (Pe/Lu/Ss)	b38c6 (Sa), 10.2H2 (Lu), PT90A (Da), STH293 (Sh)
	CD5a	8 (2)	b53b7 (Sa)	PG71A (Da), PG75A (Da), PG99A (Da), PG114A (Da), PG116A (Da), 1H6/8 (Do), BB6-9G12 (Pe)
	wCD6a	3 (1)	a38b2 (Sa)	PG90A (Da), MIL8 (St)
	wCD8a	4 (1)	76-2-11 (Pe/Lu/Ss)	PT36B (Da), PT81B (Da), STH101 (Sh)
	wCD8b	3 (0)	11/295/33 (Sa)	11/122/28 (Sa), PG93A (Da)
	wCD8c	3 (3)	PG164A (Da)	SwNL554.1 (Bi), STH106 (Sh)
	wCD8	1 (1)	UCP1H122 (Zu)	
	SWC1a	5 (1)	11/8/1 (Sa)	K263.3D7 (St), MUC13A (Da), PT15A (Da), PT80A (Da),
	SWC1	5 (0)		PT91A (Da), PT37A (Da), 11/305/44 (Sa), 335-2 (Mg), 76-6-7 (Pe/Lu/Ss)
	SWC2	2 (0)	b30c7 (Sa)	PG124A (Da)
Activation	wCD25	2 (1)	K231.3B2 (St)	PGBL25A (Da)
B Cells	wCD1	1 (0)	76-7-4 (Pe/Lu/Ss)	
	wCD21	3 (2)	IAH-CC51 (Ho)	BB6-11C9 (Pe), C35 (Wh)
	SWC7	2 (1)	IAH-CC55 (Ho)	2F6/8 (Do)
Macrophages	SWC3a	3 (0)	74-22-15 (Lu/Pe/Ss)	6F3 (Pe), DH59B (Da)
	CD14	4 (3)	My4 (Co)	TÜK4 (Dk), biG10 (Sc), biG13 (Sc)
	SWC9	2 (2)	PM18-7 (Ki)	C4 (Wh)
Null cells	SWC4	3 (0)	MAC319 (Bi)	MAC318 (Bi), PG83A (Da)
	SWC5	2 (0)	b37c10 (Sa)	PG92A (Da)
	SWC6	1 (0)	MAC320 (Bi)	
Lymphoid Cells	CD16	1 (1)	G7 (Ki)	
	CD18a	3 (0)	PNK-I (Ki)	MHM23 (Dk), H20A (Da), MUC76A (Da)
	wCD29	2 (2)		UCP1D2 (Zu), FW4-101 (Ma)
	SWC8	2 (2)		MUC20A (Da), MIL3 (St)
	wCD44a	3 (0)	Z063 (Zy)	PORC24A (Da), H22A (Da)
	wCD44	4 (0)	MAC325 (Bi)	BAG40A (Da), BAT31A (Da), 25-32 (Ma)
	CD45	4 (0)		K252.1E4 (St), MAC323 (Bi), 2A5 (Do), 74-9-3 (Pe/Lu/Ss)
	CD45RA	3 (3)	STH267 (Sh)	FG2F9 (Ya), 6E3/7 (Do)
	CD45RC	4 (1)	3a56 (Sa)	MAC326 (Bi), -a2 (Sa), MIL5 (St)

Summary of monoclonal antibodies reactive with swine lymphoid cell differentiation antigens defined in the First and Second International Swine CD workshops. Clusters identifieded and mAb clustered in the Second Workshop are indicated by italic letters and the number of new mAb added to the clusters listed in parentheses. Swine CD assignments are given to swine orthologues of human CD as characterized by 1) tissue distribution, 2) molecular mass of the antigen, and 3) sequence of the respective molecules. Workshop CD (wCD) define molecules currently lacking the appropriate sequence for the swine CD antigen. Swine workshop cluster (SWC) define 2 or more mAb recognizing an antigen with the same expression pattern on a wide panel of cell types. Sources of mAb are Binns (Bi), Coulter (Co), Davis (Da), Dominguez (Do), Hammerberg (Ha), Howard (Ho), Kim (Ki), Lunney (Lu), Mackay (Ma), Magyar (Mg), Pescovitz (Pe), Saalmüller (Sa), Schütt (Sc), Sachs (Ss), Shimizu, (Sh), Stokes (St), Whittall (Wh), Yang (Ya), Zuckermann (Zu), and Zymed (Zy).

