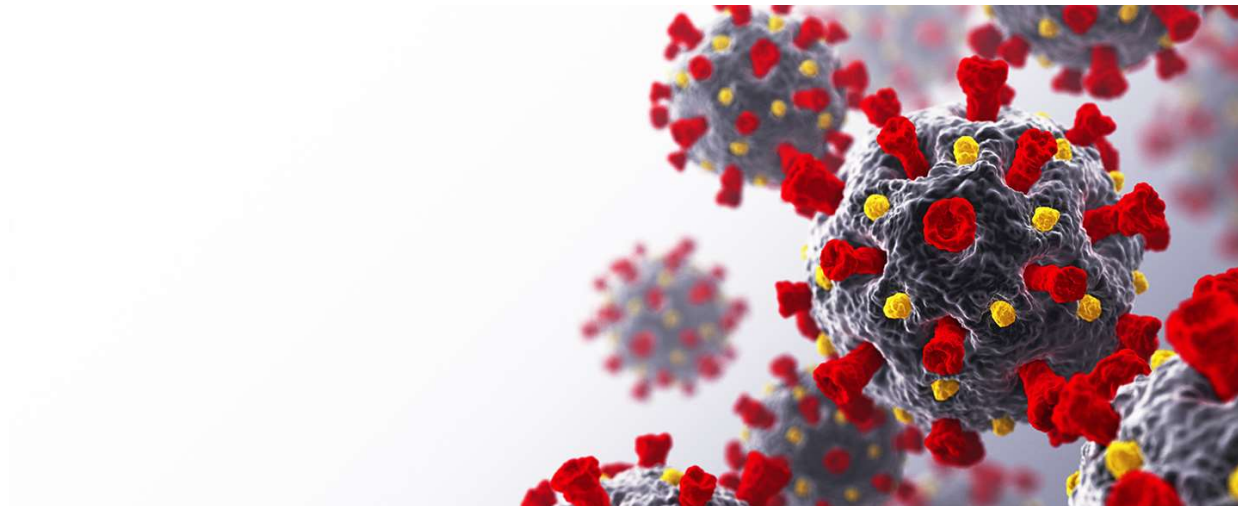


Applications Note

Using the Grenova TipNovus and TipLumis for the Reuse of Pipette Tips for COVID-19 Testing



1. Abstract

Grenova products have been used for cleaning, sanitizing and reusing pipette tips for the purpose of COVID-19 PCR testing. In a CLIA certified diagnostics lab, Pipette tips were successfully washed and dried using the TipNovus Gen 4 system alongside the TipLumis for the sanitary storage of these tips. Both default and custom methods were used to test the performance of the system. Negative QC and blank results were used to identify the possible contamination of the tips. Furthermore, the pipette tips originating from one part of the process (ie. DNA extraction) were washed and reused in other parts of the process (ie. Sample aliquot). There was no contamination seen from the dates of 5/9/20 to 5/13/20 as indicated by the negative QC and blank results. Out of the 26 negative QC and 174 blanks ran, all samples resulted appropriately as negative. It has been determined that the default TipNovus protocols were sufficient in producing clean Hamilton 1000uL and 300uL pipette tips for reuse in all COVID-19 PCR testing steps.

2. Introduction

A large number of Hamilton 1000uL and 300uL tips are used to perform COVID-19 sample transfer, DNA extraction, and PCR plate transfer on the Hamilton STAR. The high volume of tips being used for each sample comes with great operational cost and cost to the environment. In addition, the high demand for lab consumables during the COVID-19 crisis calls for a stronger control over its supply chain. For these reasons, Grenova's pipette tip washing products were employed to clean and sanitize pipette tips for proper reuse in the COVID-19 PCR testing.

Applications Note

To perform the process, a TipNovus and TipLumis combination was used. A TipNovus is customizable benchtop tip washing system that is capable of cleaning, sanitizing, and drying contaminated pipette tips for reuse. A TipLumis further dries, sanitizes and stores 45 tip racks at a time and is used to improve the sanitizing and to expedite the turnover for tip reuse. Following these instruments' installation, the performance of the instruments was tested in order to ensure the validity of the patient results reported.

