natural feed additive blends

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Preface

With respect to the progress in different fields of science, the animal production has also been evolved. Modern animal production is based on new discoveries of molecular biology that enables nutrituonist to produce better and beneficial diets for animal feeding. Biochemistry and molecular biology are the main sources of these informations which help to understand the actual process of digestion and absorption.

On the other hand, several decades after using antibiotics in animal feeding many problems have been evolved in relation with resistance to these materials and serious side effects in feed chain from animal to human. Recent studies and researches are going to solve this problem by using natural additives as pre- and probiotics. APC natural feed additive blends are one of these natural products which were introduced by APC Agrar Production and Consulting Ges.m.b.H. company to Iranian Fara Roshd Company around four years ago. This material was advertised as the other products from other companies but its natural source needed more attention which sounds different, particularly in relation with environmental pollution. In this respect Fara Roshd Company in Iran decided to do some researches on it. Because Fara Roshd, as a trading company needed to be confident about this material. In addition this product was going to the farmers which normally need the more in formation and these data's should come from researches in Iran environment which is different from Europe.

R&D Dept
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Introduction:

Before defining the experiment design and results it should be better to explain the physiology of digestive system in poultry species.
In this case the relation between the out come of using APC natural feed additive blends in feed ration will be more obvious.

Structure and function of poultry digestive system:

Digestive system in poultry is composed of different parts that maintenance of feed in these compartments is related to many physical and chemical parameters.
These compartments include: esophagus, crop, proventriculus, gizzard, small intestine colon, pair of cecum and cloacae. Movement of feed in each part is influenced by the motility of former and later part.
Litetatore revinis of Bjornhay in 1981 and 1989 have complete informations in this area.

Esophagus and crop:

In poultry, tongue, hyoid apparatus, and larynx are the essentiul anatomic compartments which lead the feed and fluid toward the esophagus. Peristaltic movements of the esophagus have the major role in this situation which is combined with mucous secretions of salivary glands and esophageal gland to lubricate esophagus for feed movement. The interesting point about poultry feeding behavior is filling of the compartments by feed from lower parts. For example the eaten feed is firstly localized in proventriculus and gizzard and after filling these parts accumulates in crop. Integrated mechanisms between gizzard, proventriculus, esophagus and crop are very complex and interesting, and physical and chemical compositions of feed have important effects on them.

Proventriculus:

Transfer of feed from crop to proventriculus occurs via second part of esophagus. This process is regulated by gizzard function through isthmus, which is under the mechanical and chemical control.
Researches on turkey show that gizzard contraction has five stages (Dziuk and Ouke, 1972). All these stages happen in 20-25 seconds.

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Small and large intestine:

Peristaltic and segmental movements are essential for feed transfer, digestion and absorption in small and large intestine. These motilities are continous and force the digested feed towards the end of digestive system and are related to gizzard motility as well. Duodenal contents move to the jejunum irregularly. Anti peristaltic motility which its orgin is in coprodeum forces the digested feed to the cecum. Cecum contains water and fermentable materials which is different from colon contents (Bjornhag and Sperber, 1977). Transfer of urine to cecum is usual in poultries and is believed that it transfers water soluble materials to cecum (Bjornhag, 1989).

Quantitative aspects of feed passage through poultry digestive system:

There are three ways to evaluate the feed passage rate in the digestive system of poultry (sibbald, 1980b). Duration of feed maintenance in poultry digestive system depends on mechanical resistance, humidity, previous feed intake volume and present feed volume. Dry matter of feed is one of the factors which affect the duration time seriously. Crop is a resovoir part, but it contents may remain inside for several seconds to one day. Actually the feed passage from gizzard affects the crop emptying seriously, and the physics. Chemical content of feed in the gizzard is an important factor in this relation. Large particles remain in gizzard for longer period and non-digestible materials such as sands remain in this part for several months.
Sib bald (1980 a) has shown the average time of passage is around 10 hours, but other believes it may long around 60 hours (Duke etal, 1969). But the important point is that physiologically poultry digest feed enzymatically and also by fermentation, that the later needs more time.
In this relation the chemical situation of the poultry digestive system should be noticed particularly, the pH as a main factor for hydrolysable and fermentable feed stuff.