Table 6. Laboratories participating in the Second International Swine CD workshop

Laboratory name	Participating Scientists and Addresses
Aasted	Drs. B. Aasted, K. Gori, K.R. Petersen,Dept. Vet. Virology and Immunology, Royal Vet. University, 13 Bulowsvej, DK-1870 Frederiksberg C, Denmark
Arn/Sachs	Dr. D. H. Sachs, Mr. S. Arn, Transplantation Biology Research Center, Massachusetts General Hospital, MGH East, Bldg. 149, 13 Street, Charlestown, MA 02129, USA
Bianchi/Zwart	Drs. A.T.J. Bianchi, R.J. Zwart, Central Veterinary Institute CDI, P.O.Box 65, Edelhertweg 15, NL-8200AB Lelystaad, The Netherlands.
Binns/Whyte	Drs. A. Whyte, R. M. Binns (retired), Mr. S. Licence, AFRC Institute for Animal Physiology, Babraham, Cambridge CB2 4AT, England
Blecha	Drs. F. Blecha, S. Facher, Dept. of Anatomy and Physiology, Kansas State University, VMS 228, Manhattan, Kansas 66506, USA
Chen	Dr. Z. Chen, Diagnostic and Clinical Research, Pharmingen, 10975 Torreyana Road, San Diego CA 92121-1111, USA
Chu	Dr. R. M. Chu, Pig Research Institute Taiwan, P.O. Box 23, Miaoli, Chunan Taiwan 35099
Davis	Drs. W.C. Davis, I.R. Barbosa, M.J. Hamilton, Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, WA 99164-7040, USA
Dominguez	Drs. J. Dominguez, F. Alonso, A. Ezquerra, R. Bullido, CISA-INIA, 28130 Valdeolmos, Madrid, Spain
Horstick	Dr. G. Horstick, Uniklinik Mainz, II. Medizinische Klinik, Langerbeckstr.1, 55131 Mainz, Germany.
Howard/Sopp	Drs. C. Howard, P. Sopp, BBSRC, IAH, Compton, Newbury, Berkshire, RG20 7NN, U. K.
Kim	Dr. Y. B. Kim, Department of Microbiology and Immunology, Finch University of Health Sciences, The Chicago Medical School, 3333 Green Bay Road, North Chicago, Illinois 60064, USA.
Lipp	Dr. J. Lipp, VIRCC, Laboratory of Transplantation Immunology, Brunner Strasse 59, A 1235 Vienna, Austria
Lunney	Dr. J. K. Lunney, Ms. P. Boyd, USDA ARS Helminthic Diseases Laboratory, Animal Parasitology Institute, Building 1040 BARC-East, Beltsville, MD, 20705, USA
Mackay	Dr. Charles Mackay, Leukosite INC, 800 Huntington Ave, Boston, MA, 02115, USA
Magyar	Dr. A. Magyar, Department of Immunology, University of L. Eötvös, H-2131 Göd, Javorka S.u.14., Hungary
McCullough	Drs. K. McCullough, A. Arriens, A. Summerfield, Institut für Viruskrankheiten und Immunprophylaxe, Forschungsanstalt des Bundesamtes für Veterinärwesen, CH-3147 Mittelhäusern, Schwitzerland
Murtaugh	Drs. M. Murtaugh, M. Pampusch, K. Burger, Dept. Vet. Pathobiol. Coll. Vet. Med.; Univ. MN, 1971 Commonwealth Ave., St.Paul, MN 55108, USA
Nielsen	Dr. J. Nielsen, Ministry of Agriculture, State Veterinary Institute for Virus Research, Lindholm DK-4771 Kalvehave, Denmark
Novikow	Dr. B. Novikov, All-Russian Research Institute of Veterinary Virology and Microbiology, 601120 Pokrov, Vladimizskaya obl., Russia
Pescovitz	Dr. M. D. Pescovitz, Ms. B.K. Book, Indiana University, Transplantation Section, Dept. Surgery,University Hospital C430, 926 West Michigan Street, Indianapolis, Indiana 46223, USA
Pirbright	Drs. S. Denham, A.H. Corteyn, P. Kirkham, H. Yang, T. Whittall, R. M. Parkhouse, IAH Pirbright Laboratory, Ash Road, Pirbright, Woking GU24 ONF, England
Saalmüller	Drs. A. Saalmüller, T. Pauly, Federal Research Centre for Virus Diseases of Animals, P. O. Box 1149, 72001 Tübingen, Germany
Schuberth	Drs. H. J. Schuberth, W. Leibold, Immunologie der Tierärztlichen Hochschule Hannover, Bischofsholer Damm 15, D-30173 Hannover, Germany
Schütt	Dr. C. Schütt, Institut für Immunologie und Transfusionsmedizin,