3. Methods and Procedure

All Hamilton 1000uL and Hamilton 300uL pipette tip racks were saved on the Hamilton instead of being discarded. The 1000uL tips racks were washed using the default standard protocol that was optimized for the tip. The standard protocol utilizes a standard setup using both water and Grenoclean to clean the tips. Since these tips also touch patient samples, a custom standard wash protocol with a GrenoClean soak was created for testing. The 300uL tips were washed using the extended method. The extended method is differentiated by the standard method by taller soak heights in the compartment in order to reach the shorter tips.

After the wash, these tips were labeled accordingly and reused back into the testing process. These steps were repeated from the dates of 5/9/20 to 5/13/20 over multiple runs and steps.

4. Results

In order to be considered positive for COVID-19, CT value between 8 and 40 should be seen. Any undetermined values, <8 CT and >40 CT are considered negative. All negative QC and blank data had a result of undetermined or values <8 CT.

Acceptance Criteria

CT Value	Result
<8	Negative
8-40	Positive
>40	Negative
Undetermined	Negative

Negative QC data

# of Tests	# Undetermined	<8 CT	8-40 CT	>40 CT	Negative Result	Positive Result
26	24	2	0	0	26	0

Applications Note

Well	Well Position	Omit	Sample Name	Target Name	Task	CT	Ct Mean	Ct SD
167	G23	FALSE	GW000162	RdRp	NTC	Undetermined		
191	H23	FALSE	GW000162	E Gene	NTC	Undetermined		
167	G23	FALSE	ID000425	RdRp	NTC	Undetermined		
191	H23	FALSE	ID000425	E Gene	NTC	Undetermined		
359	O23	FALSE	GW000162	RdRp	NTC	Undetermined		
383	P23	FALSE	GW000162	E Gene	NTC	Undetermined		
167	G23	FALSE	GW000162	RdRp	NTC	Undetermined		
191	H23	FALSE	GW000162	E Gene	NTC	Undetermined		
359	O23	FALSE	ID000425	RdRp	NTC	Undetermined		
383	P23	FALSE	ID000425	E Gene	NTC	Undetermined		
167	G23	FALSE	GW000162	RdRp	NTC	Undetermined		
191	H23	FALSE	GW000162	E Gene	NTC	Undetermined		
359	O23	FALSE	GW000162	RdRp	NTC	Undetermined		
383	P23	FALSE	GW000162	E Gene	NTC	Undetermined		
167	G23	FALSE	ID000425	RdRp	NTC	Undetermined		
191	H23	FALSE	ID000425	E Gene	NTC	Undetermined		
167	G23	FALSE	ID000425	RdRp	NTC	Undetermined		
191	H23	FALSE	ID000425	E Gene	NTC	Undetermined		
359	O23	FALSE	GW000162	RdRp	NTC	Undetermined		
383	P23	FALSE	GW000162	E Gene	NTC	Undetermined		
167	G23	FALSE	GW000162	RdRp	NTC	Undetermined		
191	H23	FALSE	GW000162	E Gene	NTC	Undetermined		
359	O23	FALSE	ID000425	RdRp	NTC	Undetermined		
383	P23	FALSE	ID000425	E Gene	NTC	Undetermined		
358	O22	FALSE		N1	NTC	0.907	0.746	0.599
382	P22	FALSE		N2	NTC	0.464	0.709	0.402

Blank Data

# of Tests	# Undetermined	<8 CT	8-40 CT	>40 CT	Negative Result	Positive Result
174	0	174	0	0	174	0

Well	Well Position	Omit	Sample Name	Target Name	Task	Reporter	Quencher	CT	Ct Mean	Ct SD
2	A2	FALSE		N1	UNKNOWN	FAM	None	0.330	0.746	0.599
4	A4	FALSE		N1	UNKNOWN	FAM	None	0.412	0.746	0.599
6	A6	FALSE		N1	UNKNOWN	FAM	None	0.888	0.746	0.599
8	A8	FALSE		N1	UNKNOWN	FAM	None	0.384	0.746	0.599
10	A10	FALSE		N1	UNKNOWN	FAM	None	0.402	0.746	0.599