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Effect of pH on digestion, absorption and normal micro flora in poultry:

The pH is an index factor in solution medium. In digestive and absorptive circumstances it plays an important role, which is vital. The solutes dissolved in solution affect the pH as solution seriously. Most of the raw materials, which are used as feedstuff for poultry, have alkaline characteristics that increase the pH in digestive system. Table 1 shows the acid binding capacity of several raw materials. As noticed these materials affect the normal pH of the digestive system, especially inorganic compounds such as calcium bicarbonate with an acid binding capacity around 20,000.

Table 1

	Meq/Kg (Min- Max)
Corn	135-172
Wheat	180-240
Rice	480-520
Sunflower Meal	850-900
Soya	1000-1200
Fishmeal	1500-2100
DCP	8000-10000
Limestone	19000-21000

On the other hand these materials are essential to balance a ration, but their negative effect on pH is not a suitable side effect. In addition most of the pathogens are more active in alkaline pH than acidic. Table 2 compares several micro organisms and their optimum pH for growth. As mentioned the useful micro organisms such as lactobacillus SPP need acidic pH, but pathogens pH is more alkaline.

Table 2

Micro organism	pH
Lactobacillus spp	5,4 - 6,4
Escherichia coli	6 - 8
Salmonella spp	6.8 - 7.2
Campylobacter jejuni	6.8 - 7.2

It is more interesting if we have a look at the natural pH of different parts of poultry digestive system in table 3. In natural feeding the pH value in all parts is more acidic than alkalin, but with respect to the table 1 raw material change to alkaline.

Table 3

	pH
Crop	6.3
Proventriculus	1.8
Gizzard	2.5
Duodenum	6.4
Jejunum	6.6
Ileum	7.2
Caecum	6.9
Cloaca	7.0

The effect of pH on interaction between cations and anions is more complicated (Choct, 2001), besides in acidic pH of the digestive system all the absortive functions are more effective for all nutrients and in this respect the immunity system has the maximum efficiency (Nillipoura etal, 2001).

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Finally, it is believed that reducing the intestinal pH will have these effects:

1. Decreasing the micro organism population
2. Limiting the pathogens and increasing saprophytes
3. Anti-clostridium effects
4. Increasing the absorptive surface of epithelium and vill.
5. Better digestion and absorption

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References:

- Bjornhag, G. and Sperber, I. 1977. Transport of various food components through the digestive tract of turkeys, geese and guinea fowl. Swedish J. agric. Res., 7, 57- 66.
- Bjornhag, G. 1981. Aspekte des Transports von Darminhalt durch den Gastrointestinaltrakt des Geflugels. Ubers. Tierernahrg., 9, 293 - 306.
- Bjornhag, G. 1989. Transport of water and food particles through the avian ceca and colon. J. exp. Zool., suppl. 3, 32- 37.
- Choct, M. 2001., Alternatives to In- feed antibiotics in monogastric animal industry, ASA Technical Bulletin vol. AN30.
- Duke, G.E., Dziuk, H.E. and Hawkins, L. 1969. Gastrointestinal transit- time in normal and bluecomb diseased turkeys. Poult. Sci., 48, 835 - 842.
- Dziuk, H.E. and Duke, G.E. 1972. Cineradiographic studies of gastric motility in turkeys. Am. J. Physiol., 222, 159 - 166.
- Nilipour, A.H., Yegan, M., and Butcher, G.D. 2001. How nutrition affect immune response in poultry, word Poultry- Elsevier, 17 (6), 42 - 44.
- Sibbald, I.R. 1980a. The clearance time and rate of passage of feed residues. Poult. Sci, 59, 374 - 377.
- Sibbald, I.R. 1980b. The passage of oat and other feed residues through the adult cockerel. Poult. Sci., 59, 2136 - 2144.