EMA-Universität, Fleischmannstr., D-17487 Greifswald, Germany
Shimizu Dr. M. Shimizu, National Institute for Animal Health, Ibaraki 305, Japan
Stokes/Haverson Drs. C. Stokes, K. Haverson, M. Bailey, Dept. Veterinary Medicine, University of Bristol, School of Medicine, Langford Bristol, BS18 7DV England
Tlaskalova Drs. H. Tlaskalova, J. Sinkora, M. Sinkora, Z. Rehakova, Czech Academy of Science, Institute of Microbiology, 142 20 Prague 4 KRC, Videnska 1083, Czech Republic
Trevichavsky Dr. I. Trebichavsky, Gnotobiological laboratory, Novy Hradek, 549 22 Novy Hradek, Czech Republic
Valpotic Drs. I. Valpotic, N. Petrinec, M. Tornaskovic, G. Lackovic, Ms. L. Sver, Dept. Biology, Veterinary Faculty, University of Zagreb, P. O. Box 190, Cro-41000 Zagreb, Croatia
Walker/Lee Drs. J. Walker, R. Lee, Centre for Animal Biotechnology, School of Veterinary Science, Univ. Melbourne, Parkville, Victoria 3052, Australia
Zuckermann Drs. F. Zuckermann, W.M. Schnitzlein, C. Peavey, D. Schabacker, R.J. Husmann, University of Illinois, Dept. of Veterinary Pathobiology, 1828 VMBSB, 2001 South Lincoln Avenue, Urbana, Illinois 61801, USA

G00004

Second International Swine CD Workshop Summary

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Abstract:
The Second International Swine Cluster of Differentiation (CD) Workshop wasorganized to standardize the assignment of monoclonal antibody (mAb) reactivity toswine leukocyte differentiation antigens. This IUIS supported workshop took placein 1993-1996 and was chaired by A. Saalmuller; 25 laboratories worldwide analyzed the 176 submitted mAb and 9 internal standard mAb. As a result of thesummary workshop session, revisions in the existing nomenclature for Swine CDwere accepted so that rules are now in accord with those for the human CDmolecules: swine CD# assignments are only given to swine orthologues of humanCD when characterized by tissue distribution, appropriate molecular mass of theantigen, and sequence of the respective molecule; lacking this wCD# are assigned.Swine workshop cluster # (SWC#) are assigned for clusters of 2 or more mAb with common phenotypes on swine cells. Based on this revised nomenclature thefollowing CDs are designated in swine: wCD1, CD2 [2 new mAb], CD3 [6, 3 eachagainst 2 epitopes], CD4 [1], CD5 [2], CD6 [1], CD8 [3; 1 against a new CD8cepitope], CD14 [3], CD16 [1], CD18, wCD21 [2], wCD25 [1], wCD29 [2],wCD44, CD45, CD45RA [3], CD45RC [1], SWC1 [1], amd SWC7 [1]. Two newclusters, SWC8 [2] and SWC9 [2], were also characterized. These internationallycharacterized mAb should be very useful for scientists using the pig for veterinaryand biomedical research.

Introduction:
1. Introduction
The Second International Swine CD workshop, supported by the Veterinary Immunology Committee (VIC) of the International Union of Immunological Societies (IUIS), was organized to standardize the assignment of monoclonal antibodies (mAb) reactive with porcine leukocyte differentiation antigens and to define new antibody clusters. The Second International Swine CD workshop's structure was based on the first Swine CD Workshop (Lunney, 1993; Lunney et al., 1994); it was organized by the first author with the support of the first workshop's chair. It was based on internationally approved standards for CD nomenclature (Naessens et al., 1996).