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12	A12	FALSE		N1	UNKNOWN	FAM	None	0.771	0.746	0.599
14	A14	FALSE		N1	UNKNOWN	FAM	None	0.375	0.746	0.599
16	A16	FALSE		N1	UNKNOWN	FAM	None	0.456	0.746	0.599
18	A18	FALSE		N1	UNKNOWN	FAM	None	0.851	0.746	0.599
20	A20	FALSE		N1	UNKNOWN	FAM	None	0.431	0.746	0.599
22	A22	FALSE		N1	UNKNOWN	FAM	None	0.424	0.746	0.599
24	A24	FALSE		N1	UNKNOWN	FAM	None	0.447	0.746	0.599
50	C2	FALSE		N1	UNKNOWN	FAM	None	0.663	0.746	0.599
52	C4	FALSE		N1	UNKNOWN	FAM	None	0.333	0.746	0.599
54	C6	FALSE		N1	UNKNOWN	FAM	None	0.310	0.746	0.599
56	C8	FALSE		N1	UNKNOWN	FAM	None	0.750	0.746	0.599
58	C10	FALSE		N1	UNKNOWN	FAM	None	0.241	0.746	0.599
60	C12	FALSE		N1	UNKNOWN	FAM	None	0.488	0.746	0.599
62	C14	FALSE		N1	UNKNOWN	FAM	None	-0.143	0.746	0.599
64	C16	FALSE		N1	UNKNOWN	FAM	None	0.802	0.746	0.599
66	C18	FALSE		N1	UNKNOWN	FAM	None	-0.372	0.746	0.599
68	C20	FALSE		N1	UNKNOWN	FAM	None	0.588	0.746	0.599
70	C22	FALSE		N1	UNKNOWN	FAM	None	-0.523	0.746	0.599
72	C24	FALSE		N1	UNKNOWN	FAM	None	0.353	0.746	0.599
98	E2	FALSE		N1	UNKNOWN	FAM	None	0.205	0.746	0.599
100	E4	FALSE		N1	UNKNOWN	FAM	None	0.409	0.746	0.599
102	E6	FALSE		N1	UNKNOWN	FAM	None	0.475	0.746	0.599
104	E8	FALSE		N1	UNKNOWN	FAM	None	0.328	0.746	0.599
106	E10	FALSE		N1	UNKNOWN	FAM	None	0.304	0.746	0.599
108	E12	FALSE		N1	UNKNOWN	FAM	None	0.321	0.746	0.599
110	E14	FALSE		N1	UNKNOWN	FAM	None	0.330	0.746	0.599
112	E16	FALSE		N1	UNKNOWN	FAM	None	0.563	0.746	0.599
114	E18	FALSE		N1	UNKNOWN	FAM	None	0.450	0.746	0.599
116	E20	FALSE		N1	UNKNOWN	FAM	None	0.381	0.746	0.599
118	E22	FALSE		N1	UNKNOWN	FAM	None	0.215	0.746	0.599
120	E24	FALSE		N1	UNKNOWN	FAM	None	0.667	0.746	0.599
146	G2	FALSE		N1	UNKNOWN	FAM	None	0.520	0.746	0.599
148	G4	FALSE		N1	UNKNOWN	FAM	None	0.384	0.746	0.599
150	G6	FALSE		N1	UNKNOWN	FAM	None	0.377	0.746	0.599
152	G8	FALSE		N1	UNKNOWN	FAM	None	0.673	0.746	0.599
154	G10	FALSE		N1	UNKNOWN	FAM	None	0.368	0.746	0.599
156	G12	FALSE		N1	UNKNOWN	FAM	None	0.646	0.746	0.599
158	G14	FALSE		N1	UNKNOWN	FAM	None	0.560	0.746	0.599
160	G16	FALSE		N1	UNKNOWN	FAM	None	-0.344	0.746	0.599
162	G18	FALSE		N1	UNKNOWN	FAM	None	0.766	0.746	0.599
164	G20	FALSE		N1	UNKNOWN	FAM	None	0.723	0.746	0.599

