sample is can inform the results of the consumer test and guide product developers in refining the product to meet consumer wants/needs.

Traditional descriptive analysis methods include: Quantitative Descriptive Analysis (QDA®; Stone *et al*., 1997), Spectrum™ Descriptive Analysis Method (Muñoz and Civille, 1992), the Flavor Profile method (Keane, 1992) and the Texture Profile method (Muñoz *et al*., 1992). Each of these methods differs in areas such as panel training procedures, intensity scales and more. For chocolate research, modified or hybrid methods of descriptive analysis are also frequently used in addition to or in place of traditional descriptive methods (e.g. Guinard and Mazzucchelli, 1999; Silva *et al*., 2013). Often this is to facilitate investigation of a very specific research question, or in an effort to reduce time and/or cost. An alternative descriptive analysis method previously applied for the evaluation of chocolate products is Free-Choice Profiling (e.g. Thamke *et al*., 2009). In contrast to other conventional descriptive methods, in Free-Choice Profiling, untrained panelists assign descriptors individually. This method can be useful when considering the semantic differences in how different populations would describe chocolate samples. Choice of descriptive analysis method should be based on the end goal of the research (i.e. does the end goal require comparison of data across time? Is a full profile needed, or is there a focus on specific attributes?).

21.2.5 Time–intensity analysis

Time–intensity analysis is a particularly useful method for the evaluation of chocolate products. This method allows for the investigation of the temporal nature of attributes, which, as chocolate melts, can have a significant influence on its perception. For instance, a study by De Melo and colleagues (2007) utilised the Time–Intensity method to evaluate the temporal profile of sweetness in milk chocolate samples formulated with different sweeteners (De Melo *et al*., 2007). Chocolate has very unique melting characteristics, and this method of analysis can potentially illuminate differences that may be overlooked by other methods.

In addition to Time–Intensity analysis, another method called Temporal Dominance of Sensations has potential for application in chocolate products. Whereas in Time–Intensity analysis the intensity of a sensation is quantified over time (Lee and Pangborn, 1986), Temporal Dominance of Sensations evaluates which sensation(s) dominate the integrated profile over time (Pineau *et al*., 2009). While this method has yet to be used in the published literature to evaluate chocolate products, it may prove insightful for investigating chocolate flavour.

21.3 Special considerations

As chocolate and cocoa products are such unique products, they may require some special considerations when planning and executing sensory evaluation. Attention should focus on good sensory practices in an effort to reduce noise or

bias and to gather accurate data. While this list is not exhaustive, examples and some recommendations are listed below:

21.3.1 Use of coloured lighting

Chocolate samples have the potential to look very different from one another in colour. Whether the difference stems from alkalisation processes or the presence of milk ingredients and so on, it may be an important aspect in some tests. Particularly, differences in colour are of great concern when conducting a discrimination test. If the desired outcome is to determine if differences observed under natural circumstances are detectable, then these colour differences are part of that overall experience. However, if the objective of a test is to evaluate specific differences in say for example flavour or melting, it may be helpful to disguise colour differences by using coloured lights. Similarly to what is used for meat products, a red light or a combination of red and green lights may be used together to minimise the detectable differences.

21.3.2 Sample presentation

Presentation order is always important as it can aid in avoiding systematic biases in the results of a sensory test. Here we define bias as "systematic error manifested as a persistent positive or negative deviation of the method average from its accepted true value" (ASTM, 2013). Randomisation of samples, whether complete or incomplete depending on the requirements of the test, can help prevent order effects that may be seen for samples in the first position or in latter positions. In milk chocolate specifically, panelist performance for evaluating samples was compared for simultaneous and monadic sample presentation (Mazzucchelli and Guinard, 1999). The authors concluded that, while the panels showed better discrimination using simultaneous presentation, monadic presentation was significantly faster. Each presentation technique has pros and cons that must be thoughtfully considered for the specific test.

Additionally, order is important for the limitation of potential carry-over effects. Chocolate, especially dark chocolate or high cacao solid-containing chocolate, has attributes such as bitterness and astringency that are known to linger and can potentially influence the ratings of subsequent samples. Thus in some instances, rather than randomising the presentation order of the samples, it may be important to evaluate samples with the highest risk of carry-over at the end of the sample set. Rinsing and waiting between samples is very important for avoiding the carry-over effects and will be discussed under the next section.

21.3.3 Palate cleansers

Cleansing the palate between samples is essential for the accurate evaluation of chocolate samples, especially as chocolate tends to have bitterness and/or astringency that can build up or carry over and potentially interfere with