2. Organizational Plan
We started the second workshop with a call for mAb in October 1993. Of the 33 laboratories planning to participate in the Second Swine CD workshop, 16 laboratories submitted 176 mAb; the addresses of the respective laboratories are summarised in Figure 6. A total of 25 laboratories offered their experience to perform the analyses necessary for the clustering of the mAb; their tasks and contributions to the workshop are shown in Figure 2. To facilitate the identification and the assignment of the new mAb clusters, 19 mAb with known reactivity to distinct porcine CD antigens, characterised in the First International Swine CD Workshop (Lunney, 1993; Lunney et al., 1994), were included in the analyses as internal standards. The mAb analysed in the Second Workshop as well as the internal standards are shown in Figure 3.
The strategy set up for the analyses of the panel of mAb was adopted from the First International Swine CD workshop; in a first round a few preselected laboratories (Figure 2). The results of the analyses of the whole panel of mAb will be discussed in more detail below. From these analyses preliminary clusters were determined (Figure 1). MAb belonging to different clusters were distributed to subset groups for further, more precise analyses in a second round (Figure 4).
Based on the previous workshop and proposals from the Second Workshop participants, six subset groups were

created: the T-cell/ activation subset with Mark D. Pescovitz (Indianapolis, IN, USA) as subset chair; the B-cell subset chaired by Sylvia Denham (Pirbright, UK). The myeloid group was directed by Javier Dominguez (Madrid, Spain); the "null-cell" marker panel, containing mAb directed against gd-T-cell receptor (gd-TcR+) T lymphocytes was moderated by Bill Davis (Pullman, WA, USA). Chris Stokes (Bristol, UK) supervised the adhesion molecule panel and Federico Zuckermann (Urbana, IL, USA) chaired the CD44/CD45 panel. Based on these second round analyses, the final clustering data was defined and, where possible, detailed epitope analyses performed.

Materials and Methods:

3. First Round Analyses

For the Second Workshop the collection of the mAb ended in June 1994. During this time 15 tubes of each mAb were collected in the laboratories of Chris Stokes (Bristol, UK) and Joan K. Lunney (Beltsville, MD, USA) for further distribution to the analysing laboratories in Europe, Australia, Africa and America, Asia, respectively. The workshop is grateful to Dr. Alphonso Torres, USDA, Plum Island, NY, who facilitated the safe importation into the U.S. of samples from restricted viral research laboratories.

In July 1994 the whole panel of mAb was distributed to the laboratories performing the first round analyses. To assure that mAb were clustered appropriately, care was taken in the first round analyses to include a broad panel of lymphoid cells as well as specialized cell populations for the first round analyses. Thus, besides analyses of peripheral blood mononuclear cells (PBMC) and lymphoid tissues, analyses were performed on representative cell subsets and cell lines, such as alveolar macrophages, the L14 B-cell line, lymphoblastoid cell lines, gd TCR expressing cell lines, fetal liver cells, SLA I-transfected mouse fibroblasts. All together 40 data sets with the full panel of mAb on 18 different cell types were obtained for the primary cluster analyses.

The detailed data from the first round analyses are summarized in the 22 preliminary clusters that resulted from the analyses of the data using the Leukocyte Typing Database IV (Gilks et al., 1990). These results were reviewed by the antibody donors and subset group chairs. Once these clustering data were approved, the mAb were distributed to the respective subset groups as outlined in Figure 4. Clearly defined clusters of mAb were usually given to just one subset group for second round analyses. However, clusters of mAb, or individual mAb, which were not identified as belonging clearly to a specific subset group were distributed for further analyses to as many as three different subgroups for the more specific, second round analyses. As summarized in Figure 4, 57 mAb were distributed to the T cell/activation antigen group, 42 mAb to the B cell group, 48 mAb to the myeloid subset group, 32 mAb to the "null cell" group, 59 mAb to porcine adhesion molecules group, and 48 mAb to the CD44/CD45 group. In January 1995 the second round analyses of the respective subgroups started; they were collated by the chair in May 1995, so that further tests could be performed prior to the workshop summary session in July, 1995.