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166	G22	FALSE		N1	UNKNOWN	FAM	None	0.407	0.746	0.599
168	G24	FALSE		N1	UNKNOWN	FAM	None	0.606	0.746	0.599
194	I2	FALSE		N1	UNKNOWN	FAM	None	0.405	0.746	0.599
196	I4	FALSE		N1	UNKNOWN	FAM	None	0.329	0.746	0.599
198	I6	FALSE		N1	UNKNOWN	FAM	None	0.376	0.746	0.599
200	I8	FALSE		N1	UNKNOWN	FAM	None	0.401	0.746	0.599
202	I10	FALSE		N1	UNKNOWN	FAM	None	0.351	0.746	0.599
204	I12	FALSE		N1	UNKNOWN	FAM	None	0.378	0.746	0.599
206	I14	FALSE		N1	UNKNOWN	FAM	None	0.357	0.746	0.599
208	I16	FALSE		N1	UNKNOWN	FAM	None	0.386	0.746	0.599
210	I18	FALSE		N1	UNKNOWN	FAM	None	0.446	0.746	0.599
212	I20	FALSE		N1	UNKNOWN	FAM	None	0.414	0.746	0.599
214	I22	FALSE		N1	UNKNOWN	FAM	None	0.429	0.746	0.599
216	I24	FALSE		N1	UNKNOWN	FAM	None	0.357	0.746	0.599
242	K2	FALSE		N1	UNKNOWN	FAM	None	0.321	0.746	0.599
244	K4	FALSE		N1	UNKNOWN	FAM	None	0.367	0.746	0.599
246	K6	FALSE		N1	UNKNOWN	FAM	None	0.380	0.746	0.599
248	K8	FALSE		N1	UNKNOWN	FAM	None	0.367	0.746	0.599
250	K10	FALSE		N1	UNKNOWN	FAM	None	0.359	0.746	0.599
252	K12	FALSE		N1	UNKNOWN	FAM	None	0.396	0.746	0.599
254	K14	FALSE		N1	UNKNOWN	FAM	None	0.363	0.746	0.599
256	K16	FALSE		N1	UNKNOWN	FAM	None	0.407	0.746	0.599
258	K18	FALSE		N1	UNKNOWN	FAM	None	0.452	0.746	0.599
260	K20	FALSE		N1	UNKNOWN	FAM	None	0.456	0.746	0.599
262	K22	FALSE		N1	UNKNOWN	FAM	None	0.423	0.746	0.599
264	K24	FALSE		N1	UNKNOWN	FAM	None	0.361	0.746	0.599
290	M2	FALSE		N1	UNKNOWN	FAM	None	0.342	0.746	0.599
292	M4	FALSE		N1	UNKNOWN	FAM	None	0.792	0.746	0.599
294	M6	FALSE		N1	UNKNOWN	FAM	None	0.408	0.746	0.599
296	M8	FALSE		N1	UNKNOWN	FAM	None	0.741	0.746	0.599
298	M10	FALSE		N1	UNKNOWN	FAM	None	0.710	0.746	0.599
300	M12	FALSE		N1	UNKNOWN	FAM	None	0.416	0.746	0.599
302	M14	FALSE		N1	UNKNOWN	FAM	None	0.458	0.746	0.599
304	M16	FALSE		N1	UNKNOWN	FAM	None	0.541	0.746	0.599
306	M18	FALSE		N1	UNKNOWN	FAM	None	0.409	0.746	0.599
308	M20	FALSE		N1	UNKNOWN	FAM	None	0.444	0.746	0.599
310	M22	FALSE		N1	UNKNOWN	FAM	None	0.867	0.746	0.599
312	M24	FALSE		N1	UNKNOWN	FAM	None	0.422	0.746	0.599
338	O2	FALSE		N1	UNKNOWN	FAM	None	0.765	0.746	0.599
340	O4	FALSE		N1	UNKNOWN	FAM	None	0.239	0.746	0.599
342	O6	FALSE		N1	UNKNOWN	FAM	None	0.382	0.746	0.599