Comparison between APC natural feed additive blends and citric acid feed additives on broiler

Performance

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This experiment was conducted to evaluate the APC natural feed additive blends of Agrar Produktion & Consulting Ges.m.b.H. in broiler performance in Iran (Saveh). The citric acid was also compared as another feed supplement simoultanously in prallel group. 480 one day old of broiler chicken (Cobb 500) were used in a randomized design test with three treatments and four replicates including 40 chicken in each replicate (3_4_40). Group A received 0.2% APC natural feed additive blends, group B received 2% citric acid and group C received the normal ration without any feed additive as the control. Groups A and B received 40% less Ca and P compared with the control group. Analyses of the ration in different periods of the experiment are shown in tables 1a and 1b.
The average body weight, feed intake and feed conversion ratio were obtained every week. Blood samples, intestinal tissue (midjejunum) and digested content of ileum were also collected for serologic, histologic and microbial experiments, respectively.
The results were analyzed by ANOVA, Scheff and Don can test were used for comparing the averages.

Feed formulas for the trial:
1a

Ratio (%)	0-14			15-28			+29		
	A	B	C	A	B	C	A	B	C
APC	0,2	-	-	0,2	-	-	0,2	-	
Corn	50,70	48,90	47,40	50,66	48,86	47,90	54,82	53,02	52,15
Soya	41,69	41,69	42,69	39,69	39,69	39,53	35,71	35,71	35,89
Poultry Fat	4,59	4,59	5,55	6,71	6,71	8,19	6,68	6,68	7,95
Methion	0,28	0,28	0,29	0,33	0,33	0,30	0,30	0,30	0,30
Lysin	0,10	0,10	0,11	0,19	0,19	0,04	0,09	0,09	0,08
DCP	0,99	0,99	2,04	0,64	0,64	2,09	0,68	0,68	1,83
Limstone	0,48	0,48	1,06	0,68	0,68	1,08	0,68	0,68	0,96
Salt	0,47	0,47	0,37	0,40	0,40	0,37	0,34	0,34	0,34
Premix	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50
Citric acid	-	2	-	-	2	-	-	2	-

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Contents of the formulas for trial:

1b

	0-14			15-28			+29		
	A	B	C	A	B	C	A	B	C
Energy	2902	2902	2950	3082.4	3022.7	3102.7	3130.3	3070.5	3144.6
Protein	21.19	21.19	21.5	20.48	20.35	20.21	19.13	18.99	19
Lys	1.267	1.268	1.30	1.289	1.285	1.164	1.121	1.117	1.111
Met	0.600	0.600	0.611	0.641	0.638	0.606	0.596	0.592	0.592
Met+cys	0.948	0.948	0.960	0.980	0.973	0.938	0.920	0.913	0.898
Ca	0.537	0.537	1	0.528	0.527	1.01	0.528	0.527	0.911
P avail	0.320	0.320	0.50	0.257	0.255	0.500	0.256	0.254	0.45
Na	0.201	0.201	0.16	0.174	0.174	0.162	0.151	0.15	0.15
Fibre	4.16	4.16	4.20	4.05	4.01	3.98	3.86	3.82	3.81

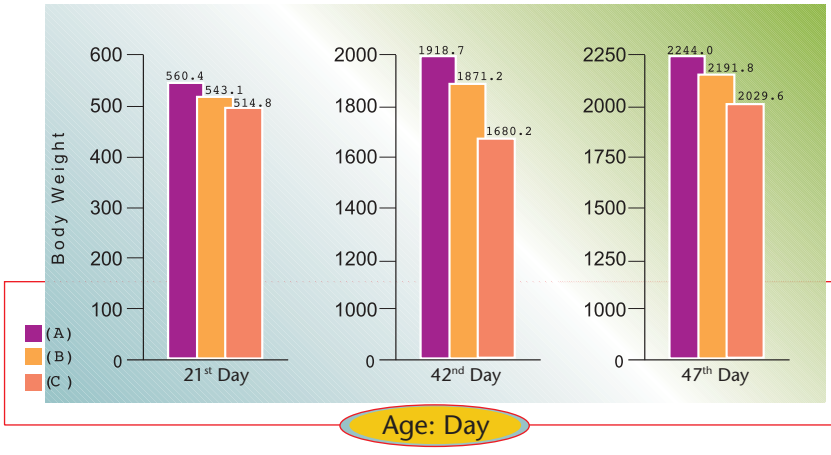
Results:

I - Body weight:

The results are shown in table 2 and its related histogram. Difference between the results are significant between the group ($p<0.05$), the highest body weight gain on 21, 42 and 47 days of experiment is related to group A which is comparable with group B, but different from group C.