5. Nomenclature

The results of the first and second round analyses were discussed during the workshop summary meeting in Davis, CA, on July 16, 1995. At this meeting, revisions in the existing nomenclature for Swine CD were approved, so that the rules are now in accord with those for human CD molecules, and to those recently approved for ruminant CD antigens (Naessens et al., 1996). Swine CD numbers will now be given to mAb reactive with swine orthologues of human CD molecules when homology is proven, as outlined in the rules given below.

Rules for CD#/SWC# Assignment

1) suitable tissue distribution and lymphoid cell subset expression
2) appropriate molecular mass of the antigen recognized by the mAbs
3) reactivity of mAbs with the cloned swine gene products, or cross-reactivity of the mAb on the human gene products.

In some cases this reactivity would not be fully proven, mainly due to the lack of cloned gene products. For these CD antigens, the respective clusters will be assigned by the prefix "w" which will lead to "wCD" antigens. In addition to the orthologues of human CD antigens, in swine there are a large number of mAb that recognize clearly defined molecules expressed on a wide panel of cell types. These swine differentiation antigens appear not to have been

detected on human leukocytes and could represent differentiation antigens expressed on cells underrepresented in the human immune system, e.g., subpopulations of gd-TcR+ T lymphocytes. Alternately, these mAb may recognise differentiation antigens which are unique to the porcine immune system, and do not match with any known human CD antigen. For these molecules Swine Workshop Clusters (SWC) designations have been assigned, as originated in the First International Swine CD Workshop (Lunney, 1993; Lunney et al. 1994). It should be noted, that these clusters are designations specific for swine antigens; SWC numbers do not correspond to the ruminant or bovine workshop cluster (BoWC) numbers.

Results:

6. Summary of Second Round, Subset Analyses

Each subset group performed more extensive analyses on appropriate cell populations. With these studies they were able to verify cell subset binding specificity and to detect true CD clusters. Figure 5 summarizes the clusters of mAb and the CD and SWC assignments that resulted from this workshop, and the first workshop. More detailed summaries of the second round analyses of this workshop are cited in this text and will be published in a special issue of Veterinary Immunology and Immunopathology which will appear late in 1997.

a. T cell/activation antigen group

The T cell/activation antigen group chaired by Mark Pescovitz analyzed reactivity on enriched T cell populations and established finer T cell clusters. Once clusters of mAb for specific CD antigens were identified more detailed 2-color analyses were performed to establish epitope reactivity (Pescovitz et al., 1997a). This resulted in the identification of six new mAb reactive with porcine CD3, an antigen which was not recognized by mAb submitted for the First International Swine CD workshop. Four of these were generated by Huaizhi Yang (Pirbright, UK) by deliberate immunization of mice with the recombinant porcine CD3g-chain. Interestingly, as outlined in Figure 5, these 4 mAb recognize 3 independent epitopes of the swine CD3 molecule, assigned as the CD3a, CD3b and CD3c epitopes, based on inhibition studies. Of the 6 CD3 mAb, the epitope recognized by one (STH164) was found to be different from the epitopes described, and without evidence that this mAb recognizes the cloned porcine CD3 sequence, this mAb was clustered into the wCD3 group (Figure 5; Pescovitz et al., 1997b).

Disappointingly, for several T cell CD antigens, more mAb were assigned to the same unique cluster to which all other mAb known had previously been shown to be reactive (Figure 5; Pescovitz et al., 1997a). Thus, two mAb were assigned to the CD2a cluster, now represented by 7 mAb to just the 1 cluster (Pescovitz et al., 1997a). Similarly, for CD4, 1 new mAb adds to the 4 previously known CD4a specific mAb, and for CD5, an additional 2 mAb are added to the 6 known to recognize the CD5a epitope group (Figure 5; Pescovitz et al., 1997a,c). The research reported by Appleyard and Wilkie (1997) verified the reactivity of the CD5a specific mAb b53b7 with a peptide sequence of the human CD5 molecule. Because of the new swine CD nomenclature rules, this means that mAb reactive with the porcine CD5 molecule are assigned as CD5, not wCD5 (Figure 5; Pescovitz et al., 1997c).