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344	O8	FALSE		N1	UNKNOWN	FAM	None	0.411	0.746	0.599
346	O10	FALSE		N1	UNKNOWN	FAM	None	0.361	0.746	0.599
348	O12	FALSE		N1	UNKNOWN	FAM	None	0.973	0.746	0.599
350	O14	FALSE		N1	UNKNOWN	FAM	None	0.033	0.746	0.599
352	O16	FALSE		N1	UNKNOWN	FAM	None	0.623	0.746	0.599
354	O18	FALSE		N1	UNKNOWN	FAM	None	0.910	0.746	0.599
356	O20	FALSE		N1	UNKNOWN	FAM	None	0.779	0.746	0.599
360	O24	FALSE		N1	UNKNOWN	FAM	None	0.495	0.746	0.599
26	B2	FALSE		N2	UNKNOWN	FAM	None	0.437	0.709	0.402
28	B4	FALSE		N2	UNKNOWN	FAM	None	0.478	0.709	0.402
30	B6	FALSE		N2	UNKNOWN	FAM	None	0.773	0.709	0.402
32	B8	FALSE		N2	UNKNOWN	FAM	None	0.454	0.709	0.402
34	B10	FALSE		N2	UNKNOWN	FAM	None	0.824	0.709	0.402
36	B12	FALSE		N2	UNKNOWN	FAM	None	0.700	0.709	0.402
38	B14	FALSE		N2	UNKNOWN	FAM	None	0.718	0.709	0.402
40	B16	FALSE		N2	UNKNOWN	FAM	None	0.548	0.709	0.402
42	B18	FALSE		N2	UNKNOWN	FAM	None	0.783	0.709	0.402
44	B20	FALSE		N2	UNKNOWN	FAM	None	0.487	0.709	0.402
46	B22	FALSE		N2	UNKNOWN	FAM	None	0.506	0.709	0.402
48	B24	FALSE		N2	UNKNOWN	FAM	None	0.498	0.709	0.402
74	D2	FALSE		N2	UNKNOWN	FAM	None	0.438	0.709	0.402
76	D4	FALSE		N2	UNKNOWN	FAM	None	-0.009	0.709	0.402
78	D6	FALSE		N2	UNKNOWN	FAM	None	0.898	0.709	0.402
80	D8	FALSE		N2	UNKNOWN	FAM	None	0.825	0.709	0.402
82	D10	FALSE		N2	UNKNOWN	FAM	None	-0.258	0.709	0.402
84	D12	FALSE		N2	UNKNOWN	FAM	None	-0.234	0.709	0.402
86	D14	FALSE		N2	UNKNOWN	FAM	None	-0.057	0.709	0.402
88	D16	FALSE		N2	UNKNOWN	FAM	None	0.862	0.709	0.402
90	D18	FALSE		N2	UNKNOWN	FAM	None	-0.115	0.709	0.402
92	D20	FALSE		N2	UNKNOWN	FAM	None	1.016	0.709	0.402
96	D24	FALSE		N2	UNKNOWN	FAM	None	0.640	0.709	0.402
122	F2	FALSE		N2	UNKNOWN	FAM	None	0.623	0.709	0.402
124	F4	FALSE		N2	UNKNOWN	FAM	None	0.481	0.709	0.402
126	F6	FALSE		N2	UNKNOWN	FAM	None	0.395	0.709	0.402
130	F10	FALSE		N2	UNKNOWN	FAM	None	0.405	0.709	0.402
134	F14	FALSE		N2	UNKNOWN	FAM	None	0.701	0.709	0.402
136	F16	FALSE		N2	UNKNOWN	FAM	None	0.390	0.709	0.402
138	F18	FALSE		N2	UNKNOWN	FAM	None	0.473	0.709	0.402
140	F20	FALSE		N2	UNKNOWN	FAM	None	0.501	0.709	0.402
142	F22	FALSE		N2	UNKNOWN	FAM	None	0.804	0.709	0.402
144	F24	FALSE		N2	UNKNOWN	FAM	None	0.537	0.709	0.402