Table 2

Age(day) / Group	Body weight			Body weight	
	21	42	47	22-42	43-47
A	560.4±9.0a	1918.7±22.7a	2244.0±37.3a	1358.4±15.0a	325.2 ± 21.3
B	543.1±10.1ab	1871.2±57.2a	2191.8±45.6a	1328.2±47.6a	320.6 ± 29.0
C	514.8±5.9b	1680.2±25.8b	2029.6±8.2b	116.5±29.9b	349.5 ± 23.1



II - feed consumption (intake):

The results are shown in table 3 and its related histogram. Although there was difference between the feed intake between groups but it was not statistically significant, which might be related to the large deviations of the results.

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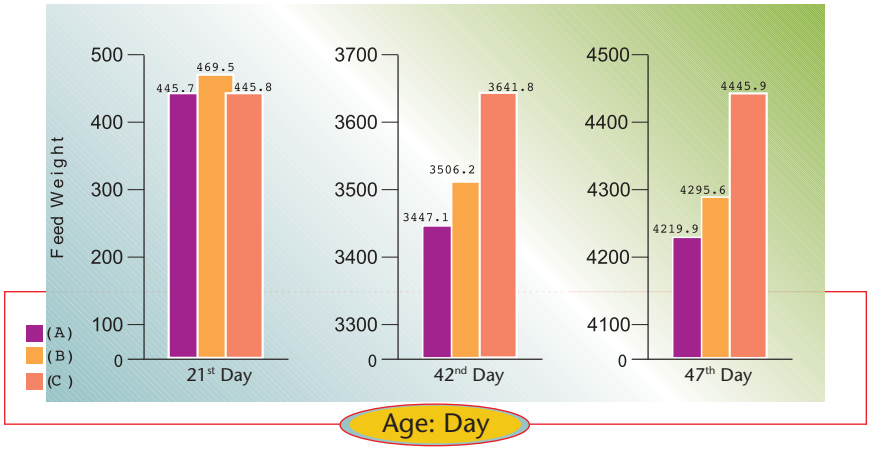
On days 21, 42 and 47 group A had the least feed intake and control group C the highest level, with an exception on day 21 that group B was slightly higher.

Table 3

Age(day) / Group	Feed Consumption (gr)			Feed Consumption (gr)	
	21	42	47	22-42	43-47
A	445.7±5.3	3447.1±80.0	4219.9±58.2	2630.6±79.1	772.9±35.6
B	469.5±7.6	3506.2±101.1	4295.6±84.4	2665.6±86.8	789.4±19.0
C	445.8±3.0	3641.8±53.8	4445.9±72.9	2773.6±55.4	804.1±19.4

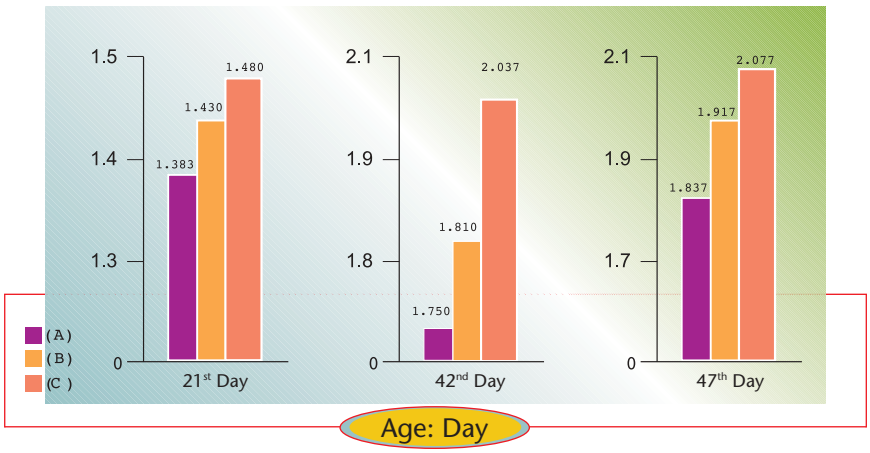


III - Feed conversion ratio:

As shown in table 4 and its related histogram the A group had the least conversion ratio and group B was intermediate and group C has the highest level ($p<0.01$).

Table 4

Age(day) / Group	FCR			FCR	
	21	42	47	22-42	43-47
A	1.383±0.012a	1.750±0.023a	1.837±0.033a	1.903±0.035a	2.414±0.198
B	1.430±0.012ab	1.810±0.002ab	1.917±0.015a	1.976±0.030ab	2.635±0.214
C	1.480±0.015b	2.037±0.038b	2.077±0.027b	2.309±0.068b	2.319±0.143



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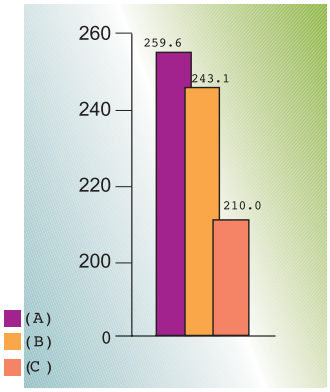
IV - EEF:

The results of this factor are shown in table 5 and its related histogram. As this factor indicates the difference is significant ($p<0.05$) with the optimum result of group A.



$$EEF = \frac{\text{Body weight (kg) x Alive (\%)}}{\text{Production period (days) x FCR}} \times 100$$

Table 5

Group	EEF
A	259.6 ± 4.7^{a}
B	243.1 ± 6.9^{a}
C	210.0 ± 0.98^{b}

V - Intestinal pH:

The pH was measured by 10 times dilution of intestinal content and measured by digital pH meter. As the results show in table 6 and its related histogram, the lowest pH was related to group A ($p<0.05$).

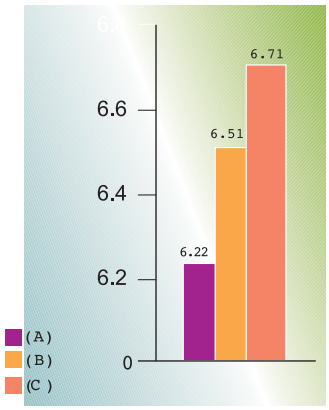


Table 6

Group	pH
A	6.22 ± 0.22^{a}
B	6.51 ± 0.45^{ab}
C	6.71 ± 0.31^{b}

VI - Microform content of intestine:

Microbial experiments show a significant difference between groups ($p<0.05$). Group A had the lowest microbial population with high ratio of lactobacillus to coli bacillus (table 7).

Table 7

Group	Total micro flora in the intestine	Colibacillus	Lactobacillus	Lactobacillus / Colibacillus
A	1.15×10^{7a}	0.4×10^{7a}	6.5×10^{6}	1.625^{a}
B	3.5×10^{7b}	3×10^{7b}	1.7×10^{6}	0.06^{b}
C	5×10^{7b}	4×10^{7b}	0.5×10^{6}	0.01^{b}

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VII - Serum electrophoresis:

The results of serum electrophoresis were also interesting.
The results are shown in the following page that indicate with the highest level of Gama -Globulin in group A, and medium and lowest level in groups B and C respectively. (graph attached)

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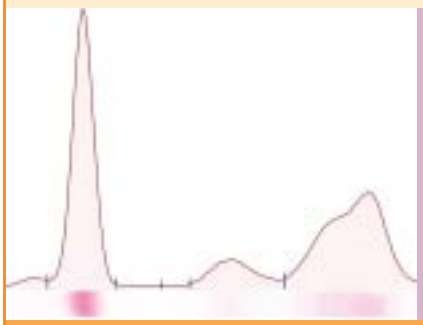
Avian Electrophoresis — Group A