The only T cell swine CD antigen for which 2 epitopes had previously been defined was CD8 (Saalmüller et al., 1994). During this workshop, one more mAb was identified as binding to the wCD8a epitope, none for wCD8b, and a new wCD8 epitope, designated wCD8c, was characterised (Pescovitz et al., 1997a; Zuckermann et al., 1997a). The latter is important since this epitope is localised on the chain of the CD8 heterodimer that is differentially expressed, i.e., the wCD8c epitope is negative on CD4+/CD8+ dual positive cells. Thus, if homologous with humans, this epitope is expected to be expressed on the CD8 beta chain since, in humans, CD4+/CD8+ cells express CD8 as an alpha chain homodimer. Another wCD8 clustered mAb (UCP1H12-2) appears to recognise a possible fourth epitope on the wCD8 molecule (Figure 5; Zuckermann et al., 1997a).

The gene product of the porcine CD6 gene is still unknown. Because the newly defined mAb (MIL8) and the standard (a38b2) recognise different epitopes, all are assigned into the wCD6 group (Figure 5; Pescovitz et al., 1997d). For SWC1, another mAb to an unknown determinant was added. For SWC2 no new mAb were identified. A second mAb was uncovered identifying the porcine wCD25 (Figure 5; Pescovitz et al., 1997a). No mAb reactive with new activation antigens were identified during the second workshop.

b. Null Cell Subset

Analyses of mAb assigned to the null, or gd-T-cell, subset did not confirm any new defined clusters of mAb (Figure 5; Davis et al., 1997). A series of broad mAb cluster were revealed. It is hoped that developments in the area of gd-T-cell studies will stimulate the production of new mAb that further define markers on this important immune cell subset. This workshop, like other CD workshops, does not verify assignments for T-cell receptor mAb or for mAb reactive with immunoglobulin or major histocompatibility complex antigens.

c. B Cell Subset

For the B-cell group, two more mAb against the B-cell specific wCD21 antigen were identified (Figure 5; Denham et al., 1997). No new wCD1 mAb were identified. Another mAb was assigned to the SWC7 group (Denham et al., 1997). Overall, there is still a general lack of mAb recognizing swine B cell specific CD antigens.

d. Adhesion Subgroup

Two new Swine Workshop Clusters were defined during the workshop: SWC8 and SWC9 (Figure 5). SWC8 is an antigen expressed on granulocytes, B lymphocytes, epithelial cells and fibroblasts, which is also represented on CD8 high positive T lymphocytes (Haverson et al., 1997). SWC9 is a cluster with an antigen specific for mature macrophages. Two mAb were marked to recognize the porcine wCD29 antigen (Figure 5; Haverson et al., 1997).

e. Myeloid Cell Subgroup

The SWC9 antigen seems to be a dimeric molecule with an appropriate molecular mass of 205 kDa under non-reducing and 130 kDa under reducing conditions (Dominguez et al., 1997a). For other myeloid markers, three mAb raised against human CD14 and cross-reactive with the porcine orthologue were confirmed (Figure 5; Dominguez et al., 199b). The porcine CD16 has been cloned and independent work by Kim and his associates have verified that the mAb G7 reacts with its gene product (Wierda et al., 1993; Halloran et al., 1995).

f. CD44/CD45 Subgroup

Major progress was made in the classification and characterization of the anti CD45 mAb due mainly to the cloning and expression of different CD45 cDNAs (Schnitzlein and Zuckermann, 1997). Three new mAb were specified to recognize an epitope on the porcine CD45RA; one new mAb was characterized for its specificity to the porcine CD45RC gene product (Figure 5; Zuckermann et al., 1997b; Schnitzlein and Zuckermann, 1997).

Discussion and Conclusions:

7. Overall Conclusions

The Second International Swine CD Workshop produced substantial results. Of the 176 submitted mAb, which have been analysed by 25 laboratories all over the world, 16 mAb were assigned to existing CD groups (CD2a, CD4a, CD5a, wCD6, wCD8, CD14, wCD21, wCD25); 2 other mAb to existing SWC. More importantly, for the work on the porcine immune system, was the definition of 5 new swine CD antigens, namely CD3 (recognized by 6 new mAb to 3 epitopes), CD16 (1 new mAb), wCD29 (2 mAb), CD45RA (3 mAb) and CD45RC (1 new mAb). In addition, two new SWC molecules were defined with the addition of mAb reactive with SWC8 (2 mAb) and SWC9 (2 mAb) antigens. This means that 33 mAb, out of the total of 176 mAb tested in the workshop, were assigned to existing or newly defined workshop clusters.

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Comments:

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Questions and Answers