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174	H6	FALSE		N2	UNKNOWN	FAM	None	0.444	0.709	0.402
180	H12	FALSE		N2	UNKNOWN	FAM	None	0.481	0.709	0.402
182	H14	FALSE		N2	UNKNOWN	FAM	None	0.470	0.709	0.402
184	H16	FALSE		N2	UNKNOWN	FAM	None	0.565	0.709	0.402
186	H18	FALSE		N2	UNKNOWN	FAM	None	0.696	0.709	0.402
188	H20	FALSE		N2	UNKNOWN	FAM	None	0.824	0.709	0.402
192	H24	FALSE		N2	UNKNOWN	FAM	None	0.439	0.709	0.402
218	J2	FALSE		N2	UNKNOWN	FAM	None	0.173	0.709	0.402
220	J4	FALSE		N2	UNKNOWN	FAM	None	0.375	0.709	0.402
222	J6	FALSE		N2	UNKNOWN	FAM	None	0.498	0.709	0.402
224	J8	FALSE		N2	UNKNOWN	FAM	None	0.400	0.709	0.402
228	J12	FALSE		N2	UNKNOWN	FAM	None	0.438	0.709	0.402
230	J14	FALSE		N2	UNKNOWN	FAM	None	0.732	0.709	0.402
232	J16	FALSE		N2	UNKNOWN	FAM	None	0.477	0.709	0.402
234	J18	FALSE		N2	UNKNOWN	FAM	None	0.509	0.709	0.402
236	J20	FALSE		N2	UNKNOWN	FAM	None	0.535	0.709	0.402
266	L2	FALSE		N2	UNKNOWN	FAM	None	0.488	0.709	0.402
268	L4	FALSE		N2	UNKNOWN	FAM	None	0.405	0.709	0.402
270	L6	FALSE		N2	UNKNOWN	FAM	None	0.441	0.709	0.402
272	L8	FALSE		N2	UNKNOWN	FAM	None	0.430	0.709	0.402
274	L10	FALSE		N2	UNKNOWN	FAM	None	0.419	0.709	0.402
276	L12	FALSE		N2	UNKNOWN	FAM	None	0.479	0.709	0.402
278	L14	FALSE		N2	UNKNOWN	FAM	None	0.497	0.709	0.402
280	L16	FALSE		N2	UNKNOWN	FAM	None	0.498	0.709	0.402
282	L18	FALSE		N2	UNKNOWN	FAM	None	0.312	0.709	0.402
284	L20	FALSE		N2	UNKNOWN	FAM	None	0.568	0.709	0.402
286	L22	FALSE		N2	UNKNOWN	FAM	None	0.507	0.709	0.402
288	L24	FALSE		N2	UNKNOWN	FAM	None	0.515	0.709	0.402
314	N2	FALSE		N2	UNKNOWN	FAM	None	0.460	0.709	0.402
316	N4	FALSE		N2	UNKNOWN	FAM	None	0.878	0.709	0.402
318	N6	FALSE		N2	UNKNOWN	FAM	None	0.473	0.709	0.402
320	N8	FALSE		N2	UNKNOWN	FAM	None	0.453	0.709	0.402
322	N10	FALSE		N2	UNKNOWN	FAM	None	0.446	0.709	0.402
324	N12	FALSE		N2	UNKNOWN	FAM	None	0.793	0.709	0.402
330	N18	FALSE		N2	UNKNOWN	FAM	None	0.505	0.709	0.402
332	N20	FALSE		N2	UNKNOWN	FAM	None	0.564	0.709	0.402
334	N22	FALSE		N2	UNKNOWN	FAM	None	0.691	0.709	0.402
336	N24	FALSE		N2	UNKNOWN	FAM	None	0.491	0.709	0.402
362	P2	FALSE		N2	UNKNOWN	FAM	None	0.700	0.709	0.402
366	P6	FALSE		N2	UNKNOWN	FAM	None	0.475	0.709	0.402
368	P8	FALSE		N2	UNKNOWN	FAM	None	0.455	0.709	0.402

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370	P10	FALSE		N2	UNKNOWN	FAM	None	0.194	0.709	0.402
374	P14	FALSE		N2	UNKNOWN	FAM	None	0.509	0.709	0.402
376	P16	FALSE		N2	UNKNOWN	FAM	None	0.458	0.709	0.402
380	P20	FALSE		N2	UNKNOWN	FAM	None	0.466	0.709	0.402
384	P24	FALSE		N2	UNKNOWN	FAM	None	0.417	0.709	0.402

5. Discussion

The use of pipette tips washed by the TipNovus-TipLumis combination has shown no reportable contamination as seen in the QC and blank data. Any possible contamination picked up by the pipette tips were removed by the tip washer setup. Since both the default and custom programs yielded similar results, it has been determined to use the default low resource intensive default method moving forward. Programs can be customized if there are any deviations or interferences that may arise in the future.

Additionally, tips used in one step of the method can be reused in other steps of the method since crossover was also tested successfully. Repeat use of the same tips can also be concluded from this experiment since the same tip racks were washed multiple times. The limit on the number of times each set of tips can be used before discard is still to be determined. As pipette tips are being reused, QC and blank data will be continually monitored for trends as well as the integrity of the tips themselves. A limit for the number of times a tip can be washed will be then determined. This testing was performed using Hamilton tips exclusively and further testing may be needed on other tip types. However, it can be noted that the same method of action is used with other tip types with the primary difference being how the tips are held within the system.