Fraction	%		%	Reference Range [%]
Prealbumin	1.9	↓	0.1	14.0 - 17.0
Albumin	44.9		1.2	40.0 - 60.0
Alpha1	0.7	↓	0.0	3.8 - 4.3
Alpha2	0.4	↓	0.0	4.5 - 5.0
Beta	9.8	↓	0.3	15.6 - 18.9
Gama	42.3	↑	1.2	27.0 - 29.0
Total	100		2.7	

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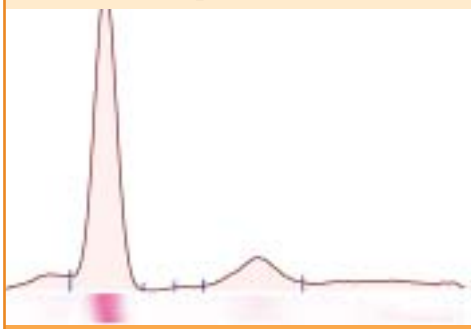
Avian Electrophoresis — Group B



Fraction	%		%	Reference Range [%]
Prealbumin	5.2	↓	0.1	14.0 - 17.0
Albumin	58.3		0.8	40.0 - 60.0
Alpha1	1.9	↓	0.0	3.8 - 4.3
Alpha2	0.8	↓	0.0	4.5 - 5.0
Beta	8.8	↓	0.1	15.6 - 18.9
Gama	25.0	↓	0.3	27.0 - 29.0
Total	100		1.3	

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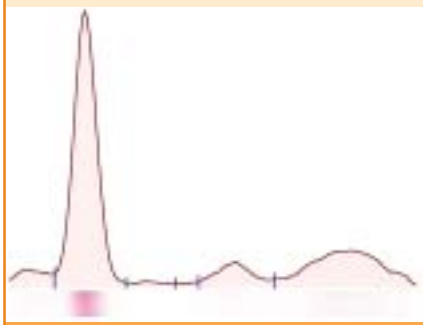
Avian Electrophoresis — Group C



Fraction	%		%	Reference Range [%]
Prealbumin	1.3	↓	0.0	14.0 - 17.0
Albumin	74.3	↑	1.2	40.0 - 60.0
Alpha1	0.8	↓	0.0	3.8 - 4.3
Alpha2	0.9	↓	0.0	4.5 - 5.0
Beta	3.9	↓	0.1	15.6 - 18.9
Gama	18.8	↓	0.3	27.0 - 29.0
Total	100		1.6	

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VIII - Histology of midjejunum:

Histological results were very much interesting. The picture of the epithelium showed serious damages to the cell content of group C, but intact with conditions in group A.
The pictures are shown in the following figure from group A and C.

Feeding conventional

Group C

Feeding with APC natural feed additive blends

Group A

shown by lens No 10

Group C

Group A

shown by lens No 40

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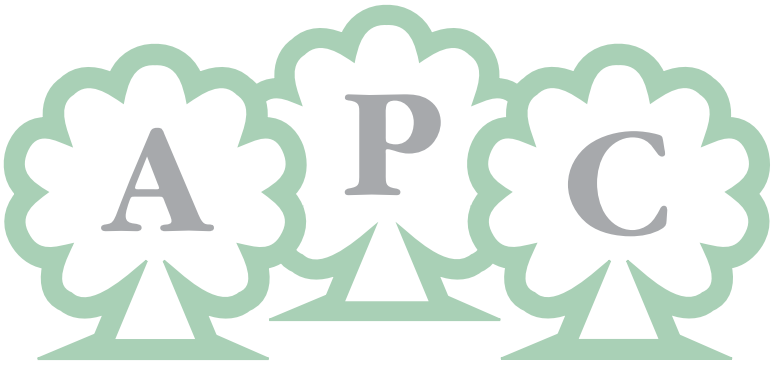

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